

**Appendix C: Special Topics**

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## **Chapter 1**

### **Safety**

#### **Highlights**

The region has a serious safety problem. The region has the worst safety record in Texas and is one of the most unsafe metropolitan areas in the country.

The H-GAC safety program aims to improve safety in the region through roadway and design improvements and through supporting other safety activities (education, enforcement, emergency response access).

The plan identifies high-risk populations (e.g., teenagers, elderly) for education and enforcement efforts

The plan identifies high-risk behaviors (e.g., speeding, red-light running, failing to yield, DUI) for improved public education and enforcement

The plan identifies high crash locations and other safety hot spots for safety improvements.

The plan prioritizes safety improvements for pedestrians, bicyclists, railroad grade crossings, and commercial motor vehicles.

The plan identifies 344 major crash hot spots that account for 20% of the region's serious crashes. The RTP programs \$172 million for mitigating these hot spots but produces \$123 million in annual benefits, essentially paying for the mitigation costs in a year and a half.

#### **Introduction**

H-GAC has been developing a safety program over the last three years. This document summarizes progress to date and indicates future directions. In addition, a strategic safety plan is outlined that will be incorporated into the Regional Transportation Plan (RTP).

#### **Why is Safety Important for Transportation?**

The first question that has to be asked is why is safety important for transportation? While this may seem obvious to most people, it is still worthwhile articulating some of the reasons why safety is important.

#### **High Degree of Consensus About Safety**

First, there is a high degree of public consensus about safety. The public expects and insists that the road be safe. When people get into vehicles, either as drivers or passengers, they have a reasonable expectation that they will not be killed or injured during their trip. When people go out walking or ride a bicycle, again, they have a reasonable expectation that they won't be killed or injured by a motor vehicle. There are few areas of public policy that have such a uniformly high degree of consensus about the importance.

## Leading Cause of Death for Youth

Second, motor vehicle crashes are a major public health problem in the United States. Every year, nationally, there are more than 40,000 persons who are killed and more than two million persons who are injured in motor vehicle crashes.<sup>1</sup> Between 1998 and 2000, there were 1,793 fatalities and 274,926 injuries in the eight-county H-GAC region.

According to the U. S. Department of Health and Human Service, deaths from motor vehicle crashes in 1998 were the leading cause of death for every age group from 1 through 34, and are among the ten leading causes of death for every other age group.<sup>2</sup> For all age groups, unintentional injuries is the fifth leading cause of death, of which motor vehicle crashes account for 43%. For every age group, there are more motor vehicle crash fatalities than there are homicides and suicides.

Nationally, males are far more likely than females to be killed in a motor vehicle crash by more than a 2:1 ratio (22.1 per 100,000 population compared to 10.7 per 100,000 population). But, there are interactions between gender and ethnicity. From 1996-1998, American Indian males, particularly, and African-American males had a higher age-adjusted motor vehicle crash fatality rate than Hispanic males or non-Hispanic White males (with rates of 43.2, 25.0, 22.1, and 21.4 per 100,000 population respectively). These differences have been noted since at least 1985 and Black-White differences in motor vehicle fatality rates have been noted as far back as 1950.<sup>3</sup> There is no ethnic, socioeconomic, religious, or any other type of group that is not affected by motor vehicle crashes. It is one of the major, if not *the* major, public health problem in the United States.

## Crashes are a Major Source of Congestion

There is also fairly good evidence that motor vehicle crashes are a major source of congestion. It has been estimated that about half of congestion is due to population growth with the other half being due to incidents.<sup>4</sup> Since motor vehicle crashes are a major portion of incidents, their impact is considerable. As will be shown later, many of the crash hot spots are in traffic bottleneck locations. The bottlenecks, undoubtedly, contribute to the higher number of crashes at those locations. But, in turn, the crashes contribute to the congestion.

## Costs of Motor Vehicle Crashes

It should be realized that safety affects the region's transportation in many ways. First, there are the human costs - fatalities and injuries to those involved and suffering for friends and relatives. Second, there are the medical costs. The approximately 90,000 individuals who are injured each year in a motor vehicle crash in our eight county region have extensive medical costs. The National Safety Council is commissioned by Congress to document and to estimate the costs of motor vehicle crashes. Their estimates of comprehensive costs for 1999 were \$3.1 million per

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<sup>1</sup> National Safety Council, *Injury Facts (2000 edition)*. National Safety Council: Washington, DC. 78.

<sup>2</sup> U.S. Department of Health and Human Services, *Health United States, 2000*. Washington, DC. Table 33, 176-177.

<sup>3</sup> U.S. Department of Health and Human Services, *ibid*, Table 45, 206-209.

<sup>4</sup> Anthony Downs, *Testimony on Peak-hour Traffic Congestion*. Testimony before the Committee on the Environment and Public Works, U.S. Senate. Washington, DC. March 19, 2002.

<http://www.anthonysdowns.com/peakhourtestimony.htm>; Jeff Paniati, "Traffic congestion and sprawl". Press Club Event, Federal Highway Administration: Washington, DC. <http://www.fhwa.dot.gov/congestion/congress.htm>; David Schrank and Tim Lomax, *2003 Urban Mobility Report: Volume 2*; Annual Urban Mobility Report, Texas Transportation Institute: College Station, TX, 12

fatality, \$153,453 for an incapacitating injury, \$39,481 for a non-incapacitating evident injury, and \$1,787 for a possible injury.<sup>5</sup> These comprehensive costs include not only the direct economic costs, but also a measure of the value of lost quality of life associated with deaths and injuries and the willingness to pay for safety (e.g., through insurance). Breaking down the fatalities and injuries for our eight-county region, the 1,793 persons who were killed and the 274,926 persons who were injured between 1998 and 2000 cost our region approximately \$11.9 billion over the period.

Third, there are operational costs for personnel that have to deal with the consequences – EMS, police, public works and roadway agencies. On the weekends, the major trauma centers in the region (Ben Taub, Memorial Hermann, and the University of Texas Medical Branch in Galveston) are frequently overwhelmed with motor vehicle crash victims and have to divert cases to other hospitals in the region.

Fourth, there are the effects of crashes on traffic flow, as has been mentioned above. Crashes have a ‘cost’ in terms of increasing travel time. The ‘congestion index’ of the Texas Transportation Institute makes this cost explicit by quantifying the value of lost time in traffic.<sup>6</sup> As they point out, motor vehicle crashes are a major source of lost travel time.

Fifth, there are the insurance costs. Every time there is a motor vehicle crash, insurance companies are required to pay for medical treatment, property damage repair, expenses associated with the deceased, legal costs associated with resolving disputes over damage, and other ancillary services (e.g., funeral costs, medical equipment). The large number of crashes in the region puts tremendous pressure on the insurance companies who, in turn, pass the costs on to consumers. Thus, it’s not surprising that Texas and the Houston-Galveston region, in particular, have among the highest insurance costs in the nation.

### **Crashes Can Be Prevented**

The sixth and final point is that crashes can be prevented. Prior to about 30 years ago, there was public passivity with respect to automobile safety. However, with public pressure and Federal and State legislation, both fatality rates and crash rates have dramatically fallen. It has become increasingly evident that crashes can be prevented and that the crash rate (crashes per 100 million VMT) can be significantly reduced.

However, many people have taken a fatalistic attitude toward motor vehicle crashes, as if they are some inevitable consequence of having a motorized society. We frequently call them “accidents” as if they are caused by some random act of nature. These are not “accidents”; these events are caused by human beings who make poor decisions when they drive. Speeding is the major cause of crashes. Nationally, speeding is involved in 46% of fatalities and 72% of injuries.<sup>7</sup> Collisions with fixed objects account for 27% of fatalities and 15% of injuries. Thirty-nine percent of fatalities involve the use of alcohol or other drugs. Fortunately, the percentage of fatalities involving alcohol or drugs has been decreasing as the percentage was over 50% in 1988. By far, speeding is the most dangerous behavior followed by failing to yield the right-of-way to another vehicle.

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<sup>5</sup> National Safety Council, *ibid*, 79.

<sup>6</sup> David Shrank and Tim Lomax, *2003 Urban Mobility Study*. Texas Transportation Institute: College Station, TX

<sup>7</sup> National Safety Council, *ibid*, 76.

As mentioned above, males are more than twice as likely to get into a serious crash as females. Further, teenagers are much more likely to become involved in a crash than older age groups. In our region, 20.7% of all serious crashes involve teenage drivers and 8.1% involve elderly persons, age 65 or older.<sup>8</sup> Older persons, age 75 or more, are more likely to be killed in a motor vehicle crash, primarily through physical frailty.

A crash is caused by human error and, because of this, H-GAC has refused to use the term ‘accident’. We believe that crashes can be prevented and have designated transportation safety as a major goal in our transportation plan.

### **Why H-GAC Has Become Involved in Safety?**

There are several reasons why H-GAC should be involved in safety. First, many crashes and fatalities occur on local roads and not just State-managed roads. In Texas as a whole, about 44% of all serious crashes occurred on local roads between 1998 and 2000.<sup>9</sup> In our region, this percentage was 53% of the serious crashes. Therefore, the burden for fixing problems at these locations falls squarely on local jurisdictions. Even for fatalities, which are the most severe of crashes, a sizeable proportion occur on local roads.

Second, transportation safety is a Federally-mandated program. The 1973 National Highway Safety Act, with subsequent amendments in 1982, 1991, and 1998 (TEA-21), requires that each State conduct a *Hazard Elimination Survey* on all public roads to identify high crash locations. It also requires that mitigating actions be developed and implemented to reduce crashes at these locations, based on a benefit-cost analysis. This is called the Hazard Elimination Program (HEP). In addition, safety at railroad-highway crossings must be addressed. For these actions, 10% of the Surface Transportation Program funds are set aside *exclusively* for safety projects, both HEP and railroad-highway crossings. TxDOT has the responsibility for managing the HEP, but can cooperate with Metropolitan Planning Organizations (MPO) and local jurisdictions.

This mandate is further established as one of the seven planning factors that MPO’s must consider in developing their long-range plan. As the MPO for the greater Houston metropolitan area, H-GAC is committed to considering safety in a very active way. It is essential for the health of the region and it is critical to the effective use of the transportation system.

Third, while there are fewer motor vehicle crashes at any particular location on local roads, compared to the high-volume State roads, generally the cost of fixing local road conditions is less than for State-managed roads. Most local road ‘hot spots’ require the re-timing of existing traffic signals or the installation of traffic signals and stop signs whereas fixing most State road ‘hot spots’ require substantial construction.

Since the Federal legislation requires that a benefit-cost analysis be conducted to utilize the HEP funds, the benefit-cost (B/C) ratio is generally much higher for fixing a local road safety problem than for fixing a State road safety problem. If B/C ratios were analyzed both on local and state roads, then the majority of safety projects would be on local roads. Safety can be a ‘win-win’ situation for both H-GAC and TxDOT as H-GAC can help identify local road safety problems

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<sup>8</sup> The share of driving-age persons who are 16-19 is approximately 9%. Thus, their 21% share of drivers of motor vehicles involved in a crash is more than double their share of the driving-age population. Considering that many teenagers do not own vehicles, their crash risk is even higher. For the elderly, their share of crashes is 8% which is slightly lower than their share of population (9%). Elderly are not more likely to become involved in crashes whereas teenagers have a much higher risk.

<sup>9</sup> Accident Records Bureau, Texas Department of Public Safety. Special compilation.

and their interaction with State-managed roads (many crashes on local roads are ‘spill-over’ effects from major arterials).

Fourth, though the responsibility for fixing a safety problem on a local road belongs to the jurisdiction, most small jurisdictions don’t have the expertise. Crash information systems require a technical infrastructure to maintain and analyze, and site analysis requires traffic safety engineering expertise. H-GAC can play a role, both in providing the analysis and the identification of problem locations for local jurisdictions as well as acting as a ‘broker’ to put local jurisdictions in contact with engineering firms who specialize in traffic safety.

Fifth, motor vehicle crashes can be a trigger for community response. While people take the safety of the road system for granted, they can become agitated when it fails or when they discover ‘hot spot’ locations. Elected officials need to be cognizant of safety concerns among the population for whom they serve.

Sixth, safety can be a good planning tool for H-GAC. If H-GAC takes the lead role in analyzing the region’s safety problems and in providing information both to local jurisdictions and to the public at large, this can help build trust and confidence with its constituents and with the wider public. H-GAC having a major safety role will help convey its message to the region. Further, safety can help link together the various land use and transportation plans that H-GAC develops, and which often work against each other. If safety is brought in as a planning factor, land use and transportation plans can often be modified to be more compatible than they would be otherwise. Safety is, often, the ‘missing link’ in planning.

### **Seriousness of the Problem**

The region has a severe safety problem. From 1998 to 2000, there were 243,616 serious crashes in the eight county region involving 1,616 fatal crashes and 158,395 injury crashes. In these crashes, 1,793 persons were killed and 274,926 were injured. Compared to the rest of the Texas, the Houston region has the worst safety problem in the State. Furthermore, the 243,616 serious crashes represented 25.9% of the State’s serious crashes.<sup>10</sup> The injuries were 27.0% of the State’s total injuries from motor vehicle crashes and 16.5% of the State total fatalities. There were more crashes in the eight-county Houston-Galveston region than in the sixteen-county Dallas-Fort Worth region (where there were 221,701 serious crashes). Putting it another way, the eight county region accounted for 25.9% of the State’s crashes compared to its 22.2% of population share.

In order to compare this to the rest of the United States, the fatal and injury crash rate per 100 million vehicle miles traveled (VMT) is used. The Houston region had a Fatal and Injury Crash Rate of 131.0; this is 36% higher than the State average (96.7) and 145% higher than the national average (53.6).

### **Purpose of the Program**

There are three main goals for the program. First, there is the goal of identifying and monitoring safety. H-GAC has built a GIS-based crash information system that documents serious crashes throughout the region. The goal is identify where there are concentrations of crashes (hazardous locations or ‘hot spots’) as a means for establishing safety projects and to monitor improvements

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<sup>10</sup> Accident Records Bureau, Texas Department of Public Safety website;  
[http://www.txdps.state.tx.us/administration/driver\\_licensing\\_control/arb.htm](http://www.txdps.state.tx.us/administration/driver_licensing_control/arb.htm)

in safety at project locations. Until H-GAC became involved, there was not a comprehensive evaluation of the scope of crashes in the region. TxDOT monitors its roads and has done so for many years, but, crashes on the local roads were not identified. Because more than half the serious crashes occur on local roads, this was a major deficiency that prevented local governments from identifying safety problems.

Second, there is the goal of implementing safety roadway improvements at hazardous locations. Once the locations have been identified, H-GAC will work with local governments, TxDOT, METRO, and other relevant organizations to implement improvements in the road system, whether they involve changes in signage, signaling, roadway design, or enforcement. There are several steps involved in identifying safety roadway improvements and include safety analysis of causal factors affecting crashes at the hot spots, conducting preliminary engineering regarding the mitigations, and identifying funding sources so that the local governments and TxDOT can leverage their funds with State and Federal funding.

Third, there is the goal of supporting other safety efforts. H-GAC deals primarily with roadway improvements. However, safety is improved not only through changes in the roadway system, but also by increased awareness, understanding of the public, and through necessary enforcement of traffic laws. It is often stated that the “Three E’s” are necessary for safety improvements – **E**ducation, **E**nforcement, **E**ngineering. Thus, H-GAC will partner with other organizations to support their safety efforts.

In short, the H-GAC safety program combines an analytic methodology with a policy framework with the combined goal of building a traffic safety program that can reduce crashes.

### **Motor Vehicle Crash Information System**

H-GAC has been analyzing crashes in the eight county region. The crash data come primarily from the Accident Records Bureau of the Texas Department of Public Safety (DPS) who compile data on all serious crashes collected by local police departments.<sup>11</sup> ‘Serious’ is defined as fatal crashes, injury crashes, and property damage only crashes where one or more vehicles was towed. This information does not include property damage only crashes where no one was injured and all vehicles were driven off (so-called ‘fender benders’).

H-GAC has developed a methodology for geo-referencing the crash information in the DPS dataset. Details of this are given in Appendix A.

### **Spatial Analytical Tools**

#### **Mapping**

To utilize the crash information system for analytical and policy purposes, a number of different analytical tools are used. First, there are simple displays. Figure 1 shows a map of all serious crashes in the eight county region. Each red dot represents a crash location. Since many locations have more than one crash, the density of the crashes is not completely captured with a sample map. Figure 2 shows a map of fatal crashes. Comparing the distribution of fatal crashes with those of all crashes, it *appears* that the fatal crashes are more dispersed than all crashes.

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<sup>11</sup> Increasingly, H-Gac is examining other databases, such as the Federal Railroad Administration railroad-highway grade crossing crash database and selected local databases. However, the DPS database is the primary one.

This would be consistent with National Safety Council data that shows that rural areas generally have a higher fatal crash rate than urban areas.<sup>12</sup>

### Visualization

Second, there are visualization tools. Using the *CrimeStat* program, the number of crashes at each location was calculated.<sup>13</sup> Figure 3 displays a map of the crash frequencies with the size of the circle being proportional to the number of crashes. As seen, the freeways and adjacent frontage roads have a disproportionate number of crashes. This is primarily because they have higher traffic volumes.

Another visualization tool is the *standard deviational ellipse*, which shows the dispersion and direction of crashes. Ellipses typically cover 70-75% of the incidents. Different types of crashes show different patterns. The standard deviational ellipse describes some of that variation. For example, figure 4 shows four standard deviational ellipses by the severity of the crash. The first is the ellipse of possible injury crashes (magenta). The second is the ellipse of probable injury crashes (light green). The third is the ellipse of incapacitating injury crashes (light purple) and the fourth, and final, one is the ellipse of crashes involving fatalities.

As seen, the ellipses become more dispersed as the crashes become more severe. There are at least two reasons for this. One, travel speeds generally are faster farther from the urban center. Higher speeds, in turn, are related to more severe crashes. Two, the larger ellipses of the more severe crashes reflect a higher percentage of nighttime incidents. For all crashes, 34.2% occur in the evening or nighttime (6 pm – 6 am). However, for fatal crashes, 60.0% occur in the evening or nighttime; the percentages for injury crashes are incapacitating (42.7% evening/nighttime); probable (38.1% evening/nighttime); and possible (31.0% evening/nighttime).

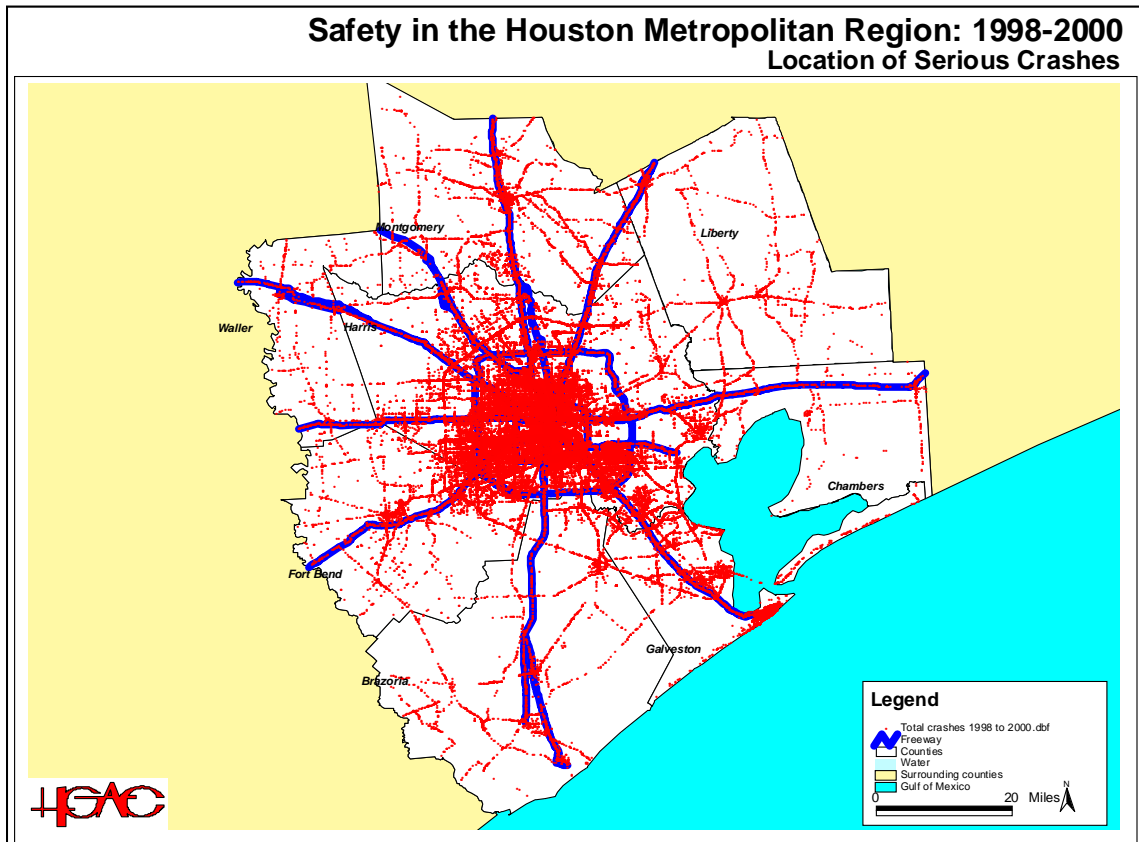
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<sup>12</sup> National Safety Council, *Ibid*, 94-95; Ned Levine, Karl E. Kim, and Lawrence H. Nitz, “Spatial analysis of Honolulu motor vehicle crashes: I. spatial patterns”, *Accident Analysis and Prevention*, 27(5), 1995, 663-674; “Risk of fatal crash is much greater when driving on rural roads”, University of Minnesota Extension Service, Aug 23, 2000; <http://www.extension.umn.edu/extensionnews/2000/RiskOfFatalCrashIsMuch.html>; Jan Ackerman, “Study says rural life more risky than urban”, Post-Gazette.com, Oct 28, 2002; <http://www.post-gazette.com/localnews/20020506study0506p1.asp>

<sup>13</sup> Ned Levine, “CrimeStat II: A Spatial Statistical Program for the Analysis of Metropolitan Crime Locations”. National Institute of Justice: Washington, DC and Ned Levine & Associates: Houston, TX. 2002. <http://www.icpsr.umich.edu/nacjd/crimestat.html>.

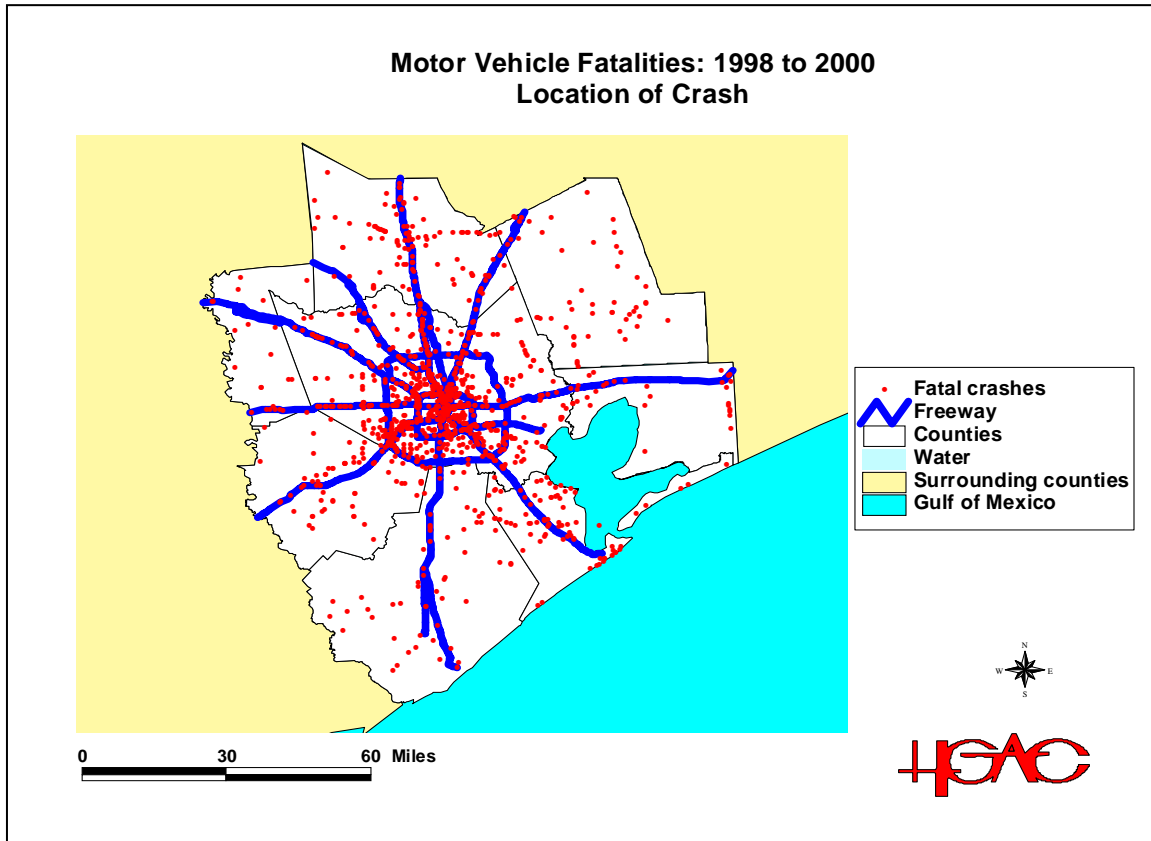


Figure 1:



On the other hand, figure 5 shows ellipses of pedestrian and bicycle crashes. These are compared to the ellipse of all crashes. Pedestrian crashes have the most concentrated distribution since they occur where there are concentrations of pedestrians, which tend to be more located in the central city (though, clearly, most cities have pedestrian activity areas). Similarly, bicycle crashes are more concentrated than crashes involving only motor vehicles crashes due to the more limited geographical scale of bicycle use.

Figure 2:



### *Hot spot analysis*

Third, there are hot spot analysis tools. One of the most useful concepts is that of a *hot spot*. A crash hot spot is a small area where there is a concentration of crashes. As opposed to a single location or single stretch of road, a hot spot frequently involves an interaction of several roads. That is, crashes occur within a small area because several intersecting roads create a higher number of conflict points where crashes can occur. Figure 6 shows the location of hot spots that averaged 100 or more crashes a year between 1998 and 2000. Most of these are along the heavily-traveled freeways (particularly IH 610 W and US 59 W) but there are several smaller hot spots along the Main Street corridor leading from downtown through Midtown to the Texas Medical Center.

Hot spot analysis is a particularly useful tool for identifying hazardous locations that need remediation. H-GAC has used this tool primarily to identify project locations. Typically, a safety study is conducted at these hot spots in order to identify remedial measures that could reduce the number of crashes.

Figure 3:

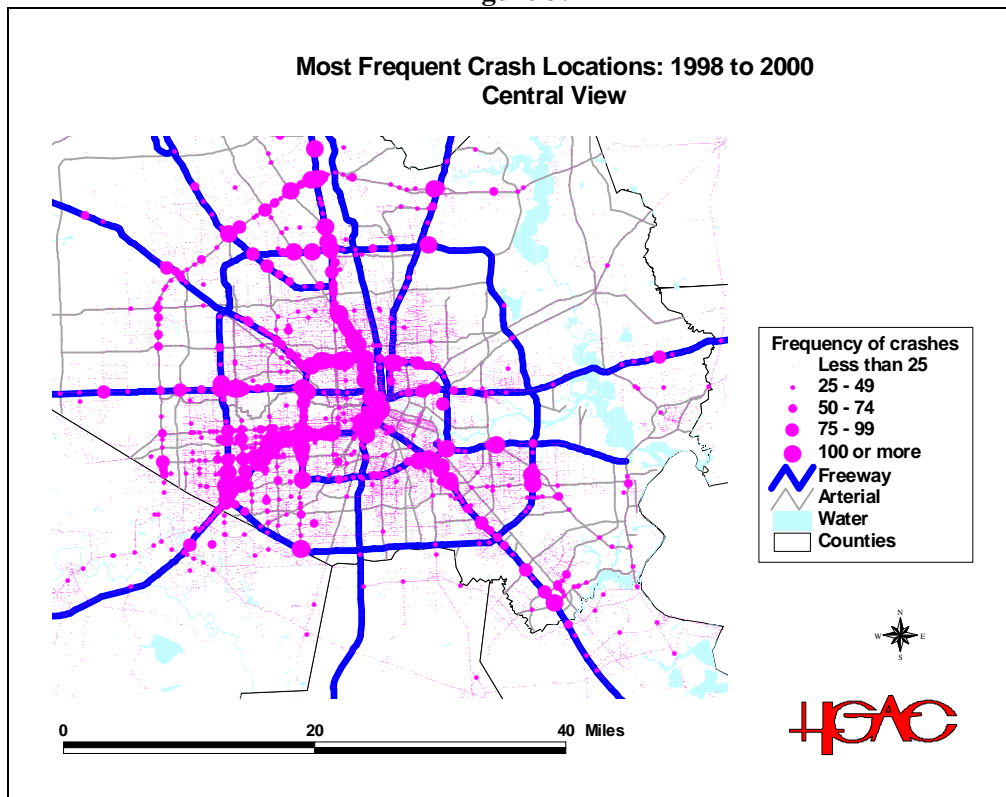
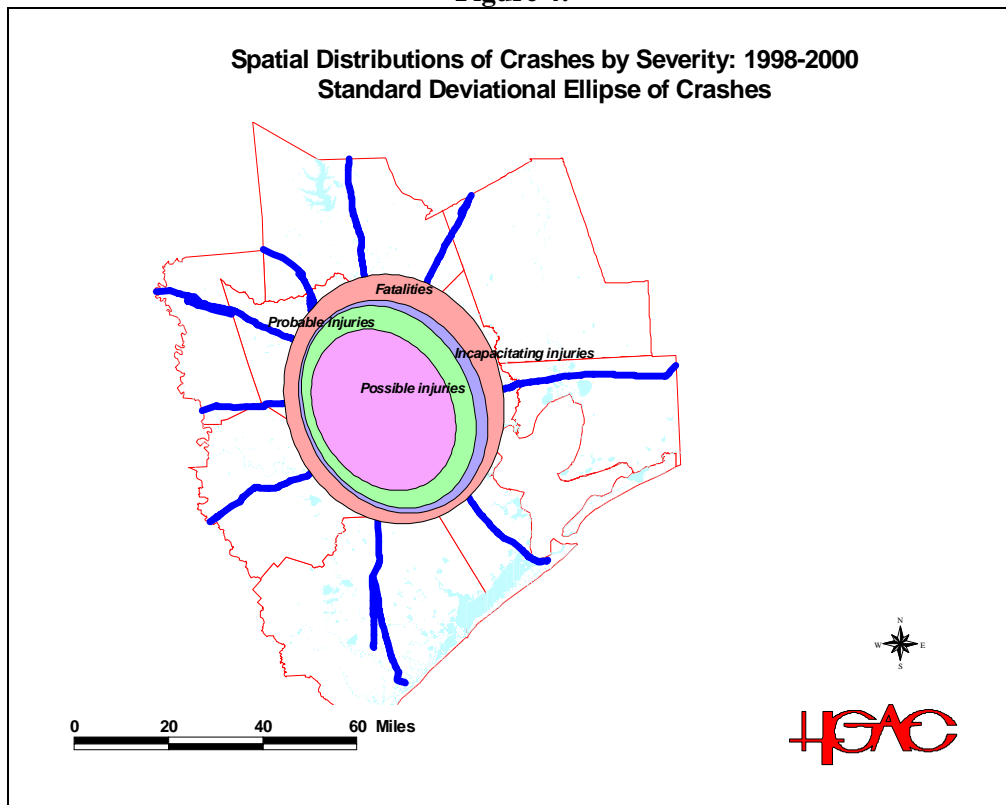
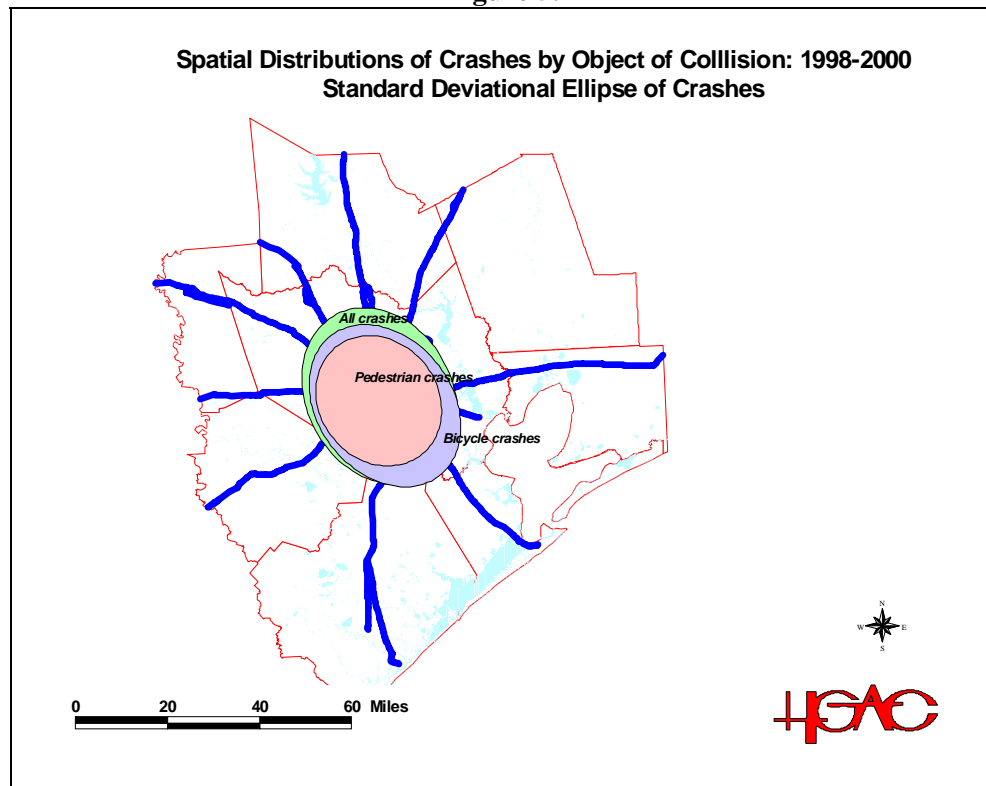


Figure 4:



**Figure 5:**



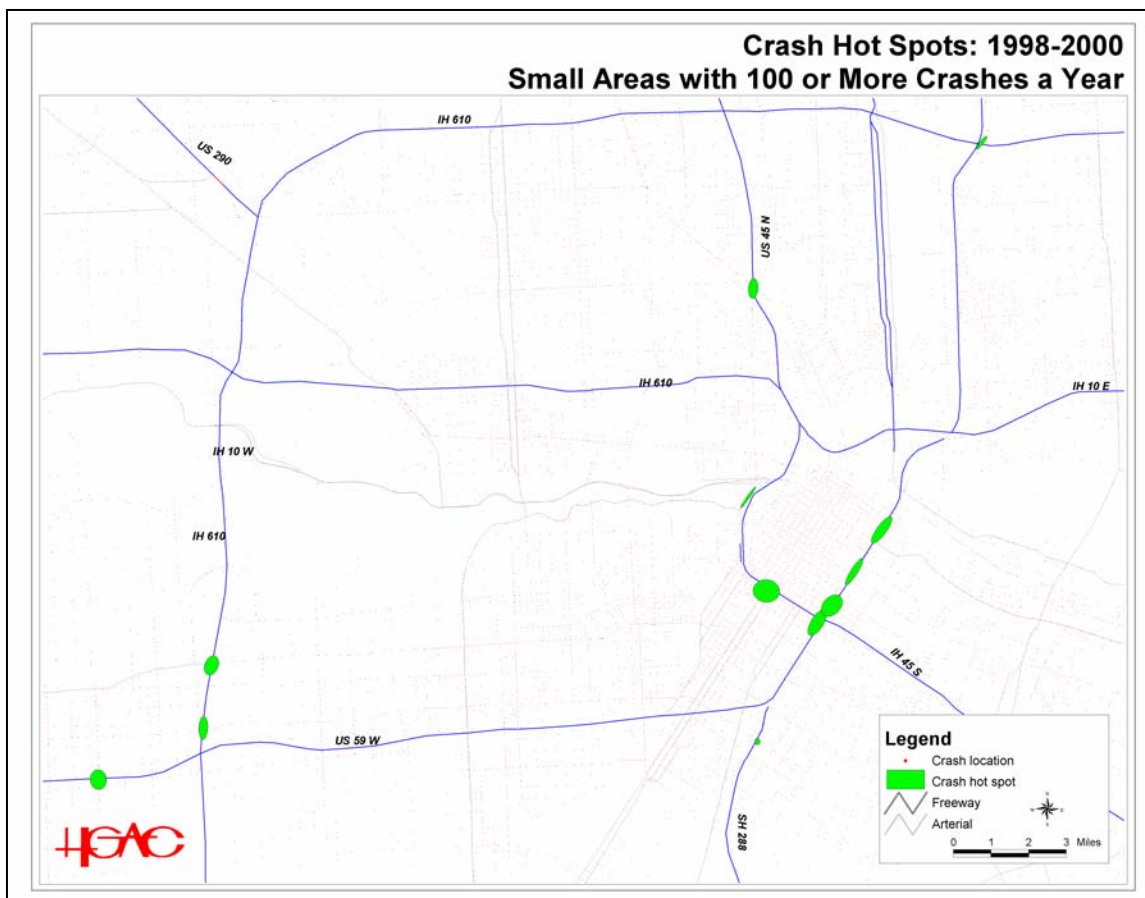
### *Crash risk analysis*

Fourth, there are crash risk analysis tools. Typically, the number of crashes is related to the traffic volume; the higher the traffic volume, the larger the number of crashes. Thus, it's not surprising that the major hot spots generally occur at locations with a high volume of traffic. An alternative approach, and one used frequently by traffic engineers, is to relate the number of crashes to the volume of traffic. The National Safety Council uses crashes per 100 million vehicle miles traveled (VMT). This allows a comparison between different roads, areas, and cities and is often necessary to know whether a particular roadway is dangerous or not.

### *Regional crash risk*

For example, for the region as a whole, there were, on average, 81,205 annual serious crashes between 1998 and 2000. For this period, annual VMT for the region was approximately 41.15 billion. Thus, the number of serious crashes in the region for the three-year period was 197 per 100 million VMT. To put this in perspective, the serious crash risk for the State of Texas was 150 per 100 million VMT for 1998-2000; because of the non-comparability of property damage crashes in Texas and the rest of the country, it was not possible to calculate a serious crash risk for the nation.

**Figure 6:**



### *County crash risk*

However, using the 150 Statewide baseline rate for the region, comparisons can be made. The eight counties have different crash risks:

<b>County</b>	<b>Crash risk</b>
Galveston	225
Harris	217
Brazoria	170
Liberty	148
Montgomery	147
Fort Bend	141
Waller	93
Chambers	60

Three counties (Galveston, Harris and Brazoria) have crash risks higher than the state average of 150. Galveston and Harris Counties, in particular, have very high crash rates.

*City crash risk*

There are differences between cities in crash risk as well. The following cities have the highest crash risk in the region:

<u>City</u>	<u>Crash risk</u>
Galveston	337
Baytown	334
Rosenberg	320
Pasadena	290
Conroe	247
Houston	231
Texas City	211

All of these cities have crash rates higher than the statewide average. H-GAC is holding meetings with these cities in order to sponsor safety studies to reduce their high level of crashes.

*Roadway crash risk*

Probably the most important comparison is between different roads. H-GAC has conducted an analysis of crash risk on selected roads. In general, the freeways have a lower crash risk while the major arterials (including the Farm-to-Market roads) have the highest. But there are exceptions. Crash risk was calculated for the following roadways and small areas (the base year is indicated in parenthesis):

<u>Roadway</u>	<u>Crash risk</u>
<b>John F. Kennedy Blvd.</b> (1999)	<b>505</b>
<b>Kirby Dr</b> (1999)	<b>415</b>
<b>Texas Medical Center</b> (1998-2000)	<b>314</b>
<b>FM 1960</b> (1998-2000)	<b>260</b>
<b>FM 518</b> (1998-2000)	<b>235</b>
<b>SH 35</b> (1999)	<b>229</b>
<b>SH 288</b> (1998-2000)	<b>199</b>
<b>FM 359</b> (1999)	<b>173</b>
<b>US 59 W</b> (1999)	<b>129</b>
<b>Spring Steubner Rd</b> (1999)	<b>69</b>
<b>Nichols Sawmill Rd</b> (1999)	<b>21</b>

It is clear that there are substantial differences in the safety of roadways, even controlling for traffic volume (which is what crash risk measures). At Bush International Airport, John F.

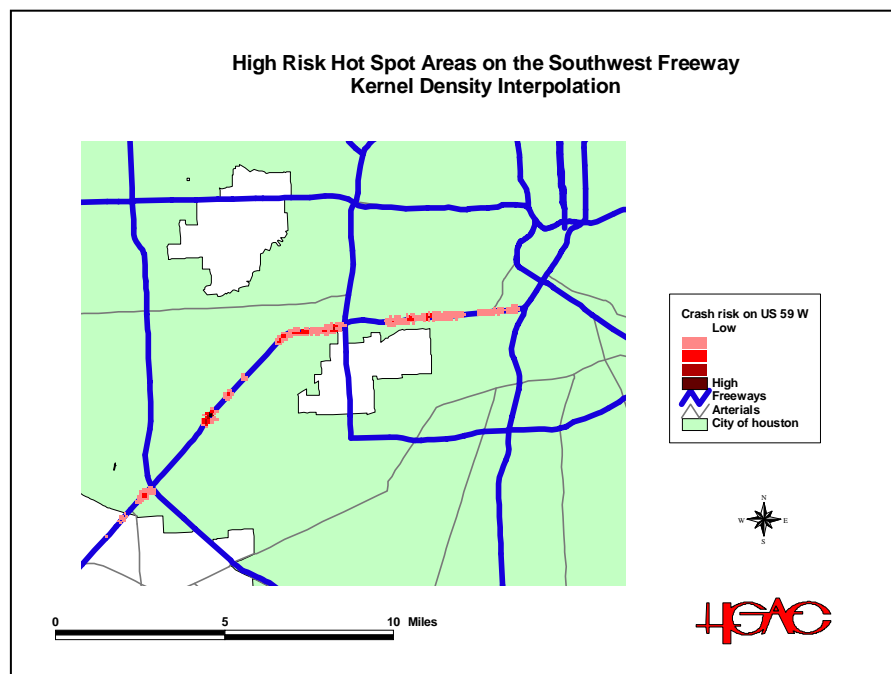
Kennedy Blvd has the highest crash risk in the region that we've yet identified; it is more than three times higher than the statewide average. The access in and out of the airport leaves a lot to be desired in terms of clear signs and safety. Vehicles, particularly visitors in rental cars, have to suddenly change lanes to access particular airline terminals. The situation is in dire need of improvement.

There are other roads that also have severe crash risks. Kirby Drive has a crash risk more than double the regional average and over two-and-a-half times the statewide average. The streets in and around the Texas Medical Center, particularly Main Street, Fannin St, and Holcombe Blvd have a high crash, more than twice that of the statewide average; they also have a sizeable number of pedestrian crashes each year particularly on Fannin St. In addition to these, FM 1960, FM 518, and SH 35 all have high crash risks. There are, undoubtedly, additional roadways with high crash risks. But, these are the ones that H-GAC has documented to date.

#### *High- risk hot spots*

The analysis of crash risk can be combined with that of crash hot spots. There are hot spots that have a high concentration of crashes relative to the underlying traffic volume. For example, figure 7 shows a kernel density interpolation of crashes relative to traffic volume on the Southwest Freeway (US 59 W).<sup>14</sup> As seen, several stretches of US 59 W have a higher crash risk. These are stretches where both there are a high number of crashes and a high number relative to the traffic volume.

**Figure 7:**



<sup>14</sup> The interpolation was produced by overlaying a grid over both a layer of crash data and a layer of traffic volume data and interpolating the data on each layer to the grid cells. The estimate of crashes was then divided by the estimate of traffic volume to produce an approximate crash risk.

## **Safety Applications**

H-GAC uses the crash information system for a variety of purposes. First, the crash information system is used to provide statistical summaries, as illustrated above in figure 7. Second, the crash information system is used to identify hot spots. H-GAC then works with the local governments and with TxDOT to study particular hot spots with the aim of proposing mitigation measures that will reduce crashes at those locations. Third, H-GAC uses the crash information system to identify types of crashes with the aim of monitoring particular types of policies. Fourth, H-GAC uses the crash information system to evaluate projects for inclusion in the long-range plan and for inclusion in the Transportation Improvement Program (TIP) list that is approved for funding from Federal and state revenue sources. Fifth, H-GAC has developed a long-range safety goal of mitigating crashes in the worst hot spots. A brief discussion of these applications follows.

### **Statistical Crash Summaries**

As mentioned above, the information system can allow the identification of crash volumes and crash risk for different roadways or different jurisdictions. Comparisons of the safety levels for different counties and cities was discussed above. H-GAC has produced a series of county, small area, and corridor analyses that are available from the safety page of the H-GAC web site (<http://www.h-gac.com/safety>).

In addition, one of our major safety products has been the analysis of crashes along particular roadways. To date, H-GAC has analyzed safety along US 59 W, SH 288, SH 35, FM 518, FM 1960, FM 359, Kirby Drive, John F. Kennedy Blvd, Spring Steubner Rd, Nichols Sawmill Rd, the Texas Medical Center, and the East End of Houston. The analysis identifies the overall volume of crashes, crash hot spots, and high-risk hot spots where relevant. Many of these write-ups are available on the H-GAC safety page.

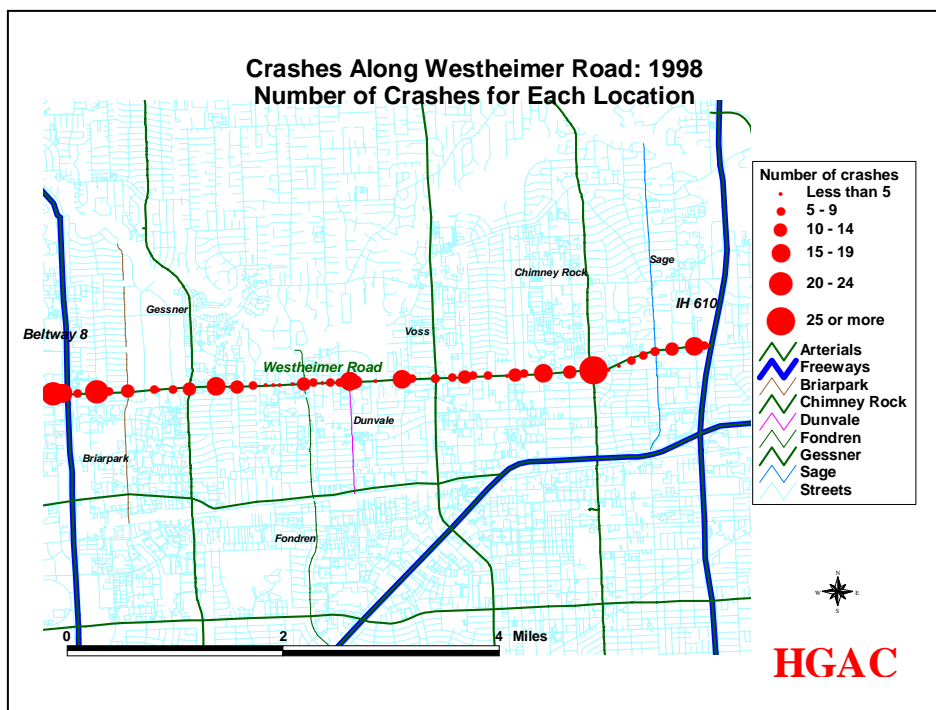
### ***Hot Spot Mitigation***

Aside from comparing roadway in terms of safety, a major effort of our safety program is to mitigate crashes. Using hot spot analysis, H-GAC works with the local government, with TxDOT, and other safety partners to study the causes of crashes at the hot spot. This type of methodology is consistent with Federal guidelines. In order to receive Federal safety funds for mitigating a hot spot (called a *hazardous location*), it is necessary to conduct an *engineering* study. This study examines each of the crashes that have occurred over a number of years and identifies a repeatable and preventable pattern. The study then makes recommendations to mitigate the hazards and conducts a benefit-cost analysis of each recommendation. The measures with the highest benefit-cost ratios are to be selected for funding. Appendix A presents a brief discussion of the Federal legislative basis for hot spot mitigation.

To date, H-GAC has completed three studies of hot spots and will start several others during 2004. First, H-GAC commissioned a study of two hazardous intersections along Westheimer Road: Chimney Rock and Dunvale. Figure 8 shows the number of crashes at the two locations in 1998. The consultant (Klotz Associates) identified a number of factors contributing to the crashes and proposed recommendations for improving safety at those locations. In both cases, the proposed recommendations were inexpensive involving changing the traffic signals to larger, 12" backlit lights and repainting turn lanes. The study was given to the City of Houston who have integrated it into their improvement plan. This study and all others that will be completed can be found on the H-GAC safety page.



**Figure 8:**



Second, H-GAC commissioned a safety study of a hot spot in the East End of Houston. A small area that covers the arterials of Harrisburg, Canal, and Navigation, in the east-west direction, and 67<sup>th</sup> St/Cesar Chavez Blvd, Wayside, and S/Sgt Macario Garcia, in the north-south direction, has been identified as having a large number of crashes, including with many pedestrians and bicyclists (Figure 9). H-GAC has partnered with the City of Houston (Public Works & Engineering, Police Department, Mayor's Office), TxDOT, the Injury Prevention Center of Texas Children's Hospital, the East End Management District, and METRO to study the factors causing the crashes. The consultant (Texas Transportation Institute) recommended fairly inexpensive improvements to minimize sideswipe crashes (e.g., lane markers, clearer striping) and reduce the number of red light running crashes (larger, backlit 12" traffic signals; clearer lane definition). Again, this study was presented to the City of Houston who have included it in their planned maintenance recommendations.

Third, H-GAC has commissioned a study of five high crash intersections within the City of Pasadena (Figure 10). The consultant (Texas Transportation Institute) has identified patterns of crashes at these intersections, mostly involving red-light running, and is proposing mitigation measures improve safety at each. When complete, the study will be presented to the City of Pasadena.

In addition to these studies, H-GAC has initiated discussions with cities throughout the region with the aim of sponsoring safety studies. Discussions have been held with the Cities of Galveston, Conroe, Sugar Land, and Prairie View and with Fort Bend, Galveston, and Montgomery Counties. Figure 11 shows the location of high crash locations within the City of Galveston. H-GAC aims to eventually conduct studies of all major hot spots in every county within the region.

Figure 9:

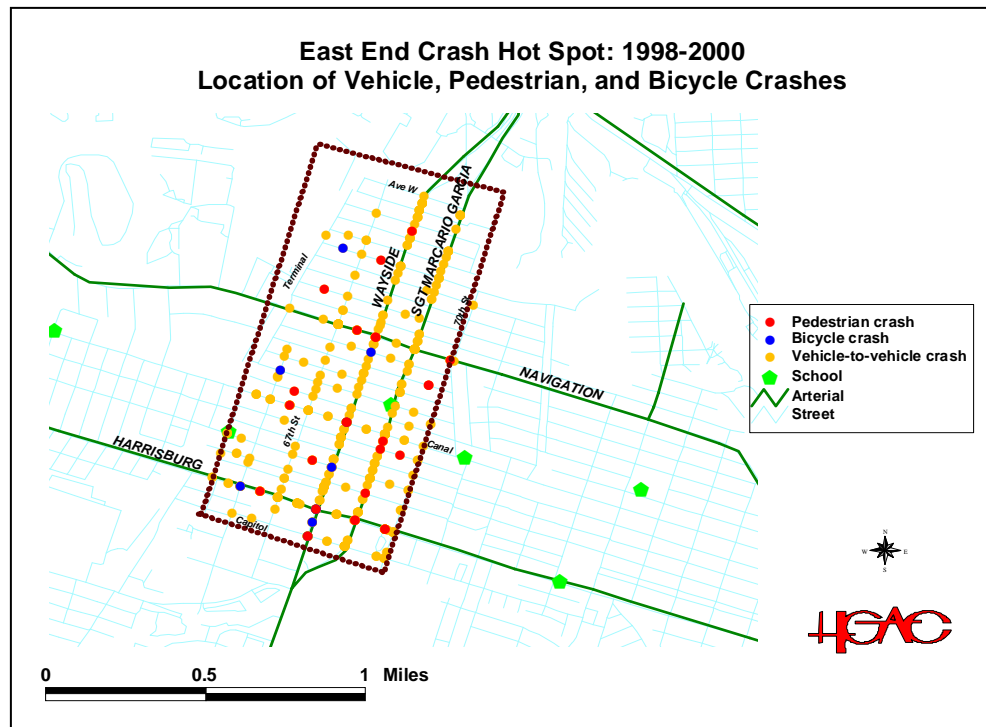
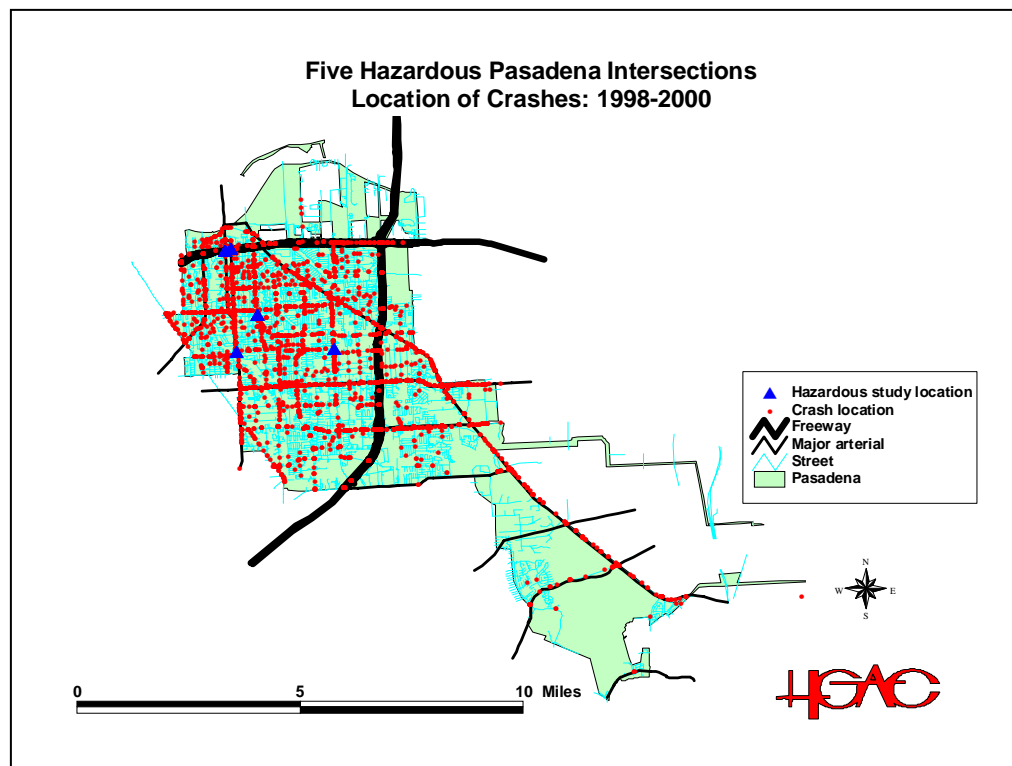
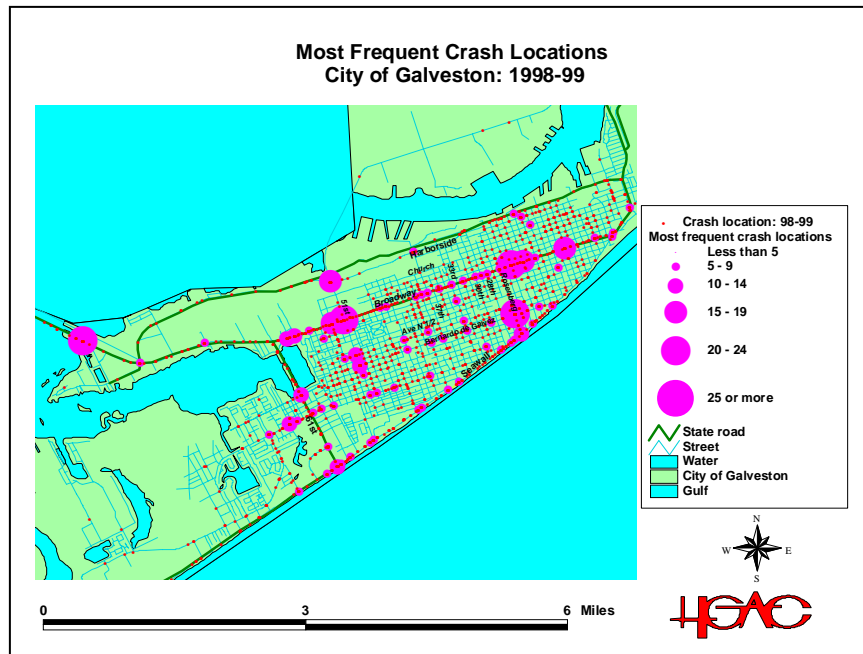


Figure 10:



**Figure 11:**



### ***Monitoring Different Crash Types***

In addition to identifying hot spots and working with local governments, H-GAC's crash information system is used to monitor particular types of crashes with the aim of formulating specific safety policies.

### ***Behavioral factors***

Driver error is involved in virtually every crash. Frequently, multiple errors are compounded in a crash. The State reporting form (ST 3) allows police officers to identify the major causes of crashes.

In the H-GAC region, the following factors are found in crashes. For each factor, if any of the drivers committed the error, the crash is identified as being associated with the behavior. Thus, multiple factors can be associated with a crash. The leading behaviors associated with crashes in the region are:

<b><u>Attributed cause</u></b>	<b><u>%</u></b>
Speeding	39%
Failing to yield to another vehicle	20%
Failing to stop at a signal or stop sign	11%
Running a red light	8%
Driving under the influence	7%
Following too close	3%
Making an improper turn	2%

We will look briefly at each of the top five behavioral factors.

### ***Speeding crashes***

By far, speeding is the most common behavior factor associated with crashes. It is involved in 38.9% of all crashes in our region. Further, the proportion of crashes involving speeding in the region appears to be higher than the national average (13%).<sup>15</sup> Figure 12 shows the location of speeding crashes. As seen, they occur throughout the region. Without a doubt, speeding is associated with more severe crashes. Of the speeding crashes, 0.5% had fatalities and 67.4% had injuries. Teenagers are slightly more likely to be involved in speeding crashes than non-teenagers (21.9% v. 20.0%).

Clearly, more enforcement is necessary to reduce speeding crashes. H-GAC supports all law enforcement efforts and supports more effective enforcement in order to reduce a serious speeding problem.

### **Failing to yield**

The second most common behavioral factor associated with crashes is failing to yield the right-of-way to another vehicle (19.9% of all crashes). Again, the severity is fairly high: 0.3% involve fatalities and 65.6% involve injuries. Teenagers are more likely to be involved in failing to yield crashes than non-teenagers (25.5% v. 19.5%).

Solving this problem is going to require an interaction between enforcement and engineering. Enforcement is important so that drivers take the time to stop at traffic control devices while improvement in access management, signage and road indicators can help minimize traffic conflicts.

### **Failing to stop**

Failing to stop at a traffic control sign or at a signal while turning is involved in 11.0% of crashes. The severity levels are particularly high for this type of crash as 0.6% involved fatalities and 69.9% involved injuries. Teenagers are not more likely to be involved in this type of crash than non-teenagers.

Reductions in these types of crashes will come about through increased enforcement as well as improvement in signage and directional indicators. Sometimes, drivers fail to stop because they are confused by signs. Most of the time, however, drivers don't want to take the time to properly stop. Increased enforcement can improve that situation.

### **Red-light running crashes**

Running red lights is another major safety problem, being associated with 7.7% of the crashes.<sup>16</sup> It is a 'failure to stop' offense, but is separated out as its own category on the state crash reporting form. Figure 13 shows a map of the frequency of red-light running crashes. An inspection of these high crash intersections shows that many are on a frontage road at the intersection with an

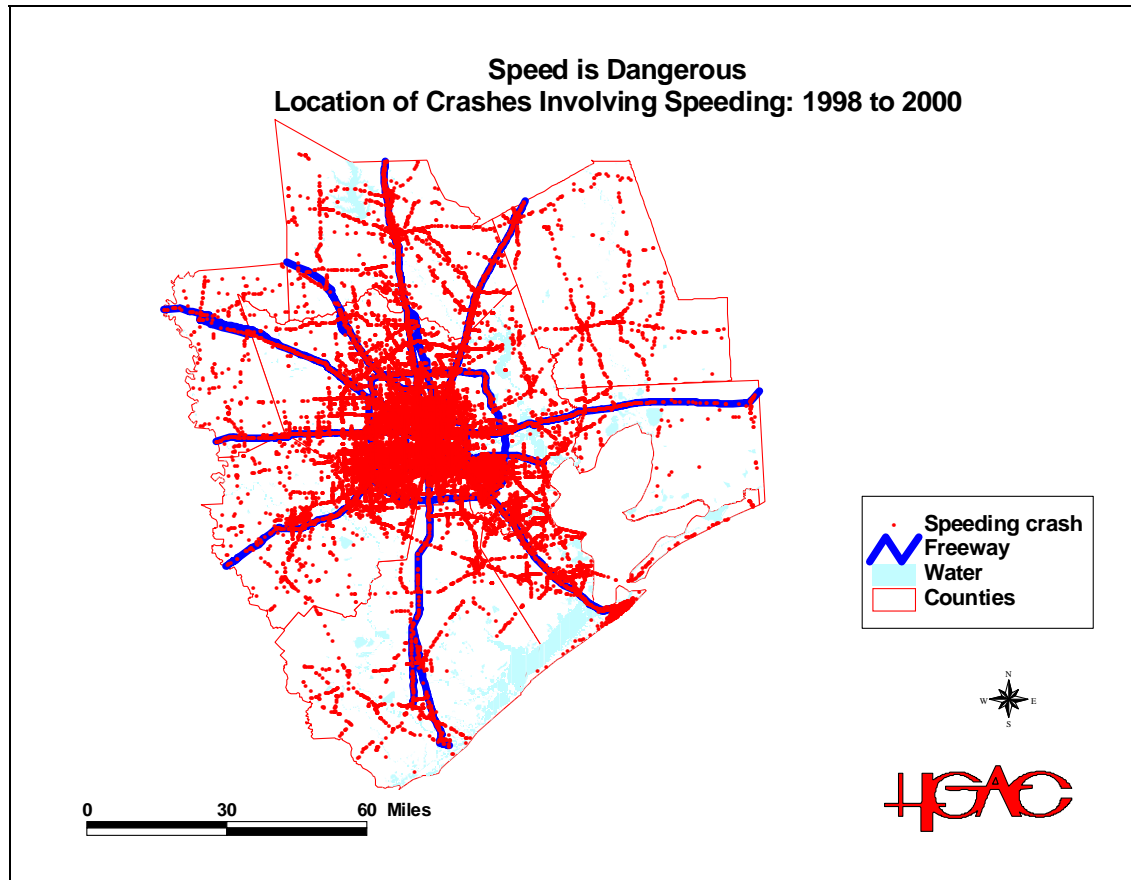
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<sup>15</sup> National Safety Council, *Injury Facts:2000*; National Safety Council: Washington, DC., 2001, 93.

<sup>16</sup> The national estimate is 5%. National Safety Council, *ibid*.

arterial. These locations are particularly hazardous. Of the 18,589 red-light running crashes in the region between 1998 and 2000, 0.5% involved fatalities and 70.8% involved injuries.

**Figure 12:**



H-GAC supports increased enforcement of traffic signals in order to reduce the number of red-lights that are run. One very effective measure is the use of automated cameras that photograph vehicles running a red-light. While the Texas Legislature has, so far, refused to enact a red-light camera law, H-GAC highly encourages them to do so, as the evidence is fairly overwhelming about the reduction in crashes that can occur.<sup>17</sup> As of May 2003, there were 79 communities in the United States who had adopted red-light cameras, and the numbers are growing rapidly. Many of the concerns about violation of individual rights and unreasonable signal tolerances can be easily dealt with today's technology.

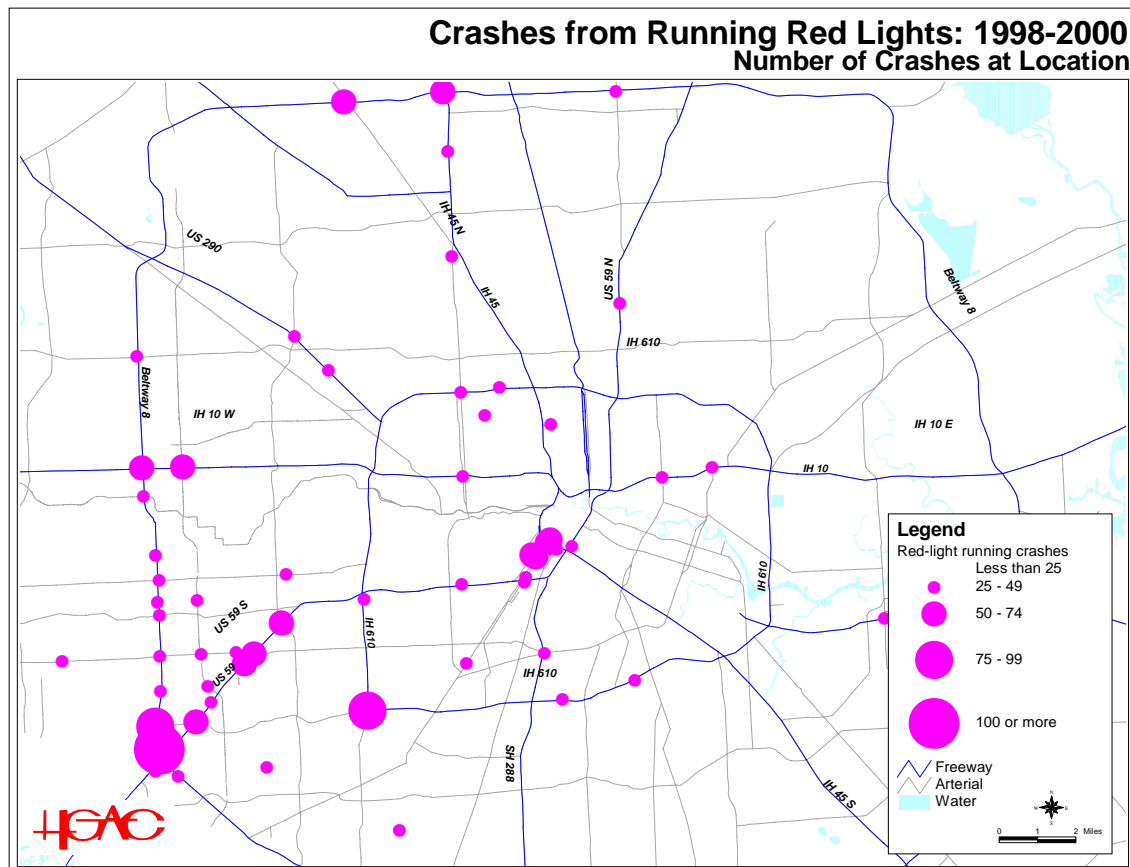
#### Driving under the influence

Driving under the influence of alcohol or drugs (DUI) is a particularly dangerous behavior. It is involved in at least 6.6% of the region's serious crashes. Nationally, alcohol is the single largest

<sup>17</sup> Insurance Institute for Highway Safety, "Red light cameras". Arlington, VA;  
<http://www.hwysafety.org/safety%5Ffacts/rlc.htm>

cause of fatal crashes. In our region, alcohol- or drug-related fatalities accounted for 37% of fatalities; nationally, DUI accounted for 41 percent of all highway fatalities in 2001.<sup>18</sup>

Figure 13:



In the region, according to the DPS database, 36.6% of fatal crashes had alcohol or drugs identified by the investigating police officer; the percentage is probably higher as the crash record is not updated after an autopsy. Overall, 3.6% of DUI crashes involve fatalities and 61.3% involve injuries (9.6% being incapacitating injuries). Contrary to popular opinion, teenagers are less likely to be involved in DUI crashes than non-teenagers (13.3% v. 21.2%).

H-GAC supports increased enforcement of existing DUI laws. In Texas, the acceptable blood alcohol content (BAC) is 0.08. Any driver who has been shown to have a BAC in excess of this level or higher can be arrested and subject to a fine or prison term and loss of license. To some extent, DUI-related deaths have decreased in Texas. Yet, enforcement can certainly be improved.

<sup>18</sup> Bureau of Justice Statistics, "Alcohol-related highway fatalities".  
[http://www.bts.gov/products/transportation\\_indicators/december\\_2002/Safety/html/Alcohol\\_Related\\_Highway\\_Fatalities.html](http://www.bts.gov/products/transportation_indicators/december_2002/Safety/html/Alcohol_Related_Highway_Fatalities.html)

For example, current state law mandates an autopsy of drivers to detect whether alcohol or drugs have been used. Yet, according to the Texas Transportation Institute, autopsies are involved in only around 33% of all fatal crashes.<sup>19</sup> Further, the rate of conducting autopsies after a fatal crash has substantially decreased substantially over the years.

### Bicycle and pedestrian crashes

The region has a serious problem for bicycle and pedestrian safety. Approximately 25.7% of the state's pedestrian crashes and 28.3% of the state's bicycle crashes occur within the eight-county region.

### Pedestrian crashes

From 1998 to 2000, there were 3,571 pedestrian crashes in the eight counties. This was 25.7% of the State's total. Of these pedestrian crashes, 2,488 (or 69.7%) occurred within the City of Houston, which alone accounted for 17.9% of the entire pedestrian crashes in the State. Of the 3,571 pedestrian crashes, 261 involved fatalities and 3,310 involved injuries.

The pedestrian crashes tend to concentrate in certain areas, typically where there are concentrations of pedestrians. The downtown area had the highest concentration followed by the midtown region, Sharpstown, and Galleria/uptown. Still, there are numerous other areas with many pedestrian crashes: Westheimer/Montrose, the East End, the Gulfton area, the Texas Medical Center, the Heights, and other areas. Some of these areas have concentrations of low income populations and some have concentrations of immigrant populations. The higher use of transit by low income and unfamiliarity with American road conditions *may* be a factor in some pedestrian crashes, though many counter-examples can be given.<sup>20</sup>

Among the driving factors associated with pedestrian crashes are speeding (involved in 6.1% of pedestrian crashes), failure to yield (3.7%), and DUI (3.2%). In the case of DUI and failure to yield, it's not clear whether the driver or the pedestrian was at fault. National data suggest less than half of pedestrian crashes occur at pedestrian crossings and that children and elderly have particularly high rates (24.3% are under 15 and 13.3% are 65 or older).<sup>21</sup> Our data does not support a higher rate for elderly; only 5.2% of pedestrian crashes involve elderly (compared to their 8.0% of the driving-age population).

H-GAC has been conducting studies of areas with a high number of pedestrian crashes with the aim of trying to mitigate those crashes. The H-GAC safety page presents a study of safety in the East End of Houston, which has a sizeable number of pedestrian and bicycle crashes (<http://www.h-gac.com/safety>). H-GAC expects to do more of these studies in the future.

### Bicycle crashes

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<sup>19</sup> Becky T. Davies, "Impediments to efforts to reduce impaired driving in Texas". Center for Transportation Safety, Texas Transportation Institute: College Station, TX. Manuscript. Oct 21, 2003.

<sup>20</sup> Insurance companies frequently cite higher risk among immigrant populations. In support of this, the East End and the Gulfton areas of Houston have high concentrations of immigrants. However, the downtown, mid-town, and Galleria areas also have many pedestrian crashes but are have small proportions of their population who are immigrants. It is an open question whether immigrants are more likely to be hit as a pedestrian.

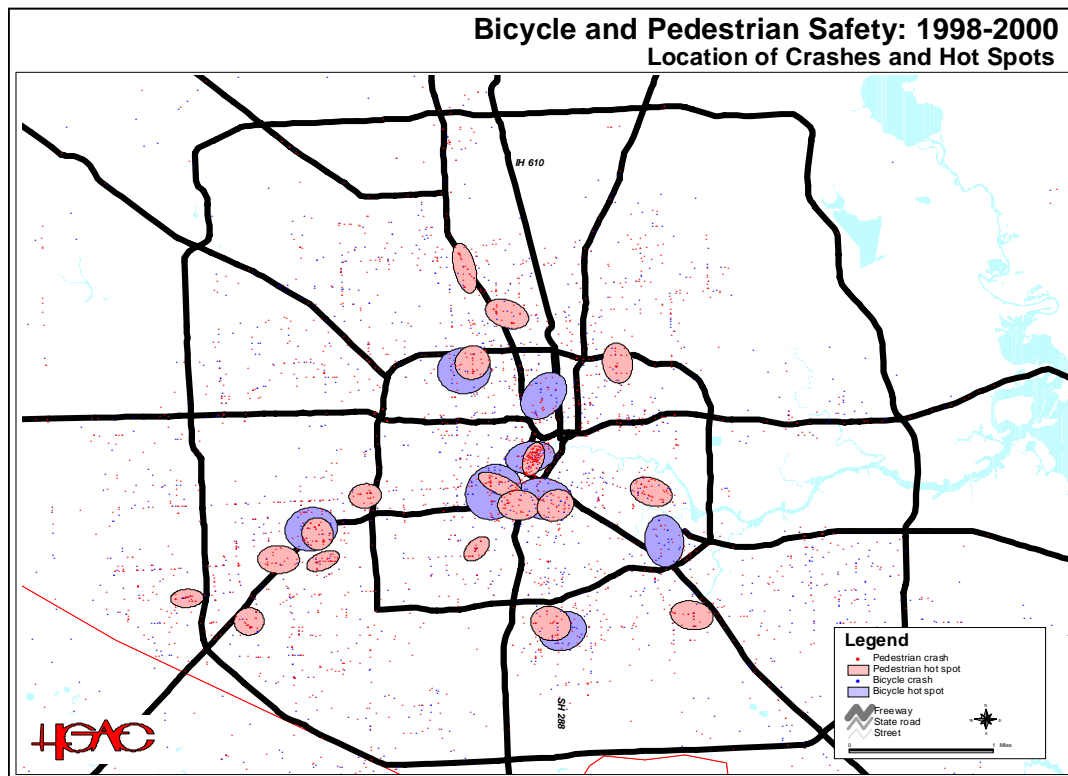
<sup>21</sup> National Safety Council, *Injury Facts:2000*; National Safety Council: Washington, DC., 2001, 96

In the region, there were 2091 bicycle crashes from 1998 to 2000. This was 28.3% of the State's total. Of these, 1188 (or 56.8%) occurred within the City of Houston. Of the 2091 bicycle crashes, 40 involved fatalities and 2051 involved injuries.

As with the pedestrian crashes, bicycle crashes tend to be concentrated, though to a lesser extent. The downtown area has the highest number followed by the East End, the south Cullen area, the Heights, and the universities area.

Among the driving factors associated with bicycle crashes are speeding (6.9% of all bicycle crashes), failing to yield (13.6%), failing to stop (2.7%), and DUI (1.6%). Again, as with the pedestrian crashes, it is not clear whether the driver or the bicyclist was at fault in failure to yield, failure to stop, or DUI crashes. Teenagers do not have a higher rate of bicycle crashes than non-teenagers and, of course, the elderly have a much lower rate. National data suggest the highest bicycle fatality rates are among the 25-44 year old population followed by the 5-14 year old population.<sup>22</sup>

**Figure 14:**



### *Crashes involving teenagers and elderly*

#### *Teenagers*

Crashes involving teenagers is a major problem. For the region as a whole, 20.7% of all the crashes involve teenagers. This is compared to its 9% share of the driving age population. There

<sup>22</sup> National Safety Council, *Injury Facts:2000*; Washington, DC., 2001, 97.



is a higher proportion of crashes involving teenagers than for the nation as a whole (16%), a result primarily due to our relatively young age structure. Most significantly, the percentage of crashes involving teenagers generally increases in the suburbs as the following breakdown by counties shows:

<u>County</u>	<u>% of Crashes Involving Teenage Drivers</u>
Brazoria	29%
Chambers	23%
Fort Bend	29%
Galveston	26%
Harris	19%
Liberty	24%
Montgomery	28%
Waller	21%

The reason for the higher proportion of crashes involving teenage drivers in the suburbs is not completely clear. The suburbs generally have an older population than the central city. Thus, the higher suburban rates cannot be explained just by the age distribution. Part of the reason may involve the higher speeds that generally occur in the suburbs and part may reflect higher incomes since the more affluent suburban counties have higher rates than the less affluent counties. There is some research that suggests that the high rate of teenage driver crashes is associated with teenager passengers, who increase substantially the likelihood of a crash for a teenage drive.<sup>23</sup>

Another factor that has been suggested is lack of experience in driving; during the first few years of driving, at any age, an individual is more likely to make errors. But, even with inexperienced drivers, teenagers are more likely to make errors than persons of other age groups.<sup>24</sup>

Crashes involving teenage drivers is not a new problem and has been observed since the National Safety Council started gathering crash statistics in 1913. For example, of the fatal crashes in the region from 1998 to 2000, 16.5% involved a teenage driver. Of the serious incapacitating type of crashes, 19.4% involved a teenage driver. Teenagers are much more likely to be involved in serious crashes than other age groups. Nationally, teenager drivers have the highest death rates per mile driven than any other age group.<sup>25</sup> The problem is particularly bad among 16 year olds. This age cohort has a crash involvement 75% higher than 17 year olds. Sixteen year olds are more likely to make driver errors, speed, and be involved in single vehicle crashes than any other age group; they are also more likely to carry three or more passengers.

H-GAC believes that special attention should be devoted to teenage drivers. For one thing, restrictions on teenage drivers would be warranted since it will save lives and prevent injuries. Most states have adopted graduated licensing laws whereby the teenage driver is supervised and

<sup>23</sup> Allan F. Williams, *Teenage Passengers in Motor Vehicle Crashes: A Summary of Current Research*. Arlington, VA; <http://www.hwysafety.org>

<sup>24</sup> University of Massachusetts, Amherst, "Novice drivers seldom anticipate dangers on road, UMass researcher finds". News Release, November 15, 2002, <http://www.umass.edu/newsoffice/archive/2002/111502drivers.htm>

<sup>25</sup> Insurance Institute for Highway Safety, *Teenage Driving Facts*. Arlington, VA; [http://www.hwysafety.org/safety\\_facts/teens/teenager.htm](http://www.hwysafety.org/safety_facts/teens/teenager.htm)

there are limits on the number of passengers, particularly other teenagers.<sup>26</sup> Recently Texas strengthened its laws controlling teenage drivers, earning an “acceptable” rating by the Insurance Institute of Highway Safety. Unfortunately, the data that we have was gathered before the changes in the law, so it’s too early to evaluate. But, it would be expected that the number of crashes involving teenagers should decrease.<sup>27</sup>

## **Elderly**

The elderly are not more likely to be involved in crashes than other age groups. Approximately 8.1% of the serious crashes involve elderly drivers, age 65 or older, while their percentage in driving-age population is 9.0%. However, the elderly are more likely to be killed or injured in a crash than other groups, primarily due to their frailty (National Safety Council, 2001; 76-77). There is also some evidence that the elderly have as high a crash risk on the basis of miles driven as teenagers, but have much lower exposure because they drive less.<sup>28</sup>

A lot of attention has been placed recently on horrendous crashes involving elderly persons. While such crashes do exist, they do, too, for other age groups. As mentioned above, the elderly, age 65 or older, are not more likely to be involved in crashes than other age groups, at least on a per driver basis, and certainly a lot less than teenagers. Still, attention must be devoted to this group because of their frailty and decreasing physical skills. Road signs need to be made to be visible by someone of poorer eyesight, as many elderly have this condition. Pedestrian signals should be timed to allow slower walking individuals time to cross. Traffic signals should be large (meaning 12” in diameter) in order, again, to allow someone with poorer eyesight to see. In short, improvements in traffic control systems will help to protect elderly persons from being killed or injured by motor vehicle crashes. Also, more frequent driving tests need to be implemented to ensure that elderly drivers are still physically capable of handling a motor vehicle. For those elderly drivers who fail a driving test, their driving license needs to be revoked.

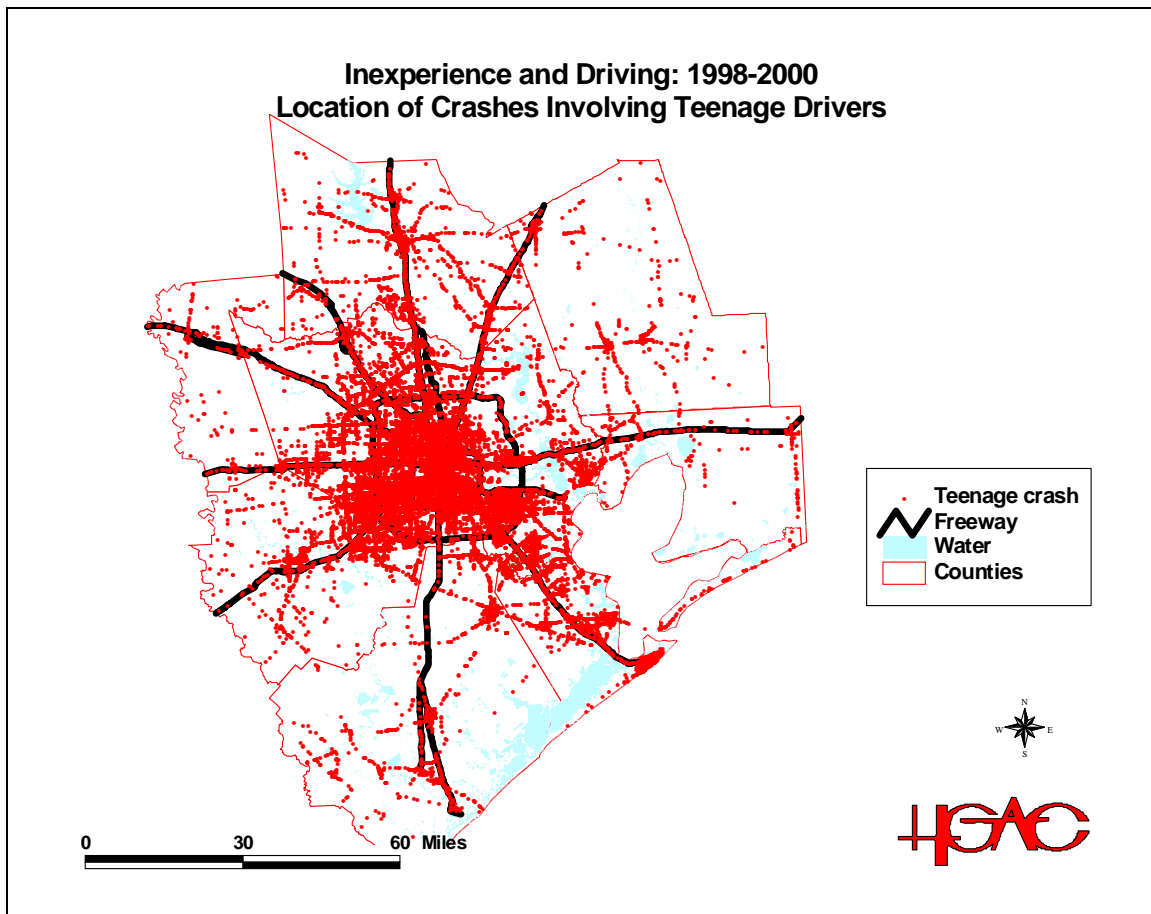
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<sup>26</sup> National Safety Council, *Injury Facts*:2000; Washington, DC., 2001, 80.

<sup>27</sup> In North Carolina, crashes involving 16 year olds dropped 26% between 1997 and 2000. Christian Science Monitor, August 18, 2000; <http://csmweb2.emcweb.com/durable/2000/08/18/p4s1.htm>.; Tri-State News, “Scientific Research on Graduated Driver Licensing Verifies Reduction To Teenage Drivers’ Risk”, February 19, 2003. <http://www.tristatenews.com/cgi-bin/articles/exec/view.pl?archive=6&num=920&printer=1>

<sup>28</sup> Insurance Institute for Highway Safety, *Q & A: Teenagers*. Arlington, VA, [http://www.hwysafety.org/safety\\_facts/qanda/teens.htm](http://www.hwysafety.org/safety_facts/qanda/teens.htm).

**Figure 15:  
Elderly crashes**

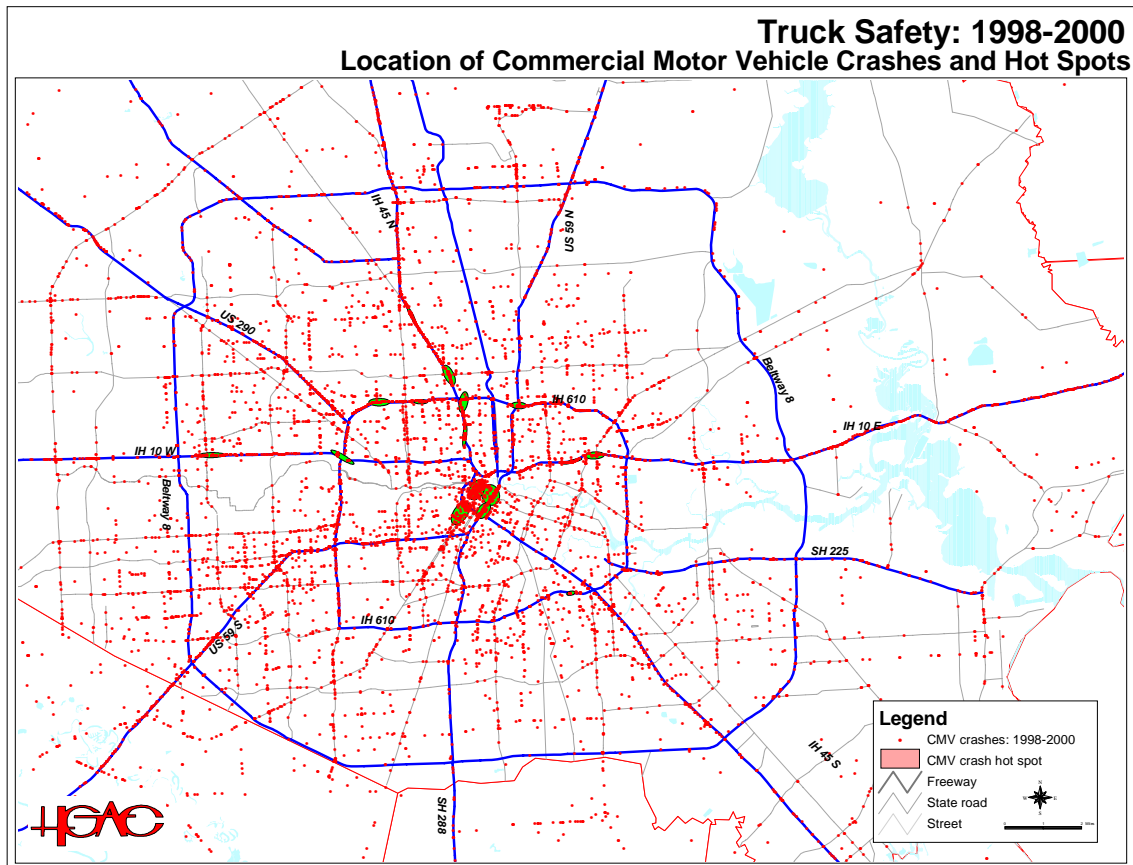


### *Truck crashes*

Because of the economic importance of freight, safety is of paramount consideration. Again, the Houston-Galveston region appears to have a serious safety problem. From 1998 to 2000, there were 15,007 crashes involving a commercial motor vehicle. This was 6.1% of all motor vehicle crashes in the eight-county region. Comparing these to the rest of the state is difficult. But a rough estimate can be obtained by calculating the per capita rate. Unfortunately, we only have 1999 data. In 1999, the number of commercial motor vehicle crashes per 100,000 population was 98.1 for the region while, for the State of Texas, per capita rate was 81.2. Thus, the region has a higher share of commercial motor vehicle crashes. Unfortunately, there is not good data on the number of commercial motor vehicles so that it's not clear whether the region's rate is high when compared to a more direct baseline.

Progress has been made in recent years due to increased weight enforcement on overweight trucks by the Houston Police Department and a "no trucks in the left lane" policy on IH-10 East and SH 225. From all accounts, severe truck crashes have been reduced on the eastern part of the region, primarily due to these policies. Nevertheless, more progress is needed.

**Figure 16:**



### ***Highway-Rail Grade Crossing Collisions***

A major indicator of how railroad safety interfaces with road safety is the number of highway/railroad crashes. Between 1990 and June 2003, there were 1,183 crashes involving a railroad train and a motor vehicle in the eight-county region, an average of about 95 a year. Unfortunately, for State and local level comparisons, there are not good baseline data. Consequently, the region's highway/rail safety is compared to the State total. Regarding rail safety, the region has a relatively severe problem, which appears to be getting worse. According to the Federal Railroad Administration, from 2000 to 2002, there were 247 highway/rail crashes in the region (there was no information for Chambers County). These involved 13 fatalities and 74 injuries. The 247 crashes accounted for 23.2% of the State's total highway/rail crashes.

However, compared to 10-years earlier (1990-1992), the percentage of highway/railroad crashes in the region decreased only slightly, but has increased as a share of the state's rail-highway grade crossing crashes; between 1990-92, the region had 252 crashes and accounted for only 15.8% of the State's total highway/rail crashes (Federal Railroad Administration database, 2003; <http://safetydata.fra.dot.gov/officeofsafety/>).

Part of this proportional increase can be explained by the region's increasing share of population. In 2000, for example, the region had 22.3% of the State's population. But, the fact that total highway/rail crashes in Texas decreased over the 10-year period from 1594 to 1073, whereas the region showed no changes in these types of crashes, suggests that safety measures have not been sufficiently taken to reduce the number of highway/rail crashes.

H-GAC has identified eight locations where there were eight or more highway/rail crashes between 1990 and June 2003:

1. Knapp Road and a BNSF (Burlington Northern Santa Fe) line in Brazoria County (13 crashes)
2. Almeda Genoa Road and a BNSF line in Harris County (13 crashes)
3. Market Street and a UP (Union Pacific) line in Harris County (12 crashes)
4. Antoine Drive and a BNSF line in Harris County (10 crashes)
5. FM 1960 and a BNSF line in Harris County (9 crashes)
6. Lawndale Road and a BNSF line in Harris County (9 crashes)
7. Hillcroft and a UP line in Harris County (8 crashes)
8. Park Terrace/Shady Park Drive and a UP line in Harris County (8 crashes)

There are 22 more locations where there were 5-7 crashes between 1990 and June 2003. In addition, there are small areas (hot spots) where there are many crashes involving trains and motor vehicles, including the East End of Houston, the Pasadena-La Porte area, and the US 90A corridor.

In short, rail-highway grade crossing safety is an important problem. To channel resources efficiently, H-GAC has placed a priority on improving safety at these locations. Consequently, all eight locations are recommended for inclusion in the RTP as potential projects.

Figure 17:

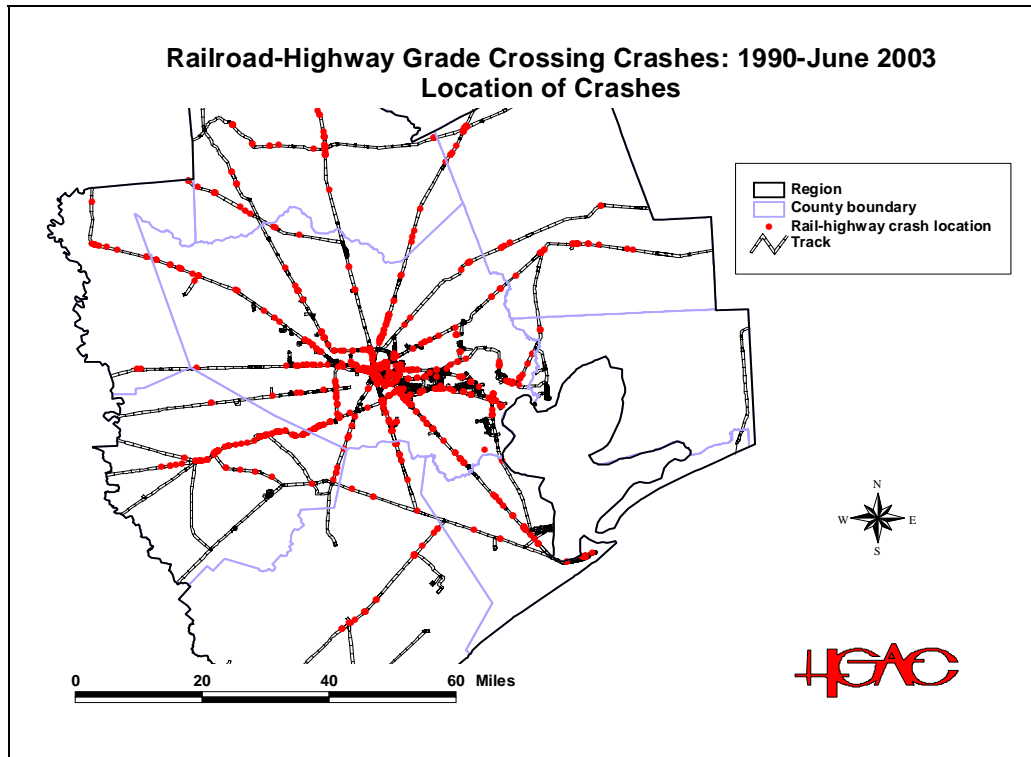
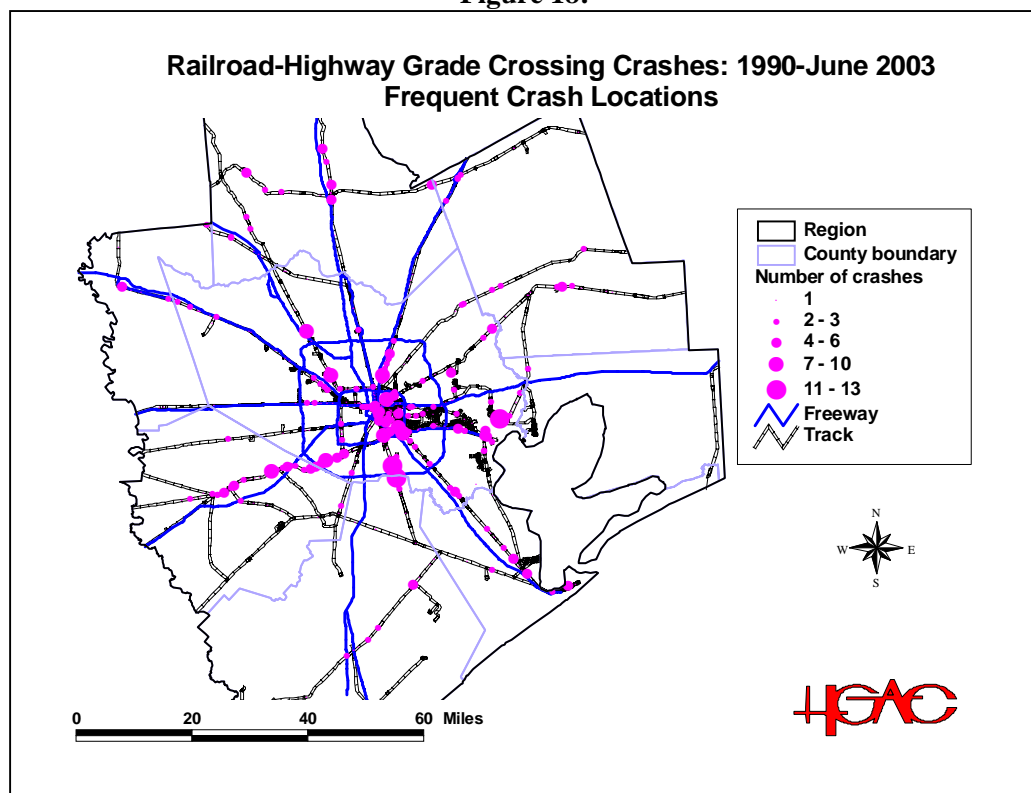


Figure 18:



## A Long-Term Strategic Safety Plan

H-GAC is developing a long-term safety plan that will significantly improve safety on the road system. The aim of our safety program is to improve safety by eliminating hazards on the roads. In order to set a long-range goal, H-GAC has identified 344 hot spot locations that account for about 20% of all crashes in the region. These hot spots were defined by those small areas with 78 or more serious crashes in the period of 1998-2000; these represents locations were there were, on average, a serious crash every two weeks over the three years. Many of these hot spots are also congestion ‘bottlenecks’. As part of the strategic safety plan, these hot spots are being prioritized for safety improvements. A 20% reduction in crashes at these locations will have a huge benefit in terms of congestion relief as well as human costs (personal, medical, insurance).

A rough estimate of the benefits and costs for mitigating these hot spots can be made. Without a detailed engineering study, the actual costs of mitigation cannot be calculated. However, as a rough estimate, on the assumption that each hot spot would cost on average \$500,000 to mitigate, the total costs would be around \$172 million; clearly, some hot spots (e.g., on freeways) would cost more while others would cost less.

The benefits would derive from the number of crashes reduced. On the assumption that mitigating each hot spot would reduce the total number of crashes at that location by 20% (again, some more and some less), it was estimated that there would be 39 fewer fatal crashes, 6,767 fewer injury crashes, and 3,065 fewer serious property damage only crashes. Using the National Safety Council methodology of estimating comprehensive costs and assuming that the distribution of fatalities and injuries for the crashes at these locations follows the same distribution as for all crashes, the approximate *annual* benefits were estimated as \$392 million.<sup>29</sup>

### Costs and Benefits of Hot Spot Mitigation

Type of Facility	Number	Number of Crashes	Estimated Cost to Mitigate	Estimated Annual Benefit
Freeway segments	150	7,766	\$75 million	\$58 million
Intersection between freeway & arterial road	70	3,756	\$35 million	\$28 million
Arterial road segments	124	4,930	\$62 million	\$37 million

Note that the annual benefit expected from improving hot spots (which would reduce the number of victims by more than 5,000 per year) almost covers the total costs for mitigating them. Based on these estimates, the benefits would pay for the costs of mitigation within a year and a half. In addition, there would be cumulative benefits for many years thereafter – 5,000 fewer victims each year, fewer medical costs, less pressure on emergency services, and less pressure on insurance rates (which are among the highest in the country).

H-GAC is committed to this goal and will work with TxDOT and with local governments to get a commitment to improve safety at these locations over the next twenty years.

<sup>29</sup> On average, for the region as a whole, each fatal crash produced 1.14 fatalities and each injury crash produced 1.76 injuries. These multipliers have been applied to the crash distribution for the 344 hot spots.

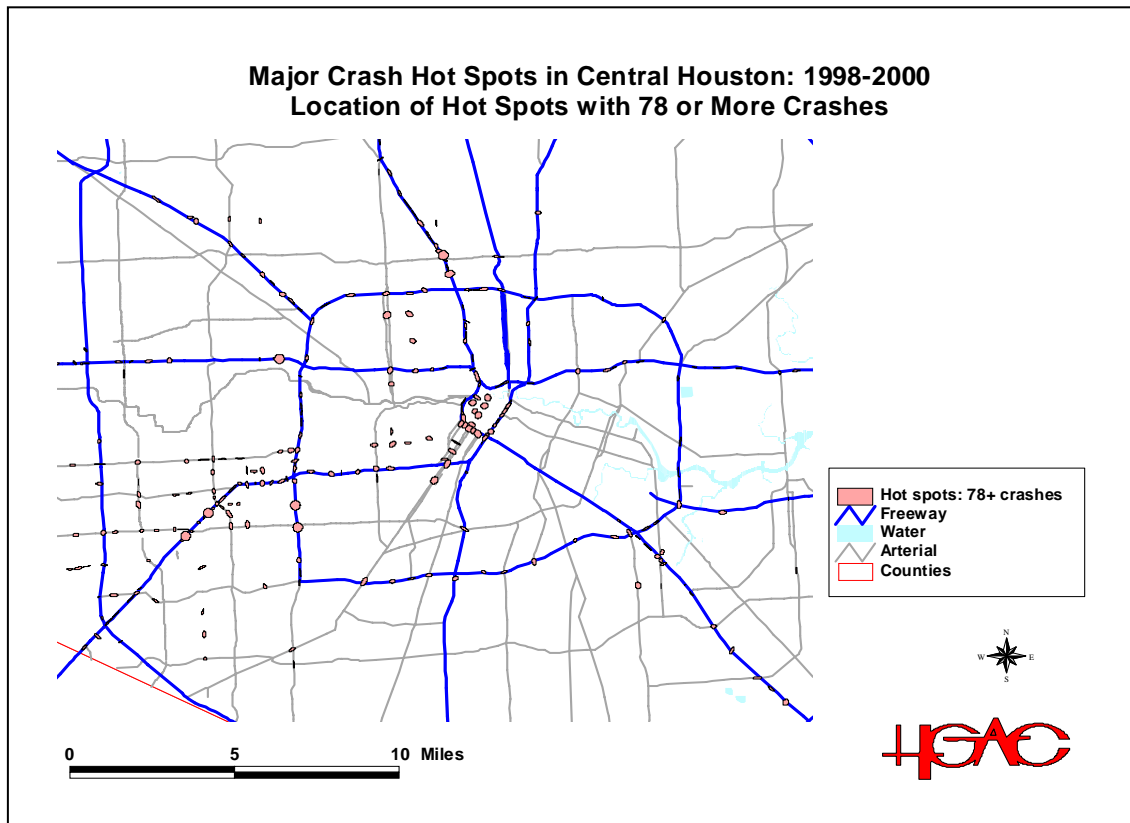
### ***Evaluating Projects for the Long-Range Plan***

H-GAC's transportation planning process includes a long-range plan that is developed every three years. Projects are submitted to H-GAC by TxDOT or local governments for inclusion in the long-range plan and for eventual funding. The projects are included on the basis of an evaluation. The Transportation Improvement Plan (TIP) includes those projects that are ready for implementation; all the engineering has been completed and financing has been arranged.

As part of the project evaluation processes, safety is being integrated as a significant factor. It is essential that projects that improve safety be given a higher ranking than those that don't. Conversely, projects that may hinder safety should be given fewer points and downgraded.

In order to implement this, H-GAC has established a point system for including safety in the projects. The process distinguishes between safety projects, which have their methodology dictated partly by Federal regulations, and non-safety projects for which safety considerations can be integrated.

**Figure 19:**



### ***Methodology for safety projects***

Safety projects are guided by Federal regulations. According to the most current Federal transportation law (the Transportation Efficiency Act for the 21<sup>st</sup> Century – TEA-21), 10% of the Surface Transportation Funds are allocated to safety, divided between two dedicated categories:



1. Railroad grade crossing safety (section 130 of Title 23 - 23 U.S.C. 130).
2. Hazard elimination of high accident locations on all public roads (section 152 of Title 23 - 23 U.S.C. 152). This is known as the *Hazard Elimination Program* (or HEP).

The allocation of funds within the 10% are not specified in the law except that the amount in each category cannot be less than the amount that were apportioned to the State in 1991. If there are additional funds beyond these levels, they may be used for other safety programs (e.g., safe communities, safe routes to school).

The Federal regulations (Part 924 – Highway Safety Improvement Program, April 1, 1998) specify the specific planning, implementation and evaluation categories that are to be used for safety. Among the more important points are, first, that funds apportioned under 23 U.S.C. 152, Hazard Elimination Program, are to be used to implement highway safety improvement projects on *any* public road including bicycle and other non-road categories, and, second, that highway safety improvements on the Federal-aid system may also be funded by 23 U.S.C. 103(a) and 23 U.S.C. 104(b). Highway safety improvements on non-Federal-aid system roads may also be funded by 23 U.S.C. 219, Safer Off-System Roads.

FHWA has issued guidelines on the implementation of the HEP called the Highway Safety Improvement Program (HSIP). It involves three components – Planning, Implementation, and Evaluation, with specific processes within each component to provide guidelines to see if a project is justifiable.<sup>30</sup> Many States, in turn, have created parallel documents with specific requirements for their State. There are four steps (called ‘processes’ in the HSIP manual):

1. Safety data collection
2. Hazardous location identification
3. An engineering study of the hazardous locations to identify crash patterns and causal factors, and to propose countermeasures
4. A prioritization of the recommended measures to mitigate the crashes.

A brief description of the steps is as follows.

#### *Safety Data Collection*

Virtually every state in the nation (including Texas) has a state agency that is responsible for collecting crash data. Thus, even though crash reports are compiled directly by the local police department that takes the information, copies of these reports are sent to the state agency if they meet the state reporting threshold. In Texas, the Accident Records Bureau of the Texas Department of Public Safety is the unit responsible for compiling these data. The Texas reporting criteria are that all crashes involving fatalities, injuries, or property damage where one or more vehicles were towed away must be reported.

#### *Hazardous Location Identification*

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<sup>30</sup> FHWA, *Highway Safety Evaluation: Procedural Guide*. FHWA-TS-81-219, Federal Highway Administration, U.S. Department of Transportation: Washington, DC, 1981; FHWA, *Highway Safety Improvement Program (HSIP) User's Manual*. FHWA-TS-81-218. National Highway Institute, Federal Highway Administration, U.S. Department of Transportation: Washington, DC, 1981; An excellent, step-by-step manual for the HEP process was produced by the Southeast Michigan Council of Government; *SEMOG Traffic Safety Manual* (second edition). Southeast Michigan Council of Governments: Detroit, MI., 1997.

From these safety data, locations that are hazardous are identified. The original HEP legislation allows this to be defined by the total number of crashes (the crash volume) or the crash risk (crashes per unit of travel) or by public request. In our region, we use a mixture of high volume and high risk to identify hazardous locations (crash hot spots), as discussed above.

### *Safety Engineering Study*

Once the hazardous location has been identified, an engineering study must be conducted to determine crash patterns and causal factors, and to propose mitigation countermeasures. The engineering study documents the crashes with collision diagrams, drawings that show the direction of the vehicles upon impact. Crashes are typically divided into ‘preventable’ and ‘non-preventable’. A preventable crash is one that is repeated numerous times (e.g., a broadside crash at an intersection due to red light running) whereas a non-preventable crash is one that is unique (e.g., someone who has been drinking runs off the road and hits a telephone pole).

Once a pattern has been established and the causal sequence determined, various mitigation measures are proposed, based on their historical experience in reducing crashes.

### *Prioritization of Mitigation Measures*

Each of the proposed mitigation measures is then subject to a benefit-cost analysis. The benefits are derived from an estimate of the crash reduction that would occur from the measure. Most State DOT’s (including TxDOT) and some university transportation centers maintain estimates of crash reduction from specific measures. The estimated crash reduction is then converted into dollar amounts based on annual National Safety Council estimates.<sup>31</sup>

The measures or measures with the highest benefit-cost ratios are then selected for funding. The HEP program requires that the engineering study and benefit-cost analysis be completed prior to application for construction funds. Generally, TxDOT does its own engineering studies for their roads, but few local governments have conducted these. H-GAC sees its role in helping local governments conduct the engineering study as a precursor to applying for HEP funds from the State.

In short, the safety funds are allocated according to a formal process that must be followed. The Federal regulations are very explicit about this process and TxDOT follows it carefully. Appendix A provides the legislative background to this program.

### *Integrating safety into non-safety projects*

With non-safety projects, on the other hand, there is not a formal process by which safety concerns are used to evaluate projects. While every sponsor of a project is concerned with safety and will change the design of the project accordingly when confronted with safety concerns, the lack of a formal methodology makes it subjective on how the concerns are implemented.

H-GAC has been experimenting with a methodology for assigning points to projects based on safety concerns. Typically, existing roadways that have serious safety problems are given a higher priority. The measure is that of serious crashes per 100 million annual VMT (or *serious crash risk*). Using our geocoded crash information system, we determine the number of crashes that occur on or are related to the particular roadway segments. Then, using our modeled VMT

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<sup>31</sup> National Safety Council, *Injury Facts*. Annual publication. Washington, DC, 79.

estimates, we calculate the daily VMT and an annualized value of this (365 times the daily VMT). Serious crash risk is then determined by dividing the number of serious crashes by annual VMT and multiplying by 100 million.

The point system comes from the regional and state averages for serious crash risk, based on the 1998-2000 data. The point allocations are:

<b><u>Crash risk</u></b> (crashes per 100 M VMT)	<b><u>Points</u></b>
Less than 150 (State average)	0 points
Between 150 and 197 (regional average)	5 points
Between 197 and 250:	10 points
Between 250 and 300:	15 points
Between 300 and 350:	20 points
Greater than 350:	25 points

It is still early in the process, but we believe that this system will allow safety to be more explicitly considered by sponsors of projects. Over time, the increased concern for safety should slowly improve the roadway system.

### **Other Safety Activities**

In addition to monitoring the safety of the road system, working with TxDOT and local governments to mitigate hot spots, and ensuring that safety is considered in project submission, H-GAC supports other safety efforts.

### **Safety Partnerships**

H-GAC has developed a number of safety partnerships with different agencies. Among the governmental and quasi-governmental agencies are TxDOT (both the central office and the Houston District), the Texas Department of Public Safety, the Texas Department of Health, Harris County, Fort Bend County, Galveston County, the Cities of Houston, Pasadena, Galveston, Sugar Land, and Conroe, Metro, and the Federal Railroad Administration. Among non-profit organizations, H-GAC participates in the Bicycle/Scooter Mobility Committee of the Texas Medical Center and has worked closely with the Injury Prevention Center of the Texas Children's Hospital. H-GAC also has a working relationship with the Center for Transportation Safety at the Texas Transportation Institute and has supported safety efforts of the University of Texas School of Public Health, the University of Houston, Texas Southern University, the Baylor College of Medicine, the Port of Galveston, and the Automobile Association of America Foundation.

H-GAC sees these safety partnerships as critical for building a coalition to improve safety in the region. Without multiple partners pushing for safety, no real improvements will be made. Engineering improvements, such as has been described in this report, cannot by themselves improve the safety situation. Only when they are combined with education, enforcement, improvements in operations and management, and law enforcement will the very high crash levels be reduced. In this sense, H-GAC sees these partnerships growing and strengthening over time. We hope to extend them to every jurisdiction in the region and to all non-profit organizations (and for-profit organizations, for that matter) that are involved with safety.

### **Safety Education**

To date, we have not yet established any courses on safety planning or other safety related activities (e.g., incident management, driver's education). We do, however, see an important role for this type of effort in the near future. We have had a number of requests to conduct courses or workshops on safety and we eventually will do this.

#### **Efforts for Fiscal-year 2004**

Over the next year, the H-GAC safety program will accomplish additional milestones:

1. The completion of the 2001 crash records to our three year database. As described above, this will involve geocoding all serious crashes from the DPS records and identifying hot spots and other hazardous locations.
2. The conducting of safety studies in the City of Galveston, Fort Bend County, and Montgomery County. Discussions are currently underway to sponsor safety studies within these jurisdictions. Eventually, we will cover all counties in the area.
3. The creation of an application template for requesting HEP funds. As mentioned above, most local governments don't have the resources or experience to conduct their own safety engineering studies and don't usually know how to request funds for mitigating the hazardous locations. We expect to produce a working template that will make this process a lot easier for governments.
4. The conducting of one or more courses on safety for local governments. It is expected that the first course will be on the safety planning process though we will eventually conduct courses on incident management and safety analysis.

More information about the H-GAC safety program can be found on the safety web page:

<http://www.h-gac.com/safety>

## **Chapter 1 Safety, Addendum A**

### H-GAC's Crash Information System Geocoding Methodology

H-GAC has developed a methodology for geo-referencing the crash information in the DPS dataset. This methodology involves several steps. First, since the DPS data set only includes five characters or numbers that identify the road on which the crash occurred and an intersecting road, if applicable, H-GAC developed a series of translation codes. Using the SAS<sup>®</sup> statistical system, the five characters or numbers were converted to proper street names. This was done on a jurisdiction by jurisdiction basis. For example, the City of Houston uses a five number code to identify the street. The SAS translation converted these numerical codes into street names. On the other hand, for Harris County roads, the street name was coded by the first five letters of the name. On State roads, particularly rural State roads, the roadway is identified by a complex code of highway + control number + section number + mile point marker. Overall, approximately 110,000 lines of codes were written in order to convert the DPS codes into meaningful street names.

Once converted, the crash location was identified as either an intersection crash or a mid-block crash. Typically, police officers record an intersecting street for intersection crashes and the block number for mid-block crashes. Where there was an intersection crash, our code indicated the intersection of two streets. Where there was a mid-block crash, our code listed the block number and the street name *if* the block number was available. Unfortunately, for many small cities, DPS does not provide the block number.

The crash information was then geocoded using several geocoding programs. The primary one was Atlas\*GIS<sup>®</sup> which is very good at matching intersection crashes. Supplementary geocoding was conducted with ArcView<sup>®</sup> which is very good at matching mid-block crashes since those involve a pseudo-street address (e.g., 4500 Westheimer Road).

### **Comprehensiveness and Accuracy**

The initial pilot data base was for the 1999 calendar year. With this data base, H-GAC was able to match approximately 82% of the eight county crashes in the DPS data set. The matching rate is higher for the larger cities primarily because DPS provides block information for mid-block crashes.

Accuracy checks were made by sampling geocoded crashes and checking whether the geocoding routine correctly placed the crash. Typically, accuracy was between 90-95%. The largest source of inaccurate matches involved frontage roads along the freeways. The address ranges are frequently inconsistent and the base street maps have not completely integrated all address ranges. There are current efforts underway to improve address range accuracy along the frontage of roads.

## **Chapter 1 Safety, Addendum B**

### Federal and State Funding Tools

There are a variety of mandates and funding sources for safety efforts within the public sector.

#### **Legislative Background**

The basis for highway safety funding is both regulatory and statutory. It starts with the Highway Safety Act of 1973 (public law 93-87; August 13, 1973). This law required that each State conduct and systematically maintain a survey of all highways (i.e., state-run roads) to identify high-hazard locations that may constitute a danger to vehicles and to pedestrians. Priorities for the correction of these hazards were required to be assigned and a schedule of projects and their improvement were required to be established. The initial legislation was to be made available solely for roads on the Federal-aid system other than a highway on the Interstate System, which was covered under other legislation. This program came to be known as the Section 152 Hazard Elimination Program (or HEP) and is part of Title 23 (23 U.S.C. 152).

In 1982, an amendment to this legislation was enacted which extended this authorization to all public roads, again excluding the Interstate Highway System which had its own authorization (Highway Improvement Act of 1982; Public Law 97-424- January 6, 1983; 23 USC 146 note). The current law (23 USC - October 1983) essentially unifies this principal. It states the “Each State shall conduct and systematically maintain an engineering survey for all public roads to identify hazardous locations, sections and elements, including roadside obstacles and unmarked or poorly marked roads, which may constitute a danger to motorists and pedestrians, assign priorities for the correction of such locations, sections and elements, and establish and implement a schedule of projects for their improvement” (Section 152. Hazard Elimination Program; II-91-II-92).

Section 133 (d) (1) of Title 23 USC of the Highway Safety Act establishes a Surface Transportation Program (STP) and states that 10% of the funds apportioned to a State for the STP program shall “only be available for carrying out sections 130 and 152 of this title”; Section 130 is for railway-highway crossing and section 152 is for the hazard elimination program. An additional 10% of the STP funds are allocated for Transportation Enhancement Activities and the remaining 80% to other programs.

With the enactment of the Transportation Efficiency Act for the 21<sup>st</sup> Century (TEA-21) in 1997, the HEP was extended to all public roads including the Interstate Highway System. TEA-21 expanded transportation safety efforts to allow HEP funds to be used for bicycle and off-road improvements, expanded motor carrier safety inspection efforts, and created a Safe Communities Program that allows cities so designated to fund safety program from a variety of categories within Title 23.

Parallel to this legislation, FHWA issued a series of regulations in 1979 (Federal-aid Highway Program Manual, Volume 8 - Highway Safety, Chapter 2 - Safety Program Implementation, Section 3 - Highway Safety Improvement Program; Transmittal 298, HHS-11, March 5, 1979), which were subsequently modified in 1991 and 1998 (Sub-chapter J - Highway Safety, Part 924 - Highway Safety Improvement Program; 23 CFR Part 924). The regulations establish three components of the highway safety improvement program:

1. Planning - a process for collecting and maintaining a record of accident, traffic and highway data; analyzing available data to identify highway locations that are hazardous; conducting engineering studies of hazardous locations; prioritizing implementations; an expected cost-benefit analysis; and special attention to rail-highway grade crossings.
2. Implementation - a process for scheduling and implementing safety improvement projects and allocating funds according to whether the public roads are on the Federal-aid system or not.
3. Evaluation - a process for evaluating the effects of highway improvements on safety including the cost of the safety benefits derived from the improvements, the accident experience before and after the implementation, and a comparison of the accident numbers, rates and severity of the project with the numbers, rates and severity had the projected not been implemented.

In short, both the legislative history and subsequent regulations have clearly established a basis for funding of safety projects.

## **Chapter 2**

### **Transportation and Land Use**

The 2025 Regional Transportation Plan (RTP) is a federally-mandated plan that is designed to meet the mobility needs of the region within the confines of projected available funding and the federal health standards for air quality.

It differs from previous long-range transportation plans in that it explicitly addresses the relationship between transportation and land use. Exploring different aspects and impacts of this relationship are a major analytical component of this RTP. Among other places, this focus is manifested in Appendix A (safety), Appendix C (enhanced pedestrian and bicycle use), Appendix H (expanded and improved network of regional arterials), Appendix J (local and commuter rail transit), and Appendix P (regional travel patterns to major employment centers). This appendix examines several transportation and land use modeling scenarios, suggests various remedies for improving local mobility, and identifies other considerations (in addition to monetary) on which transportation and land use issues should be decided.

How do transportation and land use interact? Why is it important to understand this interaction? For starters, vehicle travel is increasing and changing in character. Today there are more non-work trips and more suburb-to-suburb trips than there were fifty years ago when the first freeways were built. In the aggregate, this increase/change is largely driven by land use patterns, i.e., the increased physical separation between the places where people live, work, go to school, shop, and play, causing residents to travel farther and more often than in the past. Also, the type and location of transportation facilities influences land use patterns. For example, frontage roads and thoroughfares tend to attract more intensive commercial development, which in turn draws more traffic to the facility. The land use/transportation infrastructure is also important at the localized scale. “Pedestrian friendliness,” connectivity in subdivision design, and access management are issues that greatly affect local mobility.

Moreover, this region has not had a strong public sector tradition of land use planning or regulation (no zoning in Houston, limited land use authority in counties). While there are cities and private developers who do plan for and regulate land use, these efforts are not particularly coordinated with each other or with the planning of the regional transportation system. While there appears to be merit, and growing interest, in public dialogue on the tradeoffs (economic, environmental, mobility) of different future growth alternatives for the region, there is not as yet a consensus vision. Hence, our transportation planning has been primarily based on meeting forecasted travel demand, rather than attempting to shape demand patterns through policy.

The main reason for examining this interaction is to find other, less expensive ways to resolve the region’s congestion and mobility problems. Projections show that substantially more roadway/railway capacity projects beyond those listed in this RTP are going to be needed by 2025 to maintain the levels of mobility that are experienced today. But if capacity on the transportation network cannot be increased sufficiently due to financial constraints, it makes sense to pursue strategies that reduce travel demand. Therefore, understanding how current land use practices and paradigms incur travel demand are first steps in finding ways to reduce travel demand, and, ultimately, the expense in maintaining acceptable mobility levels.

To help illustrate the current direction of our transportation policy and how alternate policies might look, H-GAC developed a series of land use and transportation modeling scenarios that



examined various development strategies. Their outcomes (described below) indicate how mobility within and across the region can be expected to change. If nothing else, the scenarios show that the transportation needs in the Houston-Galveston region are diverse, and no single solution can provide congestion relief in all areas. More importantly, they show that coordinating land use policies with the transportation network can greatly enhance the functioning of the existing and projected network. Although H-GAC does not endorse any particular development scenario, it offers this information to those interested in policies designed to reduce congestion through a closer integration of land use and transportation planning.

#### Growth Scenarios

Mobility is determined by how well a transportation network can support the travel demands placed on it by local land uses and regional land use patterns. The 2025 RTP includes projects that focus on the supply of the transportation network, such as roadway rehabilitation, added capacity, rail, bike/pedestrian, and sidewalk improvement, as well as the demand on the network, such as demand management. But which types of land uses or land use patterns are best for mobility? Or, approaching this question from the other side, what kinds of transportation networks can best support the land uses and patterns that are present in this region?

### Methodology

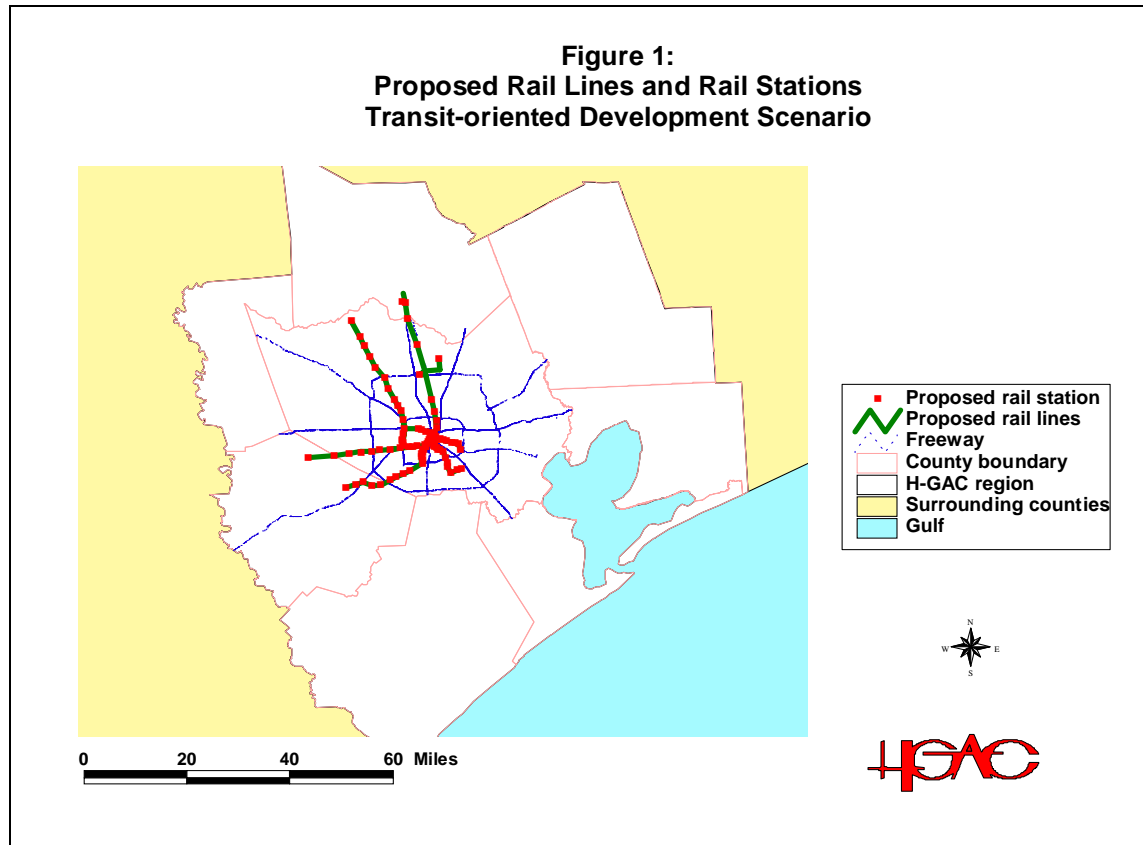
H-GAC developed several land use and transportation network scenarios to test this relationship. They were developed prior to November 2003, and therefore do not reflect the exact METRO Solutions referendum that was approved by voters. Also, various shortcomings in the scenarios became apparent after running the models and performing the interpretations, such as the selection of the baseline, not including a ‘no build beyond current TIP’ scenario, etc. Finally, it should be noted that the models used in this analysis are designed only to calculate levels of congestion and mobility. They do not take into account other factors, such as the environmental, economic or “quality of place” impacts of different regional land use patterns.

Nevertheless, the scenarios as presented here are still informative because they illustrate the degree to which differing land use patterns would affect congestion and mobility. The degree of change may not be absolutely precise, but the direction of change (increased versus decreased mobility) can be taken as correct. H-GAC used the best and latest information available for this effort, and is continuously updating and refining its models. Future scenario analyses are planned that will improve upon those presented here.

The 2025 RTP/baseline is the expected distribution of population and employment by traffic analysis zones (TAZ) if development in the region continues on the path it is currently following. It does not assume any further restrictions on land use or market manipulations as are introduced in Scenarios 1-5.

Alternative scenarios 1-5 are compared to the baseline to detect changes in their impacts. Essentially, the alternative scenarios are asking, “What happens to congestion and mobility if population and employment are rearranged differently than what the baseline forecasts?”

It must be emphasized that the H-GAC does not favor any particular modeling or land development scenario. Also, it does not guarantee that any particular change to land use or the transportation network will generate the effects on mobility as forecast by the models.



1. **No Additional Rail.** This scenario excludes the rail projects in METRO Solutions as well as the supplementary suburban rail lines.
2. **Transit-oriented development.** This scenario intensifies development along the rail lines. The existence of rail stations creates opportunities for higher density developments proximate to proposed station locations.
3. **No flood-plain development.** This scenario reduces population and employment growth in the 100-year flood plain. Since Tropical Storm Allison in 2001, concerns have been raised about potential loss of life and property through flooding under equal or more severe weather conditions.
4. **Employment concentration:** This scenario concentrates employment in the major activity centers. Houston has a number of major activity centers, such as the CBD, Texas Medical Center, Galleria-Post Oak area, Greenway Plaza, and others.
5. **Employment dispersion:** This scenario disperses employment away from the major activity centers. Emergent trends in employment concentration indicate that employment is dispersing, and no longer seeking to congregate in a few, dense employment centers.

Three types of impact are examined:

1. **Daily vehicle miles traveled (VMT):** the number of daily passenger vehicle trips multiplied by the length of travel. It is a standardized measure of automobile travel. Differences between the scenarios show the amount of improvement or worsening of total travel distance.

2. **Peak afternoon vehicle hours traveled (VHT):** the total number of passenger vehicle hours of travel that are logged during the peak afternoon period—3:30-6:30 PM. It is generally the period with the highest levels of congestion.
3. **Mode split:** the number of daily trips taken by different travel modes, i.e., car or transit. These data indicate whether the scenario increased or decreased transit trips relative to vehicle trips.

## Scenario Comparisons

### No Additional Rail

In terms of the three measures of impact (daily VMT, afternoon VHT, and trips by mode), the exclusion of the urban and suburban rail lines decreases mobility in the region because all additional traffic will have to be accommodated on the existing and planned street network..

Compared to not building any additional rail lines, the baseline (which includes an expansion of rail-based transit) has fewer total trips and VMT, and substantially decreased afternoon VHT. It does this by both slightly reducing automobile trips and substantially increasing transit trips. In other words, the baseline scenario is not substantially reducing the number of trips that the population takes, but rather, is improving the efficiency of travel by shifting some of those trips to transit and by shortening trip lengths for those roadways in which improvements have been made. The shift is subtle, but important.

Comparing the baseline and the no rail scenarios illustrates that inclusion of rail reduces the number of single person automobile trips by almost 100,000 and shared automobile trips by about 40,000. There is also a decrease of 31,000 bus trips but an increase in over 80,000 daily rail trips in the baseline versus the “no rail” scenario . In other words, building the urban and suburban rail lines can shift travel more towards rail. The majority of travel trips (98.3%) are still done by car, but there is increased use of the expanded rail system. If the region continues to develop as it has in the past, i.e., low density suburbs on the periphery, then the impacts of adding a rail system is modest. Many commuters will take the train instead of the bus, but the presence of trains will not cause large numbers of automobile drivers to use transit.

### Transit-Oriented Development

This scenario varies from the baseline by densifying employment and housing around transit stations. Instead of allowing the periphery to develop as it has in the past, new residential and commercial land uses are densified significantly along the rail lines and at the stations.

Transit-oriented development (TOD) policies have been implemented in a number of cities that have rail systems. In general, where TOD has been implemented, it tends to concentrate employment more so than housing primarily because of the increases in land values that occur around rail stations.

Compared to the baseline, TOD increases transit use. Total transit trips increase by about 4,000 while automobile trips decrease by an almost equal amount. The effect on home-to-work trips is particularly strong, as would be expected. Of the 411,293 transit trips, 218,275 (or 53%) are home-to-work trips compared to about 19% of all trips. The TOD scenario increases transit use in home-to-work trips by 4%.

One interesting result is that five corridors which will have a high-capacity rail line (including the central business district) will show an *increase* in VMT while three of the five corridors without a rail line show a *decrease* in VMT. The two non-rail corridors that show increases in VMT (IH 45 N and US 59 W) may do so due to adjacency to the rail systems. US 59 W is very close to the Westpark Tollway for its most heavily traversed sections while part of the Hobby Airport line runs along IH 45 S.

In other words, building a rail line along a corridor *increases* automobile travel along the corridor under a TOD scenario because the concentration of employment and population increases *all* vehicle trips. Persons who need to park at a transit station will drive there. Also, the increased employment will generate work trips as well as retail trips in and around the stations. In short, transit-oriented development, while increasing transit use substantially, also increases automobile use around the stations and corridors.

Conversely, areas that do not receive a rail line (except IH 45 S and US 59 W) show a decrease in VMT. Again, the reason is that trips are being ‘pulled away’ from these corridors and concentrated along the rail corridors. Overall, areas outside of a half mile buffer around the proposed rail lines show a 3.6% decrease in VMT. Thus, the corridors and areas without rail lines are the biggest beneficiaries of reduced vehicle travel from transit-oriented development. Transit use remains very low outside the rail corridors. In other words, even though the TOD scenario had a slight moderating effect on VMT, the traffic is fundamentally re-arranged by the scenario. It is more concentrated in and around the rail stations and along the corridors, and it is lessened along those corridors and areas without rail lines.

The conclusions are three-fold. First, TOD increases transit share. To make the best use of a high-capacity transit line, it is important to coordinate land use developments to increase development intensity. This allows office buildings to be built and small retail outlets to prosper, and multiplies the economic benefits of the investment, both through increased transit use and through increased economic development. If, however, land use changes around transit stations are not coordinated, then any increases in ridership will be limited. For example, putting a transit station in the middle of a freeway will minimize transit use, principally because parking availability and pedestrian access largely determine the number of users of that station.

Second, TOD increases vehicle use along transit corridors and around transit stations. This requires the coordination of improved access, circulation, pedestrian “trip chaining,” and possibly increases in capacity for the increased volume.

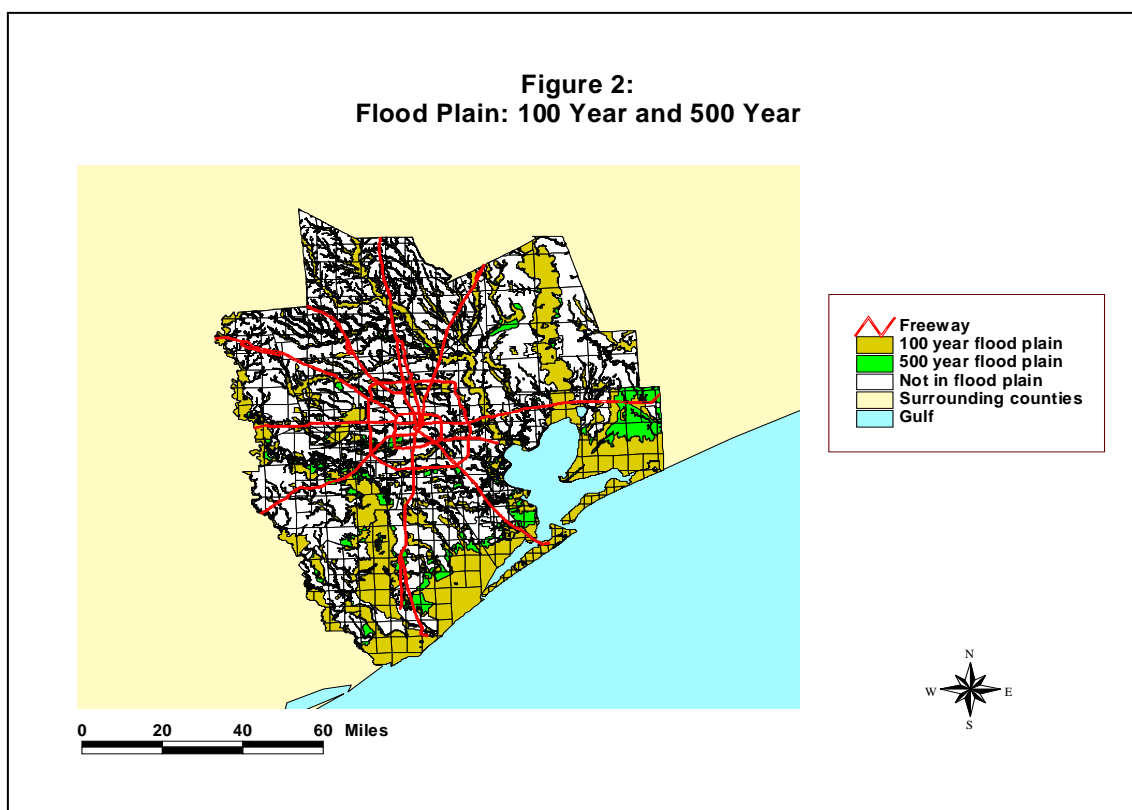
Third, TOD decreases vehicle use *outside of* the transit corridors, primarily because it will shift trips towards the transit stations and corridors, and thereby relieves congestion outside of the transit system. This reduces capital expenditures that would have had to be made in those areas because the vehicle load on those roadways will be less.

In short, TOD makes greater use of the transit system, and reduces the transportation load on large portions of the roadway network. To maximize this effect, TOD strategies have to be coordinated with local land use policies and density levels. Transit is not a ‘magic bullet’ that solves all the region’s transportation problems, but it is an important component of an overall transportation network, especially when local land uses are coordinated to make maximal use of the transit lines and stations.

#### Flood Plain

The eight-county region around Houston has numerous flood plains (see Figure 2—note: the map reflects the flood plain boundaries of 2003. It does not reflect the latest redrawing of watershed areas released in 2004). These flood plains pose hazards for those persons who live or work within them, both from severe weather conditions (e.g., hurricanes) but also from flooding caused by unusually heavy rains such as what occurred with Tropical Storm Allison in 2001.

Between 1990 and 2000, population in the 100-year flood plain areas grew by around 15%. The baseline assumes further growth of 15-20% through 2025. This scenario, however, restricts growth in the flood plain. Both employment and population are reduced by 25% for those areas within the flood plain, and redistributed to other areas within the same county.



The flood plain scenario slightly worsens regional travel conditions. For the region as a whole, the flood plain reduction scenario slightly increases transit trips, slightly decreases automobile trips, and slightly increases daily VMT. The primary reason for the slight increase in VMT is that most of the flood plains are in rural areas. Thus, as people and jobs move from flood plain areas to non-flood plain areas, those people affected by these moves will have longer trips. Moving people and jobs out of the flood plain may be environmentally sensitive and conservative in terms of risk management, and it will not have a great effect upon regional mobility.

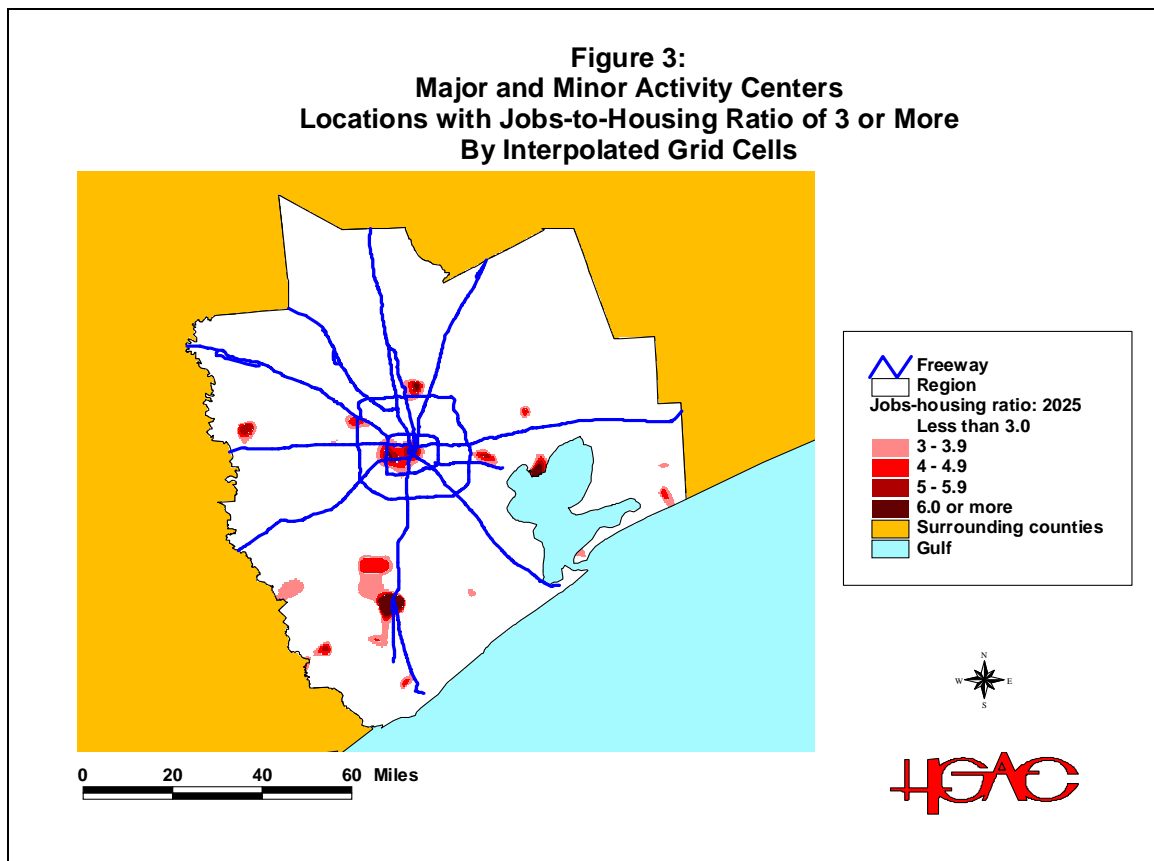
### Employment Concentration

There are numerous economic factors that lead to employment concentration, including shared rent, access to essential business services, economies of scale with regard to communication, shared facilities, and other factors. However, from a transportation viewpoint, the key question is

how such concentrations affect mobility and the transportation network. That is, from the viewpoint of getting people to their work place, is it better to concentrate the employment or disperse it? To test this question, this and the next scenario modify employment patterns, first, by concentrating it, and second, by dispersing it.

This region has a history of multiple employment centers. Like other metropolitan areas whose expansion was shaped by automobile travel, employment is no longer concentrated only in the CBD, but is spread out over several major activity centers. Among them are the Galleria-Post Oak, Greenway Plaza, Greenspoint, the Texas Medical Center, as well as the CBD (downtown). There are also other, less significant, activity centers where employment is concentrated.

Figure 3 shows an interpolation of the ratio of jobs to households. The map identifies those areas where the jobs-to-housing ratio is 3 or more. In addition to the established centers listed above, concentrations appear along US 249, in Baytown, along the Katy Freeway, and in the Lake Jackson area of Brazoria County. Even if many of these additional locations are small activity centers (small in terms of the number of employees), they are still places that are primarily used for employment.



In this scenario, employment is increased by 25% within those areas having a jobs-to-housing ratio of 3.0 or greater, and reduced in rest of that county. Compared to the baseline, further employment concentration would lead to a slight increase in transit use and a fractional decrease in automobile use. VMT would increase slightly. The increased VMT would probably come about because workers not living near the activity centers would have longer automobile commute trips.

The increased transit use would occur because many of the established major activity centers are served by transit. Further concentrating employment makes transit a more attractive commuting option. This is similar to the effect seen in the TOD scenario.

### Employment Dispersion

As opposed to the previous scenario, the employment dispersion scenario reduces employment in areas with a jobs-to-housing ratio of 3.0 or greater by 25%. This employment was and re-assigned to non-center areas within the same county.

Compared to the baseline, employment dispersion fractionally increases the number of trips, giving a slight increase in transit trips and a fractional increase in automobile trips. VMT increases slightly. Thus, there is a paradoxical situation of both employment concentration and employment dispersion leading to slight increases in VMT, when compared to the baseline.

There are, however, different impacts of this scenario on particular corridors. Seven of the tested eleven corridors show an increase in VMT, while four of the corridors show a decrease. The four showing a decrease are those that are among the most congested: IH 610 loop, IH 10 W, US 59 W, and US 290. Of the seven corridors showing an increase, several are among the least congested in the system: US 249, Westpark Tollway, and US 290A. On the other hand, IH 45 N and IH 45 S will both add VMT to their already congested levels.

The data appear to indicate that employment dispersion would shift traffic from several highly congested corridors to several that are less congested, although the effects are not completely consistent. This would be expected from an employment dispersion scenario. Congestion occurs because of the volume of trips to a certain location. If those trips are reduced, their effects on the roadway are also reduced. Conversely, the areas that receive the employment will also see an increase of trips and congestion.

### ***Modeling Conclusions***

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

As the chart above shows, each scenario has its set of implications for congestion and mobility as noted. What might the effect on the region's mobility be if parts of the various strategies were employed at the same time? Combining the TOD scenario with either the flood plain or employment concentration strategies would increase transit use by a considerable amount. However, it would also cause an increase in VMT because each policy—on its own—increases VMT over what is forecast in the baseline. Thus, a combination of these policies would likely increase VMT along affected corridors even more, but increase mobility in general.

Some combinations do not make sense. For example, the TOD scenario concentrates employment along rail corridors, whereas the employment dispersion strategy disperses employment along the same corridor. Thus, it does not make sense to have both transit-oriented

development and an employment dispersion strategy on the same corridor because they contradict each other.

Theoretically, the most fortuitous combination of scenarios that would produce the greatest relief in VMT (and, thus, improve mobility) would be to place rail lines and encourage TOD along *less* congested corridors (e.g., US 249, US 90A, Westpark), and reduce employment on congested corridors and employment concentration along the new rail corridors. The placing of rail lines along the less congested corridors would concentrate employment to some extent and absorb some of the employment shifted from the other corridors. The result could be a much better balance in VMT along each of the corridors than is currently forecast for 2025. This would, in effect, even out the mobility on all corridors—increasing VMT on the underused, and decreasing it on the overused. Alternately, entirely new corridors could be built along rail lines in relatively undeveloped areas. Employing TOD practices may be easier in areas that would not require substantial redevelopment.

Some general conclusions that can be drawn from these scenarios are:

1. Current projections anticipate continued disproportionate increases in VMT and VHT to population increases because residents are living farther away from their jobs and traveling more frequently to more destinations, often at greater distances. This is true mainly because housing has been resistant to concentration, and employment is dispersing as well.
2. Congestion in the region will likely be worse in the future than it is today despite the completion of all anticipated transportation projects that are contained in the baseline.
3. Mobility problems may be reduced if local land use policies embrace transit-oriented development (TOD). However, TOD cannot be accomplished without the cooperation of affected localities and developers. In practice, this would require substantial redevelopment around those stations located in areas already built upon, and much denser development than typical suburban settlement patterns around the stations in outlying areas.

### **Transportation Systems and the Separation of Land Uses**

Houston is often called an automobile-age city. Undeniably, automobiles and freeways have had a significant influence in facilitating the spatial growth of the city. Today, the suburbs extend far beyond the Houston city limits and spread well into adjacent counties. However, the car and the freeway are not the sole causes of this development pattern—it is also largely shaped the paradigm of the separation of land uses.

Suburbs may date back to the 1800s, but it was not until the 1950s and the advent of the modern freeways that suburbs took on many of the characteristics that define them today. Suburbs have evolved since then, as different styles and preferences have come in and out of fashion. However, their basic characteristics have remained steadfast: the strict separation of land uses, low development densities with vast predominance of single-family-detached housing; the use of winding streets, discontinuous paths, and cul-de-sacs within subdivisions; and the reliance on a sparse (and sometimes incomplete) network of arterial streets to connect subdivisions to other (non-residential) land uses.

The prevalence and popularity of suburban communities verify their enduring positive public perceptions and appeal. Touted for ascribed and actual improvements in the quality of life of their residents, suburbs are generally still seen as better places to live based on such diverse



measures as the quality of their schools, low crime rates, abundance of private and public green space, safe streets, and the focus on the (nuclear) family. Perhaps the strongest confirmation of the desirability of a suburban residence is that its attainment is evidence of financial success and comfort. The idea of ‘owning a house in the suburbs’ has been engrained into our national psyche, and is the cornerstone of the ‘American Dream’. Given these positive attributes, it is not surprising that suburbanization is pervasive, but that cities have managed to retain any traditionally identifiable urban areas at all.

Nonetheless, there are costs associated with suburbanization. Although new housing construction largely still follows suburban patterns, the negative side-effects related to separated land uses are causing reassessments of its appropriateness. Today, overcrowded tenements and poor public health resulting from incompatible mixing of land uses are largely bygone concerns, while problems relating to the transportation system have become widespread. Among the important issues at present are congestion, decreasing levels of mobility, and reduced quality of life; spiraling costs of maintaining and expanding the transportation network; and public health concerns relating to vehicle exhaust. Indeed, the very need for this RTP—to assure mobility within available funding and federally-mandated air quality standards—is testament that the transportation network itself has become a prominent object of public concern. Barring major or unforeseen breakthroughs in transit and automotive technologies, these problems are not likely to abate.

Of course the reason why we need such an expansive transportation network is because we need to use our cars for nearly every trip that we make. One way to achieve a reduction in travel demand is for our local communities to encourage mixed land uses and denser developments. Neighborhood designs that call for higher densities in compatibly-mixed, pedestrian-scaled, urban designs let walking or biking replace many of the trips now done in cars. In addition, more densely-populated neighborhoods are more easily served by transit, thereby further reducing travel demand on roadways.

Nevertheless, the reality in our region is that in many areas local land uses and regional land use patterns have been built around the car-and-roadway-based transportation network. Changing or augmenting this pattern to include mixed land uses and mass transit likely will not directly affect most established communities, and certainly will not happen overnight. But as the costs of maintaining current levels of mobility grow wildly beyond our means of paying for them, the pressure will increase to find other, adequate, and acceptable solutions to the problems of congestion and decreasing mobility.

### **Development Policies and Suburban Designs**

As the modeling scenarios showed, land use patterns and densities can have an impact on travel demand. Low-density and physically separated land uses increase travel distances. But equally important to regional mobility is the method of how local land uses are connected to and accessed by the roadway network. For example, the number of driveways on a heavily-traveled arterial roadway can significantly affect its level of congestion. Similarly, while insular suburban street patterns with limited points of entry have lower crash rates than grid street patterns, allowing even modest increases in street connectivity can reduce congestion by lowering the demand on collector and arterial streets.

There are many practices that can appreciably reduce congestion, ranging from minor modification of existing neighborhoods to major land use and density changes, by improving the

interaction between the transportation network and land uses. The following points feature various approaches which appear to hold promise for the Houston-Galveston TMA.

#### Improve Access Management

Balancing mobility concerns with the need to provide access to various land uses is one of the most vexing problems in transportation planning. Increasing access to a roadway, through intersections or driveways, diminishes its carrying capacity and increases crash risks. Research cited by the Texas Department of Transportation (TxDOT) indicates that over half the crashes in urban areas occur at intersections. Turning motions, particularly left-hand turns, pose safety risks. Improper spacing and location of driveways to high volume traffic generators can also lead to congestion and safety problems.

Related to improper spacing is the aspect of providing appropriate levels of access to a roadway based on its traffic volume and speed. Roadways higher in the functional classification such as freeway or arterials, should have very limited access, whereas roads with lower volumes or speeds, like collector or local streets, should have almost unrestricted access. This approach is not widely practiced here. Indeed, there are many instances where the frequency driveway access on highway feeder roads and arterials is unrestricted, often providing continuous left turn lanes. This practice is a contributor to the congested conditions and safety problems that prevail in many parts of the region.

A variety of access management tools address issues such as left turns, medians, and driveway spacing on major arterials. However, to be truly effective, access management should be combined with sound land use planning. This is because selecting the best design approach requires a good understanding of existing and potential future traffic patterns and access needs generated by surrounding land uses.

TxDOT has produced draft access management guidelines that cover the physical treatment of intersections, driveways, and turning lanes. The guidelines also outline how communities can implement their own access management program. State and local coordination is critical because, while TxDOT is responsible for permitting access to state roadways, local governments are responsible for regulating access to local roads, as well as overseeing land use, subdivision, and site design decisions that affect access needs on all roads.

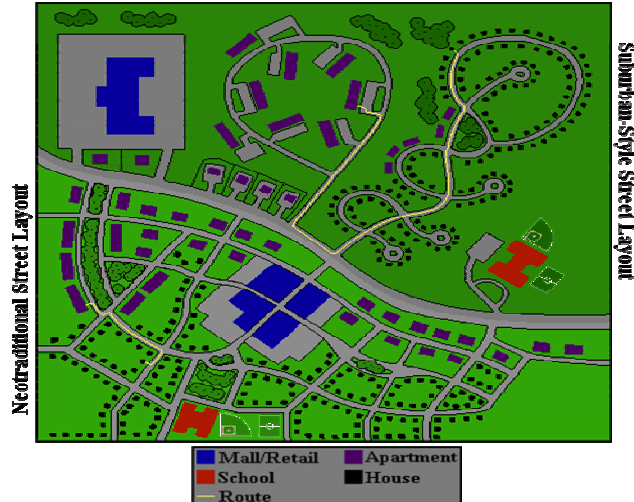
One tool that can be helpful to guide future access management decisions is a Traffic Impact Analysis (TIA). A TIA determines the potential impacts of a proposed traffic generator on a roadway and can aid traffic engineers in determining the most appropriate design and location of access. Currently, TxDOT may require a TIA for development that is seeking direct access from a state roadway. This is evaluated on a case-by-case basis. The City of Pearland and the City of Sugar Land also have a TIA requirement.

Smart Streets are another way to improve access management. See Appendix B: Operations Management for a full description.

#### Improve Connectivity

Suburban developments often use curvilinear and/or discontinuous neighborhood street layouts, as recommended by the American Association of State Highway and Transportation Officials' (AASHTO) *Policy on Geometric Design of Highways and Streets*. This insular design approach was borne out of a desire to reduce cut-through traffic and to enhance the perceptions of safety,

security, aesthetics, and the environmental features of subdivisions. Its drawbacks are that it adds distance to most neighborhood trips and forces more trips onto arterial streets. Also, disconnected local streets inhibit walking and bicycling, and make for less efficient transit, emergency response and garbage collection services. This design shortcoming severely hampers local mobility by compelling all trips outside the immediate neighborhood to use the arterial roadways.



There is a public perception that better-connected street networks lead to increased traffic volumes and property crime, although there does not appear to be research supporting this contention. Many people prefer to live on cul-de-sacs or subdivisions with limited, sometimes gated, access points. Developers also may resist a more connected street pattern because of the increased expense of providing greater street access. However, this is an area in which local governments can easily bring new developments into conformity by issuing design guidelines that prohibit insular street patterns. “Neotraditional” local street networks, loosely based on the grid concept, enhance opportunities for walking, bicycling, and transit, particularly on the journey to school, which constitutes a significant percentage of morning peak period travel demand. Additionally, there are emerging design techniques that can ‘calm’ cut-through traffic and address security concerns. These traffic-calming techniques can include narrower local street widths, offsetting the added development costs of a denser street network.

### Close Arterial Gaps

Gaps in the suburban arterial street network also limit mobility. Gaps often exist because local governments shift the burden of developing the arterial street network onto residential developers. Requiring the contribution of right-of-way (ROW) and, in many cases, construction costs, is not uncommon. Although this approach (shifting) has short-term financial benefits to local governments, it results in piecemeal construction of the arterial network, not only leaving areas largely disconnected for years while awaiting adjacent development, but also inconveniencing drivers by adding unnecessary lengths to trips. More VMT increases congestion.

Despite the financial costs to the local government, the benefits of better-connected local street network are worth pursuing. Such designs more efficiently distribute vehicle, transit, and emergency response trips over more complete local roadways.

### Use Pedestrian-Scaled, Context Sensitive Designs

Major roadways can create barriers between neighborhoods. Visual and noise impacts can make areas less attractive for residential redevelopment. High speed, high volume roadways can greatly degrade the comfort and safety of the pedestrian environment and also tend to encourage the location of high volume retail establishments with large off-street parking requirements.

These factors can limit an area’s potential to support non-motorized modes of travel. A context sensitive design approach to roadway planning, aimed at balancing mobility and community

considerations, can be particularly useful when new or expanded roadways pass through established, higher density areas. Successful context sensitive designs involve all stakeholders early in project planning. Such approaches may combine added capacity, operational improvements, and aesthetic features to produce mobility benefits, minimize adverse neighborhood impacts, or even enhance the surrounding community.

Context-sensitive designs, whether in established neighborhoods or newly developed areas, can create attractive places to live, work, and play if it responds to the community's input. Even though citizen participation can be time-consuming, frustrating, and expensive, the needs of the community are best vocalized by the residents and local businesses themselves. Engaging the public in decisions about their community generally lead to better, more creative designs, and more satisfied residents and business owners.

### Create Town/Village Centers

Much of the modeling of the land use/transportation relationship focuses on the journey to work because it tends to be the longest trip type and the one that contributes the most to peak period congestion. Encouraging people to live and work closer together may be a laudable idea, but it is difficult to implement due to the many factors that influence a person's choice of housing and place of employment.

It appears that the greatest benefits to mobility can be achieved by consolidating or eliminating the number and distance of non-work trips. Trips for shopping, entertainment, school, recreation and other services, are increasing dramatically. Localized land use decisions can have a much greater impact on these types of trips than on the journey to work.

One means of reducing these nonwork trips is by consolidating local destinations into town or village centers. The town/village center clusters various neighborhood destinations together so that trips can be made on foot or by bicycle. If properly designed, a town/village center can be accessed, by car, on foot, by bicycle, or via local or collector streets, thereby preserving capacity on major thoroughfares for longer-distance trips. This design approach can also improve both vehicular and pedestrian/bicycle safety, and is more easily served by transit. Moreover, enhancing the individuality and sense of place of the town/village centers by making them more walkable, they become destinations in themselves, thereby strengthening community identity, economic vitality, and desirability—benefits that go far beyond transportation issues.

There are, however, obstacles to creating town/village centers, particularly when they involve changing existing street layouts. Lack of developer interest and/or financing for this type of project is also an obstacle, as is the lack of regulatory tools to ensure compatible scale and design of land uses within the center. Therefore, it is vitally important that local governments encourage private capital to meet the growth and redevelopment challenges of the community by providing profitable opportunities within the restrictions of design guidelines. These opportunities can take the form of streamlined permit-letting processes, government-financed infrastructural investments, and generally making development decisions predictable, fair, and cost effective.

Several communities within the region are moving forward with ambitious town center projects, most notably The Woodlands (to which H-GAC has provided CMAQ funding to support pedestrian and transit connections) and the City of Sugar Land. The Cities of Pearland, Friendswood, and League City are also in various stages of planning revitalized town centers. The possibility of converting commercial 'strip' developments into neighborhood-oriented village centers has also been examined in H-GAC's Westheimer Corridor Study. Various concepts from

this study will likely be applicable to other major thoroughfares with intense commercial development.

#### Increase Densities/Support Cores/Offer Transportation Choices

Providing residents with more transportation choices is a key factor in reducing congestion, increasing environmental justice, and improving the quality of life. But offering a multi-modal transportation network often depends upon local facilities as well as employment and residential densities. Generally, the highest rates of transit ridership occur in metropolitan regions with high-density core cities and large centralized employment centers. Car and van pools are more attractive when they can use High Occupancy Vehicle (HOV) and High Occupancy Toll (HOT) lanes, which generally serve a limited number of central destinations. Higher population densities, along with compact, mixed land use patterns provide more opportunities for walking or bicycle trips.



Low development densities do not prevent traffic congestion. When people live in single-use neighborhoods greater distances must be overcome, and residents have no other choice than to drive to everything they need. H-GAC's 2025 Growth Forecast predicts various increases in both residents and employment in central Houston, inside the I-610 loop, within the Sam Houston Beltway, and outside of these areas. The differing levels of density among these areas will require different solutions for each situation.

However, higher densities without corresponding increases in transportation choices will only produce more congestion. The RTP is addressing some of these areas. For example, METRO Solutions will provide new transit options inside the I-610 Loop with expansions to the light rail transit (LRT) and bus networks. Phase II of the LRT projects to the north, east, southeast and west will provide a catalyst for further reinvestment inside the Loop, and increase densities. Signature commuter bus lines traveling on new and expanded HOV and HOT lanes will provide convenient options for suburban commuters.

Central Galveston, similar to Houston, has seen a surge of reinvestment, and is planning an expansion of its trolley line. H-GAC supports transit investments on the island and is currently evaluating pedestrian safety issues there to help assist redevelopment efforts. Several suburban communities are also exploring and implementing measures that strengthen the nature of their 'core' areas.

#### **Other Considerations**

Economics has been the main argument thus far in examining the interaction between the transportation network and land use patterns. Simply put: we do not have sufficient funds to meet anticipated levels of travel demand projected for 2025, thus we need to search for other ways to solve the region's transportation issues. Yet, there are other reasons, viewpoints, and contexts for understanding this interaction that ought to be considered as well.

And yet, merely examining these viewpoints is not enough: often a balance must be struck between them. For example, how much money are we willing to spend to increase the efficiency of the network? Should the level of congestion we are willing to accept be the only—or even the most important—factor in deciding how much (and on what technologies or modes of travel) we are willing to spend? How much should the negative impacts on the health or quality of life of the residents who live alongside or nearby the network be taken into consideration when changes, improvements, or new additions to the network would clearly improve the quality of life of the network’s users? These are questions that may be answered differently on the local level, but need to be addressed regionally as well.

### Public Involvement

Transportation issues cannot be decided by only a small group of planners, or even a body of elected and representative officials. Each resident’s transportation needs in the region is unique. However, community-wide consensus must be reached on how these needs are to be met. Thus, it makes sense to have broad-based public discussions on how best the region should spend its limited transportation dollars. Public and wide-spread discussion of transportation issues not only fosters a comprehension of the causes and the array of options that are available, but also reveals the differing needs and the spectrum of viewpoints of the residents.

### Local/Regional Implications

Traffic problems are not contained by or end at municipal or county boundaries. Thus, it is vitally important that neighboring local governments look beyond their borders so that they can anticipate impacts and problems. Local government should also be aware that poorly designed projects and developments that are fiscally or politically expedient in the short term may prove to be highly expensive and extremely difficult to undo or fix in the long term. Land uses may intensify or change quickly, but the transportation network does not. Building it “right” the first time, i.e., anticipating future travel demand and even changes in land use, can eliminate problems and costly retrofits from the outset.

Also, local governments need to become more involved in the development or redevelopment of their territory. Creating and uniformly applying guidelines for context-sensitive design, encouraging developments that focus on local connectivity and greater uses of non-vehicular travel, and managing the access to arterial streets are all ways that can help keep land uses and transportation networks well-matched.

### Consumer Choice

Recent surveys show that attitudes are changing with respect to the number of choices offered in transportation modes as well as housing types and locations. Apparently, more people are seeking alternatives to typical suburban tract housing. This serves as a signal that there is an increasing desire for denser housing where trip lengths are shorter and can be done by bicycle or on foot. Dense, mixed-use housing with safe, accessible, and attractive sidewalks and bicycle paths is not limited to the CBD and adjoining areas. Small cities, towns and other ‘core’ areas in the periphery can encourage this type of development.

### Investment Returns

Consumer choice involves more than just more options. It also seeks to rank those options on what the society can afford. For example, how much money should be spent in widening a

freeway? Or should the money be spent on a rail line, carpool lane, or perhaps not be spent at all? These are not trivial decisions—maximizing travel time versus maximizing investment returns of public expenditures—alone on the grounds of the amounts of money involved. Certainly most would argue that we should strive to get ‘the biggest bang for the buck’. But even beyond fiscal concerns, this aspect poses more fundamental questions, such as should society continue to allow easily-avoidable inefficiencies in local transportation networks that causes congestion on the regional network? Are taxpayers’ interests being well served when housing choice is limited to low-density suburbanization? When will we reach the point where we can no longer afford to maintain the current transportation network, much less an ever-expanding one?

### Congestion

Congestion poses some questions that can only be answered by society. While most are aware of the effects of congestion (travel delays, added pollution, frazzled nerves, etc.), congestion also has a role in shaping consumer decisions. It serves as a type of pricing mechanism. Much as a toll roads charge its users monetarily, congestion costs travelers time. Congestion encourages some people to seek housing closer to their jobs, or jobs closer to their homes; it also discourages non-essential travel during peak travel demand times. But, how much congestion is acceptable? Is the elimination of congestion our highest goal? Should other modes of travel be built to reduce congestion on roadways? Is congestion a cause (excess travel demand), a symptom (result of local network inefficiencies), or a cure (pricing mechanism)?

### Quality of Life/Health

Many issues relating to transportation are issues dealing with quality of life. And while there are many different aspects of quality of life that must be addressed with respect to the transportation network such as air quality, environmental impact, ambient noise levels, health of the residents, etc. Whereas some of these aspects are addressed through environmental impact statements and other similar studies, others are much more diffuse, and are tenuously to the transportation network. Obesity, high blood pressure, arthritis, asthma—how much are increases in any of these (or similar health issues) directly or indirectly related to the sedentary lifestyle encouraged by our transportation system and land use patterns? Should entire modes of transportation (cars, busses, trains, bicycles, walking) be restricted/promoted or encouraged/discouraged based on the way they affect air quality, ambient noise, the environment, or our health?

### Locational Viewpoints

In addition to users of the transportation system, those who live within close proximity to major facilities are also profoundly affected by transportation planning decisions.. Most people will agree that living on a quiet residential street is different that living next to a freeway or rail line. Yet, there is less consensus as to when the interests of the traveling public outstrip the interests of the affected residents. This debate often pits urban residents (who must tolerate the presence of highways in their neighborhood) against suburban and peripheral residents (who use the highways to get to their destinations). At what point do the concerns of commuters outweigh the concerns of those whose house must be torn down to make room for freeway expansion?

### ***In Summary***

The transportation and land use scenarios and discussion presented here show that other land use patterns besides typical suburban development can help reduce congestion, mainly by reducing travel demand. Given the RTP’s federally-mandated financial constraints, this region is obligated

to find alternate ways to maintain mobility. This issue is complex, and its resolution will affect many people. Because of this, the interaction between transportation and land use deserves careful and public scrutiny.



## **Chapter 3**

### **Public Involvement Process**

#### ***Introduction and Goals***

In compliance with federal regulations for publishing the 2025 Regional Transportation Plan (RTP), the public must have an opportunity to review and comment on the content of the Plan. A public involvement plan has been developed to provide a structured, ongoing forum for public and private involvement. The goals of the Houston-Galveston Area Council (H-GAC) Transportation Public Involvement Plan (TPIP) are as follows:

#### ***Education***

- Develop educational materials that support a cooperative planning process and describe regional transportation and related air quality plans and activities in a concise and straightforward manner.
- Develop educational materials on how transportation plans are affected by federal clean air mandates and how the failure to meet these mandates will affect the region economically.
- Disseminate this information to the general public.

#### ***Outreach***

- Increase awareness of and interest in transportation plans and the transportation planning process using innovative approaches.

#### ***Participation***

- Provide frequent opportunities for the general public and interested parties from private entities, the public sector, environmental interests, neighborhood organizations, the disabled and other groups interested in transportation plans to learn about and comment on the issues.

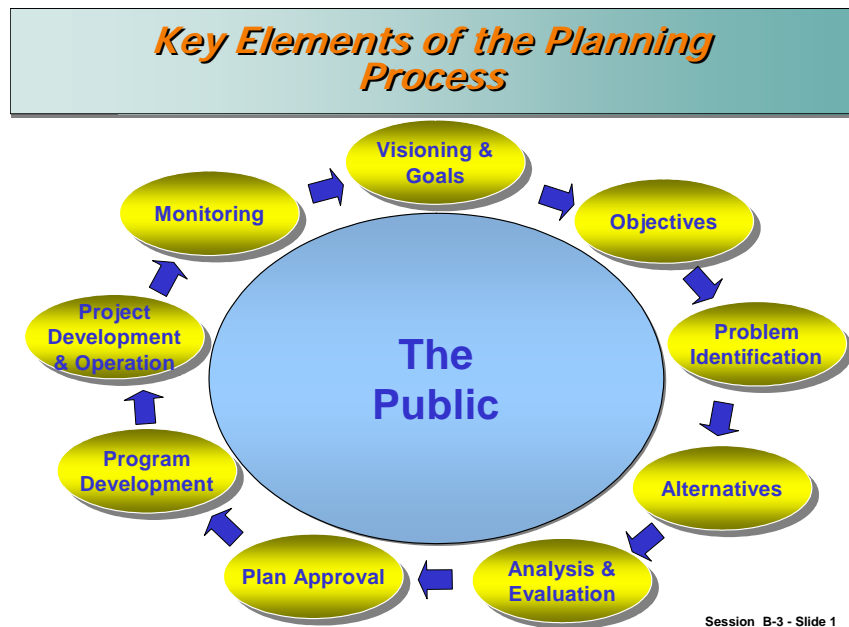
#### ***Process***

Engage the public and provide information concerning regionally significant transportation issues. H-GAC uses the following strategies to inform, educate and engage the public:

- Distribute meeting notices and information to individuals and organizations on the 2025 RTP mailing list.
- Disseminate information through newsletters, including the *VISION* for transportation issues and *Commute Solutions* for commuters.
- Hold public meetings to receive public comment prior to the adoption of or major amendment to the RTP or Transportation Improvement Program (TIP).

- Advertise meetings and legal notices in a variety of media, including newspapers, radio and TV media.
- Disseminate information through various Web sites maintained by the H-GAC Transportation Department.
- Conduct surveys, where appropriate, to determine public awareness and/or sentiment with regard to certain transportation planning issues.

The following graphic represents a visual display of the ideal public involvement process in transportation planning. The public should always be involved in the transportation planning process and at all phases in plan development.



**Potential new strategies for obtaining greater public input could include the following:**

1. Meet in more communities and with more community leaders and local organizations.
2. Conduct more periodic public opinion surveys to gauge public attitudes/opinions about transportation and air quality issues.
3. Catalog all comments received by geography to identify potential clustering of transportation issues.
4. Improve the H-GAC Transportation Web page by including a link to a public involvement page, which would include specific strategies for getting involved in local and regional transportation issues.
5. Publish a series of short informational and educational brochures to disseminate in public libraries, the H-GAC library and on the H-GAC Transportation Web page. Currently under construction is a frequently asked questions brochure.

6. Conduct additional consensus-building activities, including open houses, focus groups, listening sessions, roundtables, conferences and forums among various transportation stakeholders.
7. Schedule H-GAC presentations to be part of other meetings or presentations, such as METRO, TxDOT and City Council meetings.

### **2025 RTP Outreach Activities**

Using the H-GAC Transportation Public Involvement Plan goals as a guide, the 2025 RTP Outreach activities included:

#### **Education**

- Distributed three brochures related to the 2025 RTP: *2025 RTP Executive Summary Brochure* (2004); *Transportation Progress Brochure* (2003); and *2022 Regional Mobility Update* (2003).
- Distributed Air Quality Reference Guide(s) in 2000 and 2002.
- Periodically distributed the *Vision* Newsletter.

#### **Outreach and Participation**

- During 2025 RTP – Stage I Outreach, H-GAC conducted six meetings in various locations throughout the eight-county region. A total of 69 people attended the meetings.
- During Stage I, two surveys were conducted. The first was a telephone survey (1998) conducted to assess public opinion on transportation priorities, other transportation-related issues, funding and changes in travel patterns. Survey participants in the survey consisted of 802 residents chosen at random from the eight-county region. A Summary Report of this survey is an Addendum to this Appendix. The second survey was a mail-back public opinion survey. The findings of each survey are located in the “Survey” section of this appendix.
- During 2025 RTP – Stage II Outreach, H-GAC conducted eight meetings in various locations throughout the eight-county region. A total of 126 people attended the meetings.
- In the fall of 2000, Harris County Judge and TPC Chairman Robert Eckels distributed a mail-back public opinion survey to 60,000 Harris County residents. The purpose of the survey was to gauge public opinion on a variety of transportation issues.
- During 2025 RTP – Stage III Outreach, H-GAC conducted 14 meetings in various locations throughout the eight-county region, including 7 that were held in locations where populations are underserved by the transportation system. A total of 273 people attended the meetings.
- During Stage III Outreach, Transportation Policy Council (TPC) members sponsored and hosted 2025 RTP meetings in their respective jurisdictions.

- During Stage IV Outreach, H-GAC hosted one public hearing and three public meetings. In addition, Blueprint Houston, a local non-profit citizen group, hosted a public meeting at H-GAC.

***Summary of Outreach Activities***

Table 1: Stage I, II and III Public Meetings			
Date	Location	Attendance*	Publicity
<b>Stage I</b>			
October 14, 1998	Houston (Harris and Waller counties)	39	N/A
October 19, 1998	Galveston (Galveston County)	1	N/A
October 21, 1998	Baytown (Liberty and Chambers counties)	4	N/A
October 27, 1998	Angleton (Brazoria County)	9	N/A
November 4, 1998	Conroe (Montgomery County)	10	N/A
November 5, 1998	Sugar Land (Fort Bend County)	6	N/A
<b>Total Attendance</b>		<b>69</b>	
<b>Stage II</b>			
October 4, 2001	Houston (Harris County)	12	Press release, invitation, H-GAC Web site, <i>Houston Chronicle</i> (10/2/01 & 10/3/01)
October 9, 2001	Pearland (Brazoria County)	8	Press release, H-GAC Web site, <i>Brazosport Facts</i> (10/7/01 & 10/8/01)
October 15, 2001	Texas City (Galveston County)	14	Press release, H-GAC Web site, <i>Galveston County Daily News</i> (10/13/01 & 10/14/01)
October 17, 2001	Conroe (Montgomery County)	14	Press release, H-GAC Web site, <i>Conroe Courier</i> (10/7/01 & 10/15/01)
October 23, 2001	Meadows Place (Fort Bend County)	12	Press release, H-GAC Web site, <i>Herald-Coaster</i> (10/21/01 & 10/22/01)
October 25, 2001	Baytown (Liberty and Chambers counties)	20	Press release, H-GAC Web site, <i>Baytown Sun</i> (10/23/01 & 10/24/01)
October 30, 2001	Houston (Harris County)	13	Press release, H-GAC Web site
November 8, 2001	Houston (Harris County)	33	Press release, H-GAC Web site, <i>Houston Chronicle</i> (11/6/01 & 11/7/01)
<b>Total Attendance</b>		<b>126</b>	
<b>Stage III</b>			
May 31, 2003	Houston – East End (Harris County)	25	Media alert, flyers (6,550), H-GAC Web site

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July 8, 2003	Waller (Waller County)	20	Press release, flyers (5,000), H-GAC Web site, <i>Waller County News Citizen</i> (7/3/03), <i>Waller Times</i> (7/7/03)
July 17, 2003	Rosenberg (Fort Bend County)	25	Press release, media alert, flyers (2,500), H-GAC Web site, <i>Herald-Coaster</i> (7/16/03), <i>Houston Chronicle – This Week</i> (7/17/03)
July 29, 2003	Conroe (Montgomery County)	68	Flyers (15,500), H-GAC Web site, <i>Conroe Courier</i> (7/27/03), <i>La Informacion</i> (7/24/03)
August 5, 2003	Galveston (Galveston County)	20	Press release, flyers (5,000), H-GAC Web site, <i>Galveston County Daily News</i> (8/3/03 & 8/5/03)
August 18, 2003	Lake Jackson (Brazoria County)	32	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Houston Chronicle – ThisWeek</i> (8/14/03), <i>Alvin Sun</i> (8/18/03), <i>Angleton Times</i> (8/13/03), <i>The Facts</i> (8/17/03), <i>West Columbia Brazoria</i> (8/14/03), <i>Pearland Journal</i> (8/13/03)
September 8, 2003	Wallisville (Chambers County and Liberty County)	11	Media alert, flyers (10,000), H-GAC Web site, <i>The Progress</i> (9/3/03), <i>Cleveland Advocate</i> (9/3/03), <i>Cleveland Illustrated Paperboy</i> (9/3/03), <i>Liberty Gazette</i> (9/3/03), <i>Mont Belvieu Barbers Hill Press</i> (9/5/03), <i>Rye Big Thicket Messenger</i> (9/4/03), <i>Liberty Vindicator</i> (9/3/03), <i>Hometown Press</i> (9/3/03)
September 29, 2003	Houston – Acres Homes (Harris County)	N/A	H-GAC Web site, <i>Houston Chronicle</i> (9/27/03)
October 9, 2003	Houston – Kashmere/ Fifth Ward (Harris County)	1	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Houston Chronicle</i> (10/2/03)
October 21, 2003	Pasadena (Harris County)	5	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Houston Chronicle</i> (10/16/03)
October 30, 2003	Houston – Third Ward (Harris County)	17	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Houston Defender</i> (10/26/03)
November 6, 2003	Houston – H-GAC (Harris County)	3	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Houston Chronicle</i> (11/6/03)
November 10, 2003	Houston – Spring Branch (Harris County)	21	Media alert, flyers (5,000), H-GAC Web site
November 20, 2003	Houston – Southwest (Harris County)	25	Press release, media alert, flyers (5,000), H-GAC Web site, <i>Vietnam Moi News</i> (11/18/03), <i>Chinese Community News</i> (11/15/03), <i>Houston Chinese Press</i> (11/15/03), <i>Southern</i>

			<i>Chinese News</i> (11/15/03 & 11/18/03), <i>Liberty News</i> (11/15/03), <i>World Journal</i> (11/19/03), <i>International Daily News</i> (11/19/03)
<b>Total Attendance</b>		<b>273</b>	
<b>Stage IV</b>			
April 6, 2004	Friendswood (Galveston County)	11	Press release, H-GAC website, <i>Houston Chronicle</i> (4/4/04 & 4/11/04), <i>Galveston Daily News</i> (4/4/04), <i>Texas Register</i> (4/9/04)
April 8, 2004	Conroe (Montgomery County)	23	Press release, H-GAC website, <i>Houston Chronicle</i> (4/4/04 & 04/11/04), <i>Texas Register</i> (4/9/04)
April 13, 2004	Houston (Harris County)	41	Press release, H-GAC website, <i>Houston Chronicle</i> (04/04/04, 04/11/04, & 04/12/04), <i>Texas Register</i> (04/02/04 & 04/09/04)
April 14, 2004	Sugar Land (Ft. Bend County)	14	Press release, H-GAC website, <i>Houston Chronicle</i> (04/04/04 & 04/11/04), <i>Ft. Bend Sun</i> (04/14/04), <i>Texas Register</i> (04/09/04)
April 20, 2004	Lake Jackson (Brazoria County)	13	Press release, H-GAC website, <i>Houston Chronicle</i> (04/04/04 & 04/11/04), <i>Brazoria County News</i> (04/15/04)
April 27, 2004	Houston (Harris County) Meeting sponsored by BluePrint Houston	120	Media handled by BluePrint Houston
<b>Total Attendance</b>		<b>222</b>	
<b>Total Attendance Stage I, II, III, &amp; IV</b>		<b>690</b>	
*Attendance from sign in sheets, not including H-GAC staff or H-GAC consultants.			

### *Surveys*

#### **Mail-back Public Opinion Survey, January 1999**

- Distributed to 1,500 residents in the Houston-Galveston Transportation Management Area (TMA)
- **Received 171 responses**

#### *Findings:*

1. The survey indicates that respondents favor increased funding in transportation sectors in addition to roadways.

2. More detail is wanted on how the Plans' goals will be implemented.
3. Consideration should be given to increasing funding in strategies most likely to affect commuting choice such as carpool/vanpool facilities.

### **Telephone, Fall 1998**

802 residents chosen at random from the eight county TMA

#### Findings:

1. Some survey respondents expressed they wanted an increased emphasis in public transportation and congestion reduction.
2. Quality of life factors (environmental-related, congestion reduction and neighborhood preservation) were mentioned as important concerns to be considered when developing solutions to transportation needs.
3. 37 percent of the respondents feared there was inadequate funding to meet our transportation needs within the next 10 years.
4. Strategies mentioned for meeting potential future funding shortfalls were changing existing priorities, seeking more private sector contributions and considering new tolls and parking fees.
5. Some respondents noted they believed effective strategies to change existing commuting habits are; more flexibility in work hours and days, a guaranteed ride home program and improved transit service coverage.
6. A majority of the respondents expressed they want to continue driving, while 28 percent of drivers want a change. Options they are willing to try are transit (bus and/or rail), carpools and vanpools.

### **Mail-back Public Opinion Survey, Fall 2000**

Harris County Judge Robert Eckels distributed 60,000 to Harris County residents

Approximately 1,200 responses

#### Most common responses:

1. Support for and opposition to comprehensive rail, commuter rail, monorail
2. Support for expansion of bus routes
3. Support for park and ride/carpool/vanpool expansion
4. Support for and opposition to the expansion of the freeway system

5. Support for elimination of the HOV system
6. Support for truck restrictions in the left lane
7. Support for and opposition to toll roads
8. Support for synchronization of traffic lights
9. Support for and opposition to bike and pedestrian trails
10. Support for better fiscal responsibility and accountability
11. Support for construction project management
12. Support for a needs assessment of proposed projects
13. Support for the completion of projects before starting new projects

#### **Mail-back Public Opinion Survey, Summer 2003 – Spring 2004**

Distributed at public meetings/hearings and available online via the H-GAC website.

Approximately 58 responses.

#### **Findings:**

##### **Identified Problems:**

- #1 Congestion
- #2 Poor Pedestrian/Bicycle Access
- #3 Too Many Trucks
- #4 Poor Quality Roads
- #5 Unsafe Roads
- #6 Railroad Crossings
- #7 Highway Transit

##### **Recommended Solutions:**

- #1 Increase Transit
- #2 More Bicycle/Pedestrian Facilities
- #3 Build More Roads
- #4 Synchronize Traffic Lights
- #5 Other Incentives (Vanpools)
- #6 Improve Construction Schedule
- #7 Repair Existing Roads
- #8 Improve Safety
- #9 Reduce Railroad Crossings



***Comments Received via Letter, E-mail, Public Meetings and Other Correspondence***

Comments received by H-GAC are forwarded to the proper sponsoring agency for consideration. For example, comments received regarding transit are forwarded to METRO and comments regarding interstate projects are forwarded to the Texas Department of Transportation (TxDOT). All letters received from organizations receive a formal reply from H-GAC.

**Stage I: Summary of Comments**

*The following is a list of comments received during Stage II of public outreach. Many of the comments have been incorporated into the RTP, such as maintenance and preservation receives higher priority, transit expansion and additional transportation demand management programs are proposed, additional bicycle and pedestrian facilities are proposed, some corridor specific improvements are planned.*

***Transportation System Capacity and Efficiency***

1. Provide better maintenance of freeways.
2. Close funding gaps by changing priorities and seeking private sector funding.

***Land Use***

1. Control urban sprawl.
2. Coordinate plans with port improvements to minimize conflicts.

***Mass Transit***

1. Pursue mass transit, including rail.
2. Expand bus transit services, especially for the disabled.
3. Maximize utility of existing and future HOV facilities.
4. Build a light rail system.
5. More public transportation and congestion reduction projects.

***Travel Demand Management***

1. Increase promotion of alternatives to driving alone.
2. Workplace flexibility is the key to changing commuting habits.

***Proposed Projects***

1. Tailor transportation solutions to each community.
2. Roadway and public transportation improvements are top two priorities.
3. Recognition of inadequate funding for transportation projects.
4. Balance approach in establishing transportation priorities.

### ***Environmental***

1. Minimize transportation impacts on communities and neighborhoods.
2. Protect the environment, reduce congestion, improve air quality, and preserve neighborhoods and other quality of life issues when planning transportation projects.

### ***Bicycle and Pedestrian***

1. Expand pedestrian and bicycle facilities.

### **Stage II: Summary of Comments**

The following is a list of comments received during Stage II of public outreach. Many of the comments have been incorporated into the RTP, such as increasing synchronization of traffic lights, addressing unmet transit needs, and providing vanpool incentives. Some issues, such as restrictions on truck traffic, are subject to authorizing legislation but will remain on H-GAC's list of alternatives. Likewise, further analysis of regional unmet transit needs remains.

### ***Transportation System Capacity and Efficiency***

1. Accurate assessment of potential impacts of highway capacity increases on nearby residences, businesses and air quality.
2. Implement incentives for the timely completion of construction projects and penalties for construction projects not completed on time.
3. Restrict truck traffic to only 1 lane during rush hour and other peak periods.
4. Discontinue current HOV system and support the installation of commuter rail lines utilizing the same right of way.
5. Stop funding additional freeways and roadways as a solution to congestion problems.
6. Increase synchronization of traffic signals and lights especially during peak hours of traffic.

### ***Safety***

1. *Route trucks carrying hazardous materials away from residential areas.*
2. Provide greater bicycle and pedestrian safety on shared roadways.

### ***Land Use***

1. Restrict residential development in the floodplains.
2. Address the jobs-housing imbalance by placing jobs and housing within a reasonable proximity of one another.

3. *Curtail growth and sprawl.*

### ***Mass Transit***

1. *Expand METRO bus system and service area.*
2. Address unmet service needs of residents in rural areas with limited commuter options and the inaccessibility of transit in rural areas as a barrier to population growth.
3. Develop a comprehensive rail system including commuter rail along IH-45 (North and South), Highway 290 (Northwest Freeway), IH-10 (Katy Freeway) and U.S. 59 (North and South), and light rail to Intercontinental Airport and Hobby Airport from downtown.

### ***H-GAC***

1. Take the lead role in implementing a regional public transportation system.
2. Assume a leadership role in transportation coordination efforts with current special needs service providers.
3. Include provisions in the plan for special needs groups such as: elderly, disabled, low-income, workforce trainees, welfare-to-work recipients, and students.
4. Provide information on grant funding availability for job access programs, pilot projects, start-up providers, mobility studies and railroad safety.

### ***Emergency Management***

1. Develop additional evacuation routes particularly from Galveston County and Southeast Harris County.

### ***Travel Demand Management***

1. Develop a telecommunications infrastructure.
2. Incentives for vanpooling, especially among professionals.

### ***Proposed Projects***

1. Explanation of funding sources to be expended on future planning activities for the proposed IH-69 NAFTA corridor.
2. Opposition to any project related to the Grand Parkway/SH 99.

### ***Outreach***

1. Provide 2025 RTP presentations at civic organization meetings, Parent Teacher Organization meetings and schools.

2. Representation from unions, bicycle advocates, child advocates, the medical community, public health officials, schoolteachers, environmentalists, university researchers and industry on the Regional Air Quality Policy Council and other transportation committees.
3. More detailed explanations regarding project elements and levels of congestion.

### ***Modeling***

1. *Greater accuracy in H-GAC's modeling capabilities.*

### ***Environmental***

1. No new road construction because of the possible deleterious impacts to the region's air quality.
2. Greater public education regarding an overall environmental assessment and the conformity process.

### **Stage III: Summary of Comments**

*The following is a list of comments received by meeting location during Stage III of outreach. The H-GAC presenter responded to each comment or question at the meeting, and questions that could not be answered during the meeting were forwarded to the appropriate agency.*

#### ***East End Meeting (5/31/03)***

1. Why does the Houston region receive less funding for transportation than other parts of the state?
2. Pedestrian safety and railroad crossings are still issues in the East End. The commenter was also happy to see the Harrisburg line in the METRO Stage II plan.
3. There is a need to enforce speed limit laws on Harrisburg and Polk.
4. There is a need for a circulator or shuttle between transit center and neighborhoods.
5. How can neighborhoods receive money for improvements?
6. What can the citizens do to help agencies receive more funding for improvements?
7. How does the East End community ensure that it gets its fair share of dollars for improvements?
8. Need ADA compliant sidewalks throughout the area.
9. Rumor of a new highway from SH 225 to 75<sup>th</sup> Street.
10. Congestion on Wayside.

11. What is the level of mobility around the Gulfgate Shopping Center (IH-45/ Gulf Freeway and Loop 610 South)?

***Waller County Meeting (7/8/03)***

1. *Are concept roadways going to have controlled access? Isn't that expensive? Any indication that TxDOT will help with the concept road funding?*
2. Is there any possibility of the Colorado Valley Transit Agency (service in Waller County) being saved? Is local matching the downfall of the CTVA?
3. Has H-GAC developed a response to Commissioner Radack's light rail comments?
4. How is H-GAC funded?
5. Who will pay to move billboards for new roads? What control does a community have over billboards?
6. Can the RTP address the milling of roads?
7. Any plans to widen 1488?
8. What does 2022-2025 project list mean?
9. Does H-GAC make the final decisions on projects?
10. What is the TPC?
11. Waller has a problem with flooding because of 290.
12. What actually happens after our voices have been heard? What happens after these meetings that improves our quality of life?
13. Prairie View is experiencing flooding because of 290.
14. Any plans to build connecting roads between Waller and Harris County?
15. What methodology do you use to identify the needs on this project list?
16. Are traffic counts for other roads available?
17. Why spend money on a road we don't use or need?
18. Some of the projects on this list might not get done?
19. Is TxDOT planning on working on overpasses? Will they redirect traffic? When will this happen?
20. The city of Waller is missing some exit signs.

***Fort Bend County Meeting (7/17/03)***

1. There is a lack of projects in eastern Fort Bend County.
2. Is there a plan to make changes to the 2025 RTP, as needed?
3. What will change when U.S. 59 becomes I-69?
4. The 2025 RTP is important for smaller cities in that it enables smaller municipalities to compete for federal transportation funds. It is imperative that local jurisdictions complete long- and short-range plans?
5. To what extent should toll facilities be considered? What are the implications?
6. Would like to see more transit, bus rapid transit in particular.
7. How will HOV lanes change? Will the HOV lanes become managed lanes with congestion pricing?
8. FM 360 in southwest Fort Bend County – look at that area for improvements and development.
9. Recognize that connectivity from Fort Bend into Harris County is important.
10. There is a need for park and ride services in Kendleton.

***Montgomery County Meeting (7/29/03)***

1. How overcommitted is TxDOT for existing projects? Implementation?
2. When will red lines showing congested roadways be funded and relieved?
3. Is there a schedule available that lists when construction will begin on projects?
4. Montgomery County Woodlands Chamber of Commerce has concerns about roadway construction that currently are not in the 2025 RTP. Letter sent to H-GAC requesting these be added to the plan.
5. Transportation needs for citizens who need to get to work, doctors' appointments, etc. Need a study on public transportation needs in Montgomery County.
6. Please explain urban vs. rural road classification.
7. Does Montgomery County still have a mobility committee that feeds information to H-GAC? Does mobility committee address public transportation system needs?
8. Lack of right of way on county roads to add bike lanes.

9. How does the process work to get funding for a new kind of project in Montgomery County?
10. Who in H-GAC listens to Montgomery County needs and can help address these needs?
11. Corridor presentation – How does this work since state money is limited?
12. 100 percent plan for The Woodlands – grid roadway to meet future density demands of population.
13. Requesting specific list of projects to be implemented in Montgomery County.
14. Suggestion: FM 1488 – move up in priority to get completed.
15. Housing Authority – low income residents constricted in getting federal money for private-public partnership for mass transportation needs.
16. Is it helpful for counties to make recommendations on prioritization of projects waiting to be implemented?
17. Projects have a resident count vs. traffic count?
18. Is it planned for Hardy Toll Road to expand to Conroe?
19. Input accepted for TxDOT. Who all gives input for Montgomery County?
20. Expansion of I-45 (why the hold up at San Jacinto River Bridge). Ironical that it's an environmental issue because the delay is causing lots of emissions due to back up of traffic every day!
21. How do sidewalks/cycle paths get factored into roadway projects?

***Galveston County Meeting (8/5/03)***

1. Who are the Galveston County representatives on H-GAC's Transportation Policy Council?
2. There should be a mechanism to have big institutions, such as the Ports, pay for improvements in their areas. The usual way is to collect taxes to fund improvements for road systems.
3. We need to have a fair share of funding for transportation development. It seems like Houston gets better funding than Galveston.
4. Comment regarding intersections in Texas City and League City.
5. What is the current situation with the project to install DSL (high-speed internet) services and increase the number of teleworkers?
6. When will the Draft 2025 RTP go to the TPC for approval?

7. What is the deadline for projects to be proposed as a Candidate project for the 2025 RTP?
8. Comment made about the need for more clean fuel vehicles to reduce emissions.
9. What is the process for getting bike lanes constructed?
10. What about Bayport Rail?

***Brazoria County Meeting (8/18/03)***

1. There needs to be a link between public transportation and evacuation routes. If there is a hurricane, people need to be able to catch a bus and get out of town.
2. There is a need for public transportation for low-income households.
3. SH 288 is not a good evacuation route because it feeds into Loop 610 and the feeder roads on Loop 610 flood.
4. Rubbernecking on Loop 610 (and other highway facilities) needs to decrease. If the vision to rubberneck was eliminated, the rubber necking would cease.
5. Are there plans to add additional lanes to SH 288? How soon?
6. Is the current hurricane evacuation plan to send people to Houston?
7. Is there a current evacuation plan that is made available to the public?
8. Are there any planning studies currently underway for an east-west corridor through Brazoria County to the western part of the region?
9. When Hwy. 36 is widened, will it serve as an evacuation route?
10. What was the purpose of building the bridge in Quintana?
11. Truck traffic through Lake Jackson is a major concern.
12. Are there any short-term plans for mass transit in Brazoria County?
13. How is H-GAC getting local freight industry professionals engaged in the dialogue on freight issues?
14. Is there anything in the 2025 RTP to address the needs of low-income persons and welfare recipients?
15. Park and Pool lots in Brazoria County are overcrowded. What is the process to increase the capacity at Park and Pool lots?
16. Why can't Brazoria County residents access METRO services?



17. Connect Transportation is a joke and not a viable transportation option.
18. There is a safety gap between unlicensed immigrant workers and public transportation. Public transportation should be provided for immigrants because they can't obtain a driver's license and car insurance.
19. There is a need to make the public comments available via the H-GAC Web site.

***Liberty County and Chambers County Meeting (9/8/03)***

1. Are H-GAC's funds for TxDOT projects only?
2. There is a need in our counties for funding. Liberty needs assistance with county roads.
3. We need help with Hwy 90 today. There is a huge bottleneck at Hwy 90.
4. Hurricane evacuation - .5 miles into Liberty is a low flooding spot. There needs to be an escape for us during flooding.
5. Trinity River Bridge – What is the alternative route when TxDOT begins work on the bridge?
6. I-10 – the access roads go both ways and we need this fixed.
7. East & West Loop I-10 – Need strait shot to San Antonio without going through Houston.
8. The bridge construction combined with construction on I-10 will cut our county off.
9. 146 & 90 intersection is not an intersection. We need an intersection there.
10. Why can't we have high-speed rail out here, connecting Beaumont to Houston?
11. Will the Trinity bridge construction resemble the Sabine River Bridge construction?
12. Is the RR track crossing in Dayton slated for 2018?
13. Can H-GAC help our district get the funding we need even though we're in the Beaumont district?
14. When will the Parkway construction begin?
15. We would like to see an easing of the curve located on FM 562 South.

***Acres Homes (Harris County) Meeting (9/29/03)***

No Comments

***Kashmere (Harris County) Meeting (10/09/03)***

1. When does it become necessary for the government to “take” someone’s property for transportation projects?
2. If the METRO Solutions plan is approved, would any of the proposed routes require the taking of property in the area?
3. How are transportation projects funded?

***Pasadena (Harris County) Meeting (10/21/03)***

1. *Can the City of Pasadena still include projects for inclusion in the 2025 RTP?*
2. Does the City of Pasadena need to send projects to H-GAC that are included in the city’s Capital Improvement Plan (CIP) that are not requesting federal funds?
3. The Strawberry Road extension project is not a popular project with the citizens. It involves the demolition of 34 homes.

***Third Ward (Harris County) Meeting (10/30/03)***

1. *Bus breakdowns are a problem when patrons have to wait an extended time period before a replacement bus arrives. Does the regional vanpool program include some way of taking the patrons from a broken-down bus on to their final destination?*
2. There are some rude METRO bus drivers, also some friendly ones.
3. Why aren’t the bus-to-bus transfers timed at the Transit Centers so that disembarking passengers can get directly onto their next bus?
4. What criteria were used to decide where the rail system would connect? Were the elderly and disabled considered in the rail plans? Why isn’t the rail service planned for Cunney Homes because the poor people there are more likely to ride than the rich?
5. What about flooding, it’s a major concern in the area?
6. What about bicycle facilities, how are they planned for? What about the Rails to Trails initiative and its potential in the area, along the Columbia Tap abandoned railroad corridor?

***H-GAC (Harris County) (11/6/03)***

***Spring Branch/Memorial (Harris County) (11/10/03)***

1. What incentives are (included in the plan) for the general public to help achieve the clean air targets?
2. How are NAFTA, foreign trucks and their impacts on air quality considered? What about efforts for cleaner vehicles?

3. Why not time the traffic signals along major roads like Westheimer, if the potential benefits are so apparent?
4. What about incentives for alternative fuels?
5. Better construction management is needed. Examples include Memorial and Westview. Apparently sections of the improved roadway(s) had to be re-constructed within a short time because the road construction and the drainage improvements were not adequately coordinated.
6. Where do the H-GAC funds come from?
7. What about parallel routes during the Katy freeway expansion?
8. Why not consider alternative technologies for mass transit? A proponent of Bus Rapid Transit (BRT) within dedicated guideways expressed concerns that the Mayor stopped METRO's former Monorail plans that were approved by the voters at that time. The BRT/Guideway technology would only cost about \$1 million per mile, and would carry 30,000 people per hour in the peak direction and is self-propelled.

***Southwest (Harris County) (11/20/03)***

1. There is a need for direct park and ride/express bus service from the Clear Lake/Bay Area vicinity to the Westchase area using the South Beltway 8. The bus service that goes downtown and requires a transfer takes too long and the proposed route would be much faster.
2. Pedestrian safety is a concern, especially for the elderly in commercial districts and particularly on the weekends. The intersections near Fondren and Gessner at Bellaire Blvd., and crossings along Bellaire, Westpark, Harwin and Westheimer are hazardous for pedestrians.
3. People from other cultures do not cross at the intersections but tend to "jay-walk" across the streets to get to the shops on either side.
4. There is a need for some type of circulator or shuttle bus service that could pick up senior citizens and others at the various community centers and transport them to medical, shopping and recreational activities. Such services could also be useful to connect workers from the various apartment complexes to the METRO transit facilities nearby.
5. *There is a concern that no roadway improvements are planned for the Alief community, west of Beltway 8/Sam Houston Tollway. The commuters on the major roadways there experience significant delays each day and mobility improvements are needed.*
6. Major roadways in the general area are in need of maintenance and repair. In particular, segments along Westpark, Gessner, Fondren and Harwin show signs of significant deterioration. It was observed that large numbers of trucks using the roadways in the area are probably making the conditions worse. Many of the trucks are associated with the

major construction of the Westpark Tollway. Others are distributing goods to and from the various warehouses and shops in the commercial areas.

7. Sidewalks in the area are not well maintained, often overgrown with weeds and not continuous along the roadway segments adjacent to the retail shops, which are used by many pedestrians.

#### **Stage IV Summary of Comments:**

During this stage of public outreach, citizens had the opportunity to participate in the plan development process either via a mail back comment card (the comment card was available at public meetings and also available on the H-GAC website), in person at a meeting or public hearing, email, and snail mail (U.S. mail). H-GAC received over 200 emails and letters. The correspondence received came from private citizens as well as agencies and organizations. All comments (and a response from H-GAC) received can be viewed on the H-GAC website on the Public Involvement page of the Transportation section. Also available for viewing on the Public Involvement page are transcripts from the meetings and hearings during this stage of outreach. The most prevalent comments received included:

1. Support for an increase in bus and rail transit
2. Opposition to new road construction
3. Support for more public involvement and education
4. Opposition to specific projects (Added capacity of Arterials and Grand Parkway)
5. Opposition to the plan citing environmental concerns (quality of life, flooding, and air quality)
6. Support for better bicycle/pedestrian planning and facilities
7. Support for telecommuting and other transportation alternatives
8. Support to better explore relationships between land-use/regional growth and transportation planning

**ADDENDUM**

**TRANSPORTATION ISSUES  
PUBLIC OPINION  
SURVEY**

March 1999

Summary Report

Based Upon A Report Prepared By  
OPINIONS UNLIMITED, Inc.  
for the

*Houston-Galveston Area Council*



Funding for this report was provided by the Houston-Galveston Area Council, the Texas Department of Transportation (TxDOT), the United States Department of Transportation (US DOT), the Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA).

“The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the view or policies of the Federal Transit Administration, the Federal Highway Administration, the Texas Department of Transportation or the Houston-Galveston Area Council.”

## INTRODUCTION

As part of the public outreach program in support of an update to the current Metropolitan Transportation Plan (MTP), the Houston-Galveston Area Council (H-GAC) contracted with a private marketing research firm to conduct a regionwide telephone survey. The purpose of the survey was to assess public opinion on transportation priorities, other transportation-related issues, funding, and changes in travel patterns. The results of this survey, combined with comments from a series of public meetings in the fall of 1998, will serve as one basis for determining issues and needs to be addressed in the Plan update. Participants in this survey consisted of 802 residents chosen at random from the eight-county Houston-Galveston Transportation Management Area consisting of Chambers, Brazoria, Fort Bend, Galveston, Harris, Montgomery, and Waller counties. These individuals were contacted by telephone and asked to respond to a number of survey questions. On a regionwide basis, the margin of error for this type of survey is +/- 3.5%.

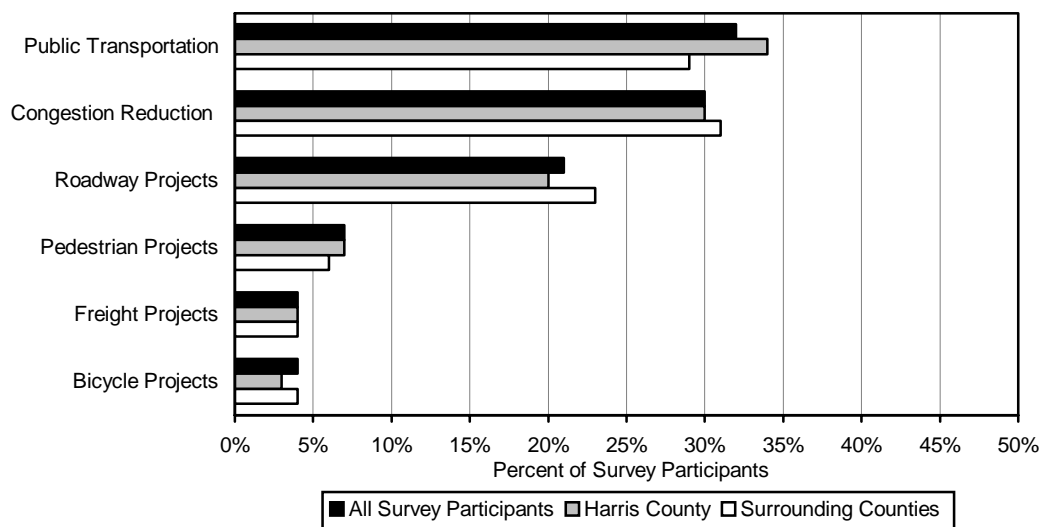
## SURVEY RESULTS

The results of the telephone survey are summarized in the following sections. Unless noted otherwise, survey results are provided for (1) the eight-county region as a whole; (2) Harris County; and (3) for the surrounding counties. The full survey results and tabulations are provided in a separate report.

### Program Priorities

In the first series of questions the respondents were asked to rate the importance of six types of transportation improvements and then asked to prioritize them. Figure 1 provides the percentage of participants who said that a particular type of transportation improvement should have the highest priority.

**Figure 1 - Priority for Transportation Improvements**



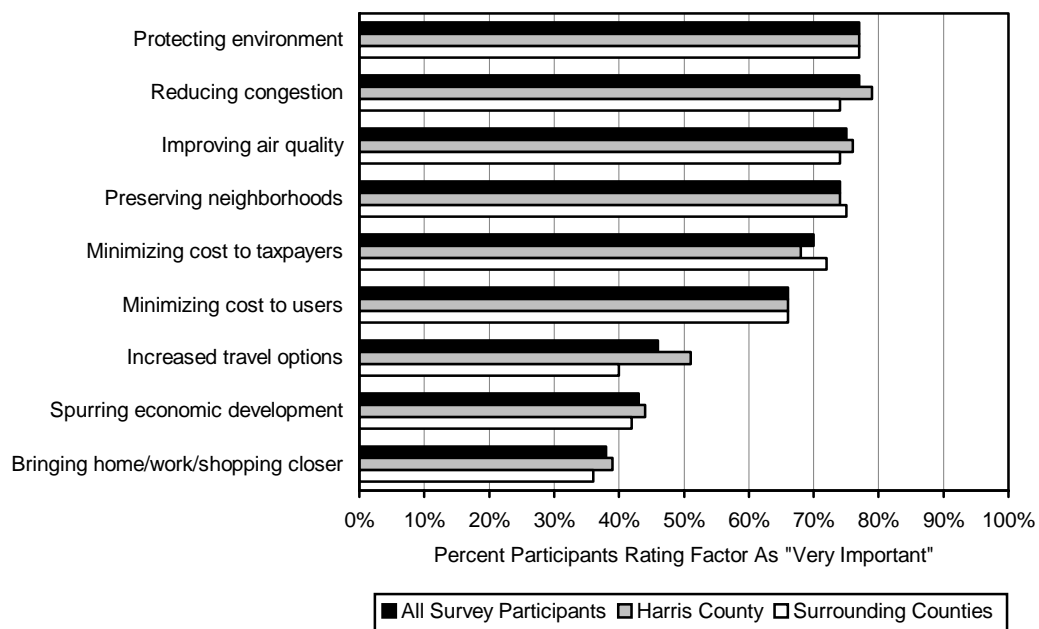
The top two priorities are for public transportation and projects to reduce congestion. In Harris County there is a slightly higher priority for public transportation (34%) than the surrounding

counties (29%). Conversely, there is a slightly higher priority for roadway projects in the surrounding counties (23%) than Harris County (20%).

### **Other Transportation-Related Factors**

Survey respondents were asked to rate the importance of nine other factors or considerations related to solving transportation problems. They were asked to rank each factor using one of the following ratings: Very Important, Somewhat Important, Not Very Important, and Not At All Important. Figure 2 shows the proportion of participants who said that each factor was “Very Important”.

**Figure 2 - Rating Other Related Factors**



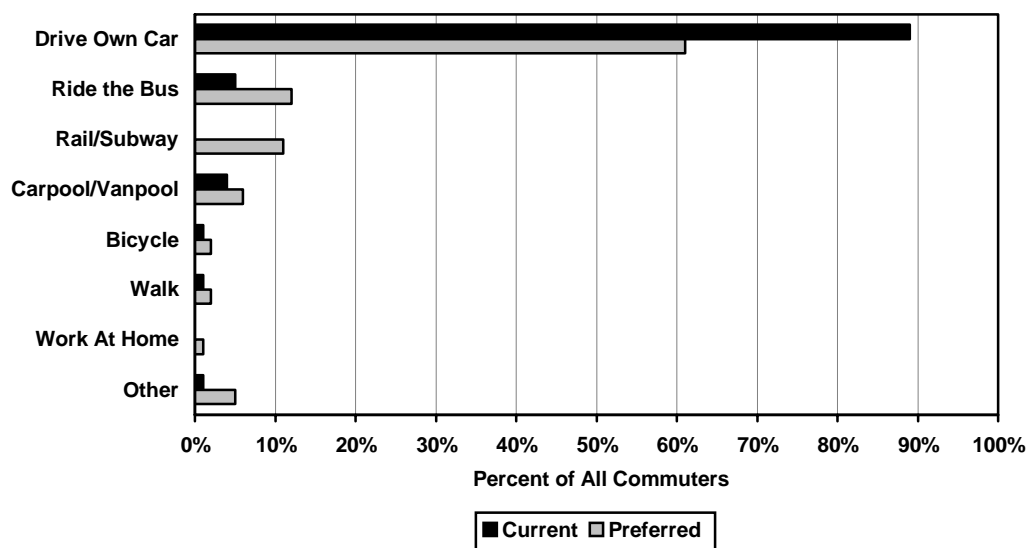
For all three groupings (regionwide, Harris County and surrounding counties) the same four factors (environment, congestion, air quality, and neighborhood preservation) ranked as most important. In Harris County reducing congestion (79%) was slightly more important than the surrounding counties (74%). Also in Harris County, increased travel options was more important (51%) than in surrounding counties (40%). In the surrounding counties minimizing cost to taxpayers was slightly more important (72%) than in Harris County (68%).

### **Method Of Travel**

Respondents were asked a series of questions concerning whether they were regular commuters, how they currently commute and how they would like to commute, and whether there were any changes in their commuting patterns in the last three years. Regionwide 74% indicated that they are regular commuters; for Harris and the surrounding counties the commuting figures were 79% and 69% respectively.

Lastly, Figure 3 compares the current and preferred means of travel for regular commuters. Differences between Harris County residents and those of surrounding counties are negligible, so the data is shown in aggregate.

**Figure 3 - Current Vs. Preferred Methods of Travel**

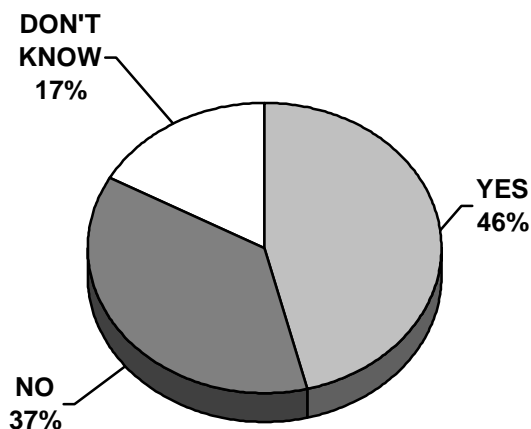


When compared with the current method of travel, the biggest change in preferred method of travel is in “Drive Own Car”, declining 28 percentage points. The next biggest changes are increases in preferred means of travel for “Rail/Subway” (+11%), “Ride the Bus” (+7%), and “Carpool/Vanpool” (+2%).

### **Funding**

Respondents were asked if they felt within the next 10 years that there will be enough money to meet our transportation needs. As shown in Figure 4, a plurality (46%) feel that there is enough money. However, a significant percentage (37%) feel there is not enough money. There were no appreciable differences between participants in Harris County and those in the surrounding counties on this issue.

**Figure 4 - Is Funding Adequate?**





Respondents who indicated funding was not sufficient were further asked what they felt should be done to meet future funding needs. They were given eight possible funding options and allowed to pick multiple choices. The results of this question are provided in Figure 5 below.

**Figure 5 - Support For Other Funding Options**

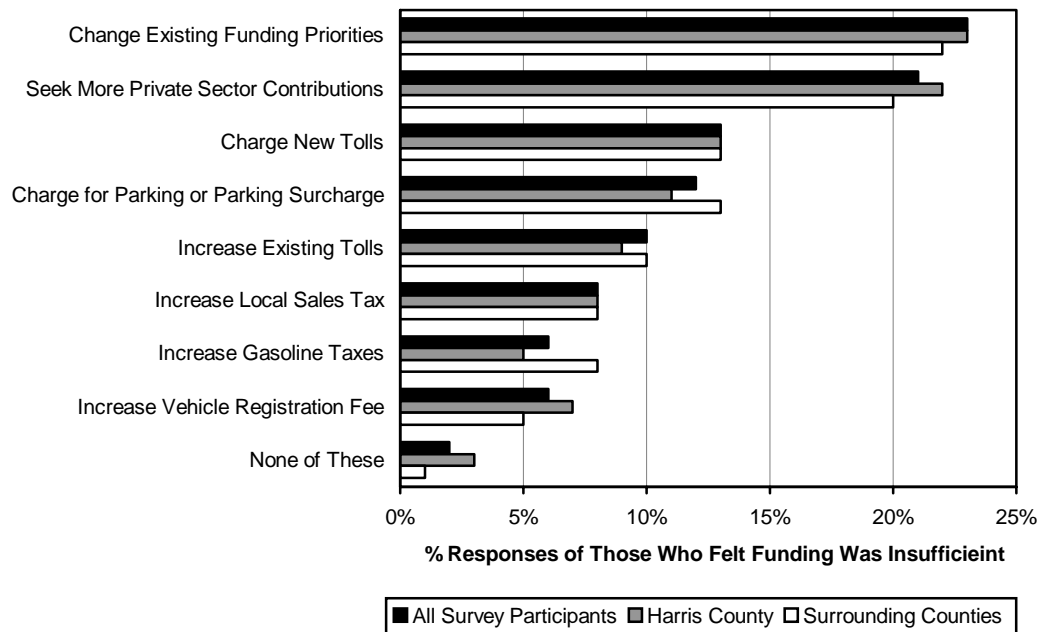


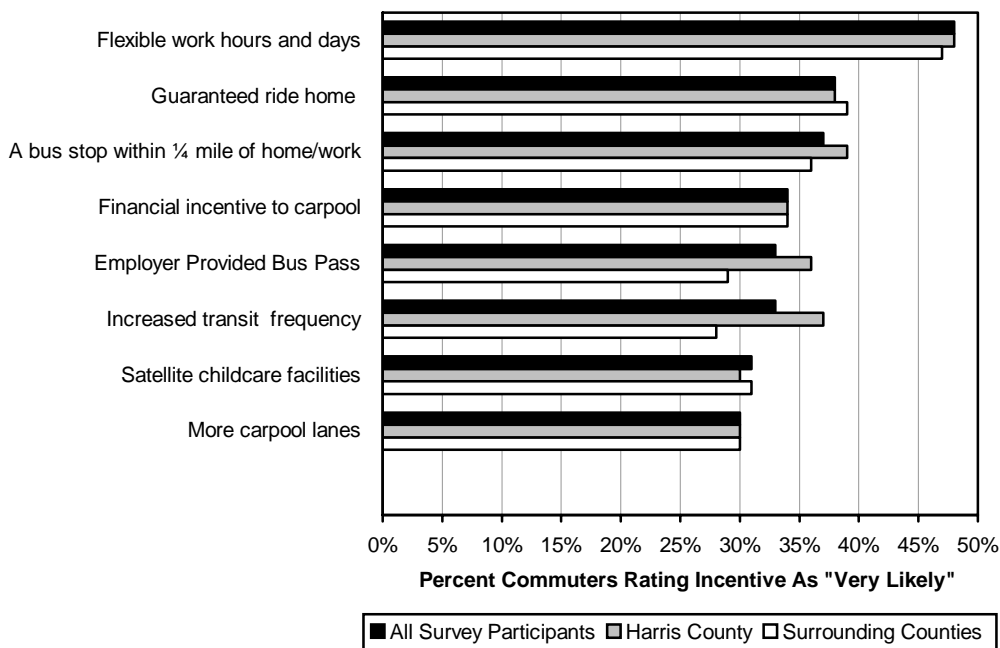
Figure 5 indicates that by far the top two choices for addressing potential transportation funding shortfalls are to change existing funding priorities and to seek more private sector contributions. Charging new tolls and charging for parking or instituting a parking surcharge are the next highest ranking choices. Overall there are few differences when comparing regional percentages with Harris County and surrounding counties.

### **Incentives To Change Travel Behavior**

Survey respondents were offered proposed incentives and asked how likely each of the incentives would change their commuting behavior. They were asked to rank each incentive using one of the following ratings: Very Likely, Somewhat Likely, Not Very Likely, and Not At All Likely. Figure 6 shows the proportion of all respondents who said the incentive was “Very Likely” to affect their commuting choices.

Based on the survey results, the most effective incentive is more flexibility in work hours and days, followed by a guaranteed ride home program and a bus stop within ¼ mile of their home or place of employment. The percentages for the next three incentives, when considering regionwide responses only, are very close. In Harris County, there is greater support for increased transit service frequency (37%) and an employer provided bus pass (36%) than in surrounding counties (28% and 29% respectively). The “more carpool lanes” incentive ranked last.

**Figure 6 - Incentives Likely To Change Commute**



## CONCLUSIONS

Based upon the survey results, the following conclusions can be drawn.

- 1) There appears to be a public desire for more of a balance in transportation priorities with an increased emphasis in the areas of public transportation and congestion reduction.
- 2) “Quality of Life” factors (environmental related, congestion reduction, and neighborhood preservation) are the public’s most important concerns to be considered when developing solutions to our transportation needs.
- 3) A significant percentage of the respondents (37%) felt there was inadequate funding to meet our transportation needs within the next 10 years.
- 4) The most preferred strategies for meeting our future funding shortfalls were changing existing priorities, seeking more private sector contributions and to a lesser extent, considering new tolls and parking fees.
- 5) The most effective strategies to change existing commuting habits are more flexibility in work hours and days followed by a guaranteed ride home program and improved transit service coverage.
- 6) Where as a majority of the public appears to want to continue driving, a significant percentage (28%) of drivers want to change. The options they are willing to try are transit (bus and rail) and carpools and vanpools.

## Chapter 4

### Environmental Justice

The information contained in this chapter relates to efforts focused on equity concerns in the regional transportation system. The first section summarizes the results of several research activities that were completed between 2000 and 2003. The second section presents the preliminary results of an initial accessibility analysis for selected areas.

#### Highlights

In 2000, H-GAC commissioned a series of consumer focus groups with low-income residents, community roundtable discussions, and in-depth interviews with community leaders on transportation and Environmental Justice. All research was qualitative and designed to get a better understanding of environmental, transportation and safety concerns of low-income residents in the region. Findings are summarized in this chapter and include the following:

- The most effective way to reach members of a community regarding environmental and transportation issues varies based on subgroups.
- With respect to adequate transportation, there are underserved markets within low-income and ethnic subgroups that should be targeted.
- The need for additional transportation development lies inside the existing system. The current public transportation system could be enhanced to include areas like neighborhoods and small communities that are currently circumvented.
- There are many safety issues associated with the current disrepair of the roads in the area.

In addition, H-GAC is conducting research to determine if certain segments of the population experience greater travel times to the four major activity centers (MACs) than other segments of the population.<sup>32</sup>

- The targeted segments of the population include zero auto households, low-income households, and census tracts populated with large numbers of minorities.
- The purpose of the analysis is to determine equity (or lack of discrimination) in terms of accessibility to various activities by the transportation system.
- The primary analysis involves the calculation of average network travel times by modes (auto and bus) to specific destinations from selected areas.
- This initial analysis will be compared with other areas to determine a relative measure of accessibility.

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<sup>32</sup> The initial analysis, as reported here, focused on work trips to major employment centers as a starting point. The MACs are Downtown/CBD, Uptown/ Galleria, Greenway Plaza and the Texas Medical Center. Future analyses will consider work and non-work trips to the MACs and other destinations.

- The same analysis will also be applied to a proposed system of transportation improvements so the results of a before-and-after scenario simulation can be presented.

## Background

On February 4, 1994, President William Clinton signed Executive Order 12898: *Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations*. Executive Order 12898 augments the 1964 Title VI Civil Rights legislation that assures that “no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.” Environmental justice (EJ) is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income. Fair treatment means that no group of people, including racial, ethnic, or socio-economic group should bear a disproportionate share of the negative consequences resulting from industrial, municipal and commercial operations or the execution of federal, state, local and tribal programs and policies (U.S. Environmental Protection Agency).” The focus of EJ embraces three fundamental principles:

- Avoid, minimize or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.<sup>33</sup>
- Ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

The U.S. Department of Transportation (U.S. DOT) expounded on EPA’s definition and stated that “in making determinations regarding disproportionately high and adverse affects on minority and low-income populations, mitigation and enhancements measures will be taken into account, as well as design, comparative impacts and the relevant number of similar existing system elements in non-minority and non low-income areas.”

The U.S. DOT has issued guidelines to Metropolitan Planning Organizations (MPOs) regarding their role in EJ. The role of the MPO is to:

- Explore needs within minority communities;
- Involve minority communities and disabled persons in the transportation planning process;
- Include minorities/disabled persons on boards and committees in leadership roles,

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<sup>33</sup> Comparisons of the relative access time to major employment centers, as measured by average travel times, is considered to be an indirect measure of access to economic opportunities (jobs, education/training). Significantly different travel times for the selected areas (or groups) should be reviewed carefully to determine if they are disproportionately high or adverse.

- Document Title VI efforts;
- Advertise public meetings in places where minorities/disabled persons go;
- Hold meetings at times and places convenient for the minority community;
- Communicate in languages other than English (orally and written);
- Consider special needs in public accommodations; and
- Follow up with the minority community after public meetings, when decisions are made and after project implementation.

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



In 2000, H-GAC commissioned Saurage Research, Inc. to conduct a series of six consumer focus groups, three community roundtable discussions and a series of 48 in-depth interviews with community leaders on Environmental Justice in the eight-county Houston-Galveston transportation management area. All research was qualitative and designed to get a better understanding of environmental, transportation and safety concerns from poverty-level residents in the region.<sup>34</sup>

## **Transportation Concerns**

### **Current Commute Patterns**

- Poverty-level residents of the surrounding counties are especially reliant on their car for their daily transportation needs. Those without automobiles rely on other means of transportation; walking, riding with friends or relatives.
- Walking and bicycling in poor neighborhoods can be a dangerous transportation alternative because of a lack of sidewalks and narrow roads.<sup>35</sup>
- Residents are relatively unconcerned about the security at bus stops, but express many safety concerns regarding walking and driving on narrow, poorly lit roads in the rural counties.

### **Using the Transit System**

Poverty-level residents desire an expansion of the public transportation system, even though it is criticized for being inconvenient, to include the surrounding counties.

## **Participating in the Process**

### ***Information Sources***

Residents are passive in gathering information regarding environmental hazards and transportation problems that affect their community.

### ***Patterns of Involvement***

- Although their history of participation does not support the belief, poverty-level residents do not feel disenfranchised from the policy-making process that affects their community. They believe they are able to participate enough to effect their desired changes.
- If necessary to effect a policy change, poverty-level residents would take action, such as attending City Council meetings, distributing petitions, seeking litigation and notifying

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<sup>34</sup> Due to the qualitative nature of the research the views and opinions summarized in this document are not representative of the general public. The information is only representative of those persons who participated in the focus groups and interviews.

<sup>35</sup> This is an important issue for the elderly and disabled since there are implications relative to lack of compliance with the Americans with Disabilities Act (ADA). Many low income neighborhoods were observed to have either poorly maintained sidewalks, or none at all, reflecting rural or outdated neighborhood street design standards.

the media. However, many recognize that their influence as a traditionally underserved population lay in their ability to mobilize the community.

### **Community Roundtable Discussions<sup>36</sup>**

#### **Key Findings<sup>37</sup>**

**August 2000**

#### ***Excerpts from Interviews with Community Leaders<sup>38</sup>***

- Road construction seems to move slower in {low-income} neighborhoods than in other communities, creating inconvenience for the residents. Additionally, it seems the cleanup and replacement of landscaping is completed correctly in other communities, as opposed to long periods of disarray in {low-income} communities.
- The placement and length of freeway entrance ramps are inconsistent tending to bypass some {low-income} neighborhoods.
- Many children live too close to their school to qualify for bussing, which means that children often have to walk through dangerous areas of the neighborhood to go to school. On days with inclement weather, many of these children do not attend school. In one instance, children must cross a Union Pacific railroad track to reach the school; if the train is sitting on the track or is in motion, children are faced with the safety hazard of crossing the railroad tracks.
- Large trucks (18-wheelers) travel on streets in low-income neighborhoods destroying the roads.
- Environmental hazards in neighborhoods, especially illegal dumping, are often not addressed because the neighborhood lacks appropriate deed restrictions or there are absentee landlords and apathetic renters; homeowners may be more proactive.
- Public outreach through the community via churches and schools, especially teaching children the issues, is key to informing this population.
- Transportation and environmental concerns are relatively unimportant to {some community members} unless their family is directly affected. Protecting the family is the first priority in {many} communities.
- Even the largest organizations and associations {in some low-income communities} tend to be reactive to environmental and transportation issues because the organizations lack the necessary internal structure to take proactive positions on issues.
- Non-Hispanic populations tend to treat the Hispanic community as a homogenous group because they share a single language. However, there are many subcultures within the greater Hispanic community.

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<sup>36</sup> Suarage-Thibodeaux Research, "Environmental Justice in Houston-Galveston Area," August 2000.

<sup>37</sup> Total of 20 community leaders: 7 African American; 7 Hispanic; 6 Asian

<sup>38</sup> Excerpts have been edited to summarize the general nature of the remarks. Brackets { } indicate edited notes.

- Education regarding environmental and transportation issues should be targeted via schools and existing organizations and associations.
- The Asian community in the Houston-Galveston area is a very heterogeneous population. They are differentiated from one another, not only by nation of origin, but also by language.
- New immigrants have difficulty adapting to the city because of the many language barriers. A guide for new immigrants is needed to provide information necessary to ease the immigration and assimilation process, including emergency phone numbers, newspaper subscriptions, school registration information, INS class availability and schedule, and voting instructions.
- The METRO bus system can be very confusing for {new residents}. The bus route brochure needs to be updated and printed in several languages. Additionally, new {residents} need instructions explaining how to use the bus system, including bus transfers.
- The Asian population has difficulty recognizing the air quality problem in the region because many originate from countries where air pollution was highly visible.
- As a community, the Asians view the act of reporting problems in their neighborhoods as unnecessary complaints. They would rather fix the problem or ignore it. Many do not know how to report problems or crimes to municipal authorities.
- Informing the Asian community will require communicating in all appropriate languages. Information can be dispersed via INS training classes, community centers, temples and churches, and via the schools in the area.

**“The Challenges of Transportation, Congestion and Construction as Described by Thought Leaders in the African-American, Asian, Hispanic, and Rural Communities”<sup>39</sup>**

**Key Findings<sup>40</sup>**

December 2002

**Public Transportation Issues**

***Modes of Transportation***

According to respondent feedback, the four most frequently mentioned methods of transportation by low-income area residents are taking the bus/METRO, riding with friends or family, walking and driving a car. Frequency of use for each of these modes varies with respondent activity.

Residents report walking as the most common form of transportation in the {low-income} community. This is because low-income persons try to live near markets and all of their other essential locales.

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<sup>39</sup> Saurage Research, “The Challenges of Transportation, Congestion and Construction as Described by Thought Leaders in the African-American, Asian, Hispanic, and Rural Communities,” December 2002.

<sup>40</sup> 48 Interviews: 8 African-American; 16 Asian; 16 Hispanic; 8 Rural



### ***Potential New Offerings***

While there seems to be sufficient transportation from the smaller communities to downtown, there is a lack of adequate transportation within the actual neighborhoods and communities. Respondents would like a system of shuttles or minibuses that run regular routes in high-use areas.

The cost of transportation is sometimes an issue for low-income residents. Respondents recommend some type of subsidized program to make travel more feasible for these people.

Respondents from all backgrounds would like to see more effective scheduling of public transportation. The daily schedules should start earlier and end later. There should be more frequent stops in high-use areas at more opportune times.

It is distinctly possible that current public transportation programs are underutilized due to residential lack of familiarity and understanding. There is a demand to educate low-income folks about what options exist and how to use them.

There appears to be a language barrier that is decreasing the optimal use of the METRO bus system for some minorities. Respondents generated valuable input and suggestions about potential ways to address the issue.

### ***Ideal Public Transportation System***

Based on respondent feedback, the ideal transportation system would be multi-level. There would be a large system that traveled to all the core areas (e.g. light rail). This would be supported by buses that ran regular routes on high-travel thoroughfares and a more personalized service, such as a jitney, to take people to specific neighborhoods and communities.

To maximize effectiveness, the current transportation system needs to extend hours of operation to accommodate non-prime time travel and increase the frequency of stops along the more popular routes.

When designing a public transportation system, all safety issues must be addressed, including proper seating, shelter, and lighting at drop-offs, as well as properly working handicap equipment that is up to code.

According to respondents, elderly and low-income residents are currently underserved by public transportation, affecting both their ability to sustain everyday life and their ability to find and keep paying jobs.

Many respondents support the new light rail; however, they often mention the need to expand the plan to cover a wider geographical area.

Respondents believe increased funding should be focused within neighborhoods and to and from places of work, shopping areas and medical centers. Some of the areas with the most demand for more funds include the East End, Chinatown and downtown.

### ***Change in Priorities***

Transportation priorities should focus more on suburbs and neighborhoods, especially those areas populated with elderly and low-income residents. Conversely, less emphasis should be placed on downtown.

### **Roadway Congestion and Construction**

#### **Effect on People's Lives**

Road construction affects different populations to varying degrees. Many respondents express deep concern about the negative effect it has on the communities.

#### **Minimizing Negative Effects**

There are two main changes in construction management that would minimize negative effects on lifestyles: avoid simultaneous construction on areas in close proximity and do as much construction as possible during non-peak hours.

Respondents voiced concerns about an unwarranted tendency to block off sections of a road when no apparent construction or safety issues exist.

An important part of minimizing the frustration associated with construction projects is to provide pertinent information to the public, including justification of underlying projects, timelines, and progress reports toward completion.

#### ***Current Street Conditions***

Common concerns among respondents include insufficient drainage and lack of sidewalks. There are also many streets that are too narrow and some that have potholes and other damage to pavement.

#### ***Duration of Construction Projects***

A large number of Hispanic respondents say construction projects take much longer in their neighborhoods than elsewhere because of two perceived reasons: it takes longer to get approval to start on projects in these neighborhoods and the Hispanic communities have no voice to complain about improper procedures that delay projects.

#### ***Getting Expenditures for Improvement***

Voting is one of the main ways respondents believe residents can assist in getting construction improvement expenditures. Elected officials are perceived to have a lot of clout in regard to these issues.

Another way for communities to assist in increasing funding for improvements is to form groups and voice their opinions. However, there are cultural, language and knowledge barriers limiting the power of minority and low-income populations to effect change through voicing their opinions.

## **Safety Concerns**

### **Unsafe Locations**

There are many locations perceived as unsafe by respondents. The most common involve road quality: lack of sidewalks, improper drainage, narrow roads, and damaged pavement. Less-cited issues include vegetation obstructions, inadequate traffic and lighting devices, excessive speed, railroad tracks, and unsafe bus shelters.

### **Making Locations Safer**

Respondents overwhelmingly requested the addition of sidewalks to make locations safer. They also wanted increased patrol of crime and construction of proper drainage systems.

### **Stoplights and Stop Signs**

Respondents agreed that additional stoplights and stop signs slow traffic down and make the roads safer; however, there are many specific locations that need attention.

The area surrounding the intersection at 71<sup>st</sup> and Harrisburg was cited by numerous respondents as critically dangerous and in need of better traffic-keeping devices.

## **Public Involvement**

### **Reaching the Community**

The most effective way to reach members of a community regarding environmental and transportation issues varies based on subgroups. Community-related gatherings are very effective for all groups. TV, radio, community newspapers and the school systems also work very well.

### **News Regarding Public Transportation**

Television is a very common place where members of a community look for general news and information. However, there are some demographic differences in the use of other media.

### **Getting Local News and Information**

General and local news and information are found quite frequently via television. However, radio is also a common source for many {low income} residents. Rural residents rely somewhat more on newspapers.

## **Strategic Implications**

**Target** – With respect to adequate transportation, there are underserved markets within low-income and ethnic subgroups that should be targeted in new master plans.

**Implode** – The highest need for additional transportation development lies inside the -existing system. The current public transportation system could be enhanced to include areas like neighborhoods and small communities that are currently circumvented.

**Renovate** – There are many safety issues associated with the current disrepair of the roads in the area.

**Educate** – The key to successful modification of public transportation is informing people of all socioeconomic classes about the current programs and asking them to provide feedback toward improvement.

## **2. Accessibility Analysis**

H-GAC conducted an analysis to determine if certain segments of the population experience greater travel times going to work in the four major activity centers (MACs) than other segments of the population. The targeted segments of the population include zero auto households, low-income households, and those areas populated with larger than average numbers of minorities. The methodology is briefly described below.

### ***Methodology***

Identify and map low-income, minority, and zero-auto Census Tracts (TAZs) in the eight-county TMA. For the purpose of this research, H-GAC used the definition by the U.S. Department of Housing and Urban Development (HUD) for low income as 80 percent of the median family income for the area (county). Table 1 (below) was used for the low-income determinations.

**Table 1: Median Household Incomes by County**

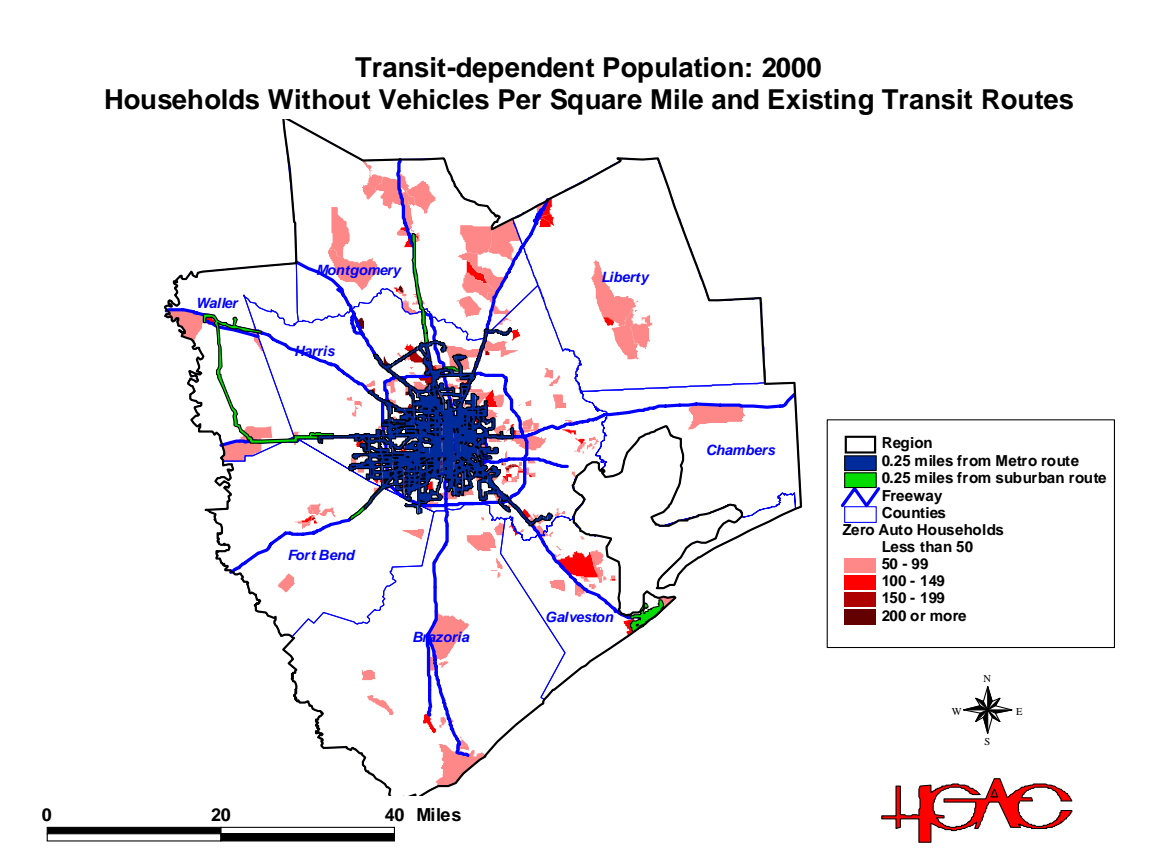
<b>County</b>	<b>Median County Household Income (Family of 4)</b>	<b>80 percent (Family of 4) Low Income</b>	<b>50 percent (Family of 4) Very Low Income</b>	<b>30 percent (Family of 4) Extremely Low Income</b>
Houston-Galveston-Brazoria CMSA	\$51,426	\$41,140.80	\$25,713	\$15,427.80
Brazoria County	\$48,632	\$38,905.60	\$24,316	\$14,589.60
Chambers	\$47,964	\$37,371.20	\$23,982	\$14,389.20
Fort Bend	\$63,831	\$51,064.80	\$31,915.50	\$19,149.30
Galveston	\$42,419	\$33,935.20	\$21,209.50	\$12,725.70
Harris	\$42,598	\$34,078.40	\$21,299	\$12,779.40
Liberty	\$38,361	\$30,688.80	\$19,180.50	\$11,508.30
Montgomery	\$50,864	\$40,691.20	\$25,432	\$15,259.20
Waller	\$38,136	\$30,508.80	\$19,068	\$11,440.80

Source: U.S. Census Bureau, Census 2000

Minority, as it relates to EJ, is defined by U.S. DOT Order (5610.2) as:

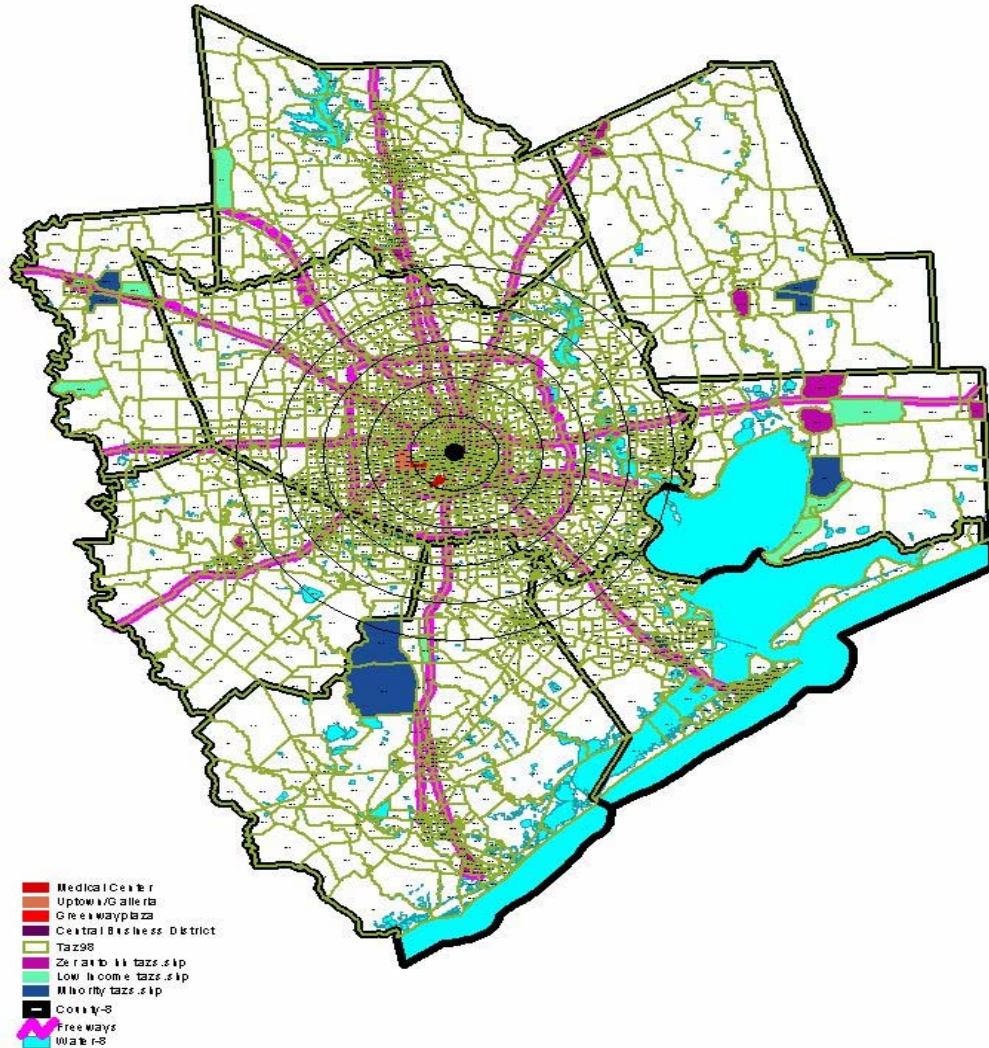
- (a) Black – a person having origins in any of the Black racial groups of Africa;
- (b) Hispanic – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race;
- (c) Asian American – a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands; and
- (d) American Indian and Alaskan Native – a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.

Zero-auto households are identified as having a higher percentage of “No Vehicle Available” than the county average. The map below shows the highest concentrations of those households outside of the City of Houston and the METRO local bus service coverage area.



The next step was to identify census tracts (represented by Traffic Analysis Zones (TAZs) within each county that met the selection criteria (See the Map below). The travel time data for those selected areas was compared with others nearby, as represented by the county averages.

### Selected TAZ's by County



*The table below summarizes the selected TAZs and the criteria that were used for that selection.*

COUNTY	% Min.	Median Inc.\$	% Zero Auto	SELECTED TAZ	% Min.	Median Inc. \$	% Zero Auto
<b>Brazoria</b>	35	48,632	5	1659	60	42,699	5
<b>Chambers</b>	23	52,986	5	2376	37	38,319	12
<b>Fort Bend</b>	54	63,831	3	1945	89	28,011	18
<b>Galveston</b>	37	42,419	8	2567	82	21,525	22
<b>Harris</b>	58	42,598	9	975	94	25,150	16
<b>Liberty</b>	25	38,361	8	2285*	24	39,360	6
<b>Montgomery</b>	18	50,864	5	2188	64	30,607	12
<b>Waller</b>	50	38,136	7	2027	50	39,846	7
<b>CMSA</b>	39	51,426	8				

Source: 2000 Census /Transportation Planning Package (CTPP)<sup>41</sup>

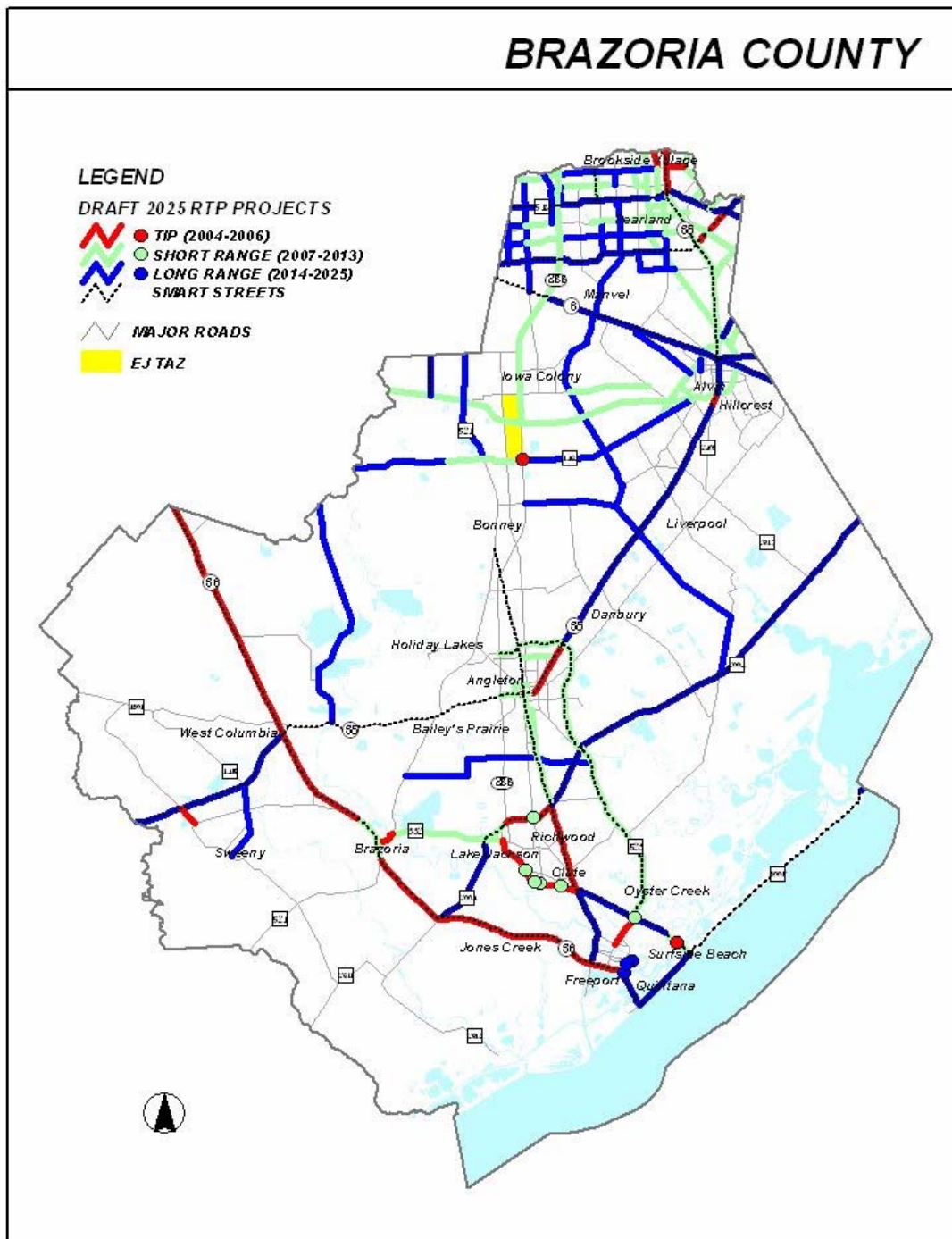
Following are a series of county profile summaries with maps that show the locations of the selected areas in relationship to projects that are in the current 2022 Metropolitan Transportation Plan (MTP) and proposed (candidate) projects for the 2025 Regional Transportation Plan (RTP). Below each map is a summary table of the results of the initial travel time analysis.<sup>42</sup>

***Brazoria County- Census Tract 6619/TAZ 1659***

Census tract 6619 (TAZ 1659) is located in the northeastern part of the county. The tract is bound on the east by State Highway 288 and by Oyster Creek on the west. The total population of the tract is 10,629. Public Transportation in the area is provided by the Gulf Coast Center-Connect Transportation which provides dial-a-ride services for the general public in Brazoria and Galveston counties.

<sup>41</sup> TAZ #2285 in Cleveland was selected for the initial travel time analysis. TAZ #2332 should be substituted for future analyses since it has more relevant EJ selection criteria (lower income, higher % minority, more zero auto households).

<sup>42</sup> Missing or un-observed values are indicated with N/A in the summary tables.



Brazoria County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 1659 Travel Time by Auto	36	N/A	N/A	N/A
TAZ 1659 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	39.4	43.2	36.7	42.7
Avg. County Travel Time by Transit	46.7	N/A	34	N/A



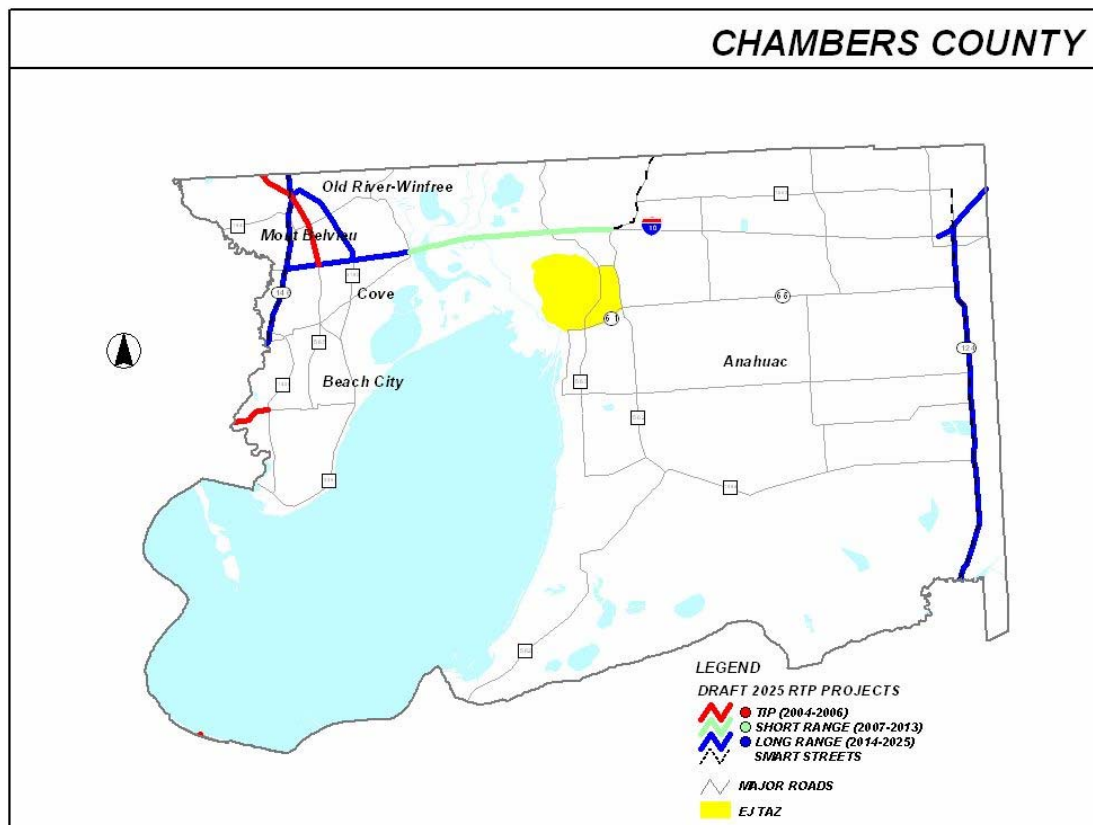
Travel to the CBD/downtown by auto is slightly faster from the selected area (36 min.) than the county average (39 min.), primarily because of its location in the northern part of the county. No transit trips are indicated from the selected area.

Brazoria County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 1659 Travel Time by Auto	30.0	N/A	30.7	34.5
TAZ 1659 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	30.6	37.7	30.4	35.7
Avg. County Travel Time by Transit	34.6	62.8	37.8	61.1

Future 2025 travel times are faster and similar for the selected area and the county in general. The data indicates improved access by auto and transit to the MACs from Brazoria County.

#### ***Chambers County- Census Tract 7103/TAZ 2376***

Census tract 7103 is located in the northwestern part of the county, where the total population of the tract is 3,144. Chambers County is not served by any rural or urban public transit services. The City of Baytown does provide 24-hour non-emergency transportation services to eligible low/moderate income senior and or disabled citizens within the city limits of Baytown. Rides for elderly and disabled are coordinated through the Senior Citizens of Chambers County program.



Chambers County/HBW 2000

	CBD	Uptown	TMC	GP
TAZ 2376 Travel Time by Auto	54.8	65.0	63.2	65.8
TAZ 2376 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. Travel Time by Auto	50.4	60.9	58.4	61
Avg. Travel Time by Transit	N/A	N/A	N/A	N/A

Current auto travel times to the MACs, for the selected area are longer than the county average, perhaps due to circuitous routes to access I-10.

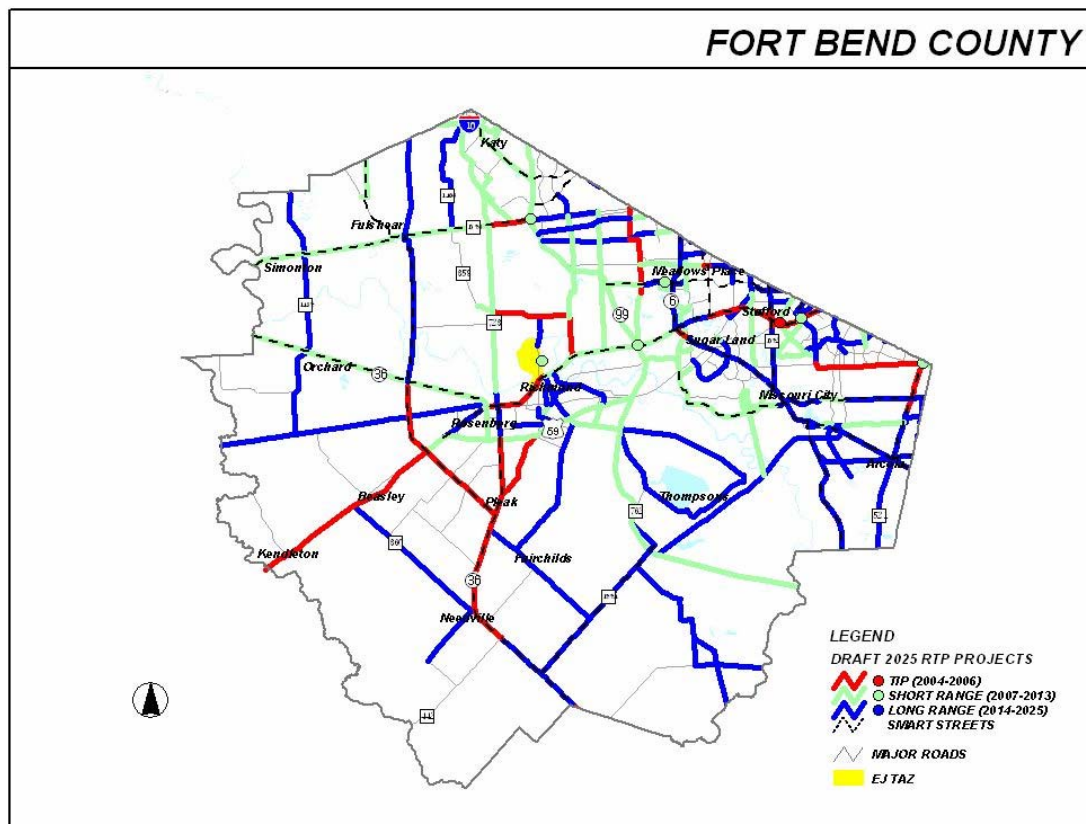
Chambers County/HBW 2025

	CBD	Uptown	TMC	GP
TAZ 2376 Travel Time by Auto	85.5	N/A	N/A	96.0
TAZ 2376 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	58.6	71.1	67.2	69.5
Avg. County Travel Time by Transit	N/A	N/A	N/A	N/A

Future travel times are longer than current for the county overall and particularly for the selected area. Further study is needed.

***Fort Bend County- Census Tract 6749/TAZ 1945***

Census tract 6749 is located in the central part of the county and includes parts of Houston. The Riverview St binds the tract to the North, the Brazos River to the West, Jackson St. to the South, and Pecan Grove to the East. The total population is 6,394. The Rosenberg/Richmond American Red Cross offers agency van transportation to Fort Bend county residents. Transportation is provided to individuals with medical appointments in Houston or Fort Bend County.



Fort Bend County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 1945 Travel Time by Auto	51.1	43.4	50.9	43.8
TAZ 1945 Travel Time by Transit	64.0	69.6	81.6	67.8
Avg. County Travel Time by Auto	36.7	32.7	34.1	31.5
Avg. County Travel Time by Transit	57.6	73.8	70	67.4

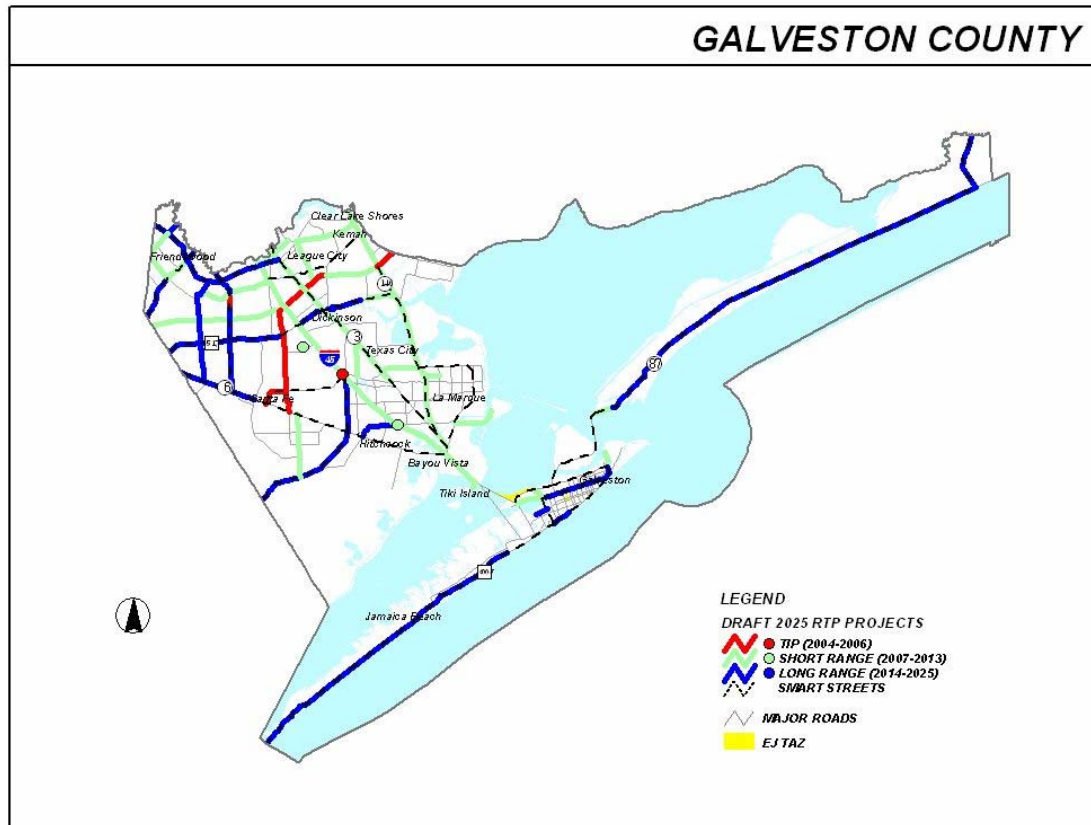
Overall the current travel times from the selected areas are longer than the county averages, for auto and transit access.

The auto and transit travel times increase in the future system perhaps due to increased congestion in the Southwest Freeway corridor. (Closer study is needed.)

Fort Bend County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 1945 Travel Time by Auto	50.3	44.1	50.6	44.6
TAZ 1945 Travel Time by Transit	64.6	69.9	95.0	73.3
Avg. County Travel Time by Auto	40	34.9	36.7	36
Avg. County Travel Time by Transit	69.1	73.3	71.6	79.5

**Galveston County- Census Tract 7251/TAZ 2567**

Census Tract 7251 is in the southern part of Galveston County. The total population of the tract is 2,219. The area is served by Island Transit, the City of Galveston's public transportation system. The Island Transit service area covers 27 square miles and provides bus and trolley services in the area.



Galveston County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 2567 Travel Time by Auto	61.0	N/A	N/A	N/A
TAZ 2567 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	48.7	59.6	58.4	61
Avg. County Travel Time by Transit	53.3	85.4	69.9	72.1

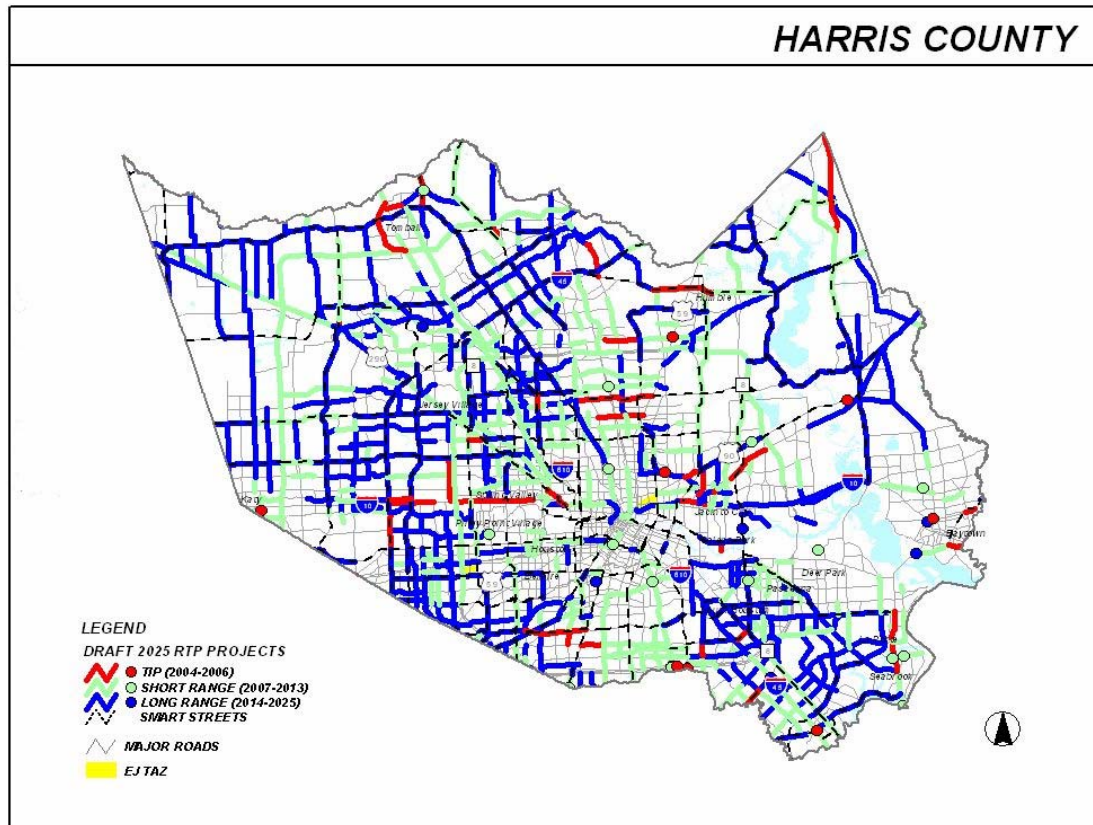
The average time to the CBD is longer for the selected area than the county average, likely due to its location on Galveston Island. Direct fixed route transit is not available from the selected area to the CBD, or other MACs, at this point. The provision of such service is not included in the RTP. Improved future travel times (overall) likely reflect planned improvements in the I-45 Gulf Freeway Corridor.

Galveston County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 2567 Travel Time by Auto	55.0	N/A	N/A	N/A
TAZ 2567 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	43.7	54.1	46.7	51.5

Avg. County Travel Time by Transit 47.5 63.4 65.1 58.2

### Harris County- Census Tract 4330/TAZ 975

Census Tract 4330 has a population of 14,449. The tract is bordered on the north by Westpark Dr. and on the south by Bellaire Blvd. The tract is bordered on the east by Beltway 8 and on the west by Gessner Road.



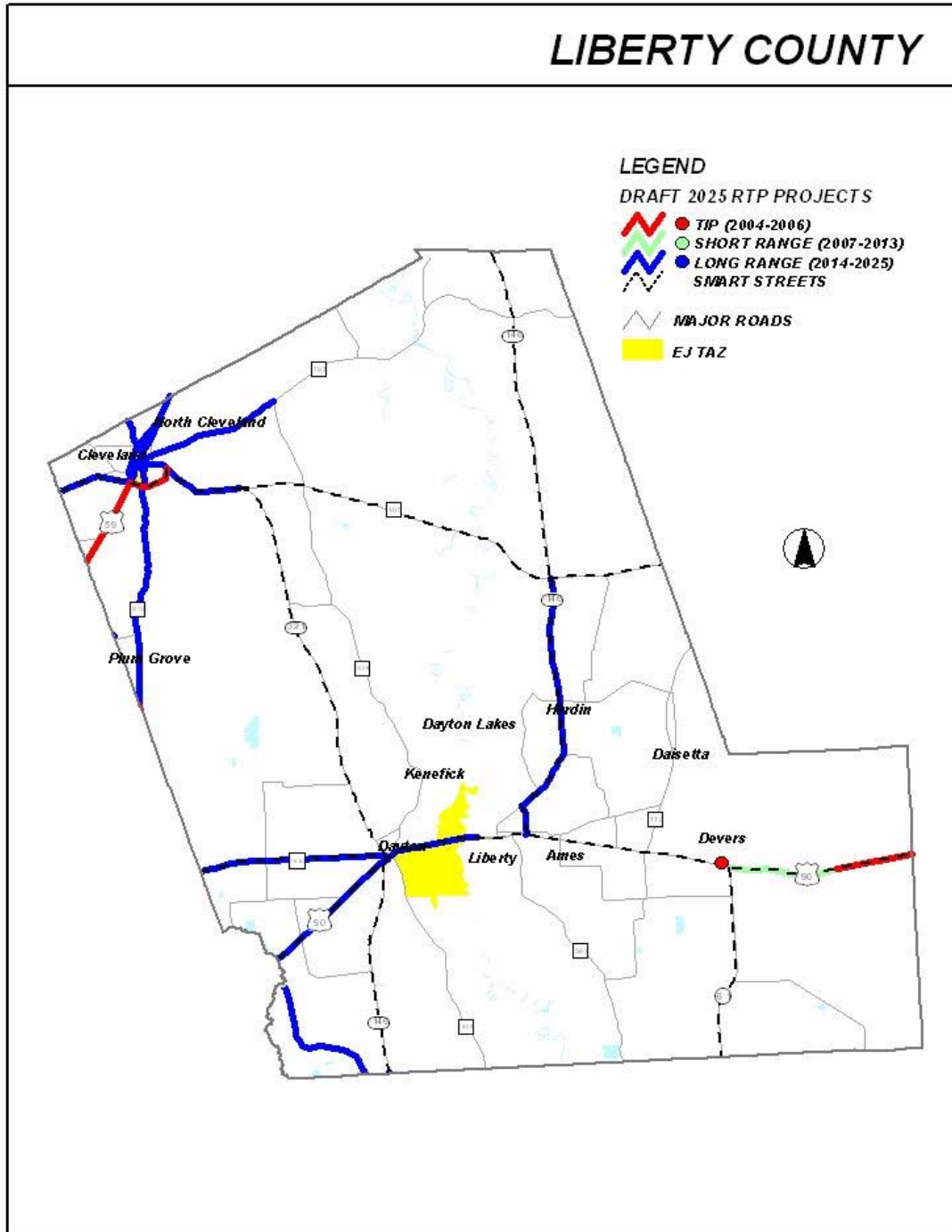
Harris County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 975 Travel Time by Auto	28.9	19.7	28.2	21.3
TAZ 975 Travel Time by Transit	69.5	72.1	80.1	79.6
Avg. County Travel Time by Auto	28.3	26.5	27.5	28.4
Avg. County Travel Time by Transit	58.4	68.5	62.9	71.1

Travel times by auto are slightly shorter for the selected area, compared to the county average. Transit times are longer. The same pattern is shown in the future system with some improvements in transit access times to Uptown, TMC and Greenway from the selected area.

Harris County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 975 Travel Time by Auto	28.6	17.9	26.7	20.9
TAZ 975 Travel Time by Transit	70.0	56.1	71.9	66.0
Avg. County Travel Time by Auto	26.6	25.7	26.2	27.8
Avg. County Travel Time by Transit	55.8	60	58.6	65.7

***Liberty County- Census Tract 7003/TAZ 2285***

Census Tract 7003 is in the western part of the county and contains Plum Grove. The total population is 8,184. The area is served by the Brazos Transit District Cleveland Community Routes, a circulator service serving Cleveland.



Liberty County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 2285 Travel Time by Auto	52.5	63.7	62.0	63.5
TAZ 2285 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	59.9	70.5	70.6	71.1
Avg. County Travel Time by Transit	63.5	N/A	N/A	N/A

Travel times from the selected area are shorter than the county average, perhaps due to circuitous routes or lack of direct access to I-10 for the majority of the county.

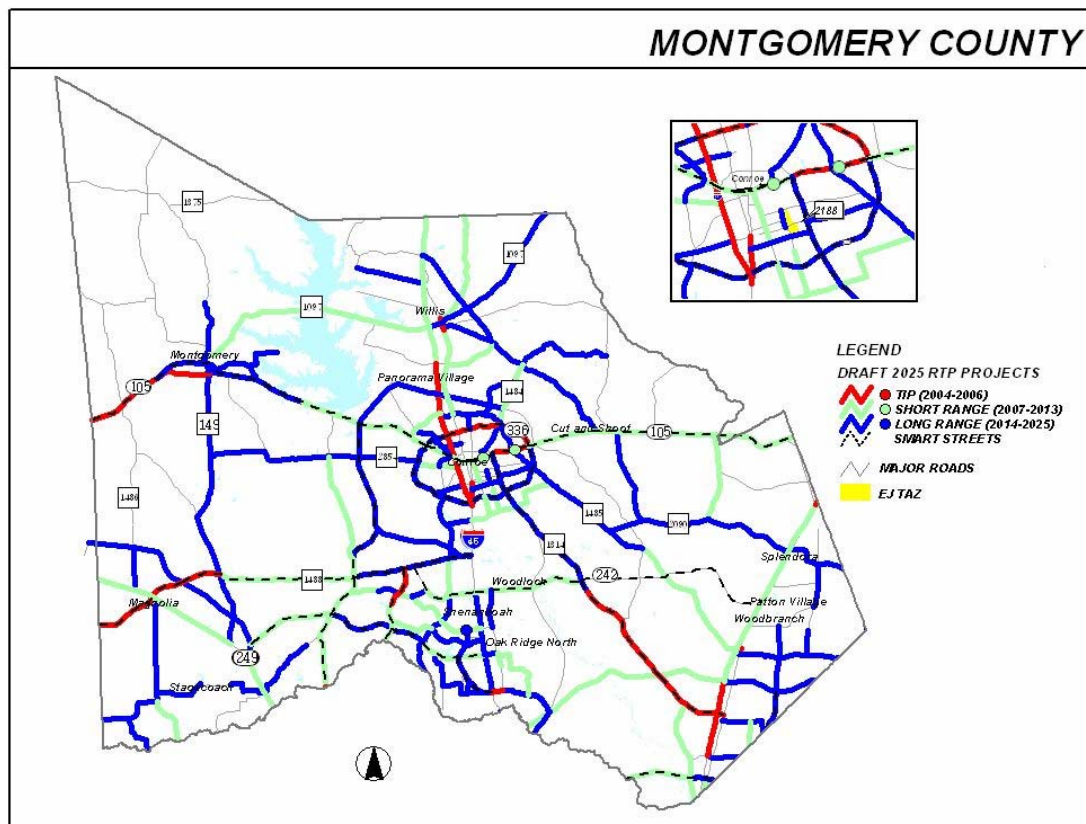
Future travel times show a similar pattern, with improved transit access.

Liberty County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 2285 Travel Time by Auto	55.4	68.0	66.0	66.5
TAZ 2285 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	59.8	72.1	67.2	69.5
Avg. County Travel Time by Transit	60.6	80	46	101

### **Montgomery County-Census Tract 6931/TAZ 2188**

Census Tract 6931 is in the central part of the county. The City of Conroe is partially included in the tract. The total population of the tract is 8,799. Montgomery County is served by express Park and Ride buses which connect to the major employment centers in Harris County. That service is provided by the Brazos Transit District.





Montgomery County/HBW 2000	CBD	Uptown	TMC	GP
TAZ 2188 Travel Time by Auto	57.0	N/A	N/A	N/A
TAZ 2188 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	53.6	61.8	62.8	63.6
Avg. County Travel Time by Transit	67.1	95.5	85.7	83.7

The travel time to the CBD is slightly longer from the selected TAZ (57) compared to the county average (54), with no transit trips from that area in 2000.

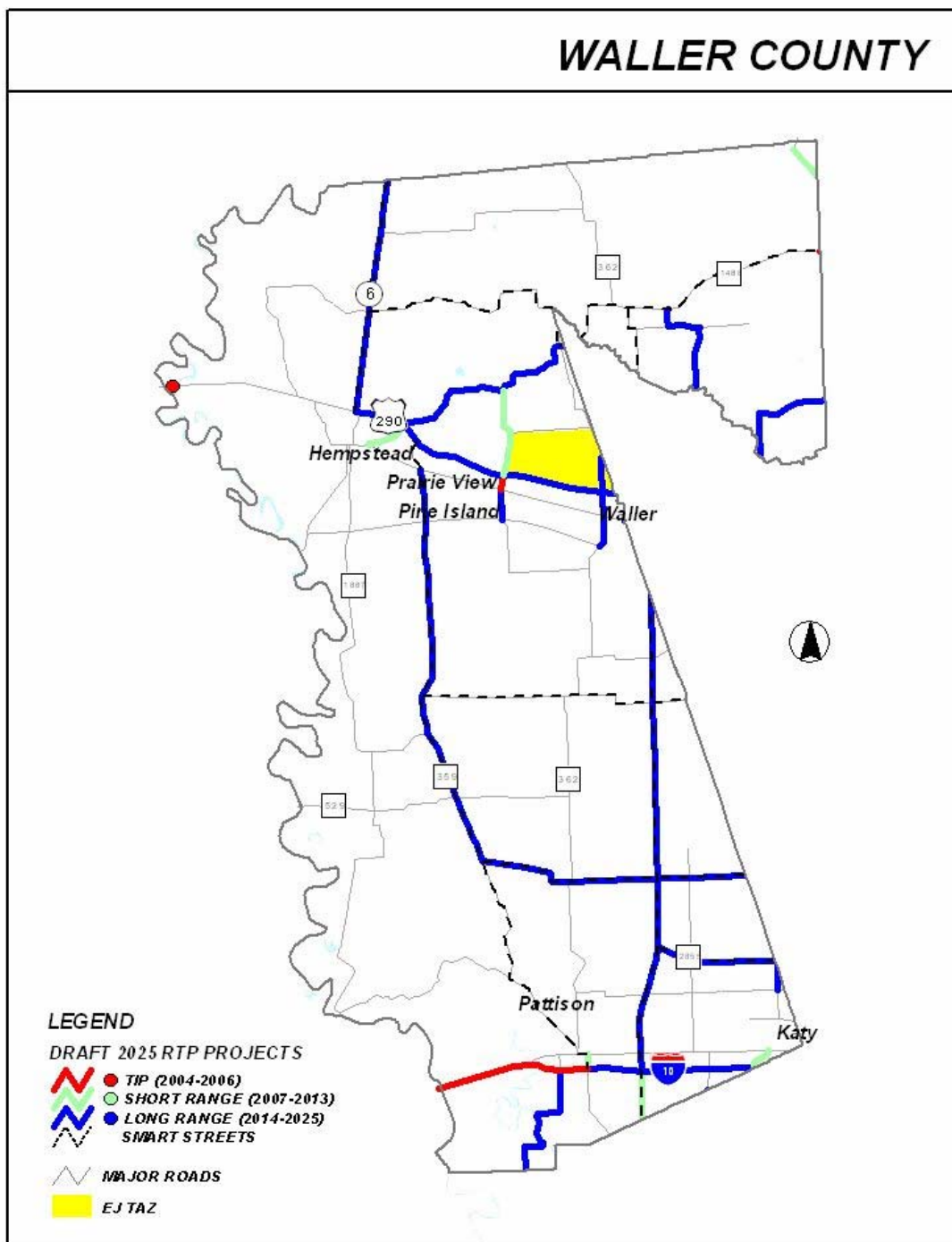
In the 2025 system auto travel times remain slower from that area to the CBD and Uptown but some improvement is seen in transit travel time to the CBD (faster than the county average). That could be a result of the extended High Occupancy Vehicle Lanes, with express bus services extended to Conroe. (Further investigation is needed.)

Montgomery County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 2188 Travel Time by Auto	52.4	64.5	N/A	N/A
TAZ 2188 Travel Time by Transit	55.6	73.5	N/A	N/A
Avg. County Travel Time by Auto	50.8	59.8	59.9	60.7
Avg. County Travel Time by Transit	60.8	69.9	67.2	101

#### Waller County- Census Tract 6803/TAZ 2027



Census tract 6803 is in northeastern Waller County near Prairie View and Pine Island. The total population of the tract is 7,914. Colorado Valley Transit provides fixed- route bus and para-transit (dial-a-ride) transportation services, while Fort Bend Senior Citizens, Inc provides transportation services for the county's aging population including: congregate meals, home-delivered meals, information and assistance.



Waller County/HBW 2000

CBD Uptown TMC GP

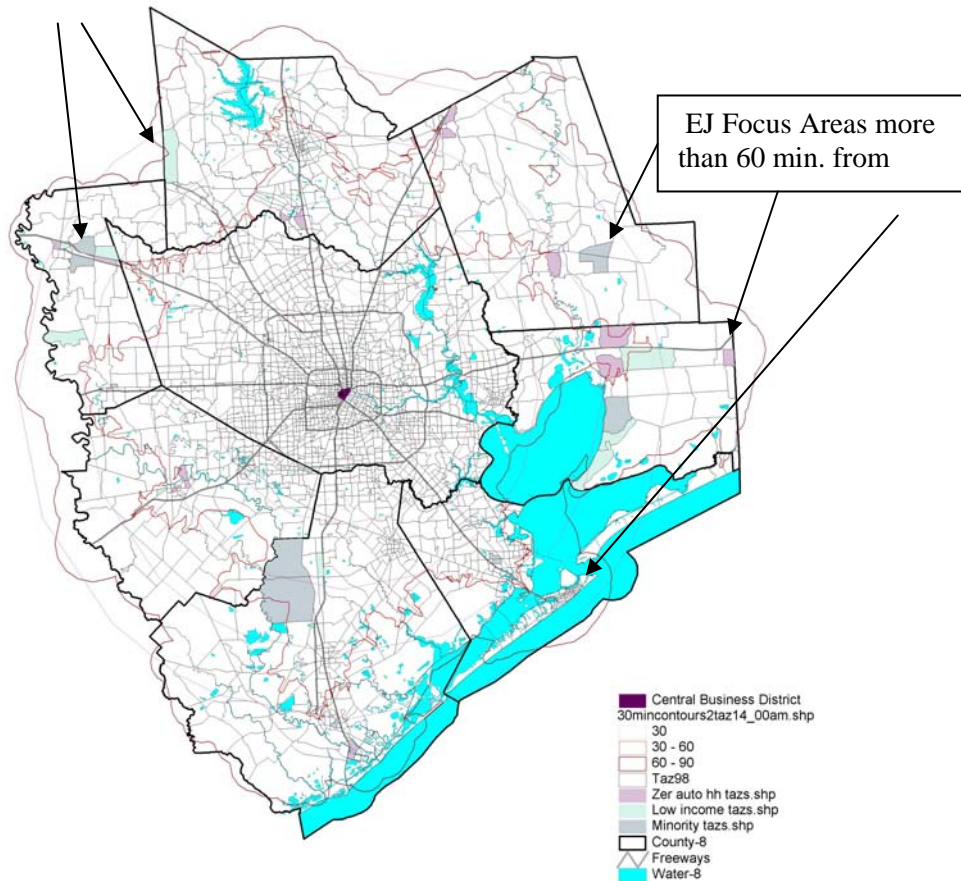
TAZ 2027 Travel Time by Auto	65.7	64.3	76.0	69.0
TAZ 2027 Travel Time by Transit	N/A	N/A	N/A	N/A
Avg. County Travel Time by Auto	61.8	62	73.1	64.9
Avg. County Travel Time by Transit	73	N/A	N/A	N/A

Average auto travel times for the selected area are slower in the current system. The 2025 system data indicates improved travel times-the selected area shows slightly shorter travel times (50 mins. to the CBD) than the county average (52). There is also improved transit access (more transit trips) from that area to all four MACs in the future system.

Waller County/HBW 2025	CBD	Uptown	TMC	GP
TAZ 2027 Travel Time by Auto	50.1	51.3	59.7	54.6
TAZ 2027 Travel Time by Transit	67.9	70.9	81.1	78.1
Avg. County Travel Time by Auto	52.2	53.3	62.2	56.2
Avg. County Travel Time by Transit	62.8	72.7	91	88.7

Figure 6 below shows the locations of the areas that have been selected to be studied based on the Environmental Justice (EJ criteria). A travel time contour (for auto access) is overlayed to highlight those areas outside of the 60-minute travel time-band to the CBD. The map Figure X shows that some of the people living in communities with the lowest household income characteristics are also located at considerable distances, by automobile travel, to job opportunities approximated by the central business district. The plight is worsened by the fact that many of the residents do not own an automobile and do not have direct access to regularly scheduled public transportation that could provide trips to those destinations. The access concern would be similar for trips to the Texas Medical Center, for medical trips, Herman Park for recreational activities, or the Uptown/Galleria for recreational or shopping trips. Those major activity centers are centrally located from the regional perspective and provide one basis of comparison to start with for a regional accessibility analysis, (see Appendix K-RTP System Evaluation for more details.)

*Figure 6: Environmental Justice Focus Areas-Selected TAZs*



### Summary and Conclusions:

For this initial analysis, the threshold for significant differences here, meaning disproportionate (adverse) access to potential economic benefits, is estimated at greater than 10% of the county average travel time. The basis for the comparison is in terms of access to jobs, educational opportunities and regional medical facilities associated with the four Major Activity Centers (MACs) discussed earlier. (Whether or not a ten percent difference from the average is significant is a subjective judgment. Empirical data should be reviewed, if it is available, to determine a more relevant threshold in the future.)

The analyzed data indicates several trip interchanges where the values for the selected areas are more than 10% of the county averages. Travel from the selected areas in Fort Bend and Chambers counties are significantly longer than the county averages and closer study is recommended.

In general, direct access to the MACs from Brazoria and Liberty Counties by transit, is not available (now) and not planned in the future system. The desirability of such transit services should be explored further with citizens and elected officials from those counties.