

Houston TranStar



2007 Annual Report

The Houston TranStar Consortium is a Partnership of Four Government Agencies
Responsible for Providing Transportation Management and
Emergency Management Services to the Greater Houston Region



METRO



INTRODUCTION

In the fourth largest city in America, operating the transportation system is the key in keeping traffic moving safely and efficiently. Houston TranStar was established in 1993 to provide for multi-agency management of the region's transportation system. It has evolved into a primary resource from which agencies respond to incidents and emergencies in Harris County and beyond.



Houston TranStar is a partnership among the four principal transportation and emergency management agencies in Harris County, including the Texas Department of Transportation (TxDOT); Metropolitan Transit Authority of Harris County (METRO); Harris County; and the City of Houston.

Houston TranStar plays a pivotal role in the travel of people and goods in the greater Houston region, saving motorists more than \$1.9 billion in reduced travel time costs over the 11 years of Center operation from 1997 to 2007.

This document is the 11th annual report for the Houston TranStar Transportation Management and Emergency Operations Center. This annual report provides a review of the performance of the center and summarizes the estimated return on investment as quantified by the estimated benefit/cost ratio.

In summary, the reduction of travel time attributable to Houston TranStar operation was about 12.3 million vehicle-hours in 2007, which has a corresponding value of \$238 million in road user cost savings and a reduced fuel consumption of almost 23 million gallons (which saved Houston-area roadway users approximately \$62 million in fuel costs). The total estimated benefits of Center operation in 2007 was just over \$300 million. Comparing the annualized TranStar operating cost estimate of \$23.2 million to the annual benefit of \$300 million yields a benefit/cost ratio of 12.9.

Houston TranStar's Mission

It is the mission of Houston TranStar and its partner agencies to provide highly effective transportation and emergency management services through the combined use of the partners' collective resources to maximize safety and mobility to the public.

TRANSTAR OPERATIONS FRAMEWORK

Houston TranStar uses a three-tiered management structure (see Figure 1) with representation of each of the four agencies on each committee. The functions of the three committees are:

- Executive Committee – comprised of agency- or division-level executive administrators; sets policy and manages fiscal and staffing matters;
- Leadership Team – comprised of administrators of the transportation and emergency management groups; administers implementation of various projects and activities and reviews funding commitments; and
- Agency Managers Committee – comprised of managers of the transportation and emergency management groups; the agency managers are responsible for daily operations.

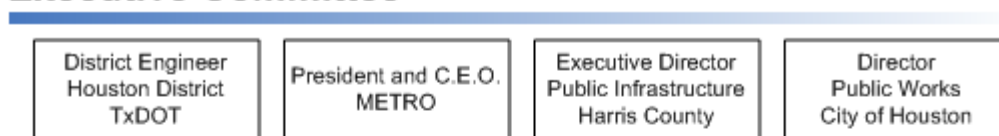
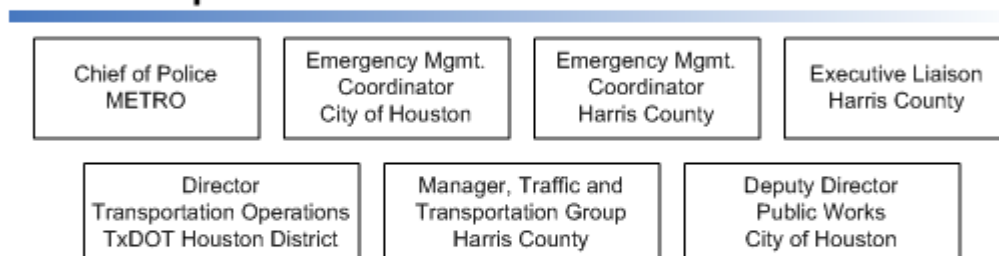
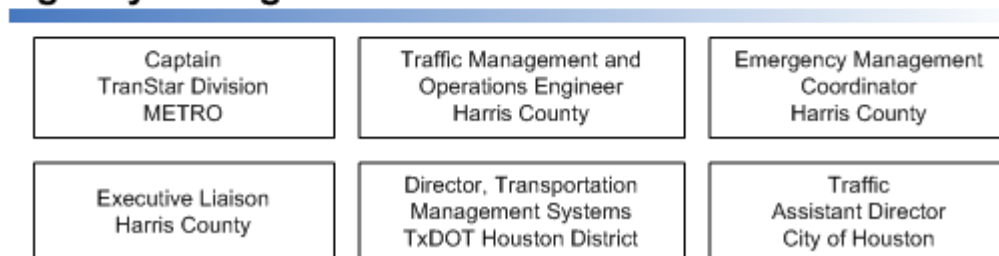
Executive Committee**Leadership Team****Agency Managers**

Figure 1. Houston TranStar Organization Chart

Houston TranStar is staffed by employees from the member agencies which support the three levels of management in operating the systems and programs housed in the Center. Operation of the Center is coordinated by a small management staff that is responsible for operating and maintaining Houston TranStar facilities, coordinating multi-agency activities, coordinating budget preparation, workshops, meetings, and facility tours, and managing public information activities.

SUMMARY OF ACTIVITIES

In 2007, the TranStar Partner Agencies continued integration activities and deployment of field devices. Accomplishments for the Year 2007 are highlighted in the following sections of this report. Some of the highlights and significant accomplishments of TranStar during 2007 included:

- Ongoing multi-agency efforts to coordinate signal timings on jurisdictional borders.
- Completed multimedia upgrades to the Briefing Room allowing wireless internet access and wireless access to projection units for presentations, scenario-based lighting and glass panels between the Briefing Room and Emergency Operations Center. Videoconferencing capability was installed in the Briefing Room.
- Coordinated with the San Antonio and Yoakum TxDOT Districts during January's severe winter weather conditions, posting advisory messages on DMS signs about the closure of IH 10 west of San Antonio.
- Continued discussions with sub-regional transportation management centers on architecture and center to center communications.
- Began work on coordinating with the Houston Ship Channel Security Project, and investigating integration of those communications systems for transportation and security monitoring.
- The American Public Transit Association examined TranStar's role in transit operations during evacuations as a national case study review.
- The University of Houston Psychology Department provided a Doctoral Student to review TranStar Center policy and procedures, conduct interviews with staff, and formulate new orientation procedures.
- The TranStar website was modified to include quick-click banners during various events including Amber Alerts, hurricanes, floods, etc.
- The City of Houston Mobile Response Team began staffing and equipping consoles in preparation of full time operation in late 2007.
- TranStar and the partner agencies hosted all eight Integrated Corridor Management (ICM) Initiative sites and USDOT representatives for a workshop in April.
- TranStar staff attended the ITS America Annual Conference in Palm Springs, California.
- Participating agencies finalized the deployment of notification software that will notify key staff during emergencies via pager, email and phone.
- TranStar staff completed upgrades related to media accessibility during events. Media will now have the capability to receive direct feeds from the Center to their trucks or stations.
- TranStar hosted several meetings of the Freight Rail Coordination Group, a group created by Harris and Fort Bend Counties and the City of Houston to focus regional efforts on improving the safety and efficiency of the freight rail system, including vehicle mobility at grade crossings.

- Development of funding agreements between TxDOT and the City of Houston for the Center building expansion project (including a new generator, communications tower, new phone system (phase I of II) and the computer room expansion) began in October.
- Discussions began with Montgomery County about becoming an ATM satellite or communications hub for TranStar.
- METRO added 200 cameras to Park & Ride Lots, allowing remote security monitoring from TranStar.
- Houston TranStar participated in a regional hurricane education and awareness campaign in coordination with H-GAC.
- The TranStar partner agencies participated in the Freeway Tolling Operations in the America's Conference in May. The conference was co-sponsored by the US Department of Transportation, Transportation Research Board, TxDOT, and Texas Transportation Institute.
- The center hosted 2,227 visitors in 2007, including 266 VIP's, 138 international visitors, 690 senior citizens, 436 school-aged visitors, 230 conference attendees, and 467 local visitors.

Texas Department of Transportation (TxDOT)

TxDOT is responsible for traffic management of freeways and state-maintained arterial highways in the region. The Computerized Traffic Management System (CTMS) has been in continuous deployment on Houston area freeways since the late 1980s. The total extent of the system now exceeds 784 directional miles, including 723 directional freeway miles and 61 miles on HOV lanes. Major components of the CTMS include closed circuit television (CCTV), dynamic message signs (DMS), highway advisory radio (HAR), freeway entrance ramp flow signals, travel time monitoring using the Automatic Vehicle Identification (AVI) system, and related fiber/communications systems and central facility computer systems. The extent of the freeway management system and other ITS components in 2007 is listed below:



- Closed Circuit Television:
 - 516 Freeway CCTV cameras,
 - 71 Regional hurricane evacuation cameras (on rural and/or remote routes)
- Dynamic Message Signs: 206 total DMS
 - 160 for freeway operations
 - 41 for HOV and P&R operations
 - 5 Portable units
- Highway Advisory Radio
 - Twelve fixed transmitting locations
 - One portable transmitting station
- Radar Detection – 76 total detectors
 - 39 Locations on evacuation routes (primarily on rural and/or remote routes)
 - 37 Locations on freeway facilities

- Flow Signals in Operation: 87 on five facilities (IH 45 North, IH 45 Gulf, US 59 Southwest, US 290 Northwest, and IH 610 North Loop)
- Automatic Vehicle Identification (AVI) System - 784 directional miles of coverage

Incident Management and Traveler Information Systems

TranStar's traveler information systems are the cornerstone of the partner agencies traffic management function and its ability to respond to and manage incidents. Monitoring systems at Houston TranStar provide extensive information of value to motorists as well as to traffic management operators at Houston TranStar. TxDOT operates and maintains this system for TranStar. Information is provided to motorists by four primary means: DMSs, HAR, the Internet, and the local media.

The 206 DMSs provide information on traffic incidents and planned construction, giving location, travel direction, and nature of incident or activity. The system is also used to display travel times, weather alerts, and Amber alerts. There were 147,854 operator activated messages and over 1.69 million automated messages displayed on DMSs in 2007.

The types of DMS messages included:

- Operator Activated:
 - 128,015 operator activated messages for incidents;
 - 6,678 operator activated messages for road closures or construction;
 - 1,870 operator activated messages for weather-related events, including:
 - 1,773 weather events,
 - 61 icing events and
 - 36 ozone alerts;
 - 5,795 operator activated messages for public service messages, including:
 - 1,902 for safety campaigns,
 - 3,382 MAP/PEAT assistance information; and
 - 511 other informational messages.
 - 4,176 operator activated messages for special events;
 - 1,320 Amber Alert & Silver Alert messages
- Automated travel time/ferry wait time messages:
 - 1,671,678 automated travel time messages
 - 20,759 Galveston-Port Bolivar ferry wait time messages.

HAR broadcasts travel information at the 12 HAR sites located throughout the area. HAR was activated to broadcast 5,600 messages in 2007. There were 4,785 HAR broadcasts for incidents, 367 messages for road closures, and 448 messages broadcast for special events using HAR.

City of Houston

The City of Houston Traffic Operations Branch, located at Houston TranStar, directs the design and installation of new traffic signals, operates and manages the city's signal system, and oversees operations and development of the signal communications infrastructure.



The need for good traffic signal operation has never been greater. Traffic congestion is a major issue for Houstonians, making signal timing optimization an excellent investment with great benefits for our cities future traffic operations. Houston has over 2,300 signalized intersections maintained and operated by the city.

The Public Works and Engineering Department's Traffic Signal Timing Optimization Program (TSTOP) is a coordinated effort between many agencies to ensure the city's traffic signals are using the latest up to date traffic data; all the while taking advantage of the most recent technologies to produce new customized signal timings. TSTOP is a revolving program that is scheduled to revisit each major corridor each four years for retiming. The central approach of TSTOP is to provide an optimized level of traffic signal operation on the city's most heavily traveled corridors and throughout some of its most heavily populated employment areas. Their program management function consists of several aspects including:

- Initial plan development - defining the scope, corridors, zones, and time schedules of TSTOP deployment,
- Ensuring the adherence of all implementation "roll outs" to the program schedule,
- Serving as the liaison between multiple working agencies, and
- Ensuring proper quality assurance/quality control measures.

In addition to providing the program management for TSTOP, the Traffic Operations Section is responsible for developing signal optimization plans for all of the selected zones. Their role in this process consists of field data collection, timing plan design, and signal timing implementation. The Traffic Operations Section continues to improve the operation of all Houston signalized intersections on a 4-year rotational program. Between 500 and 600 traffic signals are evaluated and optimized each year. In 2007, signal timing optimization continued in the Southwest Area, Lockwood Area, Memorial Area, Airline Area and Navigation Area.

Also in the 2007-2008 fiscal year, signal timing improvements began in Midtown (44 City operated traffic signals in coordination with Metro along the Red Line); Northwest Area (bounded by US290, IH-10 and IH-610, - 108 traffic signals); and South Area (bounded by South main, IH-610, and Mykawa - 134 traffic signals).

Retiming was also completed for the Downtown portion of the City. This was a joint effort with the Metropolitan Transportation Authority involving 288 city operated traffic signals and the signals along Main Street operated by METRO.

Evaluations of TSTOP corridors have indicated travel time savings of 10 to 25 percent. The City also actively coordinates signal operations in work zones and at political boundaries with TxDOT and Harris County.

Additionally, the City Traffic Operations Branch completed the following in 2007:

- Draft Master Transportation Communications Plan,
- Retrofit of Traffic Signals in the Downtown, Midtown, and Medical Center with LED indications,
- Planning for ITS deployment in West Houston, and
- Demonstration and evaluation of License Plate Reader technology for travel times on arterials.

METRO

The Metropolitan Transit Authority of Harris County provides bus and light rail transit services as its core function but is also involved in other transportation and law enforcement functions. METRO is an active partner in the operation of Houston TranStar and using Houston TranStar's collection of ITS technologies; METRO is able to provide improved service to the Authority's patrons.



METRO Programs operated from Houston TranStar include METRO bus and METRO Rail dispatch, traffic signalization systems, HOV management systems and incident management programs. METRO highlights for 2007 include:

- METRO deployed Smart Camera Technology in 2006. During 2007, the system final steps were fully completed and installed. The technology has led to the identity and arrest of several suspects committing crimes on METRO's Park and Ride lots and in a significant reduction (approximately 43%) of reported Part 1 Crimes (violent and property crimes).
- Reassigned Watch Command Officers (WCO) and supervisors to ten (10) hours shifts at TranStar to leverage efficiencies and use of all TranStar systems and to enhance field response and coordination to system safety, security, and related incidents.
- Expanded the management staff within the TranStar Division to include a Police Captain, an additional Lieutenant and one Project Manager.
- During 2007, METRO's MAP and Solo officers along with HOV wreckers responded to assistance on roadway and freeways assisted by dispatchers from TranStar. METRO MAP officers assisted 10,456 motorists; HOV wreckers assisted 1,249 motorists in 2007.

- During 2007, there were 9,123 total priority calls for service through TranStar dispatchers. The average time dispatched equal 1 minute 16 seconds, compared to 2006, average of 1 minute 29 seconds per call.
- During 2007, we continued our efforts to prepare for major incidents through on-going meetings and training measures with all partners assigned to Houston TranStar.

Harris County

The Harris County Public Infrastructure Department's (HCPID) Traffic Management and Operations Section is responsible for the operation of the County's traffic signal infrastructure and communications system from offices located within Houston TranStar. The scope of these activities includes management, operation, and construction of the County's traffic signal communications infrastructure. Significant accomplishments during 2007 included:



- Traffic Management Coordination at BW 8 @ IH 10 during the demolition of the direct connector interchange. This effort required a coordination effort between multiple agencies to revise and extend the traffic control plans originally contained in the TxDOT project in order to adjust to field conditions and situations previously unaccounted for in the design of the demolition and construction of this facility. This effort minimized the disruption to the motoring public throughout the reconstruction of the subject interchange. Traffic data collection indicated a significant reduction in travel time through the interchange with minimal (less than 30%) diversion of drivers from the interchange. Activities included:
 - Extensive public information and multi-agency resource coordination outside of the original traffic control plan.
 - Significant physical reconfiguration of entrance and exit ramps along the Sam Houston Toll Road to adjust for various short and long term lane and freeway/Tollway closures.
 - Active coordination between the City, TxDOT, multiple Contractors, HCTRA, and the Harris County Traffic Group to physically reconfigure and coordinate signal timings on frontage road approaches to the interchange between May 2007 and the end of the year, in a manner that minimized delay to the motoring public, despite the removal and replacement of the direct connectors.
- Final testing and deployment of a pilot project to deploy a GPS based emergency vehicle preemption (EVP) system along Louetta Road in north Harris County. This project, the first considered by Harris County for EVP along signalized arterials, utilized a relatively new technological approach to establish communications between emergency response vehicles and Houston TranStar that solves a number of issues relating to EVP deployment, including (1) providing remote management capabilities of the system

from Houston TranStar, (2) enhanced situation awareness for participating emergency responders, (3) enhanced advance notification of the need for emergency vehicle preemption/priority treatment, (4) minimal disruption to existing coordinated signal timings, (5) implementation of national data sharing standards between response vehicles, traffic management systems, and emergency dispatch systems, and (6) a migration plan to allow for long term data communications and routing capabilities of emergency vehicles.

Traveler Information

Local Internet and media outlets use the TranStar CCTV feeds, Internet-based incident reporting capabilities, and travel time reporting systems in their daily traffic reporting functions. In addition, traffic service organizations are housed on the operations floor of Houston TranStar. Operational highlights for the TranStar website in 2007 included:

- Average unique monthly users increased from 271,000 in 2006 to 340,600 in 2007, a 25.7 percent increase (see Figure 2).
- Access to the route builder system increased from 1.696 million total accesses in 2006 to 3.461 million total accesses in 2007, an increase of 104%.
- Views of CCTV images increased from 13.2 million views in 2006 to 99.2 million views in 2007, an increase of 651%.
- Traffic alert subscribers increased from an average monthly subscriber base of 4,520 in 2006 to 6,255 in 2007, an increase of 38%. Total monthly users at the end of 2007 were over 7,000.
- Mobile traffic data accesses increased 3.29 million in 2006 to 8.15 million in 2007, a 147% increase (See Figure 3).
- The City of Houston TrainWatch webpage averaged more than 68,000 views per month in 2007, equal to the amount seen in 2006.
- The number of personalized travel speed text messages decreased from 16.9 million in 2006 to 14.6 million, a decrease of 16 percent.
- The overall number of views to freeway speed charts decreased from 771,000 in 2006 to 620,500 in 2007, a 24% decrease.
- DMS information viewed decreased by 15% from 2006 to 2007, from 888,800 views to 773,200 views.

Figure 2. Total Monthly Unique Users -- January 2006 to December 2007

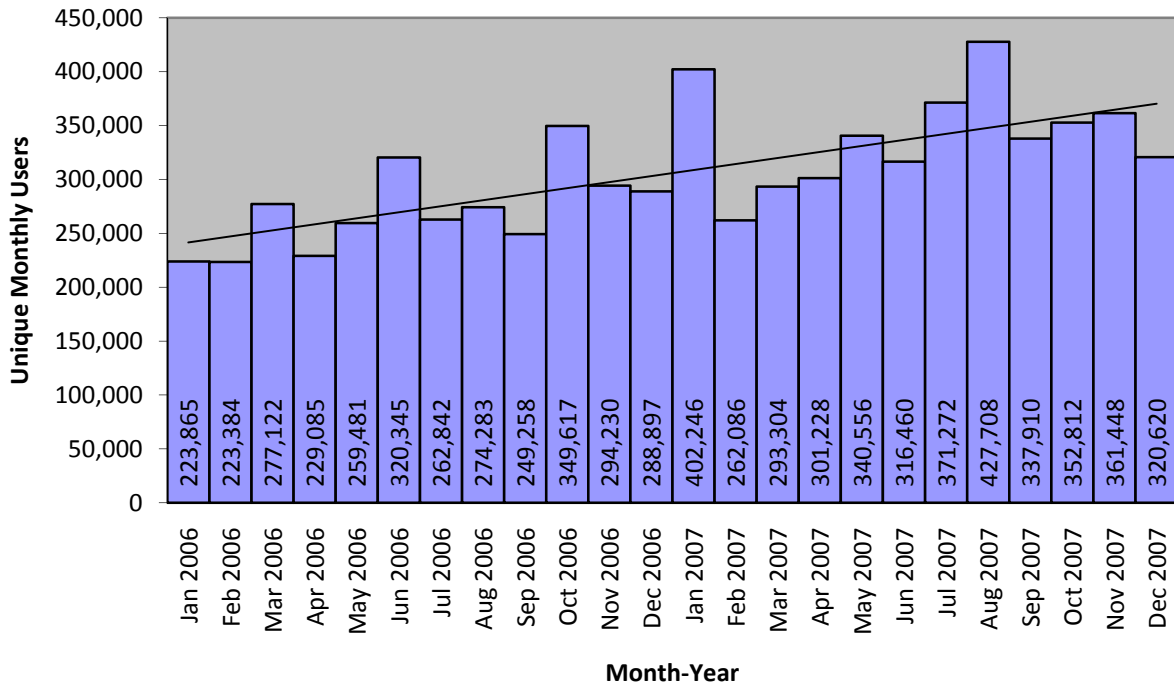
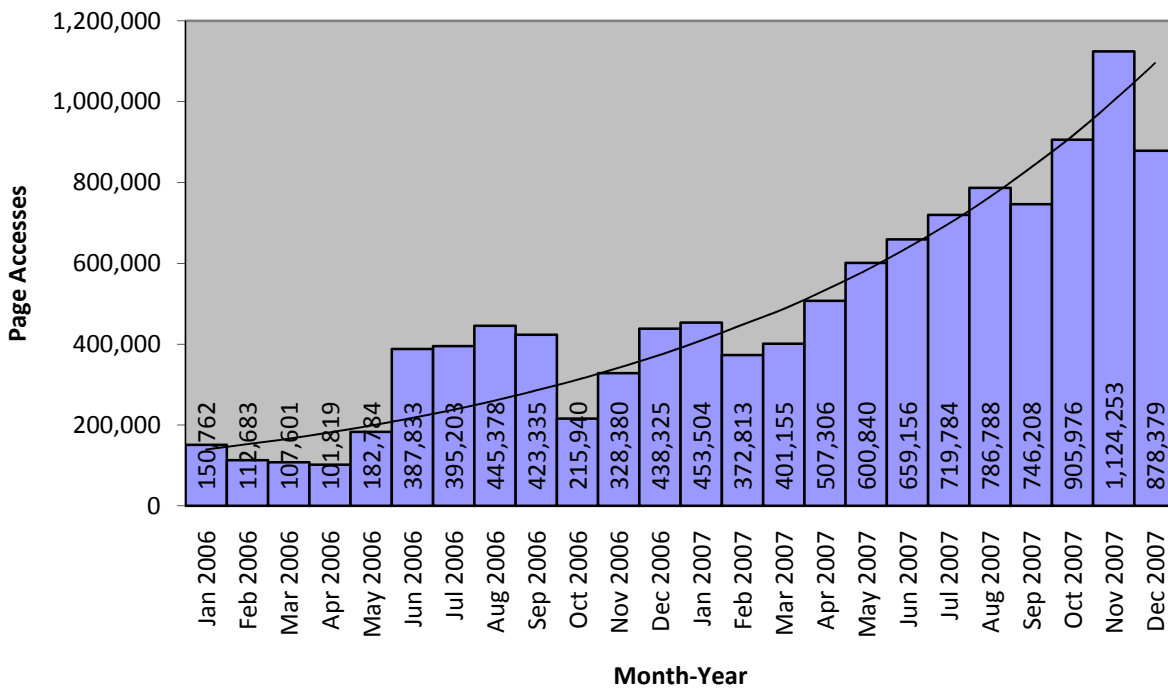
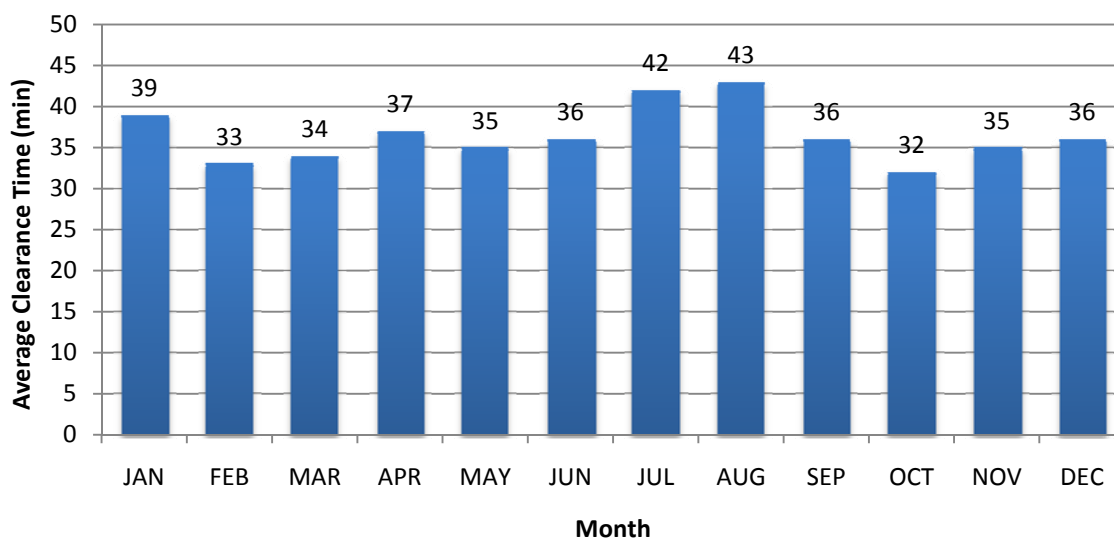


Figure 3. Mobile Traffic Data -- January 2006 to December 2007



Incident Management

Freeway incidents are a major cause of congestion in the Houston area, and the detection, response, and clearing of incidents is a vitally important function of Houston TranStar. The Houston TranStar agencies play a major role in incident response management and information dissemination. Incidents are entered into the Regional Incident Management System (RIMS) operations database by agency personnel. In total for 2007 there were 15,467 incidents recorded by Houston TranStar operators. The average incident clearance time in 2007 was 37 minutes, down almost 11% from the 41 minute average in 2006. Figure 4 shows the average clearance times by month for 2007.

Figure 4. Average Incident Clearance Time By Month, 2007

RIMS incident location and status are automatically provided on the traffic website. Operators develop and activate DMS messages providing information on the incident (e.g., traffic direction, location, type incident, lanes blocked). Figure 5 presents the managed incidents by facility. Temporal patterns of incidents by day of week, and month are illustrated in Figures 6 & 7 and give some indication of when the center is most active.

Figure 5. TranStar Managed Incidents by Facility (RIMS Reported)

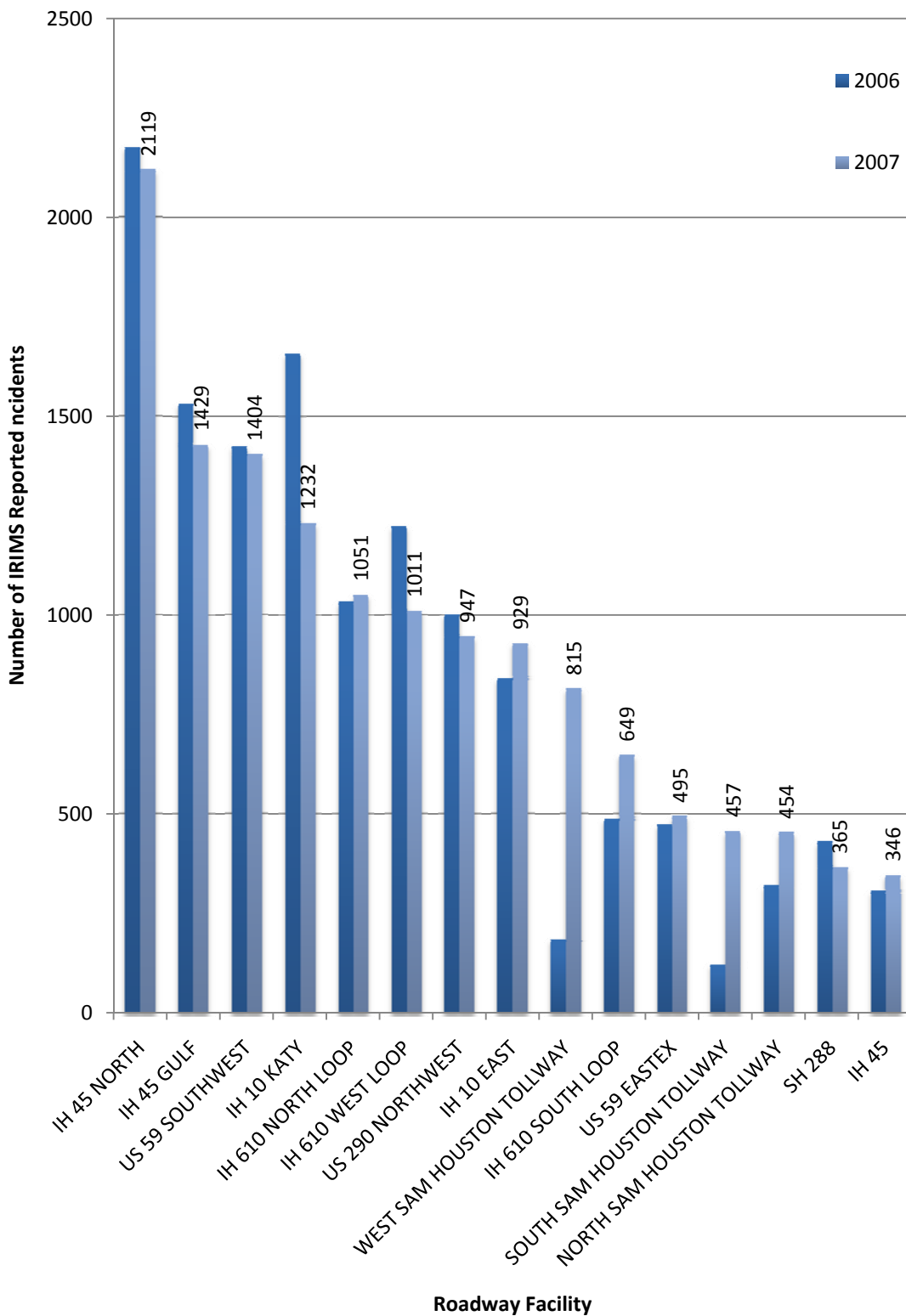


Figure 6. Incidents By Day of Week, 2007

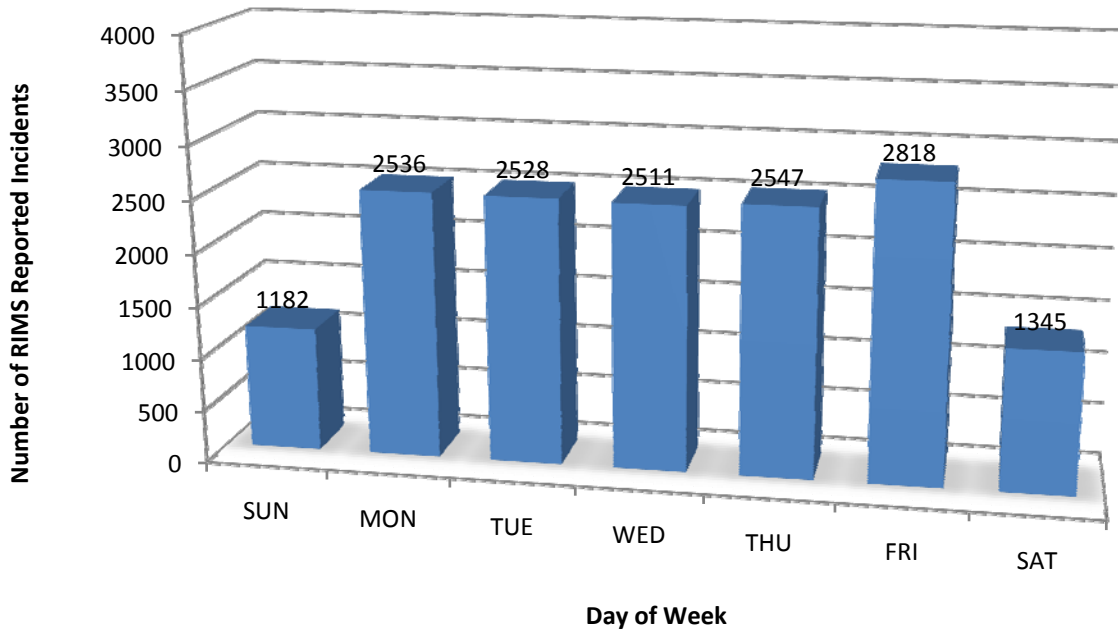
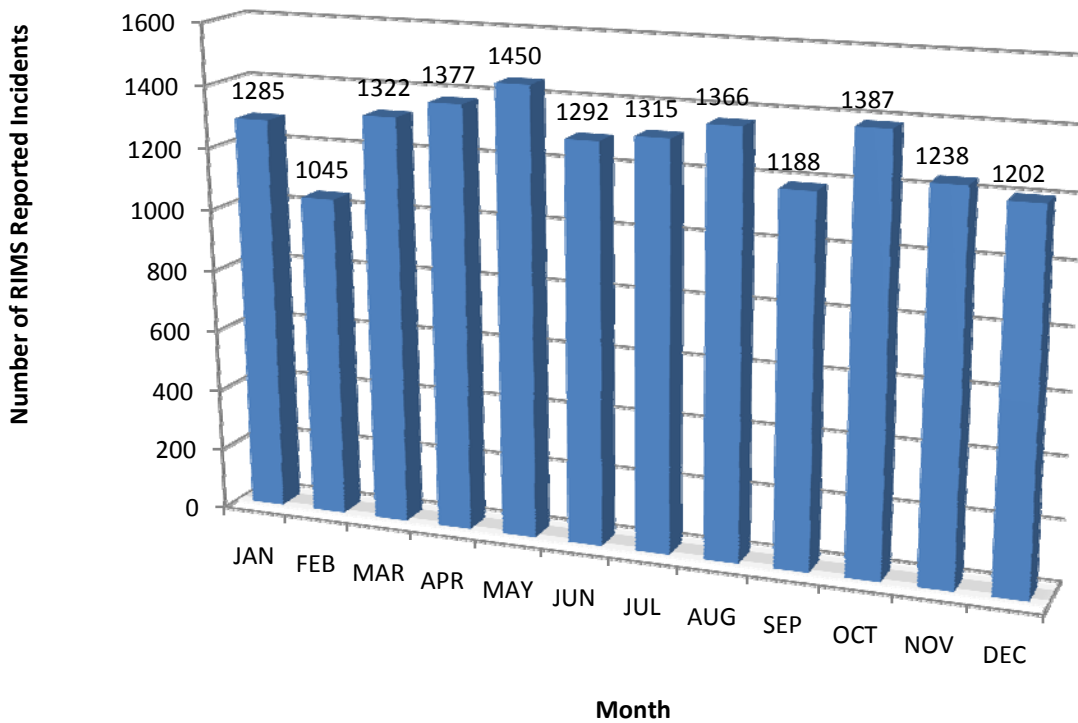


Figure 7. Incidents By Month of Year, 2007



Motorist Assistance Program (MAP)

The Motorist Assistance Program (MAP) is one of the most visible services operated by the Houston TranStar agency partnership. MAP started in 1986 with two vans operating eight hours per day. The program has expanded significantly since, operating 16 hours per day on all major freeways.



The program was expanded in 2005 to include the participation of METRO Police in addition to Harris County Deputies. There were 31,957 RIMS-reported assists handled by MAP in 2007, an increase of about 1.3% over 2006. TxDOT operators provide dispatch service to the MAP program. Figure 8 presents MAP assists by month for 2006 & 2007. Figure 9 shows MAP assists by facility for 2006 & 2007.

Figure 8. MAP Assists by Month

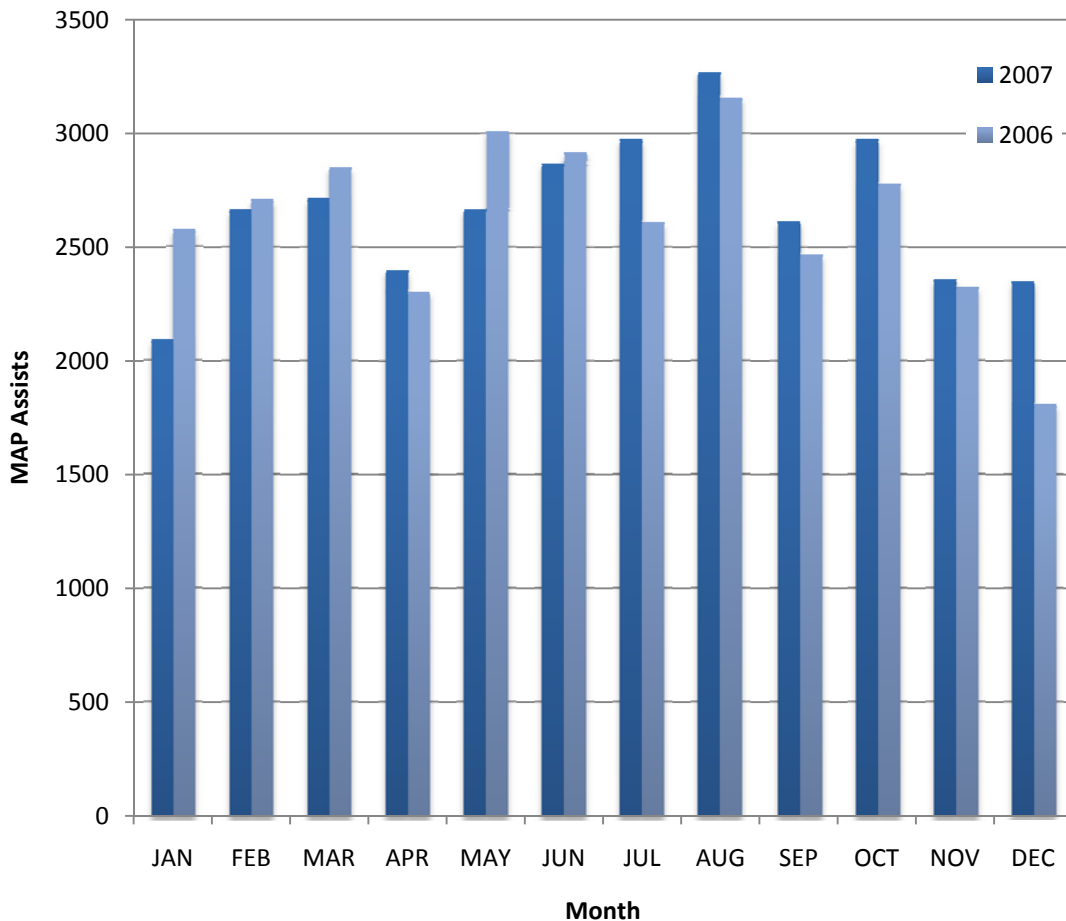
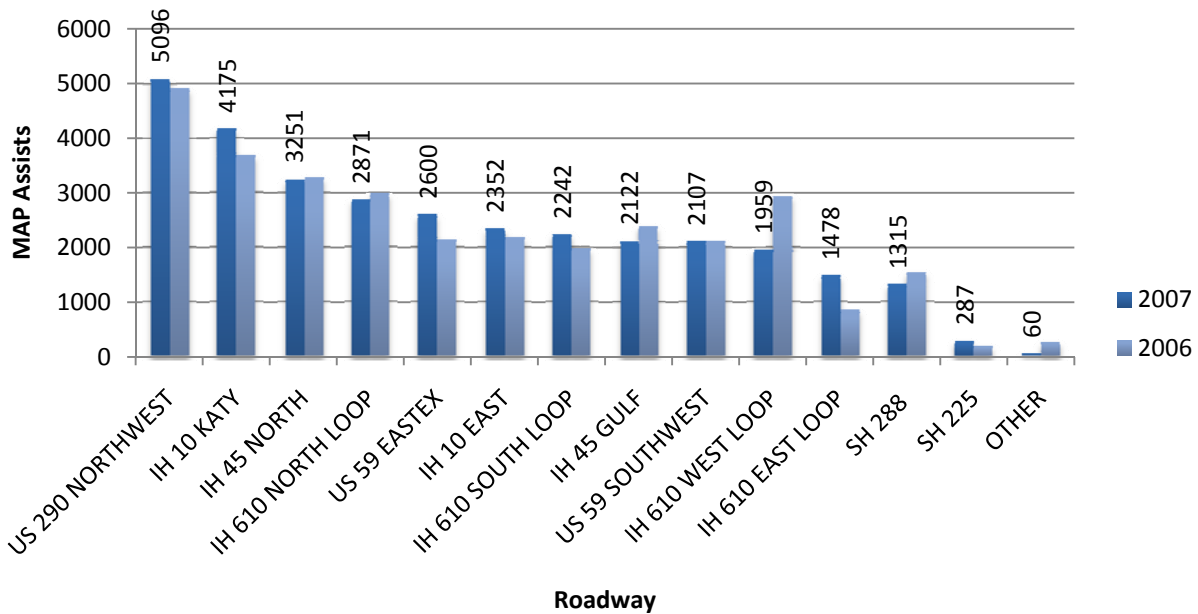


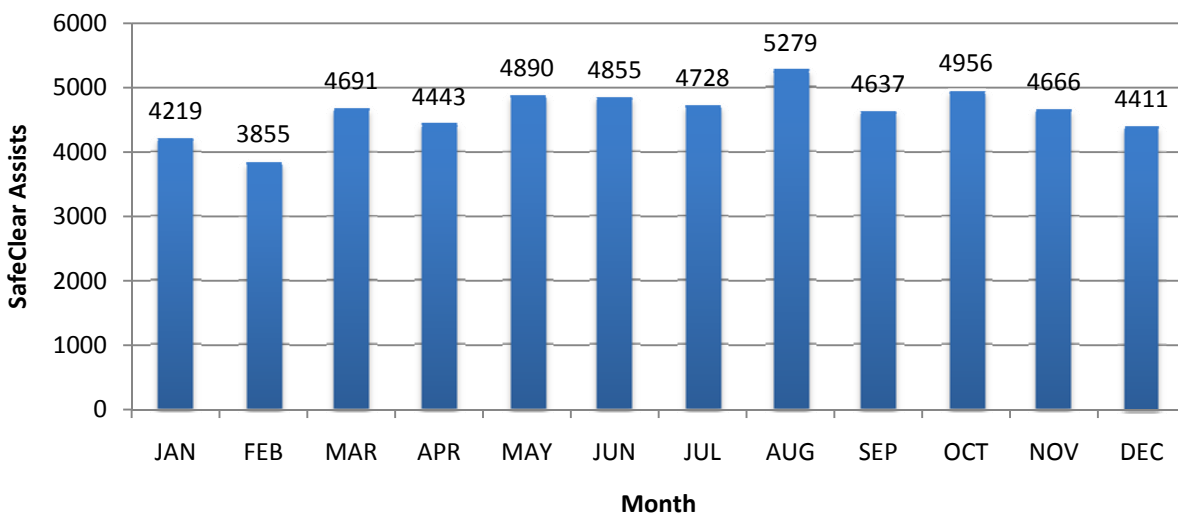
Figure 9. MAP Assists by Facility



SafeClear

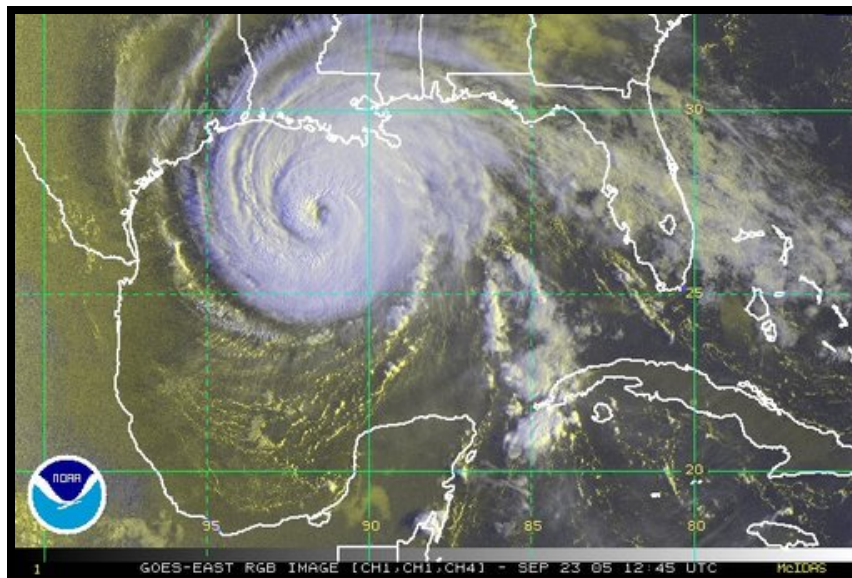
SafeClear, the City of Houston’s rapid clearance program was instituted in 2005. SafeClear is intended to bring quick response to disabled vehicles in order to reduce the occurrence of secondary crashes in the freeway queue. There were 55,630 RIMS reported SafeClear assists in 2007; a decline from 60,043 RIMS-reported SafeClear assists handled 2006. In 2007, the average time from tow authorization to clearance was 20 minutes, but ranged from an average of 13 minutes in July to 28 minutes in May. Figure 10 shows 2007 SafeClear assists by month.

Figure 10. SafeClear Assists by Month, 2007



Emergency Response

This region is vulnerable to natural, manmade, and technological emergencies and/or disasters. The Emergency Operations Center (EOC) has activated for many types of incidents including hazardous material incidents, truck crashes, pipeline ruptures, train derailments, chemical explosions, flooding, tornadoes, thunderstorms, tropical cyclones (including named tropical storms and hurricanes), fires, and



industrial accidents. Houston TranStar's partners assist the EOC during the activations by providing unique technical and managerial expertise, as well as additional manpower and facility support. The joint effort by the Houston TranStar agencies enables faster response times in dispatching the appropriate equipment and manpower, which results in more effective and efficient responses that reduce the loss of life and property of our citizens.

The Harris County Office of Homeland Security & Emergency Management (HCOHS&EM) operates from Houston TranStar. The City of Houston OEM is located in the City's Houston Emergency Center (HEC) with close coordination maintained with Houston TranStar. The HCOHS&EM expanded its stream flood monitoring system to over 170 stream level device stations, 220 rain gauge locations, and 20 wind sensor location sites along the 22 watersheds within and outside of the County, including dedicated sites for the METRO rail system and Park and Ride facilities. TxDOT operates and maintains a roadway flood, wind, and ice monitoring and reporting system that functions on the same standards and platform as HCOHS&EM in a six county region.



Due to the fact that heavy rainfall can cause traffic problems/accidents, interactive rainfall alarms were set up to be sent to the pagers of key response and emergency management personnel to help in the monitoring of the situation. To further support Houston TranStar's mission, the HCOHS&EM has created a redundant website to ensure the ability to provide information to the public through its School Closing Notification System, Ozone Warning System, Media Alert Notification System, Rain Fall Maps, and Stream Level Templates. Harris County continues to expand its regional radio system, which is currently being used by numerous agencies in the area. This radio system gives the Emergency Operations Center the

ability to communicate with the largest number of responders and governmental agencies of any radio system in the region.

With Houston TranStar's unique ability to coordinate traffic management, emergency management, and homeland security, the Emergency Operations Center continues to act as a base for regional and multi-jurisdictional training and exercises. In recognition of this ability, the State of Texas has designated the EOC and Houston TranStar as its Regional Operations Center for evacuations. Houston TranStar's mission during evacuation events is to coordinate and enhance the operations of the regions offices of emergency management (all city and county OEM's in the region). To accomplish this, the partner agencies have the combined ability to monitor and coordinate regional transportation routes based on current and forecasted weather conditions. The EOC can communicate with those agencies and jurisdictions having homeland security roles.

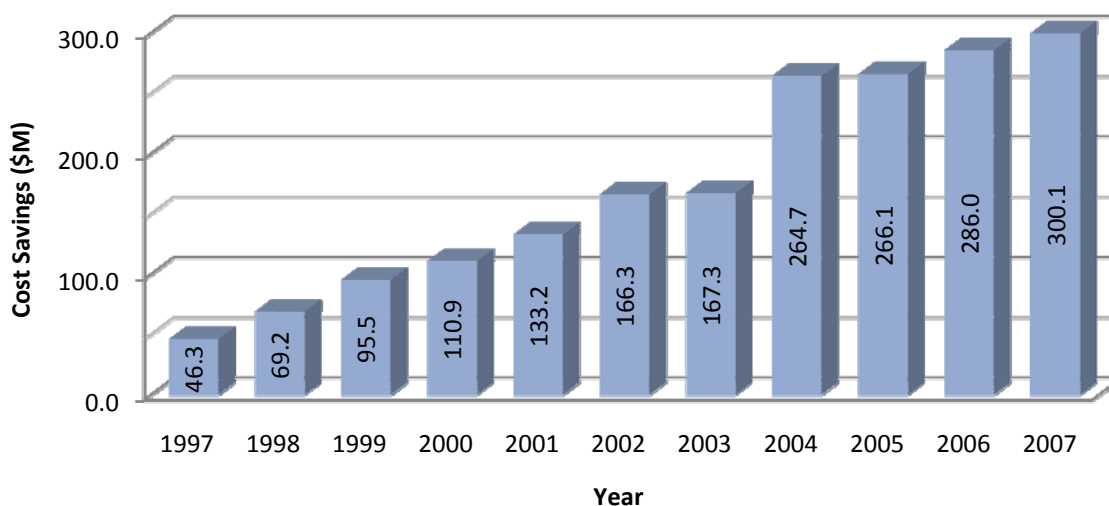
ESTIMATED TRANSTAR OPERATIONAL BENEFITS

Determining the benefits of Houston TranStar is treated conservatively since many of the benefits are not easily quantifiable and some are intangible. However, this report develops estimates of those benefits which are quantifiable; such as the cost of motorist delay savings (in time and dollars), fuel savings (in gallons and dollars), and emissions reductions (in tons of emissions). For the past 11 years, this report has used an approach which estimates the operational benefits in terms of freeway motorist delay savings.

Traffic delays on the freeway mainline system were estimated using the TxDOT AVI travel time monitoring system and traffic volumes from the TxDOT annual volume-roadway inventory files. The procedure for evaluation uses national benchmarks and experience to establish Houston TranStar quantitative goals for expected benefits. The expertise of Houston TranStar staff is relied upon to estimate performance of the transportation systems in terms of percent attainment of the goals.

The estimated costs of congestion in the Houston TranStar region were calculated to be over \$795 million in 2007. Annual benefits in the reduction of travel time were estimated to be 12.3 million vehicle-hours with an estimated monetary benefit of \$238 million. The savings in travel time are equivalent to reducing fuel consumption by over 23 million gallons for an additional savings of \$62 million. Thus, the total 2007 motorists' savings was just over \$300 million (see Figure 8). Since 1997 (when benefits were first estimated), Houston TranStar has saved Houston area motorists over \$1.9 billion in reduced traveler delay cost.

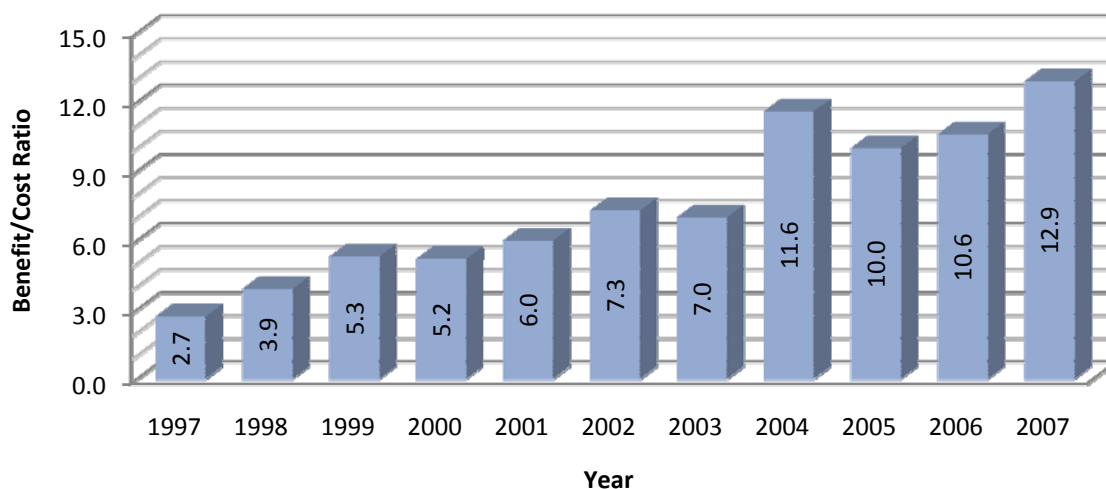
Figure 8. Annual Traveler Cost Savings



The reduction in the amount of fuel consumed also results in a reduction of exhaust emissions. Based on U.S. Department of Transportation (USDOT) Bureau of Transportation Statistics, the reduction of 23 million gallons of fuel is equivalent to a reduction of 497 tons of hydrocarbons; 3,214 tons of carbon monoxide; and 723 tons of nitrogen oxides.

A benefit/cost analysis for 2007 was performed, comparing the benefits discussed previously to the annual costs of Houston TranStar. Annual costs include annualized capital costs, annual operational costs of the Houston TranStar systems, and the annual cost of operation and maintenance of the field installations. The annualized cost estimate is \$23.2 million, which divided into the annual benefit of \$300 million, yields a benefit/cost ratio of 12.9. Historical benefit and benefit/cost information is illustrated in Figure 9.

Figure 9. Historic TranStar Benefit/Cost Ratios



There was an increase in the overall benefit/cost ratio in 2007 (12.9) as compared to 2006 (10.6). Several factors enter into this calculation when comparing 2007 to 2006:

- Motorist value of time increased from \$18.81 to \$19.34 vehicle-hour (a 2.8% increase)
- Estimated congestion increased from 37.9 to 41.1 million vehicle-hours in the TranStar managed region (an 8.4% increase – more congestion, but more potential savings due to operations and incident management).
- Estimated congestion benefits (time saved) increased from 12.16 to 12.30 million vehicle-hours (a 1.15% increase).
- Fuel savings increased from 22.8 to 23.0 million gallons (0.8% increase in savings)
- Agency managers rated center effectiveness as equal-to or below 2006 in most categories (or B/C ratio would have likely been higher):
 - Agency managers rated staff effectiveness lower as agencies were not able to replace personnel that left.
 - Agency managers also expressed concern about the loss of ITS devices during construction activity on a crucial portion of the Katy Freeway (IH 610 to SH 6).
- While congestion increased more than 8%, delay savings and fuel consumption savings due to center operation is estimated to have only increased about 1%. However, as the cost of delay and fuel increased from 2006 to 2007, the value of delay and fuel savings increased about 5%, thus increasing the benefit/cost ratio accordingly.