

# Houston TranStar



# 2008 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**

Operating and managing any transportation system is the key in keeping traffic moving safely and efficiently. Established in 1993, Houston TranStar provides for multi-agency operations and management of the region's transportation system and has evolved into a primary resource from which multiple state, county and local agencies respond to incidents and emergencies in Harris County and beyond.

Houston TranStar is a formal partnership among the 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 (including Traffic & Transportation Group, Harris County Toll Road Authority, and Office of Homeland Security & Emergency Management); and the City of Houston. Houston TranStar plays a pivotal role in the travel of people and goods in the greater Houston region, with an estimated savings to motorists of more than \$2.2 billion in reduced travel time costs over the 12 years of Center operation from 1997 to 2008.



**Figure 1. Houston TranStar**

This document is the 12th 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. It also includes conservative estimates of the impact of center operation on regional mobility, travel time speed and delay, customer satisfaction, and energy and environmental benefits.

In summary, the reduction of travel time attributable to Houston TranStar operation was estimated to be almost 11.9 million vehicle-hours in 2008, which has a corresponding value of over \$238 million in road user cost savings and a reduced fuel consumption of over 22.2 million gallons (which also saved Houston-area roadway users approximately \$70 million in fuel costs). The total estimated benefits of Center operation in 2008 were just over \$308 million. Comparing the annualized TranStar operating cost estimate of \$27.1 million to the estimated annual benefit of \$308 million yields an estimated benefit/cost ratio for Houston TranStar center operation of 11.4.

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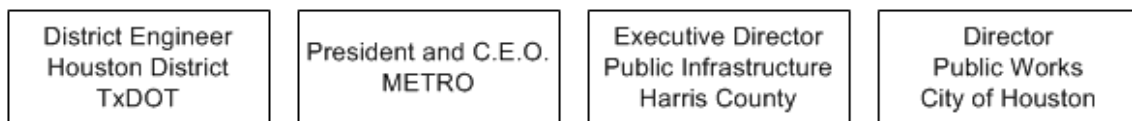
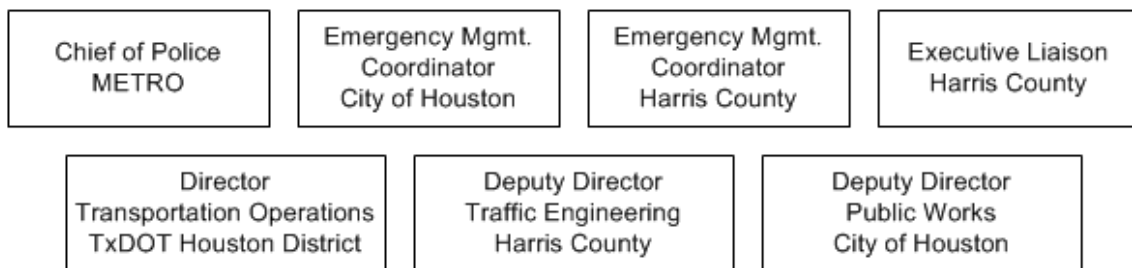
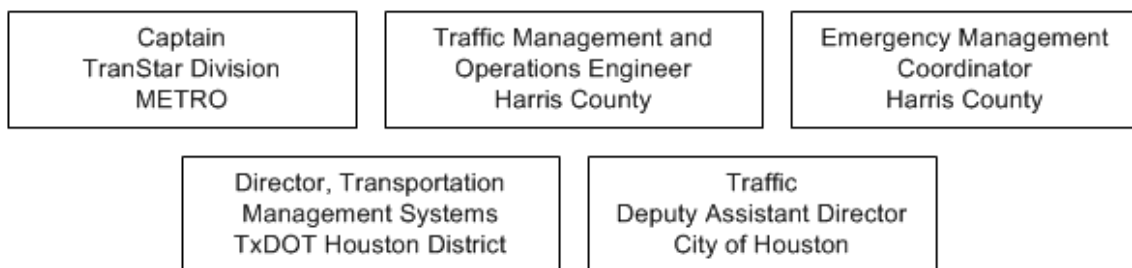
**Houston TranStar's Mission**

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 with representation of each of the four agencies on each committee (see Figure 2). The structure and functions of the three committees are:

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

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

**Figure 2. Houston TranStar Organizational 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, hosting workshops and meetings, conducting facility tours, and managing public information activities.

### SUMMARY OF ACTIVITIES

In 2008, the TranStar Partner Agencies continued transportation system operations and management (including integration activities and deployment of field devices) and emergency response. Significant activities at the center in 2008 are highlighted in the following sections of this report. Some of the highlights and significant accomplishments of TranStar during 2008 included:

#### General Activities

- Agencies continued planning for the TranStar building expansion, which is expected to be underway in 2009 and 2010. In December 2008, agency representatives traveled to Austin to finalize the Advanced Funding Agreement among TranStar partner agencies.
- Agency staff continued planning for the equipment needs for Control Room employees, including plans for updating existing hardware and room configuration.
- In 2008, the TranStar agency partners continued participation in the United States Department of Transportation (USDOT) Integrated Corridor Management (ICM) Initiative. Houston was selected as one of eight “pioneer” sites to develop concepts and requirements for an ICM System, and TxDOT, Harris County, City of Houston, and METRO were all key partners in this effort.
- TranStar staff coordinated meetings related to the 4.9 GHz radio systems dedicated to public safety, including mapping frequencies for area agencies.
- OHSEM led efforts to coordinate procedures related to HAZMAT handling during incidents.
- Houston TranStar agreed to house the Gulf Coast Freight Rail District office administrative staff and host their Website on the TranStar server.
- Edmund “Kip” Hawley, Director of the Transportation Safety Administration, along with U.S. Congresswoman Sheila Jackson Lee and transportation professionals, promoted the use of air flight e-tickets on BlackBerry® devices in a media conference.
- The Harris County Department of Education, local school districts, emergency management professionals, and METRO continued collaboration on how to facilitate using school buses and transit vehicles for evacuations.
- The City of Houston finalized consolidation of all shifts of the city’s traffic maintenance dispatch function to TranStar, combining all employees within the 24-hour per day function in one facility.



**Figure 3. High Water on IH-45 after Hurricane Ike, 9/14/2008**  
(AFP/Getty Images)

- In April, television spots were videotaped at the Center for hurricane preparedness outreach to persons with special needs.
- In April, Harris County OHSEM hosted the Annual Regional Transportation Evacuation Workshop and activated for the HURREX '08 hurricane preparedness exercise (April 29–May 1). Harris County OHSEM hosted visitors and observers from Dallas, Lubbock, Fort Worth, the Texas Engineering Extension Service (TEEX), and the British Consulate. Representatives from Texas State Senator Mario Gallegos Jr.'s office, Houston City Council Member Mike Sullivan, and Congressman Nick Lampson were in attendance.
- Discussions were conducted on the technical issues for connecting the Houston Emergency Center to the TranStar communications network, and specifications were approved by technical staff.
- Methods of providing TranStar data feeds to the Harris County Toll Road Authority (HCTRA) for tollway incident management applications were explored and data samples were made available for development purposes.



**Figure 4. IH-10 (Katy Freeway) West of IH-610  
Before Grand Re-Opening, July 2008**

- Communications connections to Montgomery County NorthStar were completed.
- The Houston-Galveston Area Council (H-GAC) conducted hurricane evacuation interviews with local jurisdictions and combined that information with data from Texas Department of Public Safety (TxDPS) to produce an updated evacuation plan for the 13-county region. More than 400 control points were removed from the previous plan and about 250 new control points were added in the updated plan. On April 17, 2008, Houston TranStar hosted a multi-county regional transportation evacuation meeting of emergency management, police, and transportation management personnel of the 13-county H-GAC region to present the Hurricane Evacuation Plan. Feedback was solicited and a Microsoft Virtual Earth-based map was created to show the current traffic control points.
- A TxDOT “Ethernet-over-ATM” deployment project enabled partners to connect to Houston TranStar. HCTRA gained a direct connection to Houston TranStar for closed circuit televisions (CCTV), dynamic message signs (DMS), and other devices used in regional incident management.
- TxDOT continued preparing agreements with the City of Sugar Land, Texas and finalized agreements with Galveston County for fiber data sharing.

- TxDOT, METRO, and HCTRA collaborated to provide an interim high occupancy vehicle (HOV) lane during the final striping operations in the reconstruction of the IH-10 Katy Freeway.
- Houston TranStar activated for Hurricanes Gustav and Ike in September, with the Center serving as nerve center for emergency operations for the response to Ike. All partner agencies were significantly affected, and regional electrical power loss affected TranStar's ability to conduct normal traffic information operations. Hurricane Ike imparted significant infrastructure damage to roadways, traffic signal systems, and Intelligent Transportation Systems (ITS) equipment. Most ITS systems and equipment were functional within 60 days after the storm's landfall, but infrastructure repair and recovery continued into 2009.
- In October, OHSEM staff testified before the Texas Senate Committee on Transportation and Homeland Security in Austin in regard to Hurricane Ike activity, and two preparedness events and one "lessons learned" presentation were given. In addition, OHSEM and a cross section of its emergency management partners hosted a post-Hurricane Ike discussion with a delegation from the Netherlands.
- TranStar conducted a post-Hurricane Ike survey via the Houston TranStar Website. The survey was used to quantify evacuation decision making and traveler experiences during evacuations from Hurricane Ike.
- The center hosted 1,975 visitors in 2008.

#### OHSEM/Emergency Operations Center Activations

The Emergency Operations Center (EOC) at Houston TranStar, anchored by the Harris County OHSEM, was activated five times for hurricane events in 2008. The first activation was April 29 through May 1 for HURREX '08, the annual State of Texas hurricane preparedness exercise. The second activation was four days for Hurricane Dolly, from July 20 through July 23. While Dolly eventually made landfall in South Texas, the Houston area was in the five-day cone for Dolly and the EOC was activated in preparation for a potential Southeast Texas landfall (see Figure 5).

OHSEM also activated for four days for Tropical Storm Edouard (from August 3 through August 6). Edouard was a short-lived tropical storm that made landfall in Gilchrist, Texas (east of Galveston) on August 5 and tracked across the Houston area (see Figure 6).

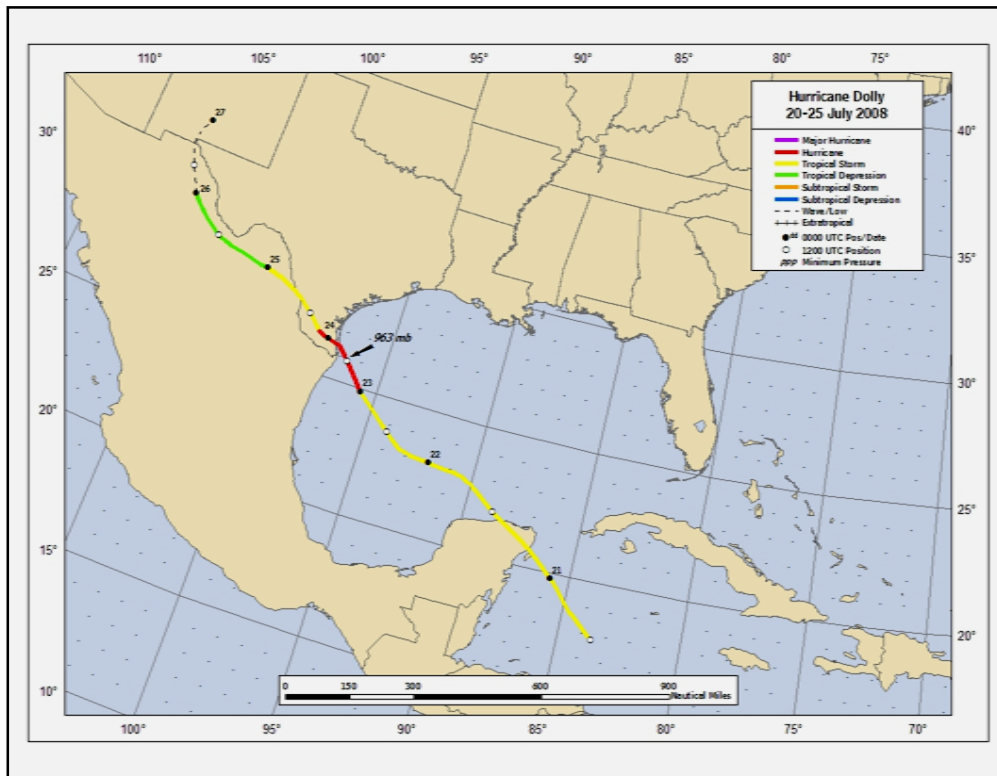


Figure 5. Track of Hurricane Dolly (National Hurricane Center Archives)

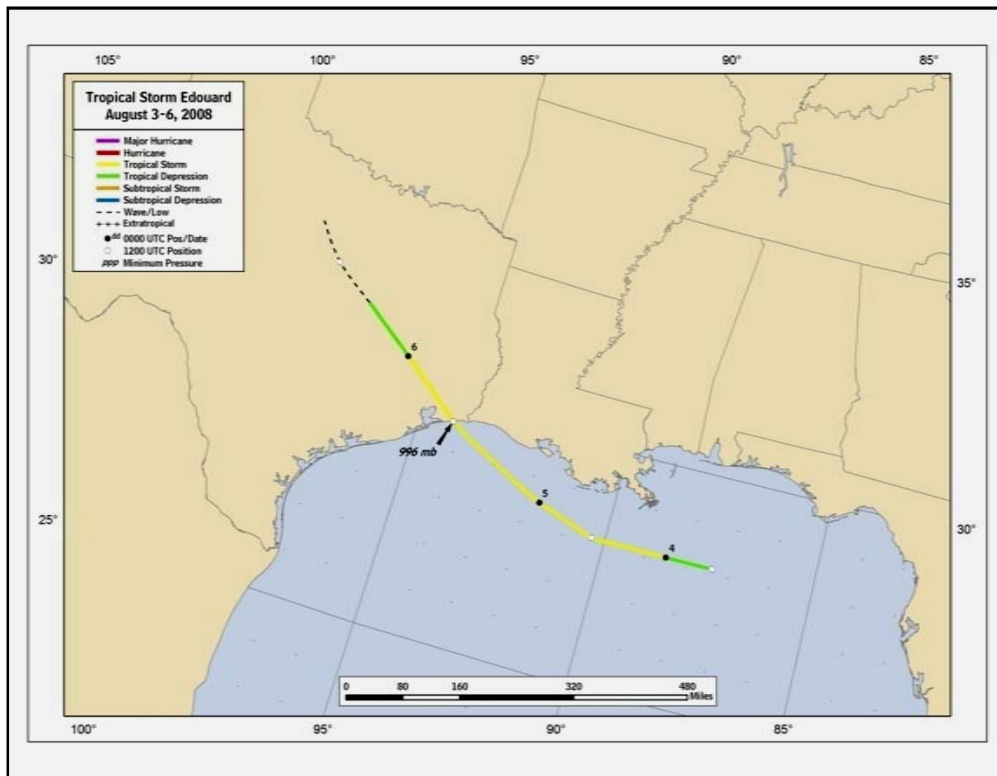
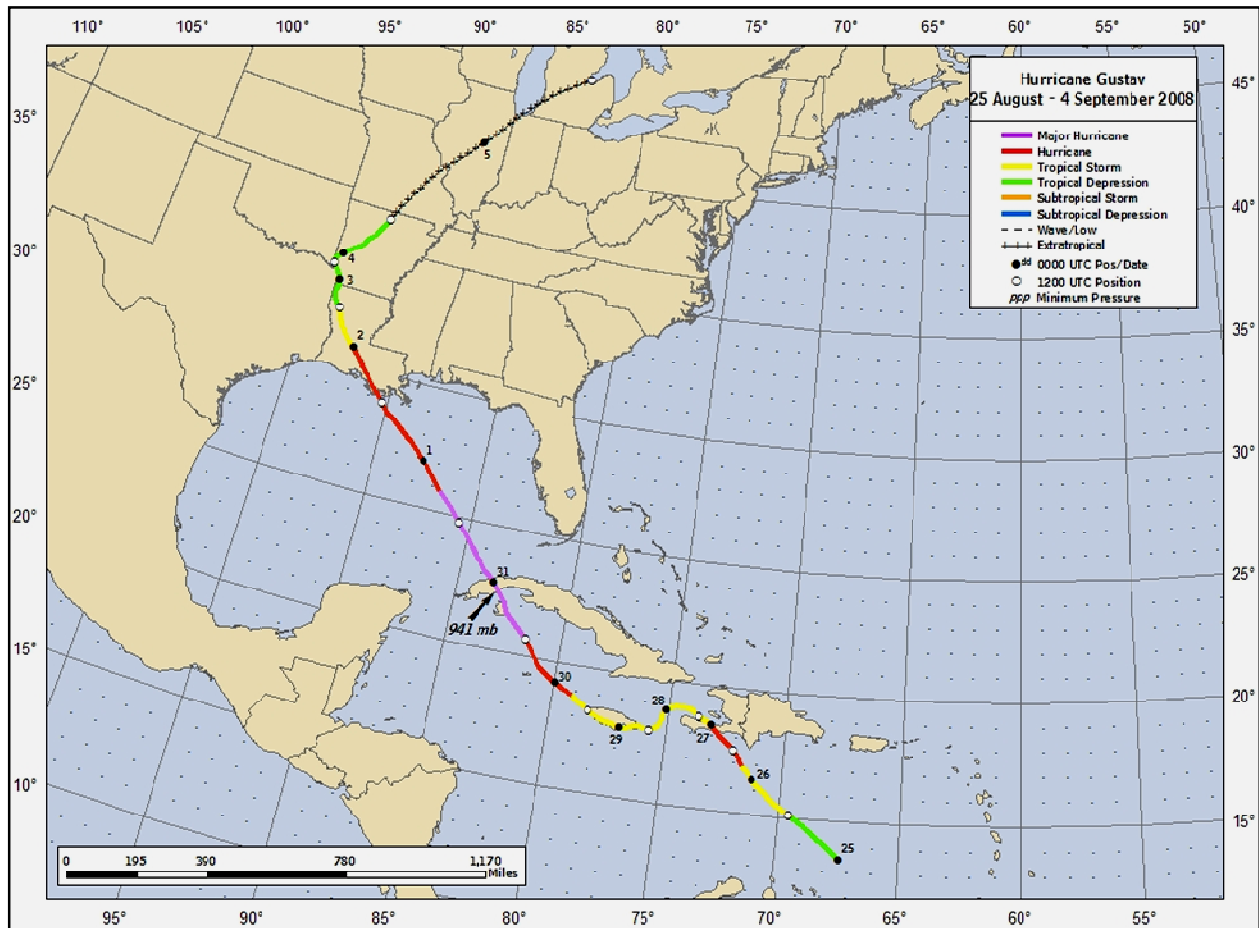


Figure 6. Track of Tropical Storm Edouard (National Hurricane Center Archives)

Hurricane Gustav prompted an OHSEM EOC activation of four days (from August 29 through September 1) and for some time the track of Gustav was moving closer to the Houston-Galveston area (see Figure 7). Gustav eventually made landfall in south-central Louisiana on September 1, but the EOC monitored mandatory and voluntary evacuations in nearby Texas counties to the east (Jefferson and Orange) and TxDOT monitored evacuation traffic coming west from Louisiana during the event.



**Figure 7. Track of Hurricane Gustav (National Hurricane Center Archives)**

OHSEM and the EOC activated for 17 days (from September 9 through September 26) for Hurricane Ike. More information about Houston TranStar's operations during Ike may be found on page 29 of this report.

#### Houston TranStar Media Highlights for 2008

- Public service announcement of TranStar's mobile alert system in the January 5, 2008 *Houston Chronicle* Business Section.
- Houston TranStar and Executive Director Jack Whaley were featured in a February 9 article in the *Los Angeles Times* in a story about the use of cell phones with GPS used as traffic probes.
- In April, Emergency Management officials from the largest cities around the nation came to Houston for the Council for Excellence in Government's Big City Emergency Managers' forum. A



media conference was held at Houston TranStar. Also in April, several media outlets covered the hurricane exercise at the TranStar Center.

- In May, 45 members of the Houston Area Police Chiefs Association converged at Houston TranStar to announce two multi-jurisdictional agreements on procedures for high-speed chases and missing persons. The event was covered by KRIV-26 Fox News, KPRC-2 NBC, KHOU-11 CBS, KTRK-13, ABC, KLXN-47 Univision, and KUHF 88.7 FM Radio.
- On May 9, Channel 11 (KHOU) broadcast its morning news from the Houston TranStar viewing room while highlighting a story on hurricane season.
- On June 6, Houston TranStar hosted a media conference with U.S. Secretary of Homeland Security Michael Chertoff, County Judge Ed Emmett, Houston Mayor Bill White, and other regional dignitaries. The group announced a \$12 million grant for ReadyHouston.gov to educate the public about hurricane preparedness.



**Figure 8. Debris on IH-45 after Hurricane Ike**  
(Eric Kayne, Houston Chronicle)

- On June 13, producers from The Discovery Channels' *Modern Marvels* spent the day at Houston TranStar developing a story about weather stations along state roadways. On August 28, the program aired, featuring Houston TranStar in one segment entitled "Dangerous Roads."
- On July 8, Channel 11 (KHOU-TV) ran a story about ACS-Lite, an innovative traffic signal coordination system being employed by Harris County Traffic. The system was covered by Channel 2 (KPRC) on August 2.
- On July 22, all local stations carried Hurricane Dolly-related stories that featured Harris County Judge Ed Emmett, with mention of activity at Houston TranStar.
- In August, Tropical Storm Eduoard, Tropical Storm Fay, and Hurricane Gustav all drew coverage from local and national news outlets.
- In September, Hurricane Ike dominated the news. Local and national media outlets broadcast continuously from Houston TranStar. The media covered coordinated recovery efforts from TranStar as local agencies collaborated on repairs to transportation systems and infrastructure. As ITS systems were brought back on-line, the media covered the traffic congestion resulting from traffic signal power issues and motorists' increased use of the freeway and tollway system.
- On November 20, Texas Governor Rick Perry addressed the Hurricane Ike recovery from Houston TranStar. All local media, as well as CNN, covered the event.

**2008 AGENCY ACTIVITY**

The following sections summarize each partner agency's activity during 2008. This includes various measures of performance of the center and programs operated from Houston TranStar.

**Texas Department of Transportation**

The Texas Department of Transportation 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 is about 812 directional miles, including 742 directional freeway miles and 70 miles on HOV lanes. In 2008, the IH-10 (Katy Freeway) Managed Lanes were not included in these totals, but these lanes will be added to monitoring in 2009. Also not separately monitored are the non-barrier-separated HOV "diamond lanes" on US-59 (Southwest) and IH-10 (Katy Freeway) as these are currently included with mainlane monitoring.



Major components of the CTMS include CCTV, 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. Total TxDOT ITS field equipment deployed as of the end of 2008 included:

- Closed Circuit Television;
  - 661 freeway CCTV cameras;
  - 71 regional hurricane evacuation cameras (on rural and/or remote routes);
- Dynamic Message Signs – 201 total DMS;
  - 168 for freeway operations;
  - 28 for HOV and park and ride operations;
  - 5 portable units;
- Highway Advisory Radio;
  - Twelve fixed transmitting locations;
  - One portable transmitting station;
- Radar-based Vehicle Volume and Speed Detection – 73 total detectors;
  - 27 locations on evacuation routes (primarily on rural and/or remote highway routes);
  - 46 locations on freeway facilities in the urban area;
- Flow Signals in Operation – 85 on five facilities (IH-45 North, IH-45 Gulf, US 59 Southwest, US 290 Northwest, and IH-610 North Loop); and
- Automatic Vehicle Identification (AVI) System – 812 directional miles of coverage.

In conjunction with Harris County OHSEM and other agencies, TxDOT has deployed field devices to support the Roadway Weather Information System (RWIS). In addition to the rain and stream level instruments deployed for flood monitoring, the following numbers of RWIS devices are reported through the joint OHSEM/TxDOT Web-based reporting system:

- Rainfall: 38 sensors;
- Roadway Flood: 13 sensors;
- Air Temperature: 16 sensors;
- Road Temperature: 7 sensors;
- Wind: 18 sensors (speed and direction); and
- Humidity: 17 sensors.

### 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: DMS, HAR, the Internet, and the local media.

The 201 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 and Silver Alerts. There were 134,473 operator activated messages and over 1.53 million automated messages displayed on DMSs in 2008. The total number of operator-activated and automated messages dropped by about 9.5% from 2007 to 2008, while the number of state-mandated Amber and Silver Alert messages increased about 230% in total over 2007. Amber and Silver Alert messages are the only communication shown on a DMS when needed, and this reduces the opportunity to post traveler information. The large increase in Amber and Silver Alert messages posted in 2008, along with interruptions in DMS service from electrical outages due to Hurricane Ike in September, are believed to have contributed significantly to the reduction in overall roadside traveler information messages presented to motorists in 2008.

The types of DMS messages included:

- Operator Activated (134,473 total);
  - 102,257 operator activated messages for incidents;
  - 4,467 operator activated messages for road closures or construction;
  - 3,907 operator activated messages for weather-related events, including
    - 2,659 for general weather events, including hurricane preparation;
    - 153 icing events;
    - 1,095 ozone alerts;
  - 13,526 operator activated messages for public service messages, including
    - 5,194 for safety campaigns;
    - 4,812 MAP/PEAT assistance information;
    - 3,520 for other informational messages;
  - 5,973 operator-activated messages for Special Events;
  - 4,343 Amber Alert and Silver Alert messages;
    - 466 for Statewide Amber Alerts;
    - 348 for Local Amber Alerts;
    - 3,529 for Silver Alerts;
- Automated travel time/ferry wait time messages (1,530,474 total);
  - 1,512,934 automated travel time messages; and
  - 17,540 Galveston-Port Bolivar ferry wait time messages.

In November 2008, TxDOT began displaying "speed ahead" messages on DMS to motorists on IH-610 (South Loop and West Loop). These DMS messages are generated when radar-based traffic speed and volume sensors detect lower speeds in northbound IH-610 mainlanes after Fournace Road. The DMS messages are intended to give drivers information about the traffic speeds ahead after the Fournace overpass and supplements the existing queue warning signing. This effort is being evaluated as to its effectiveness at providing a warning to motorists that slower speeds are ahead, and was intended to reduce speed variance and crashes.

TxDOT operators use HAR broadcasts to disseminate travel information via the 12 HAR sites located throughout the area. HAR was activated to broadcast 3,060 messages in 2008 (a drop from 5,600 messages in 2007). Of the 3,060 messages broadcast, there were 2,331 HAR broadcasts for incidents, 54 messages for road closures, and 610 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 significant benefits for our city's future traffic operations. Houston has more than 2,400 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 most up-to-date traffic data, while taking advantage of the most recent technologies to produce new customized signal timings. TSTOP'S revolving program 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.

In addition to providing the program management for TSTOP, the Traffic Operations Section is responsible for developing signal optimization plans for the selected zones. The Traffic Operations Section's role in this process consists of field data collection, timing plan design, and signal timing implementation. Between 500 and 600 traffic signals are evaluated and optimized each year. During 2008, corridors in the northern half of the City (north of IH-10) were optimized along with some select corridors in the southern portion of the City.

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.

Hurricane Ike presented challenges for the City of Houston. After storm winds had died on September 13, 2008, the City estimated that more than 2,200 of its 2,400 traffic signals were not operational. Using internal resources, assistance from the cities of Dallas and San Antonio, assistance from Harris County, as well as numerous traffic signal contractors, the city was able to place more than 100 two-person crews in the field repairing traffic signals. By October 3, 2008, power had been restored to all signals within the City of Houston and all were operational. Additional minor repairs related to the damage from Hurricane Ike continued until late November.

Additionally, the City Traffic Operations Branch reported the following in 2008:

- Awarded a contract for city-wide LED traffic signal lamp upgrades,
- Continued planning for ITS deployment in West Houston, and
- Demonstrated and evaluated Bluetooth technology for travel times on arterials.

**Metropolitan Transit Authority of Harris County**

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 by using Houston TranStar's collection of ITS technologies, METRO provides 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 2008 include:



- METRO began implementation of the Public Information and Emergency Response (PIER) System. PIER is a site-notification system to improve multi-agency interoperability for METRO Emergency Response. PIER is a Web-based, on-demand communication management application. It allows both core communicators and an extended team to work together from anywhere (at any time) to manage a wide range of critical communication tasks. In 2008 several METRO employees attended "train the trainer" courses in preparation for full implementation scheduled for early 2009 in coordination with our regional partners.
- During 2008, METRO transitioned from using METRO Police Officers to civilian staff members to provide METRO Motorist Assistance Program (MAP) services. This shift allowed METRO to concentrate certified peace officers on transit security related assignments, while maintaining a focus on regional mobility and public safety. In addition, in 2008 the SAFE Clear Program was expanded to include quick-tow service on the regional HOV network system. Both METRO MAP and SAFE Clear on the HOV lanes are now coordinated through Houston TranStar in partnership with the Houston Police Department and the SAFE Clear Management team. During 2008, METRO's MAP personnel assisted 7,806 motorists on regional freeways.
- During 2008, METRO continued efforts to prepare for major incidents through on-going meetings and training events with TranStar partner agencies.
- METRO continued remote security monitoring of the park and ride facilities through the use of the METRONet System from Houston TranStar. Remote monitoring by METRO Police Officers resulted in a 17% reduction of serious crimes reported at park and ride facilities in 2008 (84 reported crimes) as compared to 2007 (101 reported crimes).
- METRO maintained an increased state of situational awareness during the 2008 hurricane season, which included specific involvement with respect to hurricanes Dolly, Edouard, Gustav, Hanna, and Ike. While Hurricane Ike proved to be a challenge for the entire region, METRO, like many partner agencies, went into action assisting the public and partner agencies as planned. With METRO's active participation in regional hurricane planning efforts in association with its regional partners, the response and recovery activity for Ike was generally effective. However, METRO's after-action review spurred revisions in the agency's emergency management plan to incorporate the lessons learned for the next regional hurricane event.

**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 2008 included:



- An agreement between Harris County and Emergency Service District (ESD) 11 was approved by the Harris County Commissioner's Court on July 8, 2008, allowing Harris County to work cooperatively with ESD 11 in Northwest Harris County to install and operate an emergency vehicle preemption system on traffic signals maintained by Harris County.
  - The primary purpose of this system was to establish an agreement to allow ESD 11 to procure emergency vehicle preemption (EVP) system components that interface with Harris County's traffic management system. The system allowed traffic signals along coordinated arterials in Harris County to respond to requests for priority treatment from emergency service vehicles that work within ESD 11.
  - The system established open communications interfaces between the EVP system and Houston TranStar in a manner that balances regional mobility with the need to maximize the efficiency of emergency response vehicles.
  - This deployment was limited to first responders, large fire apparatuses and ambulances responding to emergency situations within the confines of ESD 11. This agreement enabled ESD 11 to purchase the necessary equipment to allow emergency vehicles to communicate vehicle information to traffic signals and provide incident data from ESD 11 dispatch centers to Houston TranStar.
  - Requests for preemption of traffic signals are matched with actual incidents, thereby minimizing the potential for inappropriate actuations of the system. The system provided significant advancement in preemption technology, including extended notifications for preemption requests, remote management of the EVP system from Houston TranStar, and authentication of preemption requests.
- Harris County continued extensive coordination between HCTRA, TxDOT, and City of Houston on the IH-10 Katy Freeway Reconstruction Project. Major efforts included:
  - Coordination of traffic signal reconfiguration and timings for major freeway detours required to reconstruct the IH-10 / Beltway 8 interchange.
  - Coordination of refinements to freeway signing and pavement markings.
  - Finalization of agreement between Harris County, TxDOT, and METRO regarding the operations of the integrated corridor.
  - Coordination of signalized interfaces at the Addicks Park-And-Ride and at the Post Oak at Katy Road intersection.
  - Design and construction of multi-agency device network that leverage traffic sensors planned for installation by all partners through Houston TranStar. This provided a common data source for traveler information and system performance.
  - Installation of fiber optics communications and network equipment necessary to establish toll road surveillance and monitoring associated with system performance, as well as critical toll facility communications infrastructure.

- As previously discussed, Hurricane Ike had a major impact on the transportation infrastructure in the region. Harris County's arterial management system consists of approximately 645 traffic signal system installations, as well as approximately 140 miles of fiber optic communications backbone that is used to support both traffic signal operations along Harris County arterials and communications with various ITS devices across the region. This infrastructure was significantly damaged by Hurricane Ike. The Harris County Traffic Group employed a three-phase approach to restoring emergency repairs to making emergency repairs to these systems following Hurricane IKE. The steps associated with the restoration effort were:
  - Phase 1 - Mitigation of "Imminent Hazard" Conditions,
  - Phase 2 - Restoration of "Normal" Operations, and
  - Phase 3 - Restoration of Non-Critical Elements.

All "imminent hazards" associated with damaged Harris County signals were mitigated within 72 hours of the abatement of hurricane conditions. By closely coordinating with Centerpoint Energy, all Harris County traffic signals were returned to normal operation by September 24, 2008. Harris County also coordinated with HCTRA to assist various cities and TxDOT in the repair and return of safe operations to approximately 500 signalized intersections not within their jurisdiction, in an effort to restore regional mobility to critical transportation corridors that support the toll road system. The total cost to effect these repairs was just over \$1,000,000.

- Harris County continued efforts toward a regional data-sharing platform for transportation and security centered data. This effort began the process of streamlining incident data entry by HCTRA Incident Command Staff by using national incident management standards and IEEE 1512 to GJXDM Exchanges. The first elements of exchange were incident notification and incident status updates from RIMS to the Toll Road Incident Management System (TRIMS).

**TRAVELER INFORMATION PROVIDED BY HOUSTON TRANSTAR**

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. The Houston TranStar Website is also the centerpiece for dissemination of detailed traveler information for public use in the Houston region.

In June 2008, the TranStar Website was moved from a single server to a load-balanced environment running on multiple servers. This provides machine redundancy and scalability, which allows the Website to seamlessly recover from equipment failures and provide enhanced performance in times of extreme user demand. This environment proved its value during the Hurricane Ike evacuation and re-entry events, when 1.75 million unique users accessed the Website. Without multiple Web servers, the ability to handle such a large number of user requests would have been impaired.

Operational highlights for the TranStar Website in 2008 included:

- Monthly Webpage accesses in 2008 ranged from 5.8 million (in November) to 20.6 million (in September), with a monthly average of about 8 million accesses. Total Webpage accesses for the year were 96.2 million, down 16.7% from 2007. The drop in Web accesses is attributed to map enhancements made in June 2007 to increase Website efficiency.
- TranStar's home page ([www.houstontranstar.org](http://www.houstontranstar.org)) received 1.2 million visits in 2008 (up 47% from 2007).
- The layered traffic map ([traffic.houstontranstar.org](http://traffic.houstontranstar.org)) received 150.2 million visits in 2008 (up 14.8% from 2007).
- Average unique monthly users increased from 340,600 in 2007 to 522,400 in 2008, a 53.3% increase (see Figure 9). The 2008 monthly average is skewed by the 1.8 million unique users who visited the site in September 2008 (surrounding the Hurricane Ike event). If we discount the extraordinary number of visitors in September, the average monthly users were 405,000, an increase of 18.9% over the 2007 monthly average.
- Access to the route builder system increased from 3.5 million total accesses in 2007 to 4.0 million total accesses in 2008, an increase more than 14% (see Figure 10).
- CCTV Views:
  - Views of CCTV images increased from 99.2 million in 2007 to 130.2 million in 2008, an increase of 31%. Since 2006, CCTV snapshot views have increased 888%. In September 2008, more than 25 million CCTV snapshots were viewed (see Figure 11).
  - Views of the regional cameras (primarily used for hurricane evacuation route monitoring) totaled 8.8 million in 2008.
    - During August (Hurricane Gustav) there were 1.2 million views of regional CCTV.
    - During September (Hurricane Ike) there were 5.7 million views of regional CCTV.



Figure 9. Total Monthly Unique Users, January 2007 to December 2008

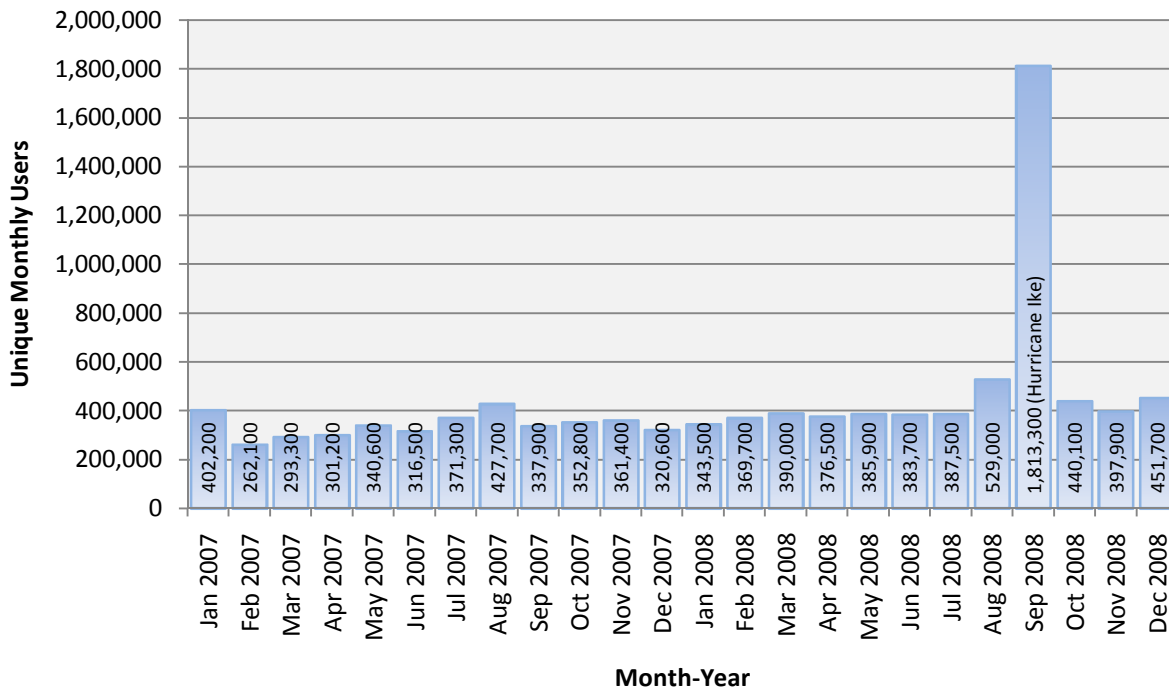


Figure 10. Route Builder Accesses , January 2007 to December 2008

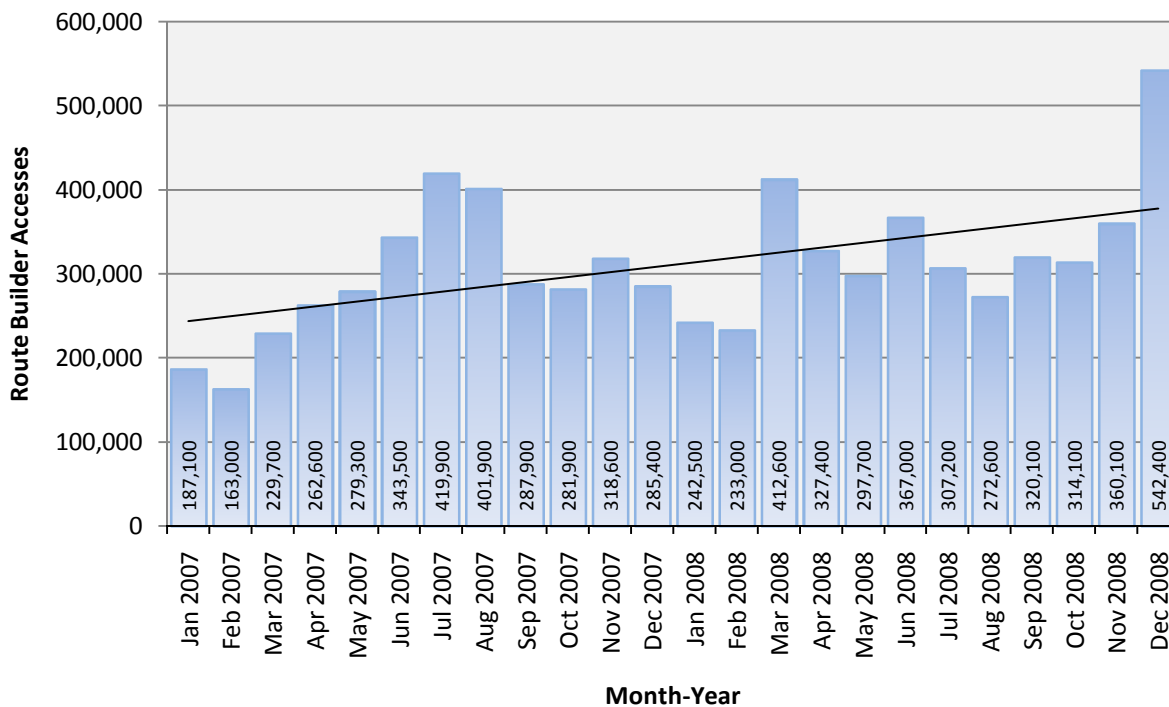
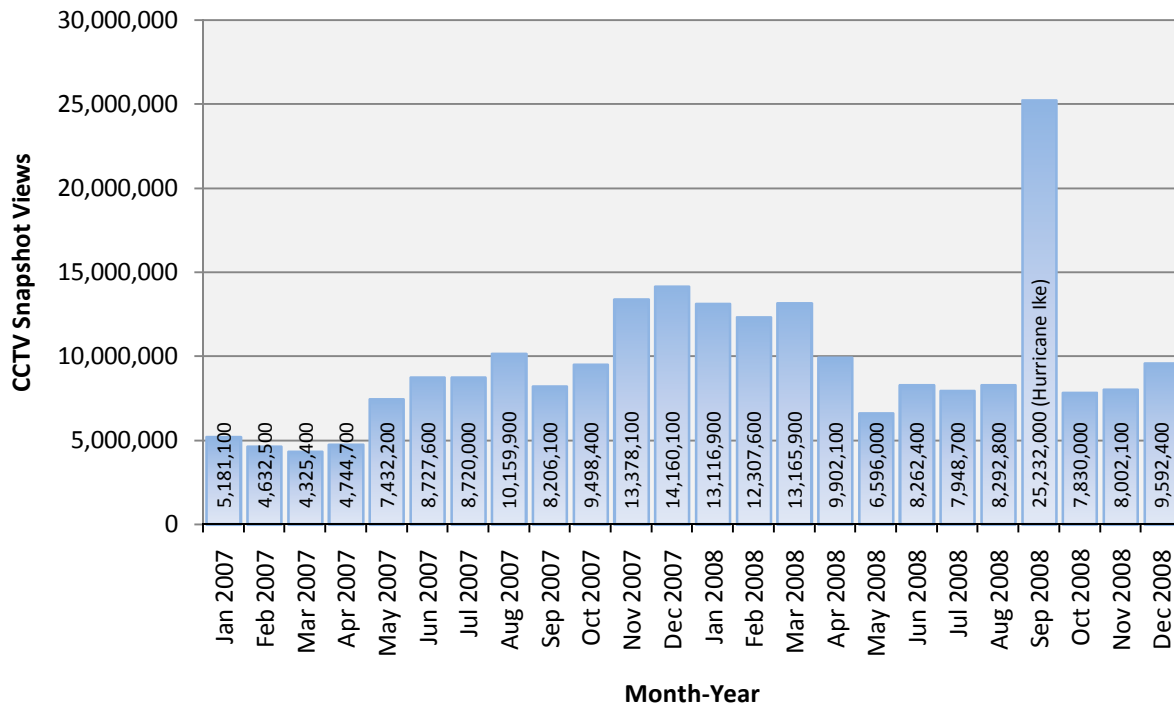
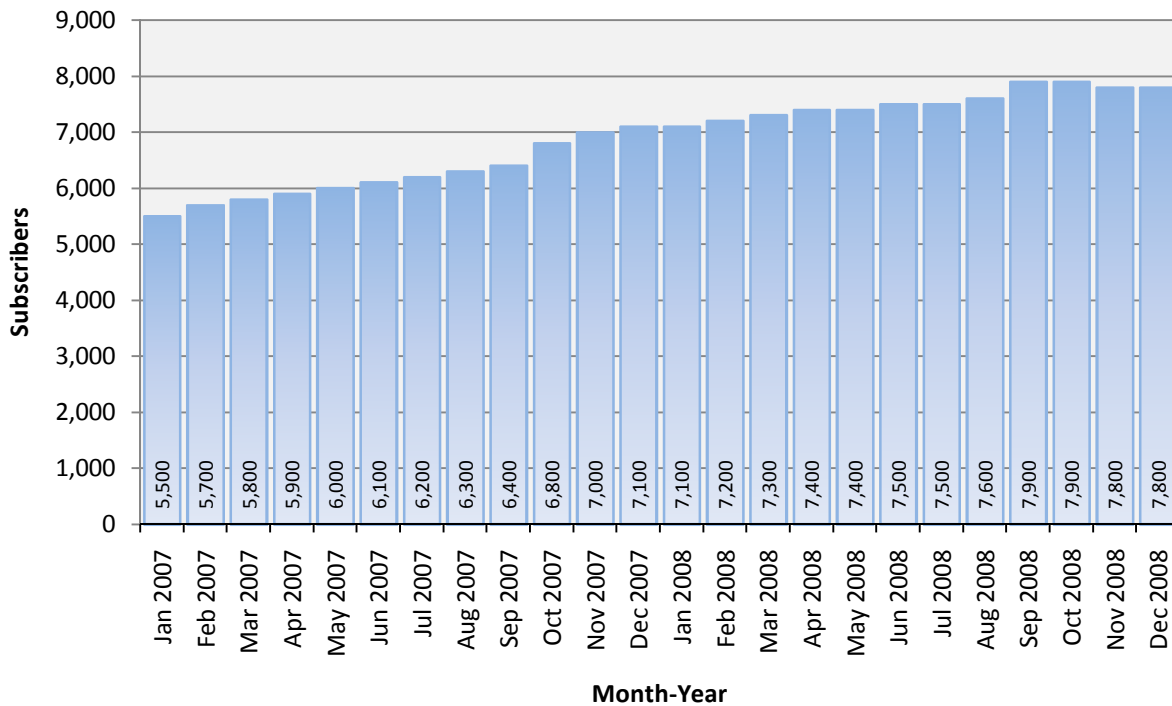


Figure 11. TranStar CCTV Views , January 2007 to December 2008



- Traffic alert subscribers increased from an average monthly subscriber base of 6,260 in 2007 to 7,530 in 2008, an increase more than 20%. Total monthly users at the end of 2008 were more than 7,900 (see Figure 12).
- Mobile traffic data accesses increased from 8.2 million in 2007 to 10.7 million in 2008, a 32% increase. Since 2006, mobile traffic data accesses have increased 227%.
- Traffic data information to third-party providers via the TranStar data feed increased 20% in 2008 (5.6 million accesses) from 2007 (4.7 million accesses). This represents a 200% increase from accesses in 2006 when data feed service began.
- The number of personalized “travel speed and time report” page accesses decreased from 14.6 million in 2007 to 12.2 million, a reduction of 16%.
- The overall number of views to freeway speed charts decreased from 620,000 in 2007 to 604,000 in 2008, a reduction of 3%.
- DMS information viewed increased by 5% from 2007 to 2008, from 773,200 to 810,400 views.
- Accesses to the Virtual Earth version of the speed maps averaged 2,690 per month, with about 26,900 accesses during 2008. This service began in March 2008 and allows zoom-in capability to street level. The Virtual Earth platform is a viable foundation for providing street level traveler information as capabilities evolve in the region.

Figure 12. Traffic Alert Subscribers, January 2007 to December 2008

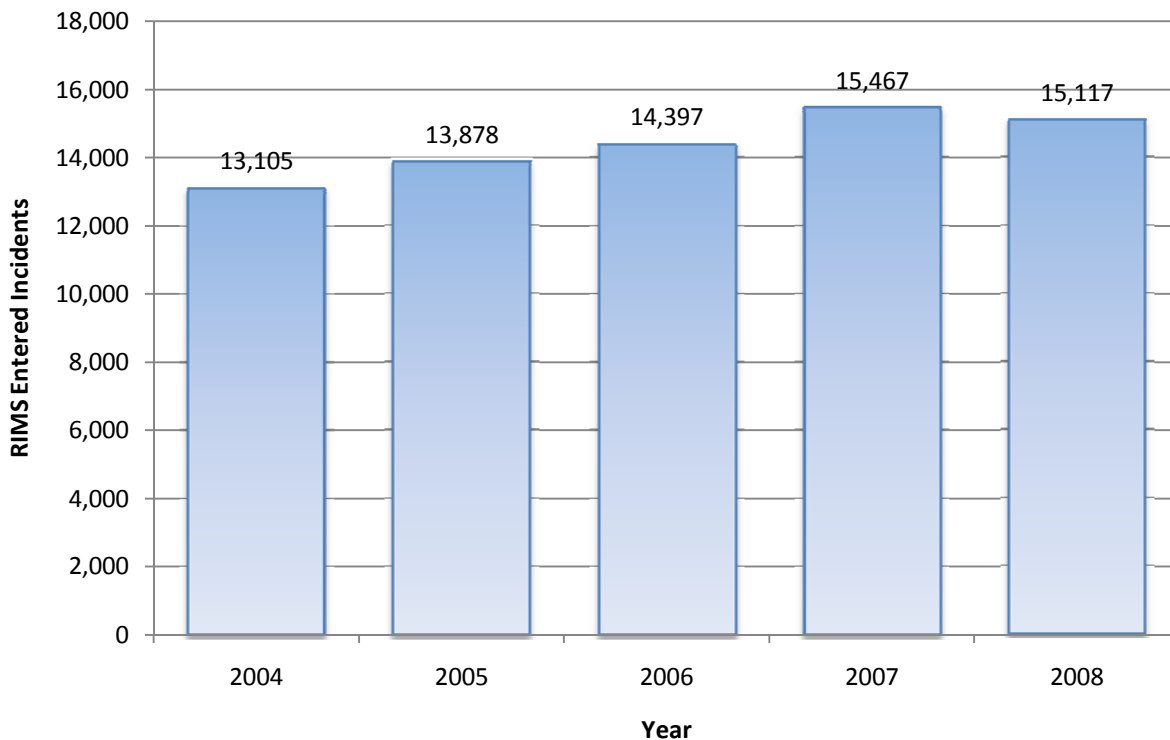


Some other notable Website achievements for 2008:

- Highest monthly total of unique users – September (1,813,340 unique users)
  - Second highest month remains September 2005 (Hurricane Rita, 700,128 unique users)
  - August (third highest month), December (fourth), October (fifth), and November (tenth) all rank in the top 10 all-time months for highest number of unique users of [www.houstontranstar.org](http://www.houstontranstar.org).
- CCTV snapshot views during September 2008 (Hurricane Ike) were more than five times the number served during September 2005 (Hurricane Rita) with 25.2 million vs. 4.8 million views.

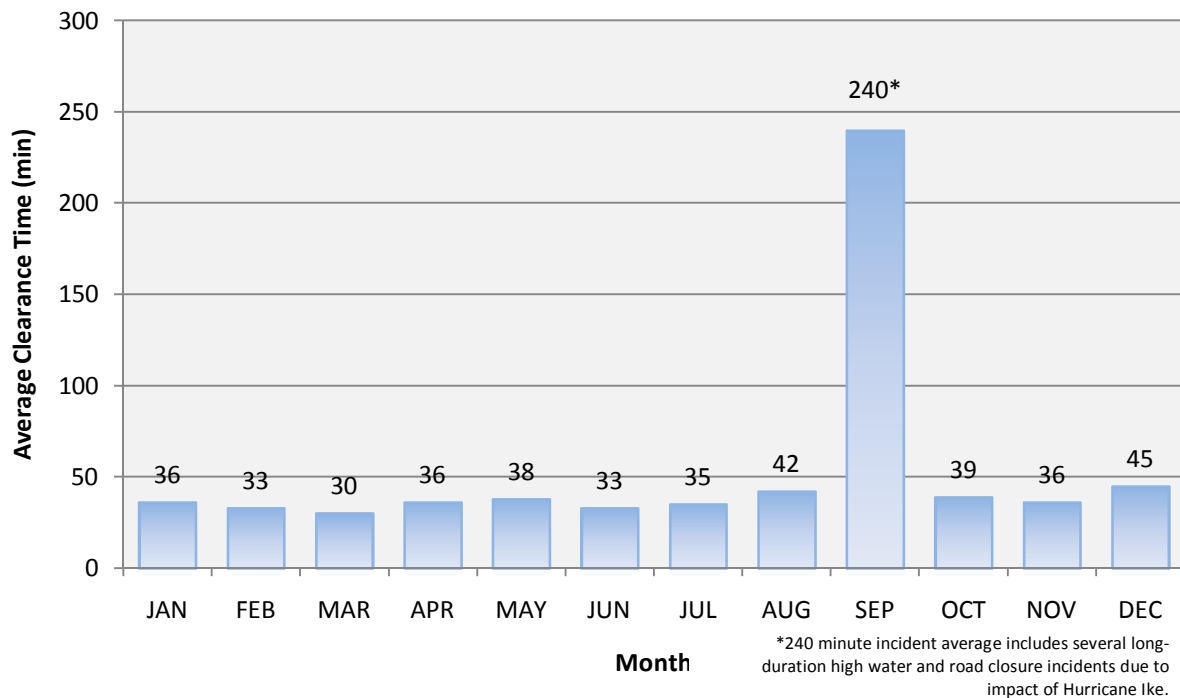
**INCIDENT MANAGEMENT**

Detection, response, and clearing of freeway incidents are important functions of Houston TranStar, and the Houston TranStar agencies play a major role in incident response management and information dissemination. A majority of incidents are entered into the Regional Incident Management System (RIMS) operations database by agency personnel. In total for 2008 there were 15,117 incidents recorded by Houston TranStar operators, largely by TxDOT personnel. This is a decrease of 2.3% when compared to total incidents entered into RIMS in 2007 (see Figure 13).

**Figure 13. Annual Total RIMS Entered Incidents, 2004-2008**

Some of the incident related performance measures determined for 2008 include:

- There were 12,342 incident-hours managed from the center in 2008.
  - This was an increase of 31% from 2007, primarily due to lengthy incidents logged in September as part of the response to Hurricane Ike, including high water incidents as noted by operators.
  - If the month of September is removed from consideration, the incident-hours managed from the center were virtually unchanged from 2007 to 2008 (down only about 0.8%).
- The average incident clearance time in 2008 was 49 minutes, but this average was also skewed by abnormally long duration incidents managed from the center in September during Hurricane Ike. If the month of September 2008 is not considered in the yearly average, the 2008 incident clearance average becomes 37 minutes, which is the same as the average clearance time in 2007. Figure 14 presents the monthly average incident clearance times for 2008.

**Figure 14. Average Incident Clearance Time by Month, 2008**

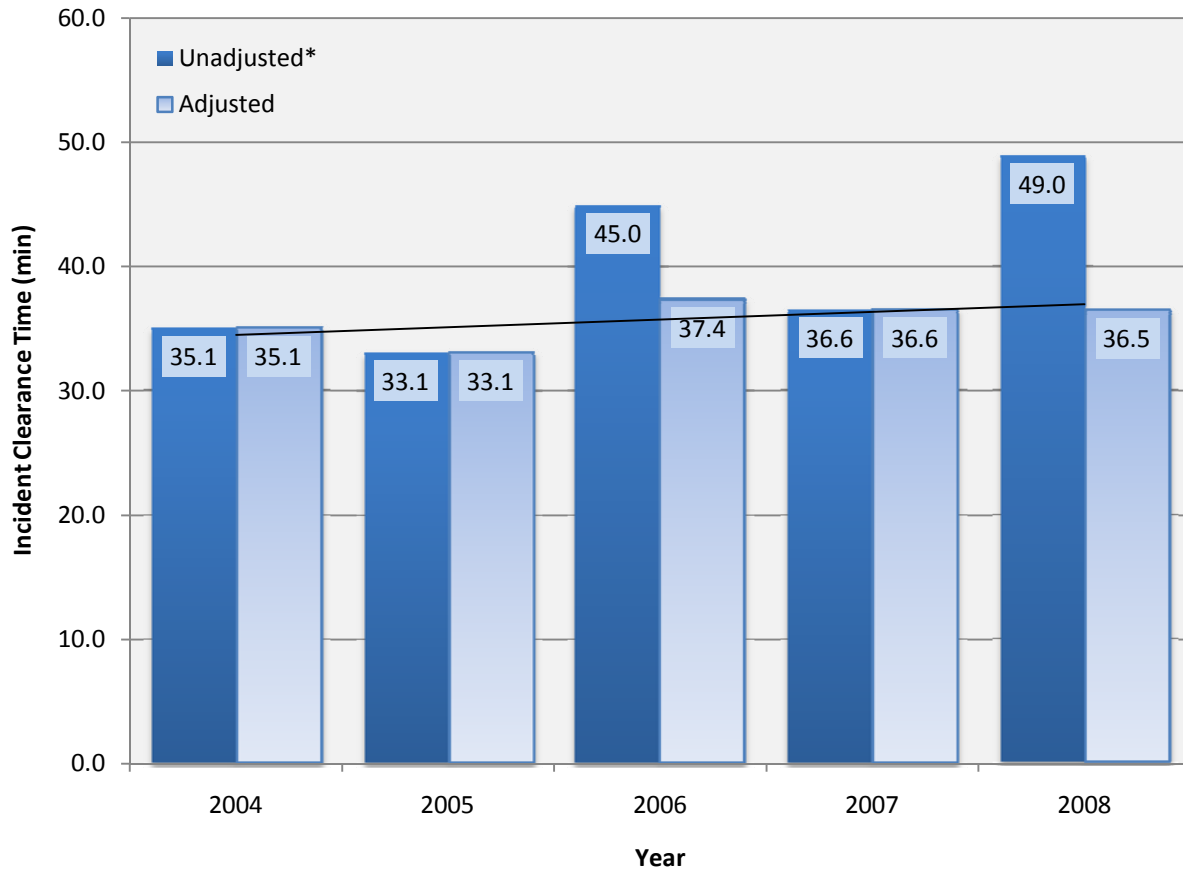
- The top five incident locations managed and/or monitored from TranStar in 2008 included:
  - US-59 Southwest Freeway Northbound at IH-610 West Loop (157 incidents);
  - IH-610 West Loop Northbound at US-59 Southwest Freeway (118 incidents);
  - West Sam Houston Tollway Northbound at South Sam Plaza (111 incidents);
  - West Sam Houston Tollway Southbound at Central Plaza (98 incidents); and
  - IH-45 North Southbound at IH-610 North Loop (84 incidents).

RIMS-reported yearly average incident clearance times are compared from 2004 to 2008 in Figure 15. Two sets of average clearance times are shown in Figure 15, “unadjusted” and “adjusted.” For the “unadjusted” clearance times it is apparent that both 2006 and 2008 show higher yearly average incident clearance times, but it should be noted that these average incident clearance times include all operator entered incidents into RIMS, including high-water incidents which may remain for extended durations. The “adjusted” clearance times have three months excluded; all three with extra-ordinary flooding events:

- June 2006 – mid-month heavy rains, high water and flooding events.
- October 2006 – mid- and late-month high water and flooding events.
- September 2008 – Hurricane Ike - high water events and extended power outages.

With these three extraordinary months excluded, the trend line shown in Figure 15 is relatively flat, indicating that for “average” incident conditions, clearance times have been fairly consistent in the past five years, varying between 33 and 37 minutes per incident.

Figure 15. TranStar Yearly Average Incident Clearance Time, 2004-2008



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 16 presents the managed incidents by facility. Temporal patterns of incidents by day of week and by month are illustrated in Figures 17 and 18 and give some indication of when the center is most active.

Figure 16. RIMS Reported Managed Incidents by Facility, 2007-2008

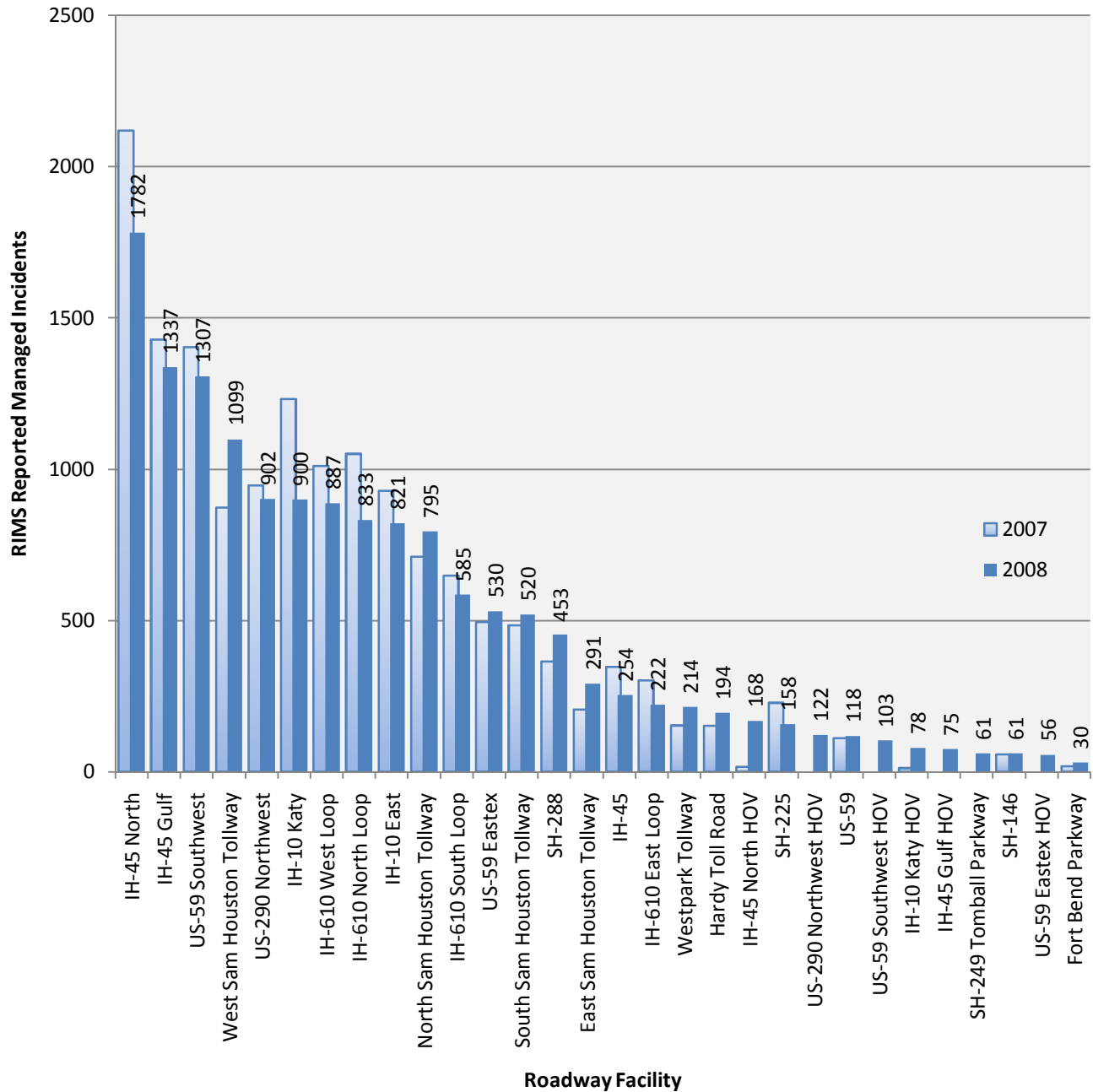


Figure 17. TranStar Managed Incidents by Day of Week, 2007-2008

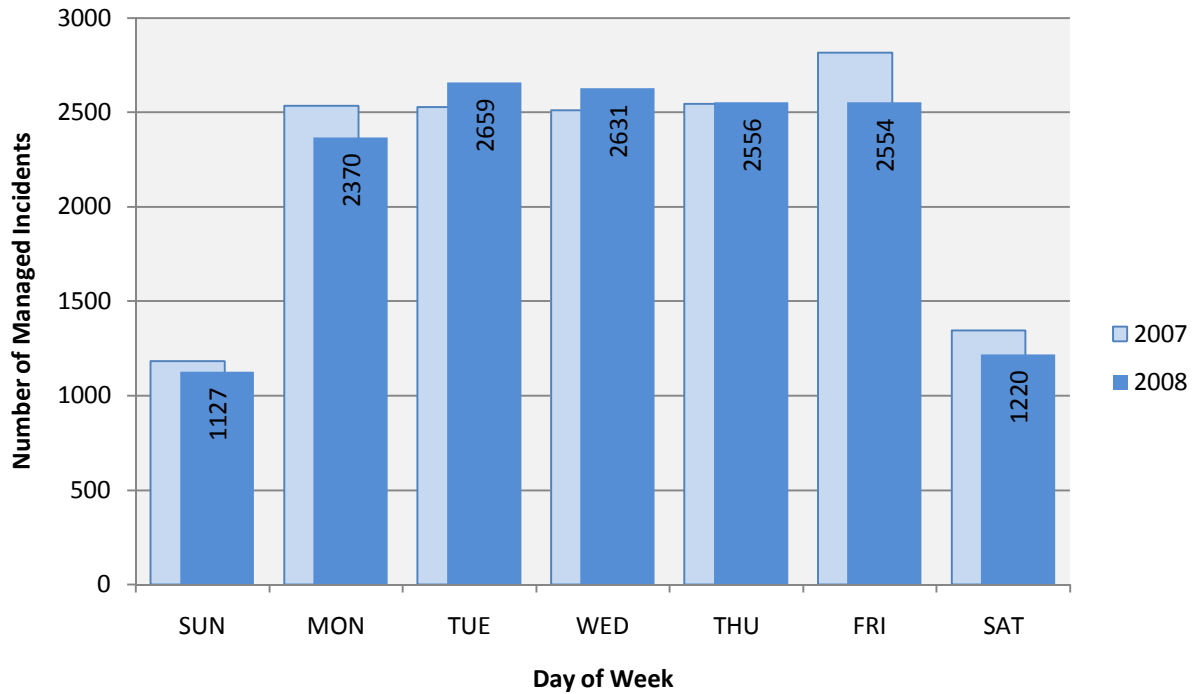
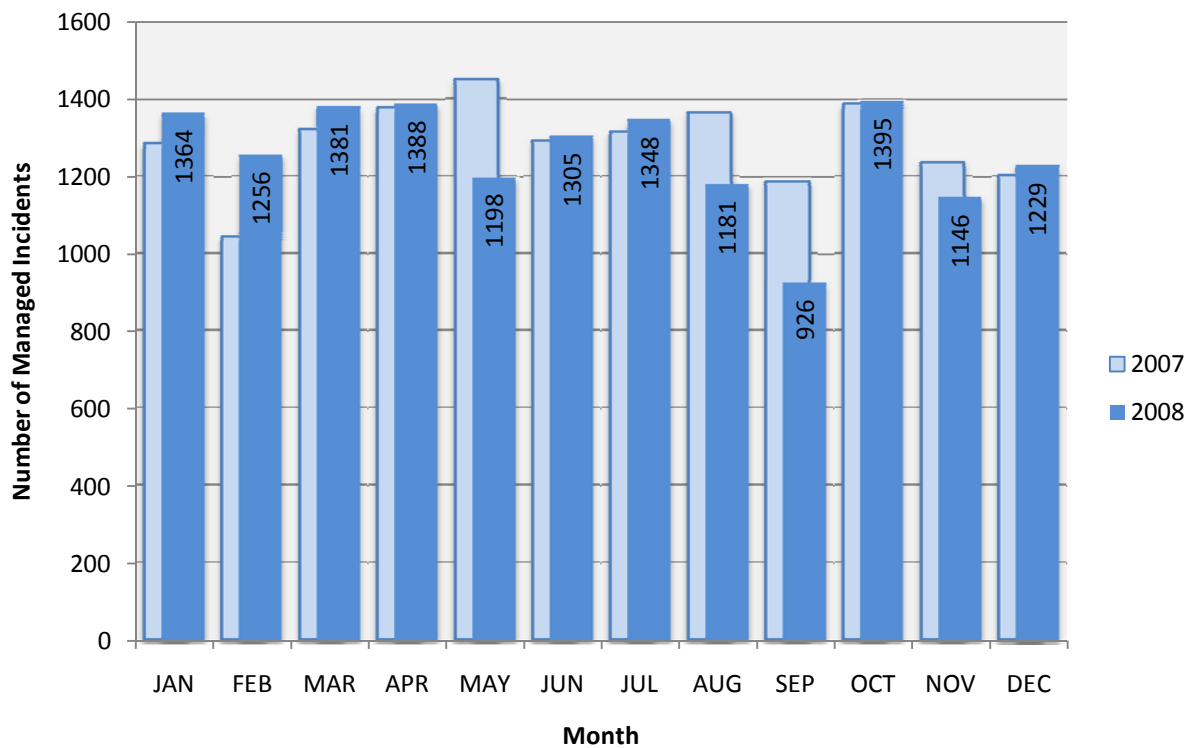


Figure 18. TranStar Managed Incidents by Month, 2007-2008





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, Monday through Friday. The program was expanded in 2005 to include the participation of METRO Police in addition to Harris County Deputies. In 2008, METRO replaced METRO Police with METRO civilian staff members to participate in MAP activity. There were 36,511 RIMS-reported assists handled by MAP in 2008, an increase of about 14.3% from 2007. The RIMS-reported MAP assists are for Harris County Deputy MAP activity only. METRO reported an additional 7,806 assists, but those are not currently entered into RIMS, the TranStar Incident Database. TxDOT operators provide dispatch service to the MAP program. Figure 20 presents MAP assists by month for 2007 and 2008. Figure 21 shows MAP assists by facility for 2007 and 2008.



Figure 19. Motorist Assistance Patrol

Figure 20. RIMS Reported MAP Assists by Month, 2007 and 2008

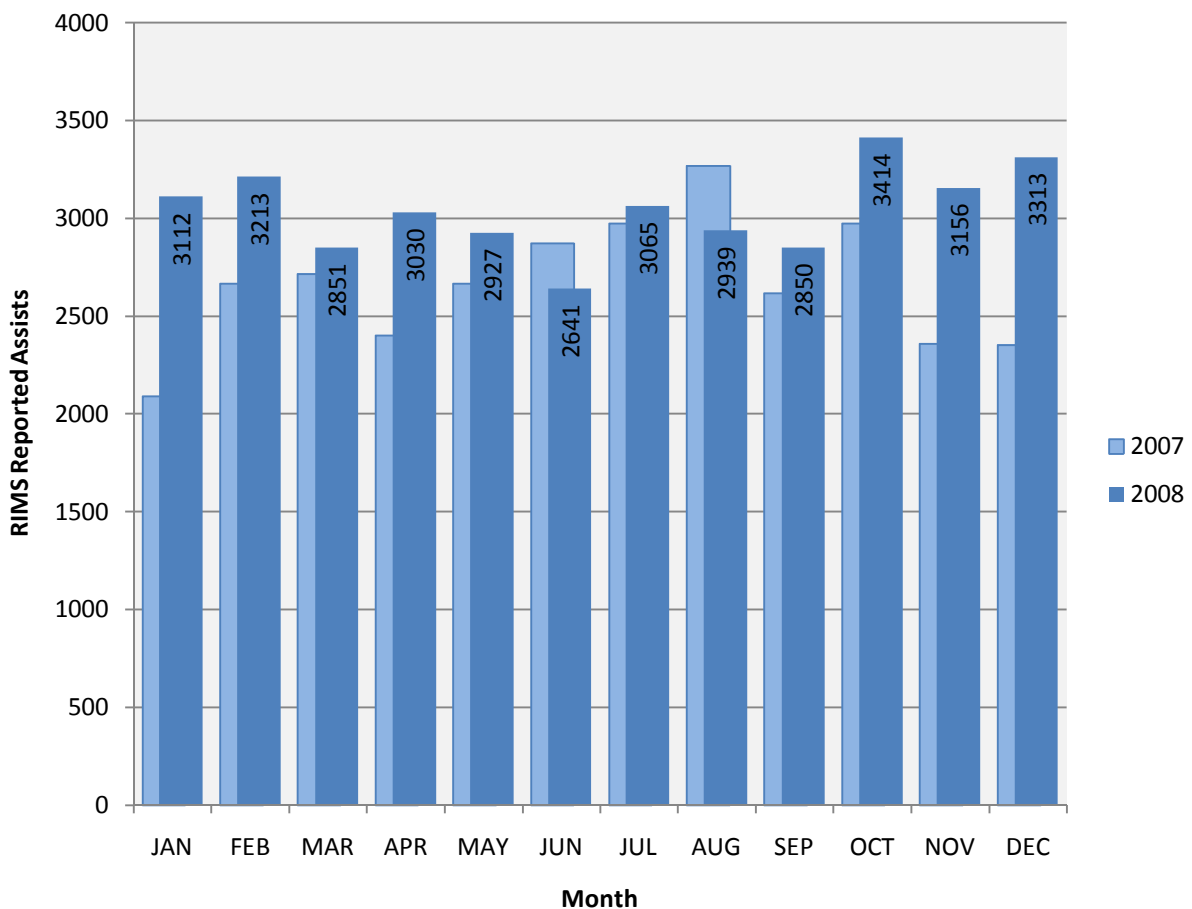
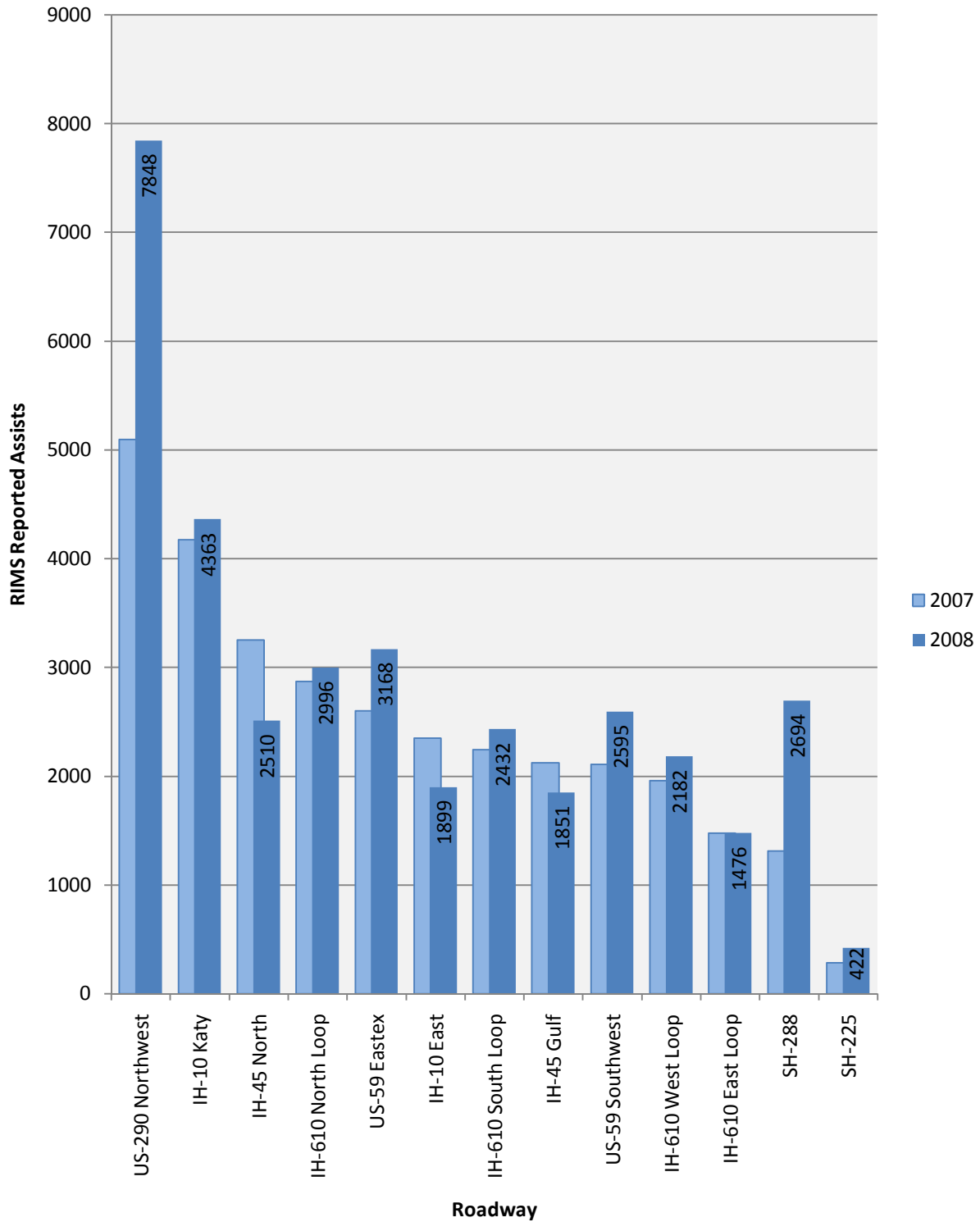


Figure 21. RIMS Reported MAP Assists by Roadway, 2007 and 2008



SAFE Clear

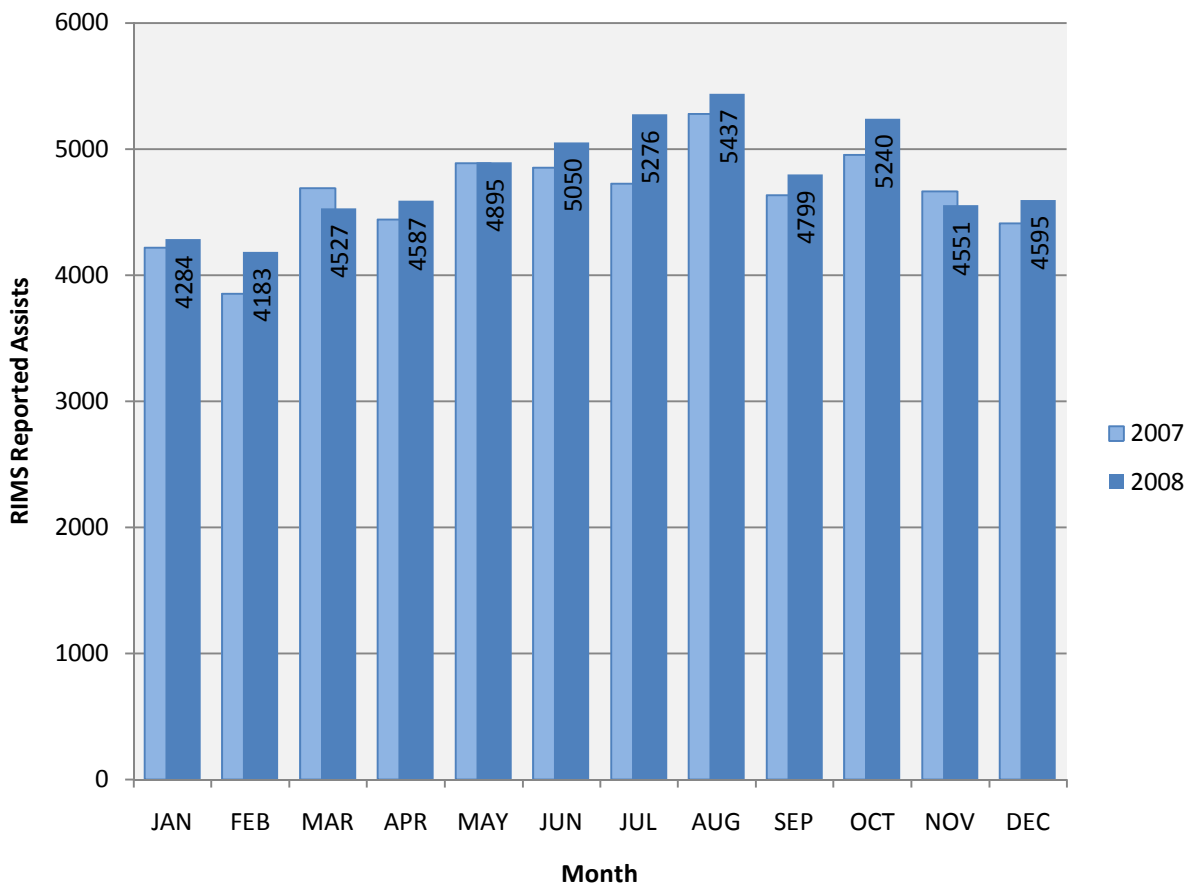
SAFE Clear, the City of Houston’s rapid clearance program, was instituted in 2005. SAFE Clear is intended to bring quick response to disabled vehicles to reduce the occurrence of secondary crashes in the freeway queue.

There were 57,424 RIMS reported SAFE Clear assists in 2008; an increase of 3.2% from 2007 assists. In 2008, the average time from tow authorization to clearance was 18.8 minutes (down 3.9% below the 2007 average). The monthly average ranged from 13 minutes in May to 26 minutes in August. Figure 23 shows 2008 SAFE Clear assists by month.



Figure 22. SAFE Clear Tow Operator

Figure 23. RIMS Reported SAFE Clear Assists by Month, 2007 and 2008



### Emergency Response

The Houston region is vulnerable to natural, manmade, and technological emergencies and disasters. As the region's largest emergency management organization, the Harris County OHSEM Emergency Operations Center and primary offices are located at Houston TranStar. The regional transportation assets and agencies housed at the TranStar facility are strategic partners in numerous local and regional disaster scenarios. Harris County's Joint Information Center, the leading source of vital public information during times of disaster, is also supported by Houston TranStar.



OHSEM stands ready to activate 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 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 residents.



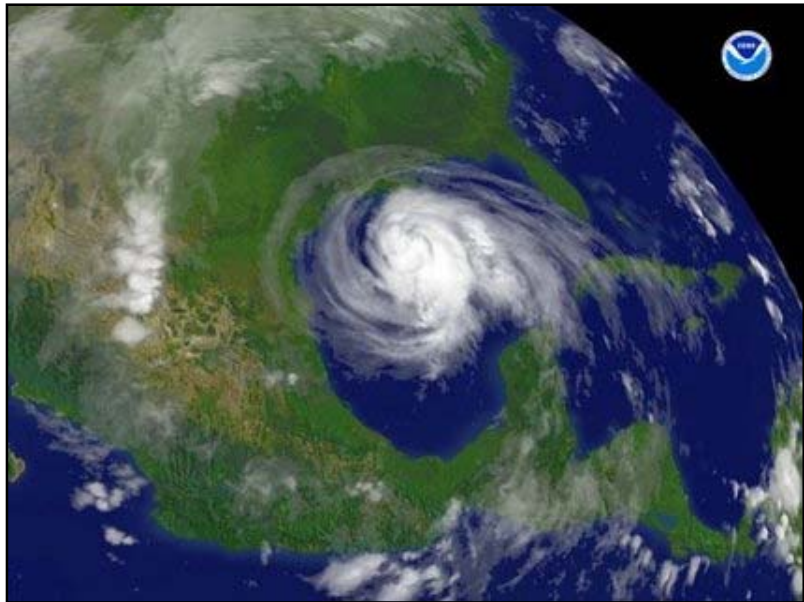
**Figure 24. OHSEM Emergency Operations Center at Houston TranStar**

OHSEM's mission is to help prepare, safeguard, and protect the citizens and property of Harris County from the effects of disasters through effective planning, preparation, response, and recovery activities. To accomplish this mission, in 2008, the Harris County OHSEM:

- Coordinated and maintained the development of a comprehensive emergency management plan;
- Activated and staffed EOC to coordinate and support efforts to respond to and recover from emergencies and disasters;
- Installed, maintained, and monitored the Harris County flood warning system;
- Provided and coordinated the development and delivery of an effective public outreach program;
- Collected, provided, and disseminated information for elected officials, the media, our citizens, partners, and other stakeholders; and
- Trained, educated, and prepared for emergencies through the development and delivery of effective classes, drills, and exercises.

Texas ranks as the state with the highest number of declared presidential disasters, many of which have occurred in Harris County. From severe weather, hazardous materials incidents and other emergencies, OHSEM exercises its basic emergency management plan routinely throughout the year.

During the 2008 hurricane season alone, OHSEM monitored twelve storms and activated for one tropical storm and three hurricanes. Hurricane Ike, making landfall on the Texas coast on September 13, proved to be the third most destructive storm in U.S. history. Harris County hosted more than 500 agency partner representatives in its EOC during that catastrophic hurricane to coordinate one of the region's most successful disaster responses. Harris County's response to Hurricane Ike has earned numerous awards and recognition that will be remembered for years to come.



**Figure 25. Hurricane Ike Barrels Toward Texas, September 2008**  
(NOAA)

OHSEM works hand-in-hand with the Harris County Citizen Corps to strengthen community preparedness. With more than 200 Community Emergency Response Teams (CERT) and over 17,000 trained disaster volunteers, the Citizen Corps is a national best-practice. On September 8, 2008, President George W. Bush recognized the Harris County Citizen Corps for their response to Hurricane Katrina during a ceremony at the White House.

The OHSEM maintains a stream flood monitoring system with more than 170 stream level device stations, 220 rain gauge locations, and 20 wind sensor location sites along the 22 watersheds within and outside 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 OHSEM in a six-county 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 region's offices of emergency management (all city and county Offices of Emergency Management 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.

**TRANSTAR'S ACTIVATION AND RESPONSE FOR HURRICANE IKE**

In late August 2008, a wave emerged off the coast of Africa, intensifying sufficiently in the next few days to be classified as Tropical Depression Nine by September 1. Within another 48 hours the storm intensified to become Hurricane Ike, and it continued west across the Atlantic Ocean. By September 4, Ike was a Category 4 storm with 145 mph winds, making it the most intense storm of the season. Ike then passed over the Turks and Caicos Islands and Cuba before entering the Gulf of Mexico on the afternoon of September 9.

In the next 24 hours Ike grew to an immense size, almost covering the Gulf with its cloud cover. In the next two days, September 10 and 11, Ike made a consistent track toward the Houston-Galveston Area (see Figure 26), with wind speeds of 110 mph (high-end Category 2 hurricane). However, Ike's unusually large wind field created a projected storm surge more compatible with a Category 4 hurricane.

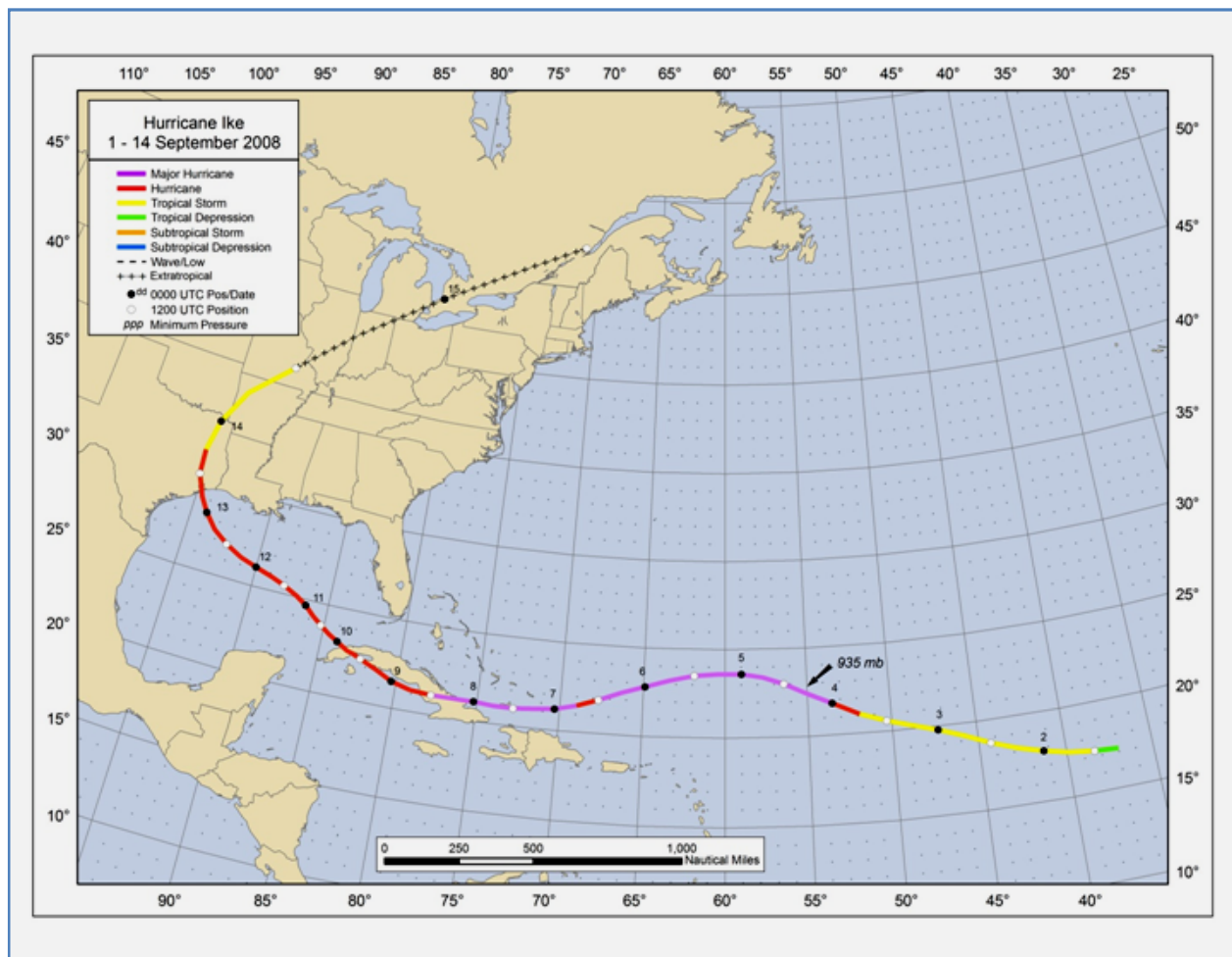


Figure 26. Track of Hurricane Ike (National Hurricane Center)

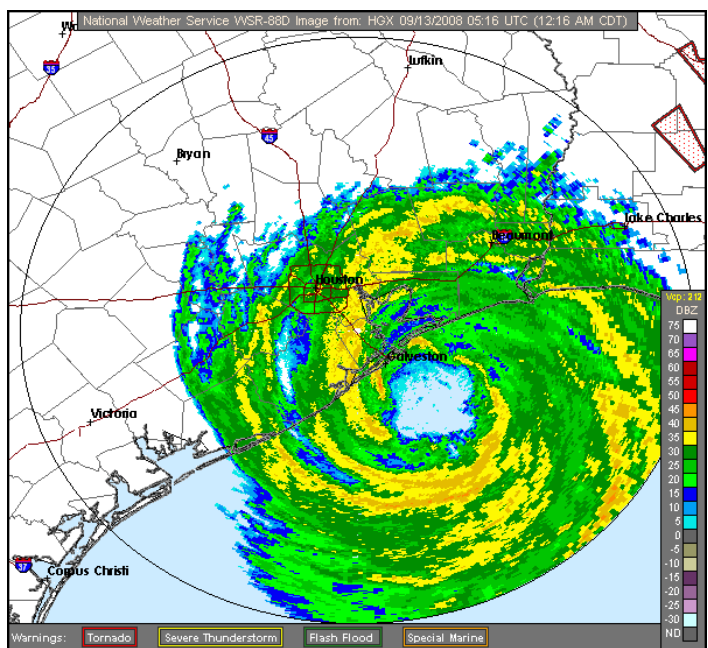
On September 10, U.S. President George W. Bush made an emergency declaration for Texas in advance of Hurricane Ike, making more federal help available for preparations and evacuations. Late on September 10, National Hurricane Center forecast models began to predict Ike making landfall on the west end of Galveston Island. Galveston issued a mandatory evacuation order for the low lying west end of Galveston Island late Wednesday night. Galveston then extended the mandatory evacuation order to the entire island on Thursday, September 11, and subsequent orders were given to evacuate low-lying areas around Harris and surrounding counties from Harris County leadership at TranStar.

During the evening of September 11, the National Weather Service in League City, Texas, issued a strongly-worded bulletin regarding storm surge along the shoreline of Galveston Bay. The bulletin advised that residents living in single-family homes along some stretches of coastal Texas may face "certain death" if they did not heed orders to evacuate. On the morning of September 13, 2008, Hurricane Ike approached the Texas coast near Galveston Bay, making landfall at 2:10 AM. at the east end of Galveston Island. Throughout the Houston-Galveston region, electrical power began failing before 8 PM on September 12, leaving millions of residents without power from days to weeks.

Twelve fatalities were reported in Galveston and Chambers Counties, where the worst storm surge occurred. Several of the deaths were Port Bolivar residents who did not leave after the first evacuation orders and were unable to leave once the rising waters cut off evacuation routes to the mainland. Two deaths were reported inland due to falling trees (in Montgomery and Walker Counties). More than 30 Texans remain missing as of the date of this report.



**Figure 27. TranStar/TxDOT CCTV Views of The Bolivar Island Ferry Landing, 9 am, 9/12/2008 (17 hours prior to landfall)**



**Figure 28. Ike Landfall, 05:16Z, 9/12/2008 (nws)**

In advance of the storm, the Harris County OHSEM coordinated efforts with local, state and federal officials proved to be valuable in its response to Hurricane Ike. Lessons learned from previous events, including the traffic nightmares caused by Hurricane Rita in 2005, paved the way for smoother evacuations. The “Zip Code Zone Evacuation Plan” served as intended, moving about 1.2 million people away from the coastal areas. Contraflow plans were in place and local and state fuel supply coordinators monitored fuel supplies needed for evacuation and re-entry. OHSEM and the TranStar agency partners constantly monitored Hurricane Ike, helping officials determine if and when evacuations would be needed. As the storm approached, evacuations were ordered according to zip codes, helping move coastal residents out first. TxDOT cameras and detectors allowed decision makers at TranStar to monitor evacuation routes and traffic flow. When bottlenecks on evacuation routes were identified, authorities dispatched personnel to areas experiencing problems. Contraflow plans for major evacuation routes (IH-45, IH-10, US-290, and US-59) were ready, but not needed, because traffic moved steadily along the evacuation routes.



**Figure 29. Damage to SH 87 at Rollover Pass Bridge, Bolivar Peninsula**

TranStar partner agencies were extremely busy after the storm. Five days after landfall, TxDOT had only 200 of 1,200 traffic signals in the Houston District operating due to both damage and power outages. TxDOT had to clear 39 miles of debris on Bolivar Highway 87 to allow emergency services to Bolivar Peninsula. TxDOT also removed 100,000 cubic yards of debris from damaged communities along the coast. TxDOT’s largest emergency contract was the restoration of Rollover Pass Bridge on Bolivar, which was severely damaged by Ike. In a period of about two months, both lanes of the bridge were restored. Regionally, freeway congestion was noted to be higher during the initial weeks after the storm as arterials were hamstrung by power outages at traffic signals. Numerous roadway facilities were closed at some point after the storm, including the following:

- SH 87 eastbound and westbound from Bolivar Ferry Landing to SH 124 (closed due to significant roadway damage);
- IH-45-Gulf Freeway south of FM 519 to the Galveston Causeway Bridge (closed to the general public as part of Galveston Island



**Figure 30. Debris on SH 146 in Kemah and Seabrook, 9/13/2008 (ABC News)**



recovery efforts; TxDPS performed credential inspections and only emergency responders and essential personnel were allowed to proceed across the causeway);

- FM 3005/Seawall Blvd from 61st Street to FM 332 (closed to the general public; local law enforcement performed credential inspection and only emergency responders, essential personnel, and residents with proof of local residency were allowed to proceed);
- SH 6 eastbound from FM 519 to IH-45 (closed to the general public; TxDPS performed credential inspection and only emergency responders and essential personnel were allowed to proceed as part of Galveston Island recovery);
- Galveston-Bolivar Ferry Operations (suspended due to storm damage to the landings until hydraulic plants were repaired);
- SH 146 southbound from FM 519 to IH-45 (closed due to roadway damage.); and
- SH 332 eastbound at Pampano Dr. to Bluewater Highway/Ave A/CR 257 (closed in Brazoria County due to high water and damage).



**Figure 31. Traffic Signal Damage, City of Houston (ABC News)**

power issues after Ike. At the end of September, 1,838 of 2,426 signals were operational (75.8%); 366 were operating as flashing signals and 222 remained without power. By mid-October, all the city's 2,426 signals were operating.

The Houston TranStar Website was used for information dissemination before the storm, providing emergency information announcing evacuation timelines and traveler information in support of evacuation. After landfall, the Houston TranStar Website became a primary source of official

After Hurricane Ike, HCTRA and Harris County Traffic Engineering staff worked together to restore inoperable traffic signals critical to Westpark, Hardy, Sam Houston and Ft. Bend toll road operations. Where power or signal repairs were needed, traffic staff assessed the damage and coordinated the responsible agency partners at the City of Houston and TxDOT to expedite needed repairs. The toll road-related work was expanded from frontage road locations to include parallel arterial corridors with signals that needed to be operational prior to the return of toll operations. At the end of September, 96% of all County signals (total 725 in Harris County) were operational: 28 were without power and 1 signal was in red flash. Restoration of all 725 County traffic signals to a basic and safe state of operation took until early October.

City of Houston Traffic forces also experienced widespread damage and

information for the Houston region during re-entry and recovery efforts. The Website was used extensively to announce various roadway closures, emergency operations, points-of-distribution for emergency supplies, and health-related announcements (including boil-water notices and generator use advisories). Some highlight statistics of Website use during the Hurricane Ike event include the following:

- The TranStar Website experienced its highest four-day usage ever from Wednesday, September 10 to Saturday, September 13, 2008, and its two highest one-day access totals on Thursday, September 11 and Friday, September 12, 2008 (see Figure 32).
- During the “Ike Event,” the Website was accessed more than 17.9 million times by more than 1.5 million unique users from September 10 to September 28.
- Accesses for the evacuation/early re-entry from 9/10/2008 to 9/13/2008 were significantly higher than accesses during re-entry from 9/14/2008 forward (see Figure 33). During-evacuation Website accesses averaged 1300% higher than a typical day, while re-entry accesses averaged 225% higher than typical.
- Accesses to the Website peaked between 11 AM and 3 PM on Thursday, September 11 (see Figure 34). At the beginning of the peak, TranStar’s 100 megabit Internet connection began to show signs of overutilization. TranStar Information Systems, with support from the Texas Transportation Institute and Phonoscope, enhanced the connection to 1,000 megabits which sufficiently handled the Internet load for the remainder of the event.
- The TranStar Emergency Web Header for hurricanes was activated on Wednesday, September 10, 2008 at 10:30 AM. The header and its contents were continually updated during re-entry to provide updated information to users.

**Figure 32. All-Time Houston TranStar Website Most Viewed Days**

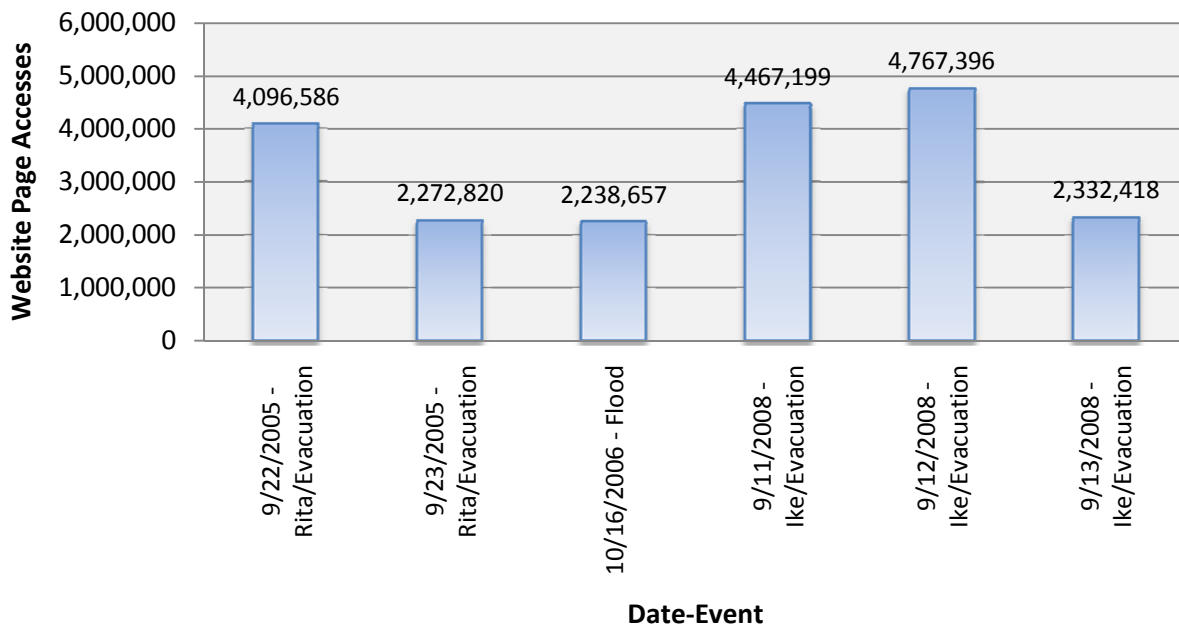


Figure 33. Houston TranStar Website Accesses by Day, September 10-28, 2008

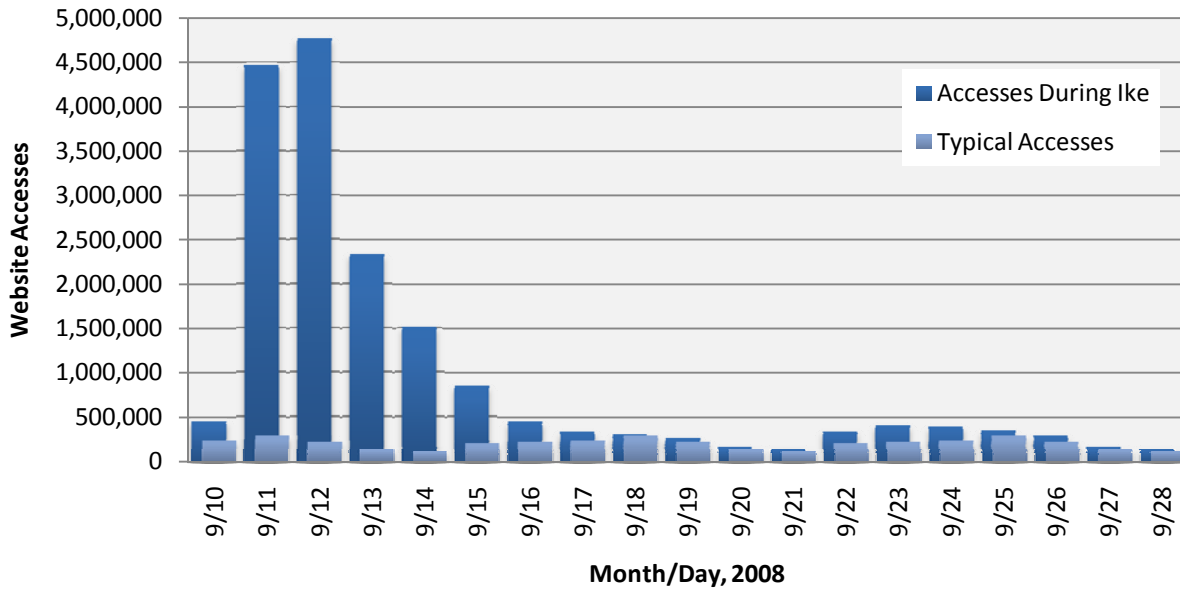
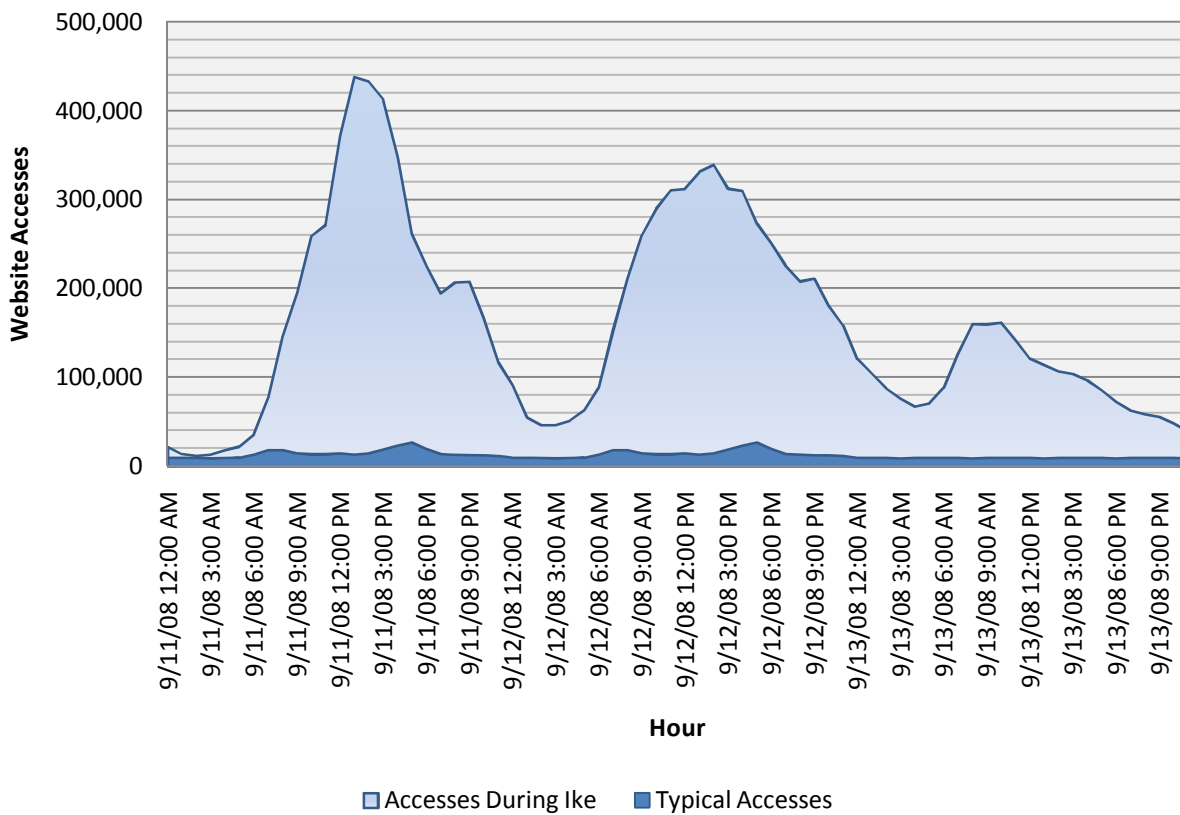


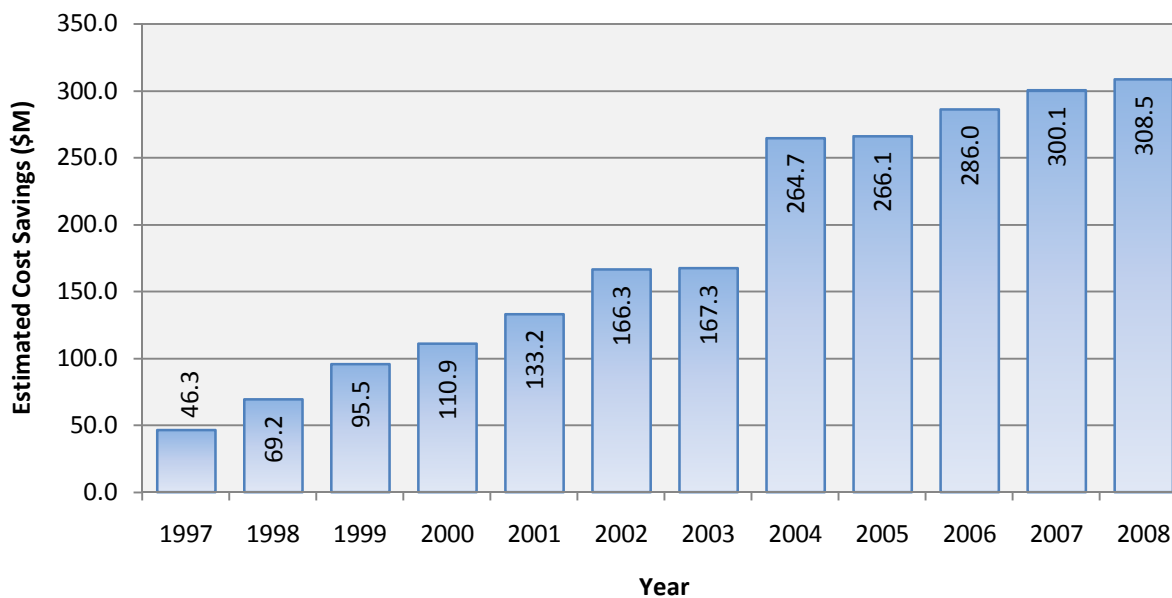
Figure 34. Website Accesses By Hour, September 11-13, 2008



**ESTIMATED TRANSTAR OPERATIONAL BENEFITS**

Determining the benefits of Houston TranStar is treated conservatively because many 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 12 years, this report has used an approach which estimates the operational benefits in terms of freeway motorist delay savings. 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.

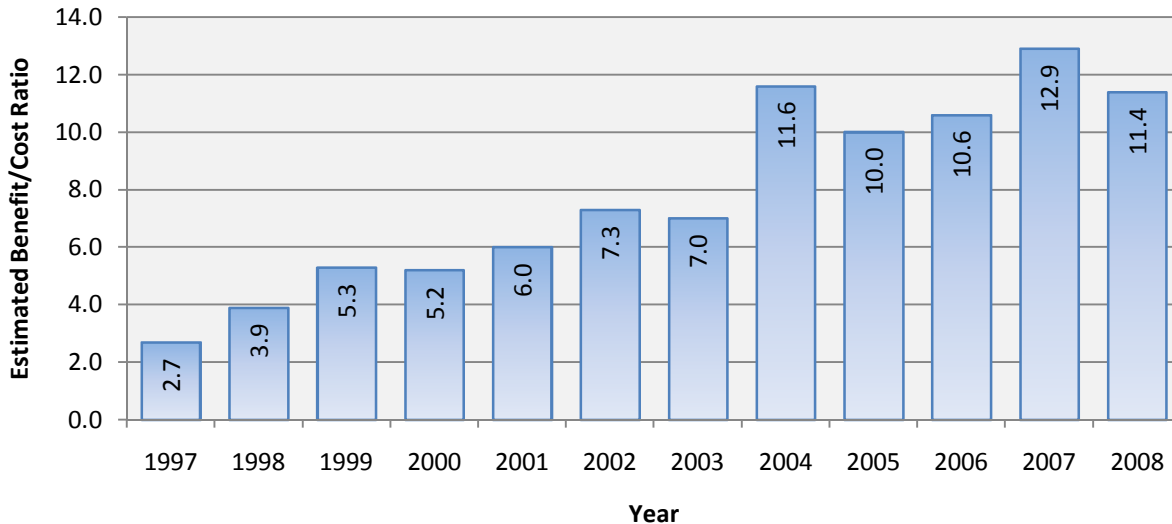
The estimated costs of congestion in the Houston TranStar region were calculated to more than \$557 million in 2008. Annual benefits in the reduction of travel time were estimated to be 11.9 million vehicle-hours with an estimated monetary benefit in excess of \$238 million. The saving in travel time is equivalent to reducing fuel consumption more than 22.2 million gallons, which results in an additional savings of about \$70 million. Thus, the total 2008 motorists' savings was in excess of \$308 million (see Figure 35). Since 1997 (when benefits were first estimated), Houston TranStar has saved Houston area motorists an estimated \$2.2 billion in reduced traveler delay and fuel costs.

**Figure 35. Annual Motorist Cost Savings**

An estimated reduction in the amount of fuel consumed would also result in a reduction of mobile source exhaust emissions. Based on USDOT Bureau of Transportation Statistics, the reduction of 22.2 million gallons of fuel is equivalent to an estimated reduction of 480 tons of hydrocarbons; 3,100 tons of carbon monoxide; and 700 tons of nitrogen oxides.

A benefit/cost analysis for 2008 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 of \$27.1 million is divided into the annual benefit estimate of \$308.5 million, yielding a 2008 estimated benefit/cost ratio of 11.4. Historical benefit and benefit/cost information is illustrated in Figure 36.

**Figure 36. Houston TranStar Benefit/Cost Ratios, 1997-2008**



Since 2004, the benefit/cost ratio of Houston TranStar has ranged from 10.0 to 12.9. In 2008, the benefit/cost ratio is solidly in the middle of this range. Several factors enter into this calculation when comparing 2008 to 2007:

- Motorist value of time increased from \$19.34 to \$20.10 per vehicle-hour (a 3.9% increase).
- The average cost of fuel in the Houston area increased significantly, from \$2.71/gal to \$3.14/gal from 2007 to 2008 (an increase of 16.1%).
- Total measured congestion via the AVI monitoring system decreased from 28.8 to 27.6 million vehicle-hours in the TranStar managed region (a 4.1% decrease).
  - The completion of the IH-10 Katy Freeway reconstruction contributed a 2.2 million vehicle-hours reduction in delay in the TranStar monitored system. This represents a 54.3% reduction in delay on the Katy Freeway when compared to 2007). This reduction in motorist delay significantly contributed to the 4.1% decrease in total TranStar monitored system delay.
  - If we disregard the IH-10 Katy Freeway (because of the large capacity increase due to reconstruction) and compare total TranStar monitored system delay in 2007 to 2008, delay increased 5%, from 24.4 to 25.7 million vehicle-hours.
- Agency managers rated center effectiveness in 2008 as nearly equal to 2007 in most categories; however agency managers remain concerned about staff effectiveness as agencies were not able to maintain adequate staffing levels to address increased responsibilities.