Houston TranStar
2006 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.

INTRODUCTION

As the fourth largest city in America, operating the transportation system is part of the solution for keeping traffic moving safely and efficiently in the region. Houston TranStar plays a pivotal role in the travel of people and goods in the greater Houston region, saving motorists more than $1.6 billion in reduced travel time costs over the ten years of Center operation from 1997 to 2006.

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.

This document is the tenth 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 estimated base cost of congestion in the Houston TranStar service area was calculated to be over $714 million in 2006. The reduction of travel time attributable to TranStar operation was about 12 million vehicle-hours, which has a corresponding value of $229 million in road user cost savings and a reduced fuel consumption of almost 23 million gallons (which saved Houston-area roadway users approximately $57 million in fuel costs). The total estimated benefits of Center operation in 2006 was $286 million. The reduction in fuel consumption also results in an approximate net reduction of exhaust emissions to be equivalent to a reduction of 491 tons of hydrocarbons; 3,179 tons of carbon monoxide; and 715 tons of nitrogen oxides. Comparing the annualized TranStar operating cost estimate of $26.9 million to the annual benefit of $286 million yields a benefit/cost ratio of 10.6.

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.

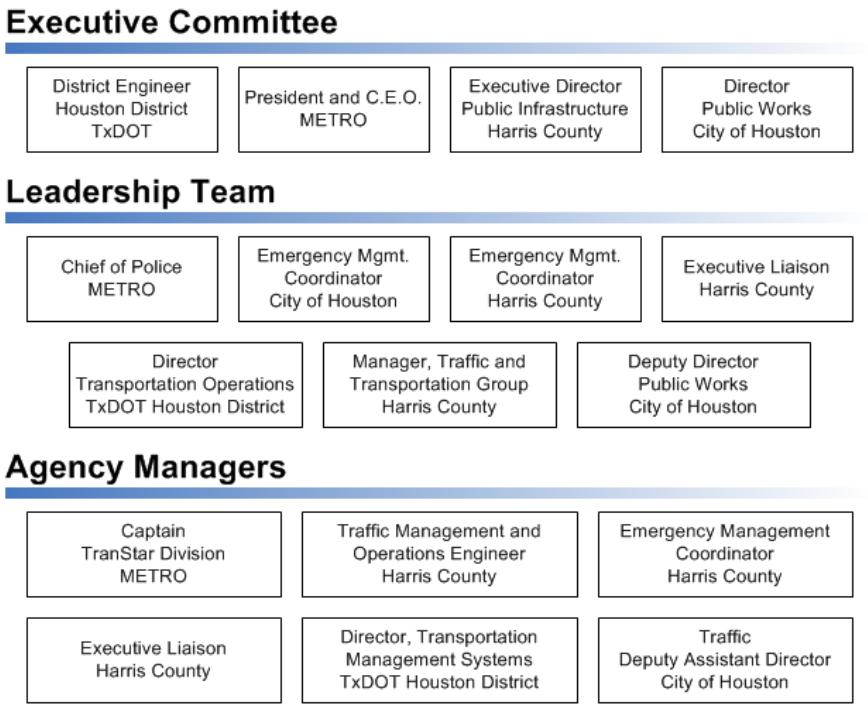


Figure 1. Houston TranStar Organization Chart

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

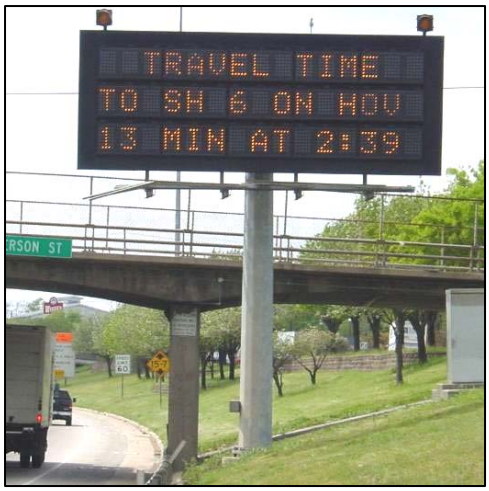
In 2006, the TranStar Partner Agencies continued deployment of field devices and development of internal management information systems at the Center.

Accomplishments for the Year 2006 are highlighted in the following sections of this report. Some of the highlights and significant accomplishments of TranStar during 2006 included:

- TxDOT completed significant deployment of capital equipment and integration of ITS for use in Hurricane Evacuation events. This deployment included pan-tilt-zoom (PTZ) CCTV, monitoring of video detection cameras (via VIVDS video servers and cellular data communications), and radar sensor detection units for speed, volume, and classification. Most sites communicate using cellular data communications. This deployment included:
  - IH 10 West: 14 PTZ cameras, 13 radar sensors
  - IH 10 East: 8 PTZ cameras, 7 radar sensors
  - IH 45 North: 11 PTZ cameras, 7 radar sensors
  - US 290: 8 PTZ cameras, 1 VIVDS video server, 4 radar sensors
  - US 59 North: 3 PTZ cameras, 5 VIVDS video servers
  - US 59 South: 2 PTZ cameras
  - SH 6: 2 VIVDS video servers
  - SH 36: 1 PTZ camera, 4 VIVDS video servers
  - US 69: 2 PTZ cameras, 3 VIVDS video servers
  - SH 146: 1 PTZ camera, 3 VIVDS video servers
  - SH 87: 1 PTZ camera, 1 VIVDS video server
  - US 96: 1 PTZ camera, 1 VIVDS video server
  - FM 105: 1 PTZ camera
  - SH 105: 1 PTZ camera
- TxDOT and the Texas Transportation Institute (TTI) conducted a survey on the topic of hurricane evacuation, specifically in relation to public actions during Hurricane Rita. More than 6,500 responses were tallied, more than any other survey conducted in the history of the TranStar website.
- Expansion of the Regional Incident Management System (RIMS) Maintenance Deficiency logging to all TxDOT Houston District Maintenance Sections. This

enhancement combines all maintenance deficiency reports into a single searchable database, allowing sharing of maintenance information across the TxDOT Houston District.

- Began upgrading Motorist Assistance Program vehicles to meet hurricane preparedness standards as specified by the Texas State Department of Emergency Management (DEM).
- TxDOT continued enhancements to RIMS, including:
  - Creation of a SafeClear form for logging SafeClear actions,
  - Inclusion of a generic search capability,
  - Hurricane evacuation response actions logging and tracking,
  - MIMS upgrades, and
  - Integration of the Personnel On Call Electronic Transfer (POCET) allowing individual maintenance sections to update and contact after-hours personnel.



- Enhanced the CCTV snapshot frame grabber to allow snapshots from all CCTV cameras in the system (TxDOT and Harris County cameras) on the internet. This includes internet and mobile internet platforms. This enhancement included the Web Snapshot Display Manager. This allows TranStar operators to easily control which cameras are displayed on the web site.
- Added new segments to the AVI system on US 59 (Southwest Freeway) – Williams Trace to Wilcrest (6.2 directional miles)
- Added a camera access page to the TranStar website.
- Added an enhanced hurricane information page to the TranStar website.
- The Houston TranStar Web Site received the Best of Texas 2006 Award for "Best Application Serving the Public". The award was sponsored by the Center for Digital Government.
- The TranStar website experienced 2.23 million hits during October 16 flood event. This was the second highest day in its history, with hourly page accesses from 3-4 and 4-5 PM higher than any single hour in its history.
- The Center hosted 89 tours for 1,540 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 770 directional miles, including 705 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 2006 is listed below:

- Closed Circuit Television:
  - 353 Freeway CCTV cameras,
  - 71 Regional hurricane evacuation cameras (on rural and/or remote routes)
  - 12 Construction cameras
- Dynamic Message Signs: 177 total DMS
  - 131 for freeway operations
  - 41 for HOV and P&R operations
  - 5 Portable units
- Highway Advisory Radio
  - Twelve fixed transmitting locations
  - One portable transmitting station
  - 32 Advisory signs
- Radar Detection
  - 39 Locations on evacuation routes (primarily on rural and/or remote routes)
- 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 - 770 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 177 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 84,784 operator activated messages and over 1.5 million automated messages displayed on DMSs in 2006.

The types of DMS messages included:

- Operator Activated:
  - 56,115 operator activated messages for incidents;
  - 6,189 operator activated messages for road closures or construction;
  - 11,654 operator activated messages for weather-related events, including:
    - 540 weather events,
    - 437 ozone alerts, and
    - 10,677 "Burn Ban" messages;
  - 6,770 operator activated messages for safety campaigns, public meeting announcements, TxDOT Job Fairs, or MAP/PEAT assistance information;
  - 3,135 operator activated messages for special events;
  - 304 Amber Alert messages

- Automated travel time/ferry wait time messages:
  - 1,480,885 automated travel time messages
  - 23,206 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 6,440 messages in 2006, a significant increase over the 817 messages broadcast in 2005. There were 6,039 HAR broadcasts for incidents, 379 messages for road closures, and 22 messages broadcast for special events using HAR.

City of Houston

The City of Houston Signal Engineering and 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.

Houston has over 2,000 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. 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 Signal Engineering and 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 Signal Engineering and 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 starting in 2006. During 2006, signal timing optimization continued with the following zones:

- Spur 527 Area – 70 Traffic Signals
- Texas Medical Center Area – 98 Traffic Signals

Work began in several other areas of the City in 2006 and will conclude in 2007. Those other areas included:

- South West Area – 180 Traffic Signals

- Lockwood Area – 40 Traffic Signals
- Memorial Area – 95 Traffic Signals
- Airline Area – 54 Traffic Signals
- Navigation Area – 70 Traffic Signals

All these zones were optimized, integrating adjacent intersections in order to establish a network operation model that works well with the major corridors in each zone. Each year the city will rotate various zones to cover all areas on a continual basis. 2007-2008 will include mostly northwest and south Houston zones. 2008-2009 will include north and outer southeast Houston zones. 2009-2010 will include west and east Houston zones. 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.

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.

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 METRORail dispatch, traffic signalization systems, HOV management systems and incident management programs. METRO highlights for 2006 include:

- Expanded Police staff to include 24-hour, 7-days per week coverage on the TranStar Operations Floor. This expansion was completed to keep pace with the new METRO Net Communications System which was scheduled to come?? on line in February 2007.
- METRO Police Officers assigned to the new 24/7 operation (which are called Watch Command Officers or WCO) will monitor over 325 new CCTV cameras placed at 26 Park & Ride lots.
- WCOs monitor direct ring down Emergency Assistance Stations located on at 26 Park & Ride lots for citizens to instantly put them in contact with a police officer.
- Each Park & Ride lot is completely covered by a Public Announcement System that is utilized by the WCO to contact and assist anyone on the lot.

- METRO deployed smart camera technology, digital recording, CCTV cameras, and the METRO Net System in 2006.
- METRO continued work on IVOMS (Integrated Vehicle Operational Management System) development and integration in 2006. IVOMS is an automatic Vehicle Location system that allows increased operator and passenger service by providing bus location and real time vehicle information directly to Bus Dispatch at TranStar. IVOMS can be used for automatic passenger counting and can be configured for traffic signal priority.

Harris County

The Harris County Public Infrastructure Department's (HCPID) Traffic Management and Operations Section manage the operation of the County's 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. During 2006, Harris County completed design and initiated construction of CMAQ 2 ATMS Project, which extended the existing ATMS system by adding 110 miles of fiber optic cable, 42 additional arterial cameras, and monitoring for 150 additional traffic signals at an estimated cost of $30 million. Harris County also completed integration of Houston TranStar Video to HCTRA Incident Management Center.

Harris County also completed signal retiming for all major signalized arterials within Harris County, including coordination with both TxDOT and the City of Houston to coordinate signal timings across jurisdictional boundaries. Specifically, Alief Clodine, Westpark Drive, and Harwin Drive, were retimed in support of the Westpark Tollroad.

Traveler Information

Local Internet and media outlets use the TranStar CCTV feeds and Internet-based incident reporting capabilities and travel time reporting systems in their daily traffic reporting functions. Local radio and television stations have access to Houston TranStar's travel time data, incident data, and the freeway cameras and use this information frequently during peak period broadcasts. In addition, traffic service organizations are housed on the operations floor of Houston TranStar. Operational highlights for the TranStar website in 2006 included:

- Total website accesses increased from 102.6 million in 2005 to 125.4 million in 2006, a 22 percent increase (see Figure 2).
- Average unique monthly users increased from 237,000 in 2005 to 271,000 in 2006, a 14 percent increase (see Figure 3).
- The number of personalized travel speed text messages increased from 13.7 million in 2005 to 16.9 million in 2006, an increase of 23 percent.
- The overall number of views to freeway speed charts decreased from 800,000 in 2005 to 771,000 in 2006, a 3.7% decrease. However, if September of 2005 is excluded (views were much higher during the Hurricane Rita evacuation) and September 2006 is excluded, the use of freeway speed charts increased from 571,000 in 2005 to 709,000 in 2006, an increase of 24%.

Figure 2. Website Access Trends

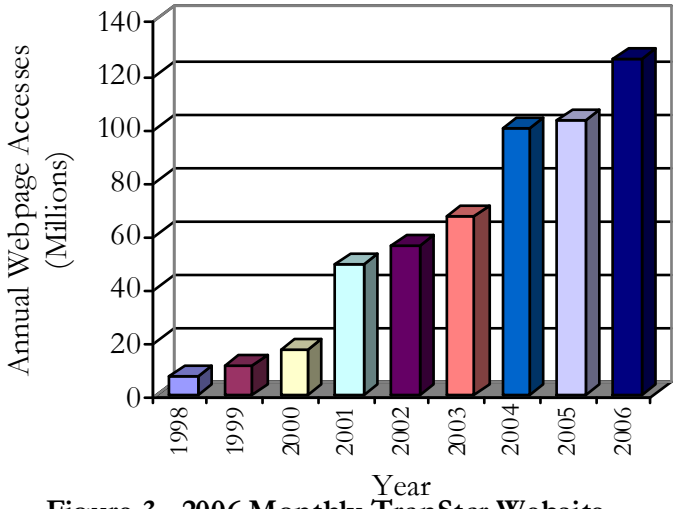
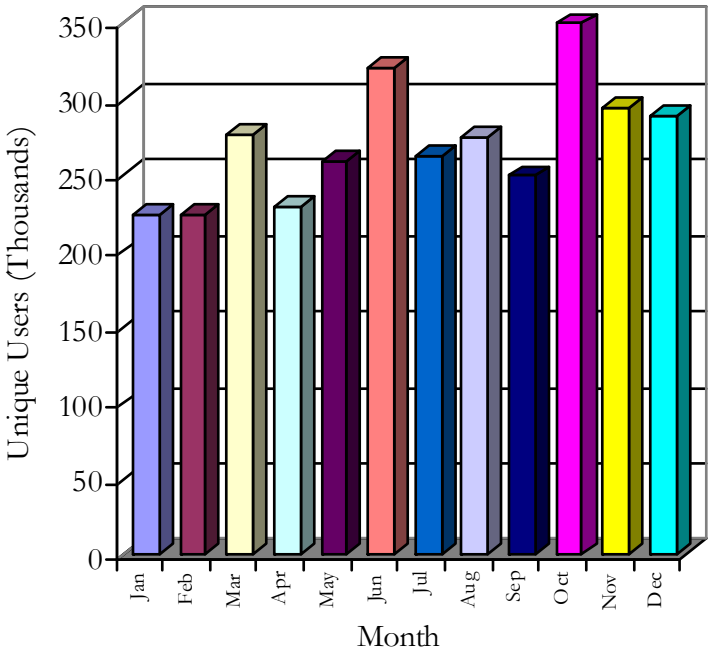


Figure 3. 2006 Monthly TranStar Website Unique Users



- Access to the route builder system increased from 1.491 million total accesses in 2005 to 1.696 million total accesses in 2006, an increase of 14%.
- Views of CCTV images increased 55% from 2005 to 2006, from 8.51 million views in 2005 to 13.19 million views in 2006.
- Traffic alert subscribers increased from an average monthly subscriber base of 3,900 in 2005 to 4,520 in 2006, an increase of 16%.
- Mobile traffic data accesses increased 265%, from 1.24 million in 2005 to 3.29 million in 2006.

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 2006 there were 14,397 incidents recorded by Houston TranStar operators, of which nearly 96% were recorded by TxDOT operators. METRO operators input the remaining 4% of incdents into 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).

There were more than 9,800 managed incident-hours in 2006. The median time that TranStar operators managed a typical incident was about 24 minutes from detection to clearance. The average incident time was just over 41 minutes. There were 2,034 of 14,397 incidents (about 14%) lasting more than one hour in duration. There were 142 incidents with durations in excess of six hours.

Figure 4 presents the managed incidents by facility. Temporal patterns of incidents by hour of day, by day of week, and month are illustrated in Figures 5, 6 & 7 and give some indication of when the center is most active.

Figure 4. TranStar Managed Incidents by Roadway Facility

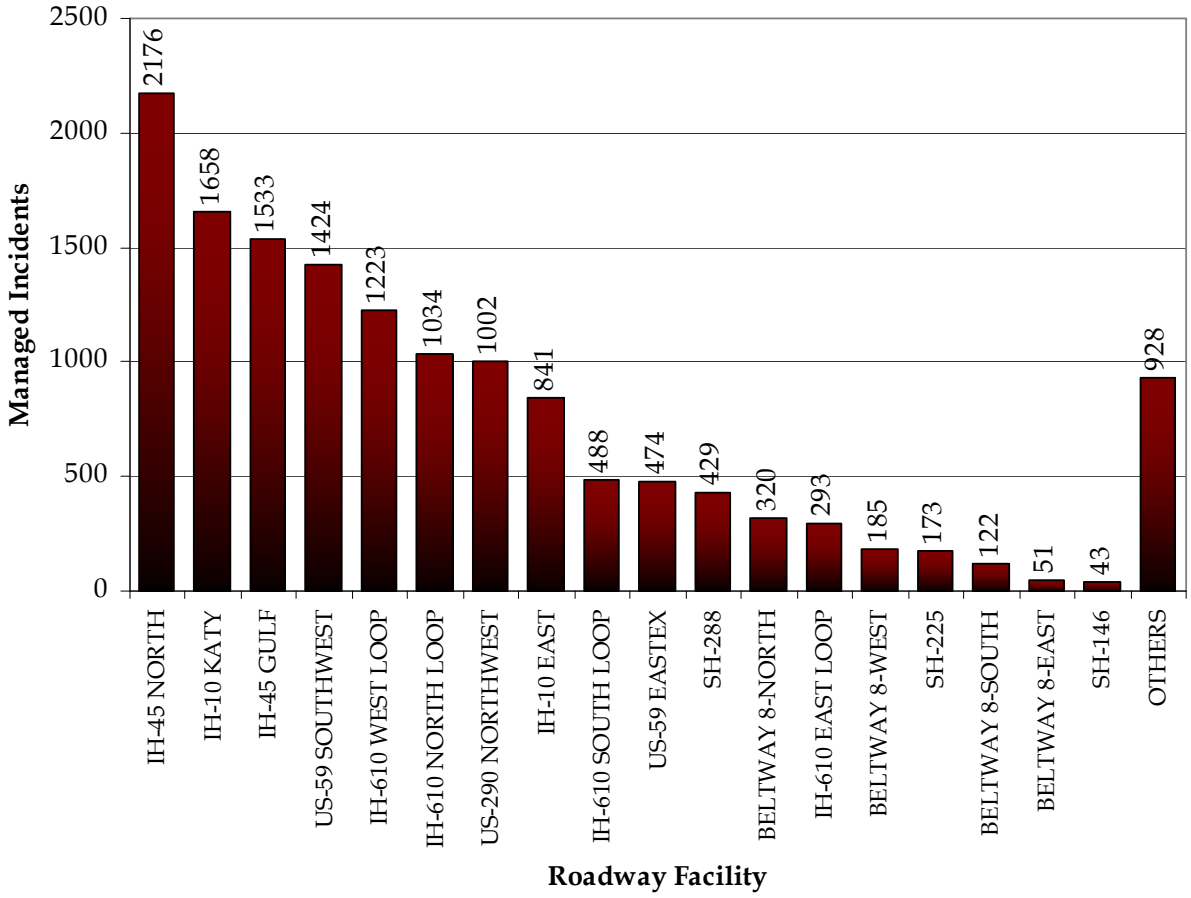


Figure 5. Incident Frequency by Hour of Day - 2006

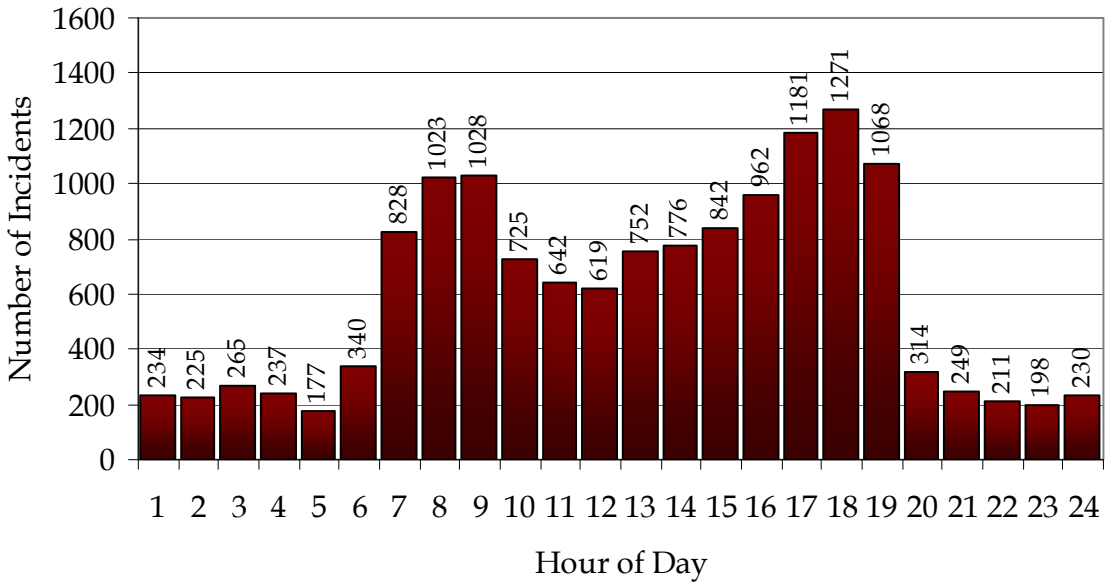


Figure 6. Managed Incidents By Day of Week (2004-2006)

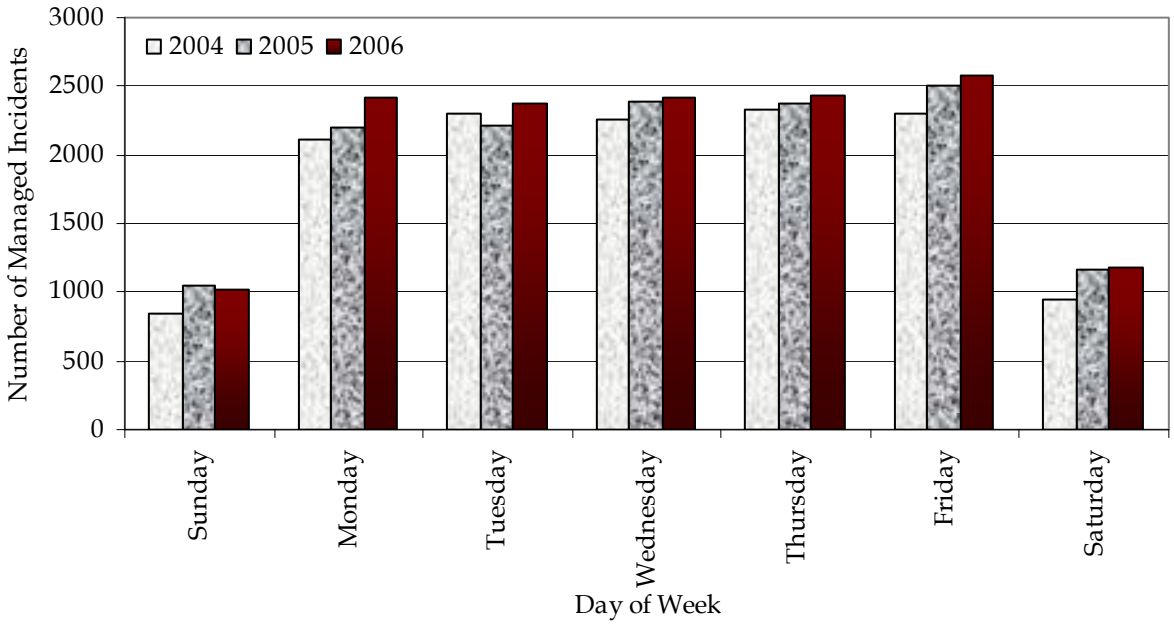
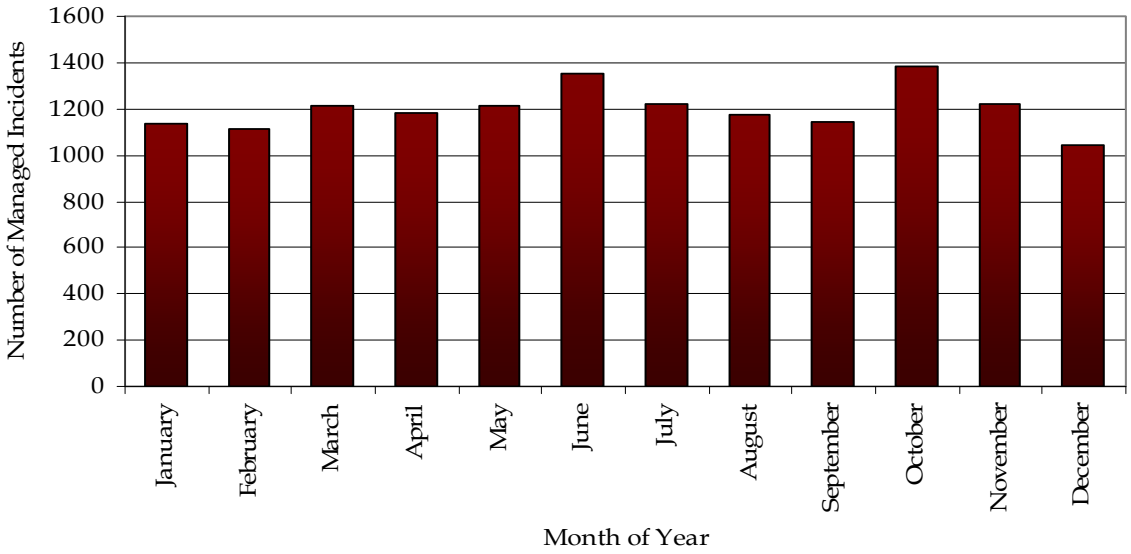


Figure 7. Number of Managed Incidents by Month



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.

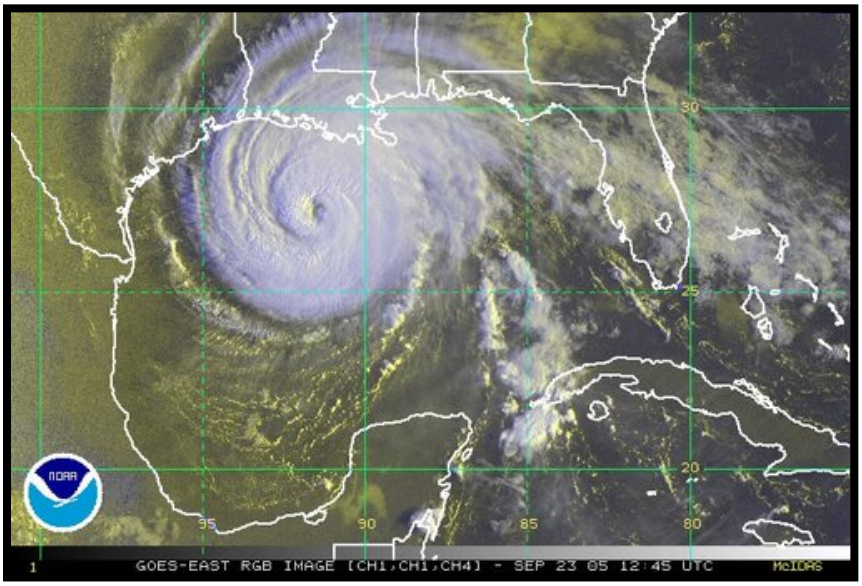
There were 31,584 RIMS-reported assists handled by MAP in 2006, an increase of about 6% over 2005 (29,805 MAP RIMS-reported assists). TxDOT operators provide dispatch service to the MAP program.

SafeClear

SafeClear, the City of Houston's fast-tow 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 60,043 RIMS-reported SafeClear assists handled 2006, an increase of about 9.6% over 2005 (54,760 RIMS-reported SafeClear assists).

Emergency Response

This region is vulnerable to natural, manmade, and technological emergencies and/or disasters. The Emergency Operations Center 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.

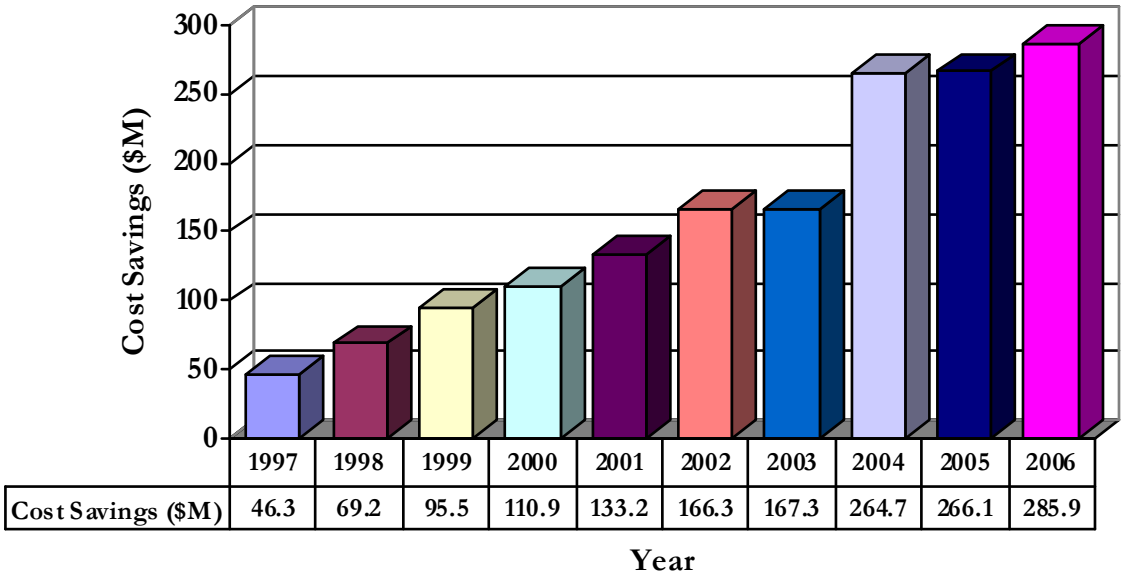
Due to the fact that heavy rainfall can cause traffic problems/accidents, interactive rainfall alarms were set up to be sent to the pagers of key response and emergency management personnel to help in the monitoring of the situation. To further support Houston TranStar's mission, the HCOHS&EM has created 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 limited and 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 ten years, this report has used an approach which estimates the operational benefits in terms of freeway motorist delay savings.

Figure 8. Annual Traveler Cost Savings



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cost Savings ($M)	46.3	69.2	95.5	110.9	133.2	166.3	167.3	264.7	266.1	285.9

Traffic delays on the freeway mainlane 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 $714 million in 2006. Annual benefits in the reduction of travel time were estimated to be 12 million vehicle-hours with an estimated monetary benefit of $229 million. The savings in travel time are equivalent to reducing fuel consumption by nearly 23 million gallons for an additional savings of $57 million. Thus, the total 2006 motorists' savings was approximately $286 million (see Figure 8). Since 1997 (when

benefits were first estimated), Houston TranStar has saved Houston area motorists over $1.6 billion in reduced traveler delay cost.

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 22.7 million gallons of fuel is equivalent to a reduction of 491 tons of hydrocarbons; 3,179 tons of carbon monoxide; and 715 tons of nitrogen oxides.

A benefit/cost analysis for 2006 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 $26.9 million, which divided into the annual benefit of $286 million, yields a benefit/cost ratio of 10.6. Historical benefit and benefit/cost information is illustrated in Figure 9. There was a slight increase in delay savings (from 11.9 million to 12.2 million vehicle-hours) from 2005 to 2006. There was also a resulting increase in benefit/cost ratio from 10.0 to 10.6 (from 2005 to 2006). The increase in delay savings reflects the increase in operational efficiency measures used in estimating delay savings, as well as the compounding effects of increased gasoline prices, value of congestion (cost/vehicle-hour), and the magnitude of estimated congestion.

Figure 9. Benefit/Cost Ratios (1997-2006)