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**The Houston Metropolitan
Traffic Safety Planning Program**

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Abstract

The metropolitan traffic safety planning program of the Houston-Galveston Area Council monitors safety in the eight-county region, identifies hazardous locations, and supports other safety efforts. Using a spatial crash information system, safety analysis is conducted of counties, cities, roadways, and hot spots. Particular attention is paid to crashes involving fatalities, injuries, speeding, red light running, teenagers, DUI, pedestrians, bicyclists, trucks, and railroad trains. Much of the effort involves distributing information about safety to local governments, and to the public at large. Working with local governments and with the Texas Department of Transportation, engineering analysis is conducted of specific safety hot spots to recommend measures to mitigate the crashes. Partnerships are created to widen the scope of safety efforts in the region. In addition, major crash hot spots have been identified and are included in the long range transportation plan. Finally, a Regional Safety Council has been established to allow a policy forum for integrating the various safety efforts of transportation, medical, law enforcement, industry, non-profit, and other organizations. An annual safety summit is being planned as are safety training courses for local governments.

Introduction

The Houston-Galveston Area Council (H-GAC), the Metropolitan Planning Organization (MPO) for the eight-county Houston metropolitan region, developed a safety program over the last five years. This paper summarizes progress to date and indicates future directions for the program. While the information is specific to the Houston region, it will be discussed in a context of metropolitan safety planning.

Why H-GAC Has Become Involved in Safety?

There are several reasons why an MPO, like H-GAC, should become involved in safety. While MPO's coordinate transportation plans for both the state departments of transportation and for local governments, they have their greatest impact on safety with local jurisdictions. First, many crashes and fatalities occur on local roads and not just state-managed roads. For example, in Texas about 44% of all serious crashes occurred on local roads between 1999 and 2001.¹ In our region, this percentage was 54% of the serious crashes. Even for fatal crashes, a sizeable proportion occurred on local roads (39% in our region). The burden for fixing problems at these locations falls on local jurisdictions.

Second, transportation safety is a Federally-mandated program. The 1973 National Highway Safety Act, with subsequent amendments in 1982, 1991, 1998, and 2005 (SAFETEA-LU), requires that each State conduct surveys of all public roads to identify high crash locations for mitigation. The new legislation, further, requires the establishment of a Strategic Highway Safety Plan, actions that will require MPOs to coordinate safety planning in their region. In addition to roadway safety, safety at railroad-highway crossings, school safety, and other issues must be addressed. The new SAFETEA-LU legislation requires that state departments of transportation collaborate with other governmental organizations, including MPO's and local jurisdictions.

Safety is also one of the seven planning factors that MPO's must consider in developing their long-range plan. As the MPO for the 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 critical to the effective use of the transportation system. Crashes impose physical and emotional costs to those directly involved and huge financial costs to everyone else.

Third, though the responsibility for fixing safety problems on local roads belongs to jurisdictions, most small ones don't have the expertise. Crash information systems require technical infrastructure and site analysis requires traffic safety engineering expertise. MPOs can play a role for local jurisdictions in providing the analysis for the identification of problem locations and by acting as 'brokers' to put local jurisdictions in contact with engineering firms who specialize in traffic safety.

¹ Crash Records Bureau, Texas Department of Public Safety..

Fourth, and finally, safety can be a good planning tool. If safety is brought in as a factor, land use and transportation plans might be modified to be more compatible than they would be otherwise. Safety is, often, the ‘missing link’ in planning.

A Serious Traffic Safety Problem

Five years ago, H-GAC decided to create a traffic safety planning program, as a result of a very serious safety problem. From 1999 to 2001, the most recent three year period for which we have data, there were 252,241 serious crashes in the eight county region involving 1,699 fatal crashes and 162,811 injury crashes. In these crashes, 1,882 persons were killed and 281,914 were injured. Compared to the rest of the Texas, the Houston region had the worst safety problem in the State accounting for about 26% of all serious crashes in Texas.² The injuries were 28% of the State’s total and the fatalities were 17% of the State’s total.

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) was calculated. The Houston region had a Fatal and Injury Crash Rate of 134, which is 36% higher than the State average (98) and 148% higher than the national average (54).

Purpose of the Program

There are three main goals for the safety program:

1. **Identify and monitor safety.** H-GAC has built a spatial crash information system. This allows the identification of hazardous locations. Until H-GAC became involved, there was not a comprehensive evaluation of crashes in the region. The Texas Department of Transportation (TxDOT) monitors its roads but crashes on local roads were not identified. This was a major deficiency that prevented local governments from identifying safety problems.
2. **Implement safety roadway improvements at hazardous locations.** Once hazardous locations have been identified, H-GAC works with local governments, TxDOT, the regional transit agency, and other relevant organizations to implement improvements in the road system.
3. **Support other safety efforts.** H-GAC deals primarily with roadway improvements. However, safety is improved by not only by changes in the roadway system, but also by increased public awareness and enforcement of traffic laws. Thus, H-GAC will partner with other organizations to support their safety efforts.

² Crash Records Bureau, Texas Department of Public Safety website; http://www.txdps.state.tx.us/administration/driver_licensing_control/arb.htm. Unfortunately, their data are more than four years out of date, a situation which makes it difficult for safety planning. The SAFETEA-LU legislation puts a priority on improving crash information systems, which should help eventually.

In short, the H-GAC safety program combines an analytic methodology with a policy framework for the goal of building a traffic safety program that can reduce crashes. It is a methodology that can be adopted by other MPO's throughout the country.

Motor Vehicle Crash Information System

The first step in developing a safety program is to obtain information on where crashes occur and where they are most concentrated. To do this, we developed a spatial crash information system, based on Geographic Information System (GIS) technology.³ While most agencies and firms that conduct crash analysis use a traditional tabular approach to data, for regional and local safety planning a spatial crash information system offers the potential to link safety analysis with planning issues.

For our metropolitan region, the crash data come from the Crash Records Bureau of the Texas Department of Public Safety who compile data on all serious crashes collected by local police departments. The data, unfortunately, are old and only cover 'serious' crashes. Initially, we tried to obtain crash data from local jurisdictions, but found that wasn't practical. Each jurisdiction maintains the data in different forms and codes information in idiosyncratic ways. Only one jurisdiction even had the data in a GIS form. There was no way to integrate such information in a consistent manner. Still, for specific safety engineering studies, we do use the actual crash reports held by the jurisdictions.

The Texas Department of Public Safety defines 'serious' crashes as fatal crashes, injury crashes, and property damage only crashes where one or more vehicles were towed. This information does not include property damage only crashes where no one was injured and all vehicles were driven off. We developed an extensive methodology for geo-referencing the serious crashes using a GIS. The key is to clean the data prior to geo-coding it so that street names correspond to the names existing in the base map file.⁴

Spatial Analytical Tools

Mapping

To utilize the crash information system for analytical and policy purposes, a number of different tools are used. First, there are simple displays. Figure 1 shows a map of all serious crashes in the region. Each dot represents a crash location. Since many locations have more than one crash, the density of the crashes is not completely captured with a simple map.

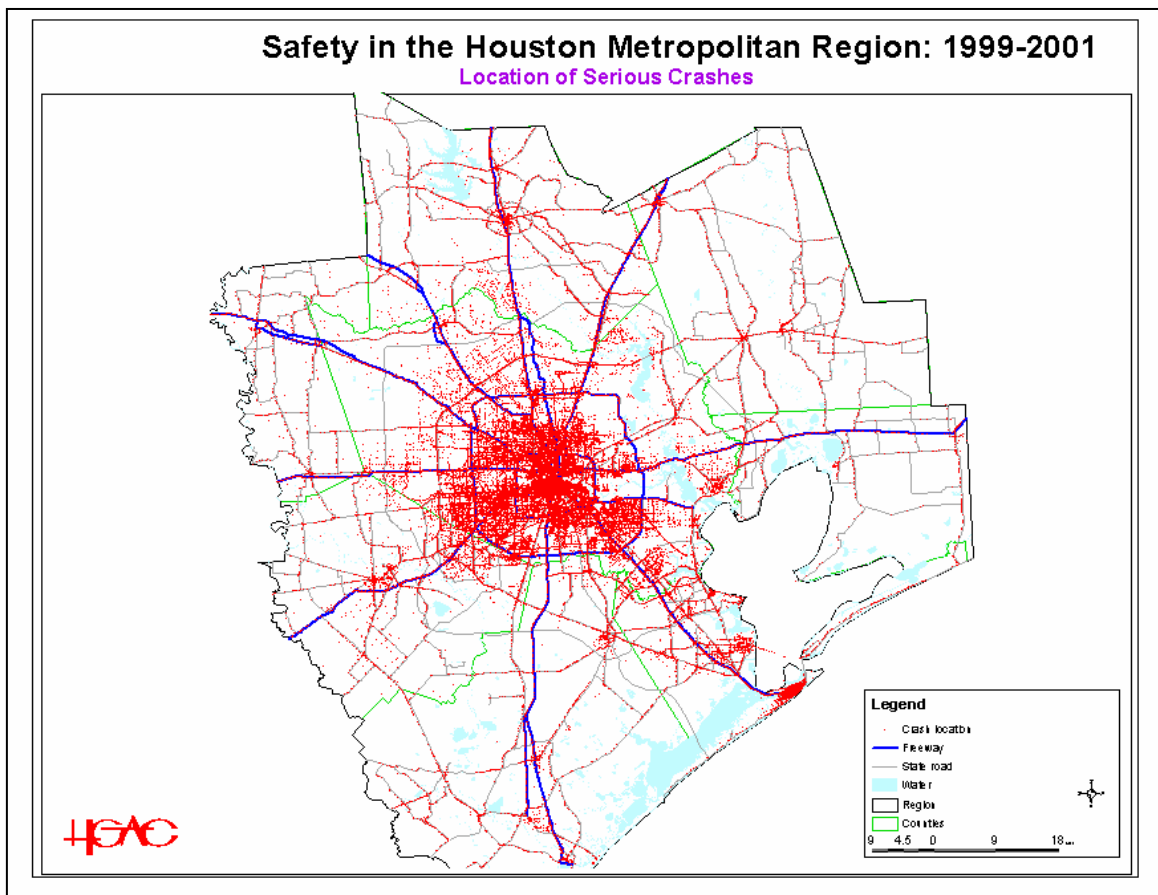
³ Ned Levine, Karl E. Kim, and Lawrence H. Nitz, "Spatial analysis of Honolulu motor vehicle crashes: I. Spatial patterns". *Accident Analysis & Prevention*, 1995. 27 (5), 663-674; Ned Levine, Karl E. Kim, and Lawrence H. Nitz, "Spatial analysis of Honolulu motor vehicle crashes: II. Generators of crashes". *Accident Analysis & Prevention*, 1995. 27 (5), 675-685; Karl Kim and Ned Levine, "Using GIS to improve highway safety". *Computers, Environment, and Urban Systems*. 1996. 20 (4/5), pp. 289-302.

⁴ Ned Levine and Karl E. Kim, "The spatial location of motor vehicle accidents: A methodology for geocoding intersections". *Computers, Environment, and Urban Systems*. 1999, 22 (6), 557-576.

Visualization

Second, there are visualization tools. Using the *CrimeStat* program, the number of crashes at each location was calculated.⁵ Figure 2 displays a map of the crash frequencies for the City of Galveston, an island city. The size of each circle is proportional to the number of crashes. As seen, the major arterial into the city has the highest concentration of crashes, though several major arterials also have concentrations, the result, primarily of higher traffic volumes.

Figure 1:



⁵ Ned Levine, "CrimeStat III: A Spatial Statistical Program for the Analysis of Metropolitan Crime Locations". National Institute of Justice: Washington, DC and Ned Levine & Associates: Houston, TX. 2004. <http://www.icpsr.umich.edu/crimestat>.

Hot spot analysis

Third, there are analysis tools. One of the most useful concepts is that of a *hot spot*. A crash hot spot is a small area where crashes are concentrated. As opposed to a single location or a 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 can create a higher number of conflict points. For example, figure 3 shows the location of major hot spots that averaged 78 or more crashes a year (one every two weeks) between 1999 and 2001. The hot spots are displayed as ellipses and were also calculated by the *CrimeStat* program. Most are along the heavily-traveled freeways but there are several smaller hot spots near downtown Houston. Figure 4 zooms in to the downtown area. As seen, there is an interaction between the crashes on the freeways themselves and on the approaching access roads. One of the characteristics of urban crash hot spots is that crashes ‘spill over’ on to adjacent roads, primarily due to congestion.

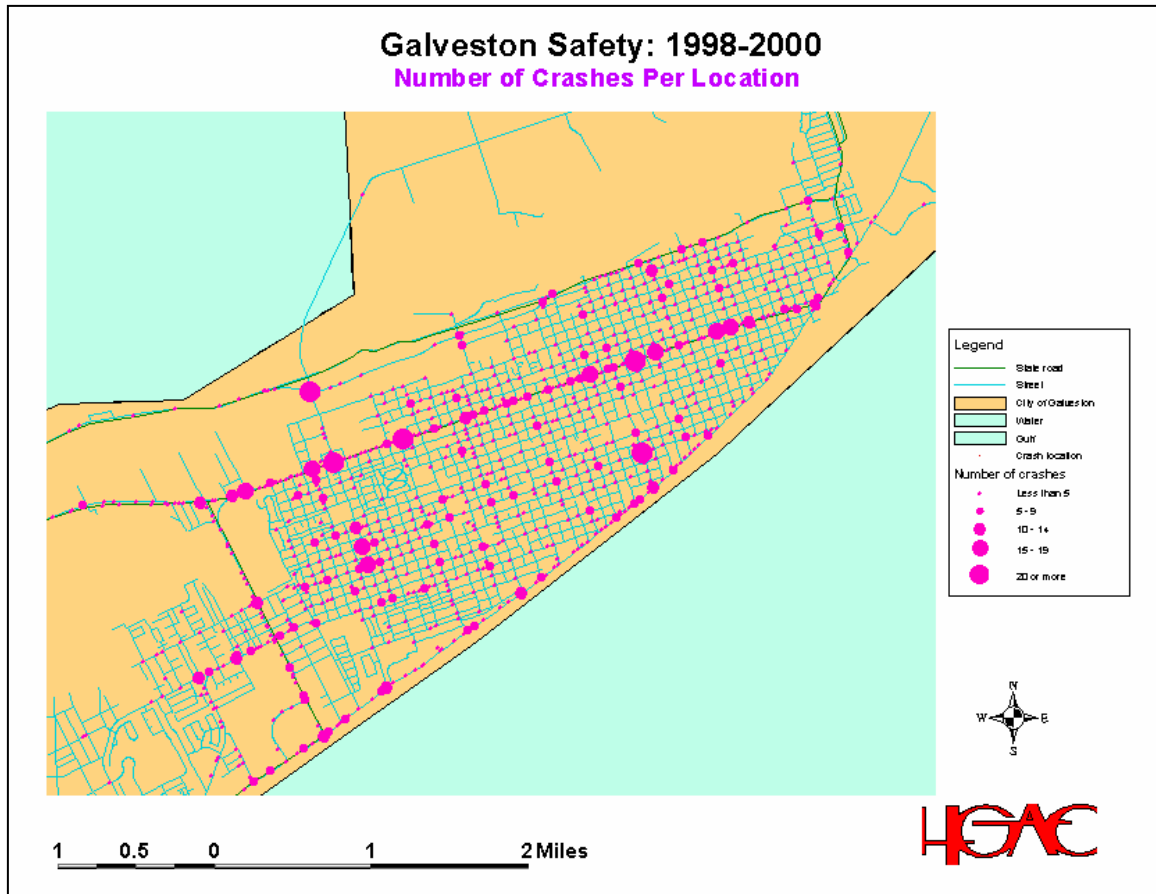
Hot spot analysis is a particularly useful tool for identifying hazardous locations and can help to identify safety projects. Typically, a safety study is conducted at these locations to identify remedial measures to reduce the number of crashes.

Crash risk analysis

Fourth, there are crash risk analysis tools. Typically, the number of crashes is related to traffic volume. Thus, it’s not surprising that the major hot spots generally occur at locations with a high volume of traffic. An alternative approach 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.

For example, for the region as a whole, there were, on average, 84,080 annual serious crashes between 1999 and 2001. For this period, annual VMT for the region was approximately 41.2 billion. Thus, *serious crash risk* in the region for the three-year period was 204 per 100 million VMT. For comparison, the serious crash risk for the State of Texas was 149 per 100 million VMT for 1999-2001; because of the non-comparability of property damage crashes in Texas and the rest of the country, it was not possible to calculate serious crash risk for the nation.

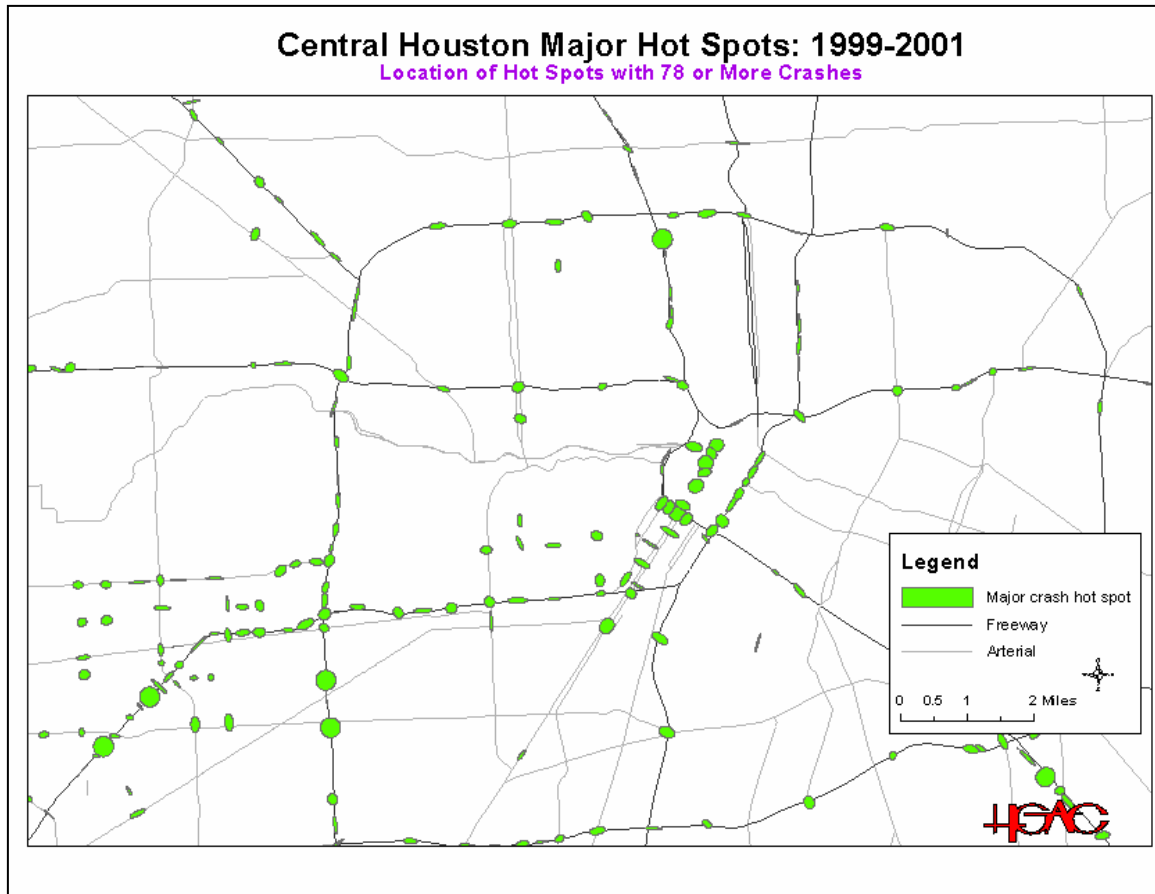
Figure 2:



County crash risk

Nevertheless, using the State baseline rate of 149, comparisons can be made. For example, the eight counties have different serious crash risks (table 1). Three counties (Galveston, Harris and Brazoria) have crash risks higher than the State average of 149. There are also substantial differences between cities in serious crash risk (data not shown).

Figure 3:



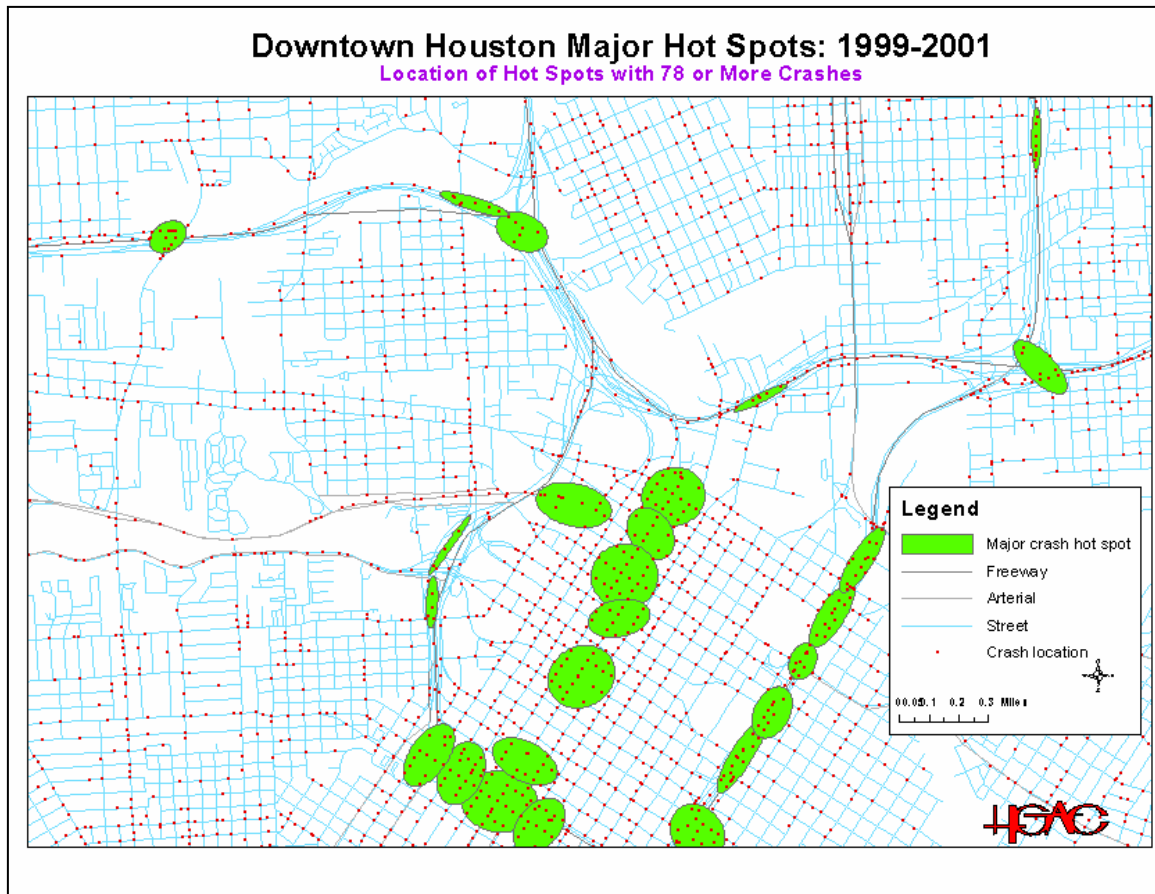
Roadway crash risk

Probably the most important comparison is between different roads. In general, freeways have a lower risk while the major arterials have the highest. But there are exceptions. Serious crash risk was calculated for the following roadways and (table 2; the base years are indicated in parenthesis). There are substantial differences in the safety of roadways, even controlling for traffic volume (which is what crash risk measures).

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 and there are stretches where both there are a high number of crashes and a high number relative to the traffic volume.

Figure 4:



In short, a spatial crash information system offers the potential to conduct both “traditional” crash analysis as well as spatial analysis to look for interactions around particular intersections or road segment.

Safety Applications

H-GAC uses the crash information system for a variety of purposes. First, the system is used to provide statistical summaries, as illustrated above. Second, the crash information system is used to identify hot spots. H-GAC works with local governments and with TxDOT to study particular hot spots with the aim of reducing crashes at those locations.

Third, H-GAC uses the crash information system to identify types of crashes to monitor particular types of policies. Fourth, H-GAC uses the crash information system to evaluate projects for inclusion in the long-range plan and in the Transportation Improvement Program 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.

Table 1
Serious Crash Risk of Counties
 Serious Crashes Per 100 Million VMT

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

Table 2
Serious Crash Risk of Selected Roadways
 Serious Crashes Per 100 Million VMT

<u>Roadway</u>		<u>Crash risk</u>
John F. Kennedy Blvd (1999)		505
Kirby Dr (1998-2001)	433	
FM 1960 (1998-2000)	260	
FM 518 (1998-2000)		235
SH 35 (1999)	229	
SH 288 (1998-2000)		199
FM 359 (1999)		173
US 59 S (1999)	129	
Spring Steubner Rd (1999)	69	
Nichols Sawmill Rd (1999)	21	

Statistical Crash Summaries

To improve public awareness of safety, H-GAC has established a safety web page and distributes a series of county, small area, and corridor safety analyses (<http://www.h-gac.com/safety>). One of our major safety products is the analysis of crashes along particular roadways. These identify the overall volume of crashes, crash hot spots, and high-risk hot spots. We continually receive requests from cities, counties and TxDOT for crash analysis of particular roadways. Most of these write-ups are available on the H-GAC safety page.

Safety Projects/Hot Spot Mitigation

Aside from statistical reports, a major effort of the safety program is to mitigate crashes. Using hot spot analysis, H-GAC works with the particular local government, with TxDOT, and with other safety partners to study the causes of crashes at the hot spot. This type of methodology is consistent with Federal safety guidelines.⁶ In order to receive Federal safety funds for mitigating a hot spot, it is necessary to first conduct a *safety engineering* study. For each location, the crashes that have occurred over a number of years are examined to identify a repeatable pattern and the likely causes. Recommendations are then made for mitigation. Each of the recommendations, in turn, is evaluated with a benefit-cost analysis. The measures with the highest benefit-cost ratios are selected for funding.

The commitment H-GAC makes involves funding the project in cooperation with the local government. Typically, H-GAC will split the costs with the local government, though the exact split depends on the resources of the jurisdiction. To date, H-GAC has completed five safety projects:

1. Two hazardous intersections along a major arterial in Houston, Westheimer Road. The consultant identified factors contributing to the crashes and proposed recommendations for improving safety. For both intersections, the proposed recommendations were inexpensive involving changing traffic signals to larger, 12" backlit lights and repainting turn lanes;
2. A hot spot in the East End of Houston that covered around 90 blocks. The consultant recommended fairly inexpensive improvements to minimize sideswipe crashes (e.g., lane markers, clearer striping) and to reduce the number of red light running crashes (larger, backlit 12" traffic signals; clearer lane definition);

⁶ Federal Highway Administration (1981). *Highway Safety Improvement Program*, FHWA-TS-81-218. December. Available at <http://www.fhwa.dot.gov/tfrc/safety/pubs/81218/intro.htm>

3. Five high crash intersections within the City of Pasadena. The consultant identified patterns of crashes at these intersections, mostly involving red-light running, and proposed mitigation measures to improve safety at each;
4. Thirteen intersections in the City of Galveston. The consultant recommended specific modifications at each of the intersections. The total cost for mitigating all 13 intersections would be about \$609,000 but would produce benefit-to-cost ratios from 2 to 72 times over the lifetime of the improvements; and
5. An analysis of 12 intersections in the City of Sugar Land. The consultant made specific recommendations for improving safety at each of the intersections, involving mitigations such as new signal timing plans, restricting access at median openings, and removing confusing signs.

The reports from all the completed studies are put on the H-GAC safety web page. H-GAC aims to eventually conduct studies of all major hot spots within the region.

Analysis of Behavioral Factors

In addition to identifying hot spots and conducting safety projects with local governments, the spatial crash information system is used to monitor particular types of crashes. ‘Driver error’ is involved in virtually every crash and the State reporting form allows police officers to report the major causes. In the H-GAC region, the following factors were identified most frequently (table 3). For each factor, if any of the drivers committed the error, the crash was identified as being associated with the behavior. Thus, multiple factors can be associated with a crash.

Table 3
Major Factors Contributing to Crashes
 Identified on Crash Report by Police Officer

<u>Attributed cause</u>	<u>%</u>
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%

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

Speeding

By far, speeding is the most common behavioral factor associated with crashes, being involved in 39% of all crashes in the region. Of these, 0.5% had fatalities and 67% had injuries. Teenagers are slightly more likely to be involved in speeding crashes than non-teenagers (22% v. 20%). Most relevant for local safety planning, approximately half occurred on local or arterial roads, not freeways. It appears to be drivers going 50 mph in a 35 mph zone or going 60 mph in a 45 mph zone that are causing about half the crashes.

Failing to Yield

The second most common behavioral factor associated with crashes is failing to yield the right-of-way to another vehicle (20% of all crashes). Again, the severity is fairly high: 0.3% involved fatalities and 66% involved injuries. Teenagers are more likely to be involved in failing to yield crashes than non-teenagers (26% v. 20%).

Failing to Stop and Red-light Running

Failing to stop at a traffic control sign involves 11.0% of the crashes. The severity levels are particularly high for this type of crash as 0.6% involved fatalities and 70% involved injuries.

Running red lights is another major safety problem, being associated with 8% of the crashes.⁷ It is a 'failure to stop' offense, but is separated out as its own category on the state crash reporting form. Many are on frontage roads at the intersection with arterials. Of the 19,012 red-light running crashes in the region between 1999 and 2001, 0.6% involved fatalities and 71% involved injuries.

Reductions in 'failing to stop' crashes will come about through increased enforcement, public support of actions, 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, they don't want to take the time to properly stop or are speeding.

One very effective measure is the use of automated cameras that photograph vehicles running a red-light. There is substantial evidence that red light camera enforcement does reduce the number of red light running crashes.⁸ However, the Federal Highway Administration and the National Highway Traffic Safety Administration issued joint operational guidelines on red light camera enforcement.⁹ Their report basically argues that intersections where the cameras are used should be carefully selected and should reflect a substantial red light running crash history; signal timing should be accurate and consistent with state standards; warning signs should be used to prepare

⁷ The national estimate is 5%. National Safety Council, *ibid*.

⁸ See the discussion on the H-GAC web site: "Facts about red light running crashes 1999 to 2001", <http://www.h-gac.com/safety>.

⁹ Federal Highway Administration & National Highway Traffic Safety Administration, *Guidance for using Red Light Cameras*. Washington, DC, March 20, 2003. <http://www.nhtsa.dot.gov/people/injury/enforce/guidance03/Guidancereport.pdf>.

drivers so as to avoid an increase in rear-end crashes; and there should substantial oversight of the process by an independent panel. H-GAC supports the use of red light running camera enforcement using the guidelines specified in the FHWA-NHTSA guideline document.

Driving Under the Influence/Driving While Intoxicated

Driving under the influence of alcohol or drugs (DUI) is a particularly dangerous behavior. It is involved in at least 7% of the region's serious crashes. Nationally, alcohol is the single largest cause of fatal crashes. In our region, 37% 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, 4% of DUI crashes involved fatalities and 61% involved injuries (of which 10% were incapacitating injuries). Thirteen percent involved teenagers, though the legal drinking age in Texas is 21. Serious drinking problems may start with teenagers that will become full-blown when they are adults.

Pedestrian and Bicycle Crashes

The region has a serious problem with pedestrian and bicycle safety.

Pedestrian crashes

From 1999 to 2001, there were 3,579 pedestrian crashes in the eight counties. This was 26% of the State's total. Of these, 276 involved fatalities and 3,303 involved injuries. Pedestrian crashes typically occur where there are concentrations of pedestrians. Some of these areas also have concentrations of low income persons, with immigrant populations. The higher use of transit along with unfamiliarity in American road conditions *may* be factors in some pedestrian crashes, though many counter-examples can be given.

Among the driving factors associated with pedestrian crashes are speeding (involved in 6% of pedestrian crashes), failure to yield (4%), and DUI (3%). 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.¹⁰ Our data do not support a higher rate for elderly; only 5% of pedestrian crashes involve elderly (compared to their 8% of the driving-age population).

Bicycle crashes

In the region, there were 1948 bicycle crashes from 1999 to 2001. This was 28% of the State's total. Of these, 5 involved fatalities and 1689 involved known injuries. As with the pedestrian crashes, bicycle crashes tend to be concentrated, though to a lesser extent.

¹⁰ National Safety Council, *Injury Facts:2000*; National Safety Council: Washington, DC., 2001, 96

Among the driving factors associated with bicycle crashes are speeding (7% of all bicycle crashes), failing to yield (14%), failing to stop (3%), and DUI (2%). 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.¹¹

Crashes involving Teenagers and the Elderly

Teenagers

Crashes by teenage drivers are a major problem. For the region as a whole, 21% of all the crashes involved teenage drivers. This is compared to their 9% share of the driving age population. However, the percentage of crashes involving teenagers is generally higher in the suburbs with some of the surrounding counties having 28-29% of all crashes involving a teenager. The reason for this 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 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.¹²

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.¹³

A higher crash among teenage drivers has been observed since the National Safety Council started gathering crash statistics in 1913. Teenagers are much more likely to be involved in serious crashes than other age groups. For example, of the fatal crashes in the region from 1999 to 2001, 17% involved a teenage driver. Of the serious incapacitating type of crashes, 19% involved a teenage driver. Nationally, teenager drivers have the highest death rates per mile driven than any other age group.¹⁴ 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.

¹¹ National Safety Council, *Injury Facts:2000*; Washington, DC., 2001, 97.

¹² Allan F. Williams, *Teenage Passengers in Motor Vehicle Crashes: A Summary of Current Research*. Arlington, VA; <http://www.hwysafety.org>.

¹³ 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>

¹⁴ Insurance Institute for Highway Safety, *Teenage Driving Facts*. Arlington, VA; http://www.hwysafety.org/safety_facts/teens/teenager.htm

H-GAC believes that special attention should be devoted to teenage drivers. For one thing, restrictions on teenage drivers are warranted since it will save lives and prevent injuries. Most states have adopted graduated licensing laws whereby the teenage driver is supervised and there are limits on the number of passengers, particularly other teenagers.¹⁵ In 2002, 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.¹⁶

Truck Crashes

Because of the economic importance of freight, truck safety is of paramount consideration. Again, the Houston metropolitan region has a serious safety problem. From 1999 to 2001, there were 15,369 crashes involving commercial motor vehicles. This was 6% 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 for 1999 (the only state data we have). In 1999, the number of commercial motor vehicle crashes per 100,000 population was 98 for the region and 81 for the State of Texas. Unfortunately, there are 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 several freeways. From all accounts, severe truck crashes have been reduced on the freeways where these policies were implemented.

Highway-Rail Grade Crossing Collisions

A major indicator of how railroad safety interfaces with road safety is the number of highway/railroad crashes. The region has a relatively severe problem, and appears to be getting worse. 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, there are not good baseline data. Consequently, the region’s highway/rail safety was compared to the State total for two three year periods. According to the Federal Railroad Administration, from 2000 to 2002, there were 247 highway/rail crashes in the region. These involved 13 fatalities and 74 injuries. The 247 crashes accounted for 23% of the State’s total highway/rail crashes.

¹⁵ National Safety Council, *Injury Facts:2000*; Washington, DC., 2001, 80.

¹⁶ 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.tristateneews.com/cgi-bin/articles/exec/view.pl?archive=6&num=920&printer=1>

However, compared to 10-years earlier, the number 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. Total highway/rail crashes in Texas decreased from 1990-92 through 2000-2002 from 1594 to 1073, whereas our region showed no changes in these types of crashes. A hot spot analysis showed there were 22 locations where there were 5 or more crashes between 1990 and June 2003.¹⁷ These locations have been targeted in the long-range safety plan for mitigation.

A Long-Term Strategic Safety Plan

H-GAC has developed a long-term safety plan for improving safety on the road system. First, there are 344 major hot spot locations that accounted for about 20% of all crashes in the region between 1999 and 2001 (see figures 3 and 4 above). These hot spots were identified with the *CrimeStat* program and were defined as those small areas having 78 or more serious crashes between 1999-2001 (an average of one every two weeks). As part of the strategic safety plan, these hot spots are prioritized for safety improvements. Reducing crashes at these locations will have a large benefit in terms of congestion relief as well as human costs (personal, medical, insurance).

Without a detailed engineering study, the actual costs of mitigation cannot be calculated, but a rough estimate of the benefits and costs for mitigating these hot spots was made (table 4). On the assumption that each hot spot would cost on average \$500,000 to mitigate (in 1999 dollars), 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 *each* year there would be 22 fewer fatal crashes, 2,125 fewer injury crashes, and 1,143 fewer serious property damage only crashes. Using the National Safety Council methodology for 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* benefit was estimated as \$79 million.¹⁸

¹⁷ *CrimeStat III*, *ibid*, <http://www.icpsr.umich.edu/crimestat>

¹⁸ On average, for the region as a whole, each fatal crash produced 1.13 fatalities and each injury crash produced 1.75 injuries. These multipliers have been applied to the crash distribution for the 344 hot spots. The National Safety Council estimate for 1999 of comprehensive costs (both the economic costs and the value of lost quality of life associated with the deaths and injuries) was \$3,100,150 for a fatality, \$153,453 for an incapacitating injury (Type A), \$39,481 for a non-incapacitating evident injury (Type B), \$18,782 for a possible injury (Type C), and \$1,787 for a property damage only crash. National Safety Council, *Injury Facts: 2000 Edition*, 79.

Table 4
Costs and Benefits of Hot Spot Mitigation: 1999-2001
 1999 Dollars

Type of Facility Benefit	Number	Number of Crashes	Estimated Cost to Mitigate	Estimated Annual
Freeway segments	150	7,766	\$75 million	\$37 million
Intersection between freeway & arterial road	70	3,756	\$35 million	\$18 million
Arterial road segments	124	4,930	\$62 million	\$24 million

Note that, given the annual benefit expected from mitigation at the hot spots, the payback period would take slightly more than two years. In addition, there would be cumulative benefits for many years thereafter – 3,200 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). In short, mitigating these hot spots will cost more than for other hot spots, but the benefits will also be greater.

Evaluating Projects for the Long-Range Plan

H-GAC’s transportation planning process includes a long-range plan that is developed every three years. Roadway and transit projects are submitted by TxDOT, transit agencies, and local governments for inclusion in the long-range plan. The projects are selected on the basis of an evaluation. The Transportation Improvement Plan 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 a significant factor and is assigned points in the evaluation. Projects that improve safety are given more points than those that don’t. 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. Details can be provided upon request.

Other Safety Activities

In addition to the above mentioned activities, H-GAC supports other safety efforts.

Safety Partnerships

H-GAC has developed safety partnerships with State agencies and many local governments within the region. In addition, partnerships have been created with several non-profit organizations. H-GAC sees these as critical for building a coalition to improve safety in the region. Without multiple partners encouraging safety, no real improvements will be made as engineering improvements are limited for improving safety. Only when they are combined with education, improvements in operations and management, quick emergency medical response, and law enforcement will the very high crash and severity levels be reduced.

Regional Safety Council

In February 2006, H-GAC launched a Regional Safety Council (RSC). The aim is to provide a policy forum for multiple disciplines to discuss traffic safety issues. The RSC will provide a forum for an inter-disciplinary approach towards safety and is made up of representatives from transportation, local government, law enforcement, emergency medical services, medical treatment, insurance, trucking, non-profit safety advocacy, and research organizations. The RSC has just started so it is too early to gauge any outcomes of the endeavor. But several committees have been created, that will allow more in-depth discussion of particular safety topics (e.g., reducing DWI/DUI crashes; reducing aggressive driving; improving freight safety; improving safety information systems). In addition, an annual safety conference is being planned. The aim is to allow a variety of safety organizations to participate and to encourage sharing of information and ideas.

Safety Education

The last activity that is being considered is safety courses. To date, we have not yet conducted any courses on safety planning. However, we have received numerous requests from city engineers for refresher courses on traffic safety engineering and requests from elected officials for courses on safety policy, safety funding, and legislative issues. We see an important role for these in the near future.

Summary

In summary, the Houston metropolitan traffic safety program is an integral part of transportation planning efforts of H-GAC. Safety has a central role in transportation planning, not just as words but as real criteria that are integrated into road plans, construction, and maintenance. Too often, safety has not been a critical factor in roadway design with shortcuts being taken in the name of mobility or cost control. The result is a high number of motor vehicle crashes, something we should not be proud of. Nevertheless, by bringing the issue to the forefront of planning, hopefully some improvements in traffic safety can materialize.