2021 – 2024
Transportation Improvement Program

Appendix B

FAST Act Compliance
and
Performance Measures - System Evaluation Report

Updated January 2021

FIXING AMERICA's SURFACE TRANSPORTATION ACT

Fixing America's Surface Transportation Act's (FAST Act) final planning rules for the Metropolitan Planning Process, the Transportation Improvement Program, and the Regional Transportation Plan (RTP) became effective on May 27, 2018. The FAST Act builds on the changes made by MAP-21 and includes provisions to make surface transportation more streamlined, performance-based, and multimodal. The Act also includes measures to address challenges facing the U.S. transportation system, including safety, maintaining infrastructure condition, reducing traffic congestion, improving efficiency of the system and freight movement, protecting the environment, and reducing delays in project delivery.

The FAST Act requirements include new planning factors – consideration of intercity bus connections, transit asset management, resiliency, and federally required performance targets. H-GAC adopted performance measure targets within the time constraints imposed by FHWA, utilizing the performance-based planning process. As a data clearinghouse, H-GAC will provide regional data to the Texas Department of Transportation when updates become available. The planning factors and H-GAC's compliance are identified in Table B-1.

PLANNING FACTORS

Table B-1: FAST Act Planning Factors

FAST Act Requirement	FAST Act Provision	Issues Addressed in 2021-2024 TIP	Where Addressed
Public Participation	23 CFR 450.316(a)	H-GAC's Public Participation Plan (PPP) was updated in 2017 to expand the list of stakeholders to be engaged in transportation planning process.	Public Participation Plan http://www.h-gac.com/transportation-public-outreach/documents/h-gac-public-participation-plan.pdf
Memorandum of Understanding	23 CFR 40.314(h)	The Memorandum of Understanding was executed between H-GAC, TxDOT and the region's transit providers.	Memorandum of Understanding http://www.h-gac.com/transportation-policy-council/meeting-agendas/documents/2018/may/ITEM-09-Interagency-MOU.pdf
Consultation and Cooperation	23 CFR 450.316(b)	2021-2024 TIP was developed with continued consultation and cooperation with state and local officials and takes into consideration the planning activities of other agencies and organizations within the MPO region.	• Public Participation Plan • Disaster Preparedness • Travel and Tourism
Resiliency and Reliability	23 CFR 450.206(a)(9)	2021-2024 TIP incorporates an assessment of the vulnerability of transportation assets to extreme weather events and identifies initiatives to improve resiliency and increase the reliability of the regional transportation system.	• Resiliency and Reliability

FAST Act Requirement	FAST Act Provision	Issues Addressed in 2021-2024 TIP	Where Addressed
Stormwater Impacts	23 CFR 450.206(a)(9)	2021-2024 TIP identifies roadways susceptible to impact by stormwater and includes a choice of projects and strategies aimed at mitigating these impacts.	• Resiliency and Reliability
Disaster Preparedness	23 CFR 450.316(b)	2021-2024 TIP identifies local emergency management operations serving the Houston-Galveston metropolitan region, details the designated hurricane evacuation routes and the Zip-Zone map.	• Disaster Preparedness
Travel and Tourism	23 CFR 450.206(a)(10)	2021-2024 TIP includes a review of opportunities to engage in recreational travel and tourism in the planning region and considers strategies to promote growth in this transportation sector.	• Travel and Tourism • Public Participation Plan http://www.h-gac.com/transportation-public-outreach/documents/h-gac-public-participation-plan.pdf
Intercity Buses	23 CFR 450.216(b) & 23 CFR 324(f)(2)	2021-2024 TIP examines the existing intercity bus services in the region and identifies opportunities to expand these services and grow additional routes and operations.	• Intercity Buses
Performance Measures	23 CFR 450.324(f)(3)	2021-2024 TIP includes the federal performance measures linked to the vision, goals, and project prioritization, establishes targets and documents the condition and performance of the transportation system.	• Performance Measures System Evaluation Report

IMPROVE RESILIENCY AND RELIABILITY

One of the FAST Act's planning factors is to improve the resiliency and reliability of the transportation system and reduce or mitigate storm water impacts on surface transportation. Resiliency is defined as: "the ability of transportation infrastructure to maintain operations and be able to recover from disasters."

It is anticipated that due to a changing climate, extreme weather events will intensify and occur with greater frequency. In response, H-GAC's ongoing resiliency planning effort proposes strategies to mitigate the effects of flooding and other extreme weather impacts and incorporates a process to provide the responsible parties with regular update reports.

In 2017, Hurricane Harvey had a major impact on transportation networks and severely disrupted the movement of people and goods across the H-GAC's Metropolitan Planning Area. All twenty-two major bayous in Houston spilled over their banks with some exceeding 10 feet above the channel banks. Other recent major flooding events have been Tropical Storm Imelda, the Tax Day Flood, Memorial Day Flood, Hurricane Ike, and Tropical Storm Allison.

Expected Impacts to Transportation Infrastructure

Due to its low-lying coastal geography and semi-tropical climate, the Houston-Galveston region is vulnerable to extreme weather events like heat, drought, tropical storms, and flooding. The risk of these extreme events impacting the region's population, economy, and transportation infrastructure is expected to heighten because of the amplification of related stressors − land use change, explosive population growth, congested transportation systems, and climate change. Transportation systems and infrastructure are particularly vulnerable to extreme weather events. With the projected rise in sea level, temperature increases, and frequency of severe storms, it is anticipated that transportation services and infrastructure will suffer more frequent disruptions or permanent damage which would seriously impede the movement of goods and people throughout the region. A summary of expected impacts is shown in Table B-2.

Table B-2: Impact of Extreme Weather Events on Transportation Infrastructure

Expected Climate & Extreme Weather Impacts to Transportation Infrastructure		
Climate Variable	**Projection**	**Impact on Transportation Infrastructure**
Relative Sea Level	Over the last century, sea level at Galveston has risen more than 26 inches, which is significantly greater than the global average. In the next 50 years, Gulf Coast sea levels are expected to rise by 1 to 6 feet.	A 4-foot increase in relative sea levels would put a quarter of the region's interstates, 10 percent of rail lines, and nearly 75 percent of port facilities at risk.
Temperature	On average, the region already experiences more than 100 days above 90 °F per year. Average temperatures could increase 2° to 4°F by 2050. Temperature increases will be most severe in highly urbanized areas due to the heat island effect.	Higher temperatures will result in higher construction and maintenance costs. At temperatures above 90°F, highways, bridges, and rail lines deteriorate more quickly. Extreme heat can cause immediate damage such as buckling.
Hurricanes and Tropical Storms	Expected to become from frequent and powerful as the Atlantic Ocean and Gulf of Mexico warm.	Associated extreme rainfall, strong winds, and coastal flooding will damage infrastructure, cause road and evacuation route closures, and overwhelm storm drains.
Precipitation	Heavy rainfall events and droughts have increased; this trend is expected to continue with longer dry periods between extreme rain events.	Heavy precipitation can result in flash floods with impacts ranging from inconveniences (temporary road closures and transit service disruptions) to permanently destroyed infrastructure. Extreme rain events are also correlated to a higher incidence or crashes and delays.
Sources: • Transit and Climate Change Adaptation: Synthesis of FTA-Funded Pilot Projects, August 2014, FTA • The Gulf Coast Study Summary, Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: The Gulf Coast Study, Phase 1 Completed in 2008, FHWA • Gulf Coast Climate Change Adaptation Pilot Study, August 2013, FTA • Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I, March 2008, The Climate Change Science Program		

Understanding the region's risk to extreme weather, in 2010, H-GAC and local partners established resiliency as a regional priority in the "Our Great Region 2040" plan and adopted increasing the region's resiliency to disaster and a changing environment as a major goal. H-GAC planning reports such as "Our Region 2040" and the "Foresight Panel on Environmental Effects" analyze the impacts of weather on the region and its transportation system.

Regional Response to Federal Resiliency Requirements

To meet federal requirements, H-GAC is incorporating resilience into its transportation planning in the following ways:

a. **Transportation Resilience and Durability Assessment Study**

In 2018, the Houston-Galveston region was selected to participate in a Federal Highway Administration's (FHWA) Resiliency and Durability Pilot Project. As part of this project, H-GAC worked with federal, state, and local partners to conduct a vulnerability and criticality assessment of transportation assets in the MPO region.

The vulnerability assessment used FHWA's Vulnerability Assessment Scoring Tool (VAST) and methodology, considering the factors of exposure, sensitivity, adaptive capacity, economic impact, and risk. Resiliency recommendations will be developed based on the results of the vulnerability and criticality assessments. Results will also be used to help prioritize funding decisions for future transportation projects.

Work on the Resiliency and Durability Pilot Project commenced in Winter 2018 and should be completed by late Summer 2020. More information about the Transportation Vulnerability Assessment can be found at http://www.h-gac.com/resiliency-planning.

b. **Working Group**

In 2019, H-GAC formed a transportation resiliency working group with the initial goal of developing a multi-year strategy to meet resiliency-related federal requirements and identify additional resiliency efforts that would reduce risk and improve safety in the region. Through the working group, H-GAC will host workshops, coordinate resiliency work with emergency management (preparedness and response) efforts, develop a plan to reduce and mitigate storm water impacts on surface transportation and other related community emergency responses.

c. **Texas Resiliency and Planning Workshops**

H-GAC has participated in several resiliency workshops hosted by FHWA, TxDOT, the Texas A&M Transportation Institute (TTI), and other Metropolitan Planning Organizations. The purpose of these workshops has been to exchange information, data sources, and resiliency strategies. As part of its transportation resiliency agenda, H-GAC works to foster a dialogue about mitigating vulnerability regionally.

d. **Cedar Bayou Initiative**

The Cedar Bayou Initiative is a partnership of public and private sector stakeholders in the Cedar Bayou watershed. Its purpose is to identify and pursue priority projects to improve flood management, resiliency, and transportation goals throughout the Cedar Bayou watershed and the greater Chambers, Liberty, and Harris Tri-County area. For more information about this initiative: http://www.h-gac.com/cedar-bayou-initiative/default.aspx Projects identified in 2018 can be grouped into three major categories:

- Dredging and other improvements to the main channel of Cedar Bayou, its tributaries and drainage channels.
- Stormwater infrastructure, detention, and runoff quality improvement.
- Improvements to transportation infrastructure to reduce flooding and improve evacuation capacity.

e. **Designing for Impact**

H-GAC is involved in the "Designing for Impact" study which is exploring strategies to reduce the impact of stormwater on the Houston-Galveston metropolitan region's infrastructure. Working

through a voluntary partnership of engineers, developers, architects, landscape architects, municipal and county representatives, the project is examining the Low Impact Development (LID) strategy as an effective and economically advantageous approach to addressing the region's stormwater containment problems.

Disaster Preparedness

H-GAC is addressing extreme weather preparedness, mitigation, and evacuation through programming and regional partnerships. H-GAC, the Texas Division of Emergency Management (DEM), and 85 local governments collaborated to develop a comprehensive Regional Hazard Mitigation Plan[1]. The plan identifies regional hazards and vulnerabilities and includes over 300 mitigation projects that could be implemented within the Houston-Galveston metropolitan region.

The "Together Against the Weather"[2] outreach campaign was initiated to help individuals with disabilities and other special needs plan for disruptions caused by hurricanes, floods, and other weather-related emergencies. The program encourages the formation of supportive partnerships that involve family members, community organizations, health care providers, and emergency management personnel, and recommends strategies for addressing the challenges that commonly arise during periods of emergency evacuation. Together Against the Weather offers several tool kits that include educational videos presented in English, Spanish, Vietnamese, and Chinese. Links are also provided to state, county, and municipal offices of emergency management. More information is available at: http://www.togetheragainsttheweather.com/index.shtml.

As a web clearinghouse, the Together Against the Weather campaign offers service providers, emergency management officials, churches, and healthcare providers with materials to help at-risk populations in the event of a major hurricane landfall. Helpful resources available through the program include preparedness information, evacuation route maps, and links to the Office of Emergency Management. A goal of preparedness for natural disasters is also found in the Comprehensive Economic Development Strategy (CEDS}[3] and emphasizes affordable approaches to reducing vulnerability such as using natural landscape for absorbing floodwaters and storm surge and making smarter decisions regarding building locations. For protecting key infrastructure assets, the recommended approach is one that carefully targets structural solutions that keep costs lower. Another supporting strategy is to assist local governments to conduct economic vulnerability assessments, encompassing vulnerability to natural disasters. Along with reducing vulnerability risk, preparedness strategies involve speeding the rate of recovery to improve safety and quality of life.

H-GAC provides interactive mapping tools such as the Regional Flood Information viewer (see Fig. B-2) which portrays critical facilities including transportation, high-density areas, and vulnerable populations.

[1] Regional Hazard Mitigation Plan: http://www.h-gac.com/regional-hazard-mitigation-planning/
[2] Together Against Weather campaign: http://www.togetheragainsttheweather.com
[3] Comprehensive Economic Development Strategy https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf

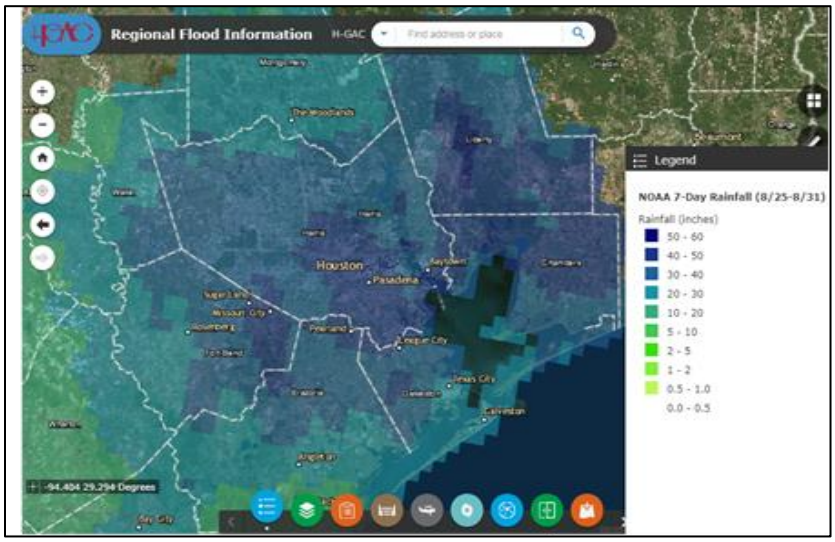

Figure B-2: 7-Day Rainfall Totals from Hurricane Harvey

H-GAC also administers the Homeland Security Planning program which promotes regional planning and response to man-made and natural disasters. The Regional Homeland Security Coordinating Council (RGSCC) assists and advises elected officials in their decision-making responsibilities on matters related to regional homeland security. H-GAC is working closely with individual counties in the development of Hazard Mitigation Plans and will continue to aid and assist the process of updating these plans.

Evacuation Plan

Evacuation routes are designated by the Texas Department of Public Safety (DPS) in coordination with local counties and municipalities. These routes are designated to evacuate the H-GAC 13 - County Regional Planning Area in the event of a natural or man-made emergency or other threats to public safety. The H-GAC Regional Planning Area has 24 signed state roadways designated as evacuation routes (Figure B-3). These evacuation routes are described in a Texas DPS Emergency Evacuation Traffic Management Plan. Houston TranStar serves as the regional emergency center and houses multi-agency operations that manage traffic incidents and respond to regional emergencies such as hurricanes and floods.

H-GAC coordinates with counties, municipalities, and the state to manage the database of regional evacuation routes and is responsible for periodic updates to the Emergency Evacuation Traffic Management Plan. H-GAC also administers the Regional Evacuation Viewer − a secure web application which provides near real-time updates of evacuation resource deployment and other related information. Users of the viewer can access current Evacuation Traffic Management Plans by county, city or corridor.

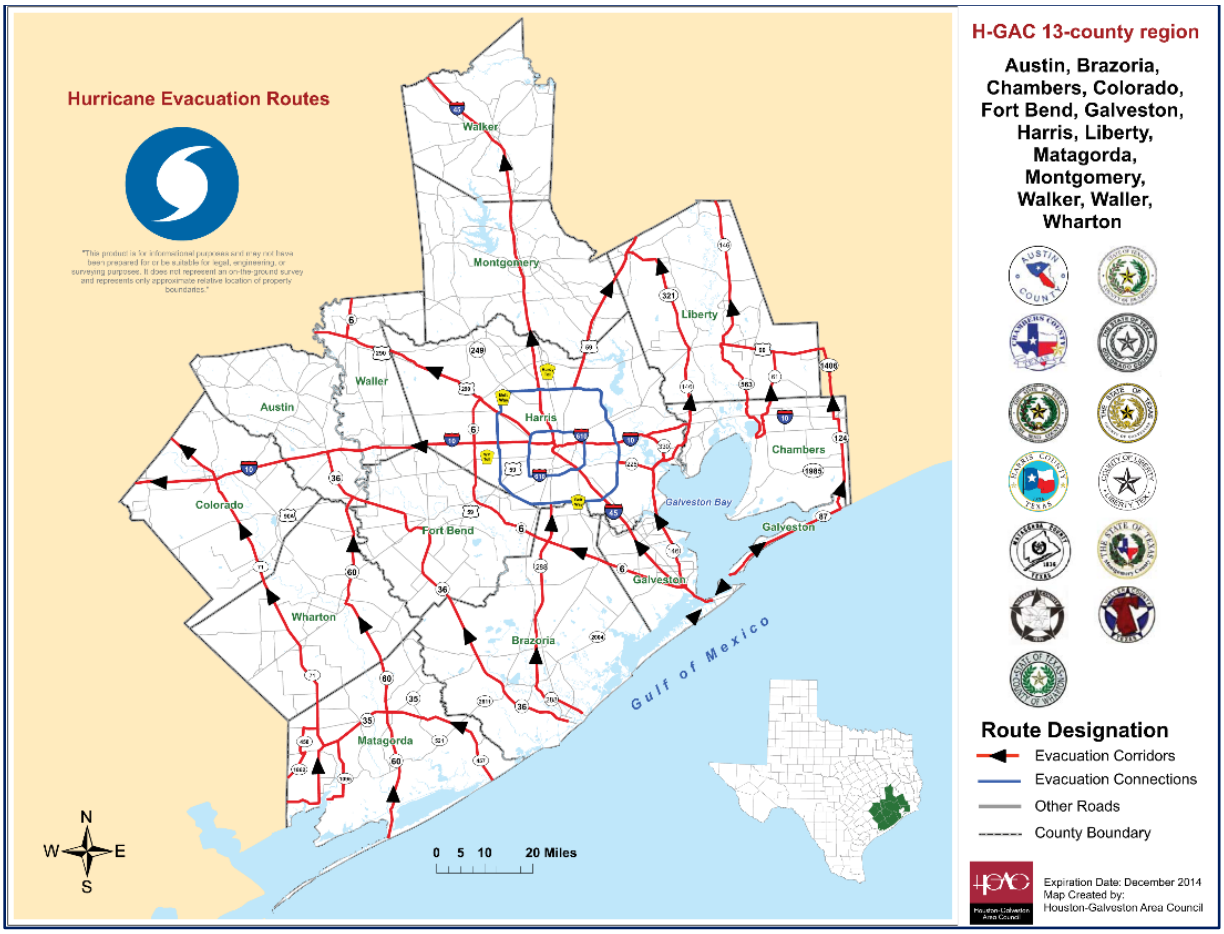

Figure B-3: H-GAC Hurricane Evacuation Routes

Hurricane Surge Zone Map

Each year, H-GAC produces a Hurricane Surge Zone Map (or "Zip-Zone Map") for distribution to the public (Figure B-4). The Zip-Zone Map is a public information tool which shows the parts of the H-GAC planning region that are most at risk for hurricane-related storm surges over a base map of postal zip codes. The Hurricane Surge Zone Map is super-imposed with the officially designated evacuation corridors and evacuation connections. Designation as an evacuation route is one criterion used in the H-GAC Regional Transportation Plan (RTP) for prioritizing capital improvement projects. It is a critical safety issue that regional evacuation routes are in good shape and have adequate capacity to handle the high levels of traffic that often ensue in a regional emergency.

The Zip-Zone map will typically be used by elected officials and emergency management personnel to conduct a phased evacuation of coastal counties based on the zip codes of the residents.

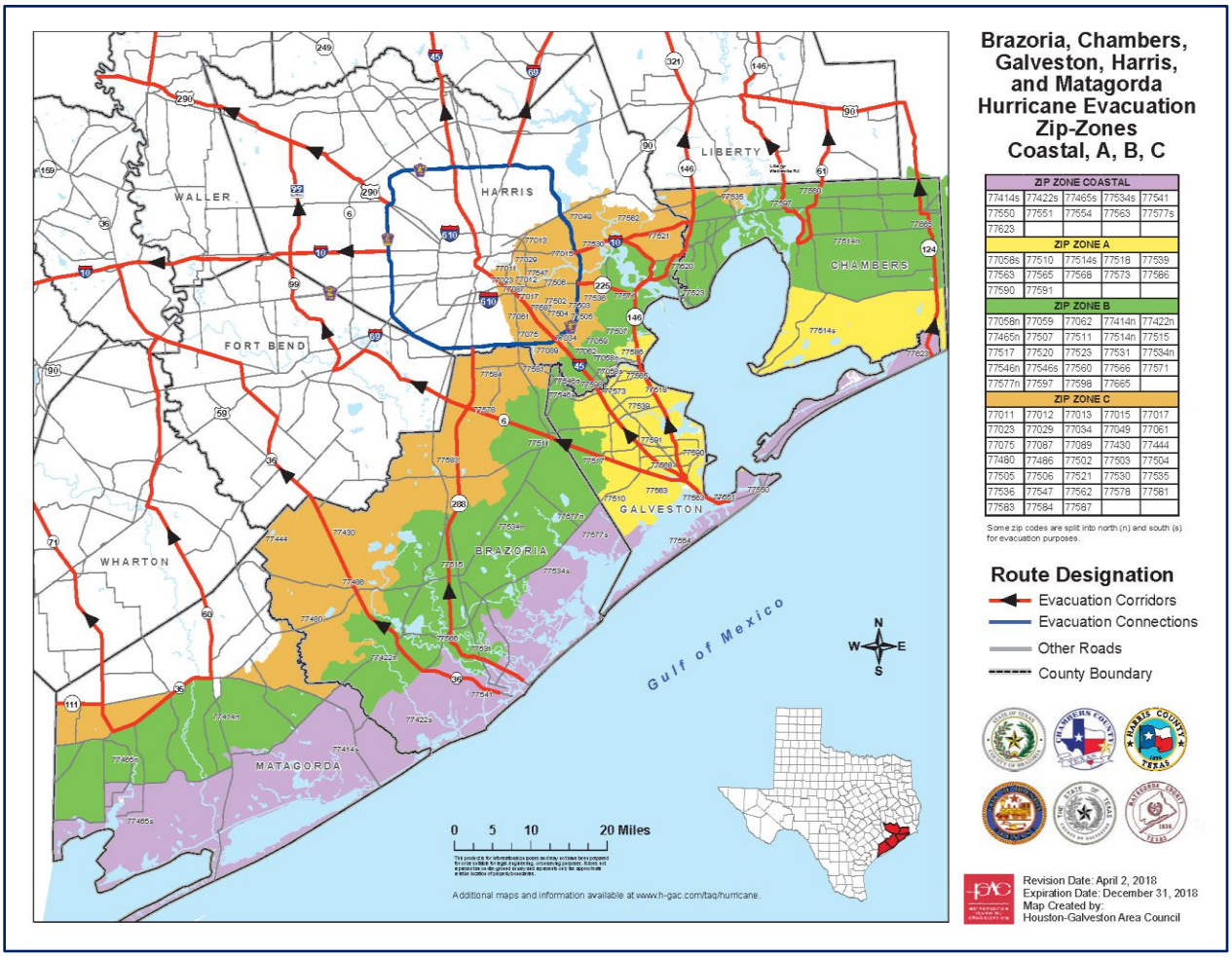

Figure B-4: H-GAC Hurricane Evacuation Zip Zone Map

ENHANCE TRAVEL AND TOURISM

The regional transportation network is an integral component of the tourism industry. The H-GAC MPO participated in a consortium to develop the "Our Great Region 2040" plan, consisting of a 24-member partnership who comprised a coordinating committee, government advisory committee, members of the public, local leaders and regional workgroups. Transportation strategies related to travel and tourism that emerged from the study include[4]:

- Optimize existing transportation network through a FIX IT First strategy and by using technology and improved incident management to maximize system capacity.
- Create a regional framework for expanding transit across the Region.
- Develop and implement policies to improve transit, pedestrian, and bicycle access between and within activity centers, connecting residents to job centers.
- Include economic, safety, and quality of life costs and benefits of transportation projects in funding prioritizations.

Travel and tourism is a growing industry in the Houston-Galveston metropolitan region and produces a large infusion of money to the local economy while providing for hundreds of jobs. The Houston-The Woodlands-Sugarland metropolitan statistical area attracts 18.3 million vistors annually and generates up to $1.1 billion in local and sales tax revenue. Local attractions include the museums, visual and performance arts, community festivals, sports (including special events such as the super bowl, final four, professional golf association tournaments, college and professional football, baseball and basketball), and world renown cuisine. Other local attractions include the Kemah Boardwalk, the Houston Livestock Show and Rodeo, Houston Zoo, Brazoria National Wildlife Refuge, George R. Brown Convention Center, shopping malls, NASA Space Center, and Galveston Cruise Terminals, (see Figure B-5). Galveston Island saw 6.5 million vistors in 2016. Almost 14 percent of these visitors were cruise travelers – an increase of 5 percent over the previous year.[5] In addition, people come from around the globe for medical treatment to the largest medical complex in the world, the Texas Medical Center with over 10 million patient visits per year.[6] Travel originating from outside the region is also generated from a significant business presence that includes five Fortune 500 companies and many high-density employment centers. The tourism industry supports more than 140,000 jobs in our region and contributed $16.5 billion to the local economy in 2017.[7]

The H-GAC 2045 Regional Transportation Plan has substantial investments dedicated to improve the roadway, transit, bicycle and pedestrian capacity that provide access to major attractions such as universities, medical facilities and other essential destinations mentioned above. The Economic Development Strategy (CEDS) and "Our Great Region 2040" plan regard tourism as regional needs and provide strategies and recommendations for further travel and tourism improvements. The H-GAC metropolitan planning region has also seen a host of local planning activities supported by Economic Development Administration grants and similar funding geared toward furthering economic development to attract business and encourage tourism.[8] Similar programs are being implemented by the Cities of Houston, Bay City, Conroe , Dayton, and Galveston among others.

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[4] http://www.ourregion.org/download/OurGreatRegion2040-FINAL.pdf (pages 30 and 31)
[5] https://www.chron.com/neighborhood/bayarea/news/article/Galveston-hits-record-high-tourism-revenues11175775.php
[6] http://www.tmc.edu/wp-content/uploads/2018/07/TMC_FactsFiguresOnePager_07052018-1.pdf
[7] https://www.visithoustontexas.com/media/press-releases/post/record-218-million-visits-to-houston-in-2017/
[8] http://www.h-gac.com/gulf-coast-economic-development-district/regional-economic-development-plan.aspx (page 13)

An engagement process soliciting the feedback of public officials and members of the public was utilized to perform a SWOT analysis, helping to shape the goals and stratgies of the CEDS. These goals have been aligned with the "Our Great Region 2040" plan, including the preservation of natural resources especially along waterways to promote recreation and tourism opportunities. One of the strategies suporting natural resource preservation recommends the creation of a regional campaign to promote eco-tourism, coastal, and wildlife tourism options across the region.

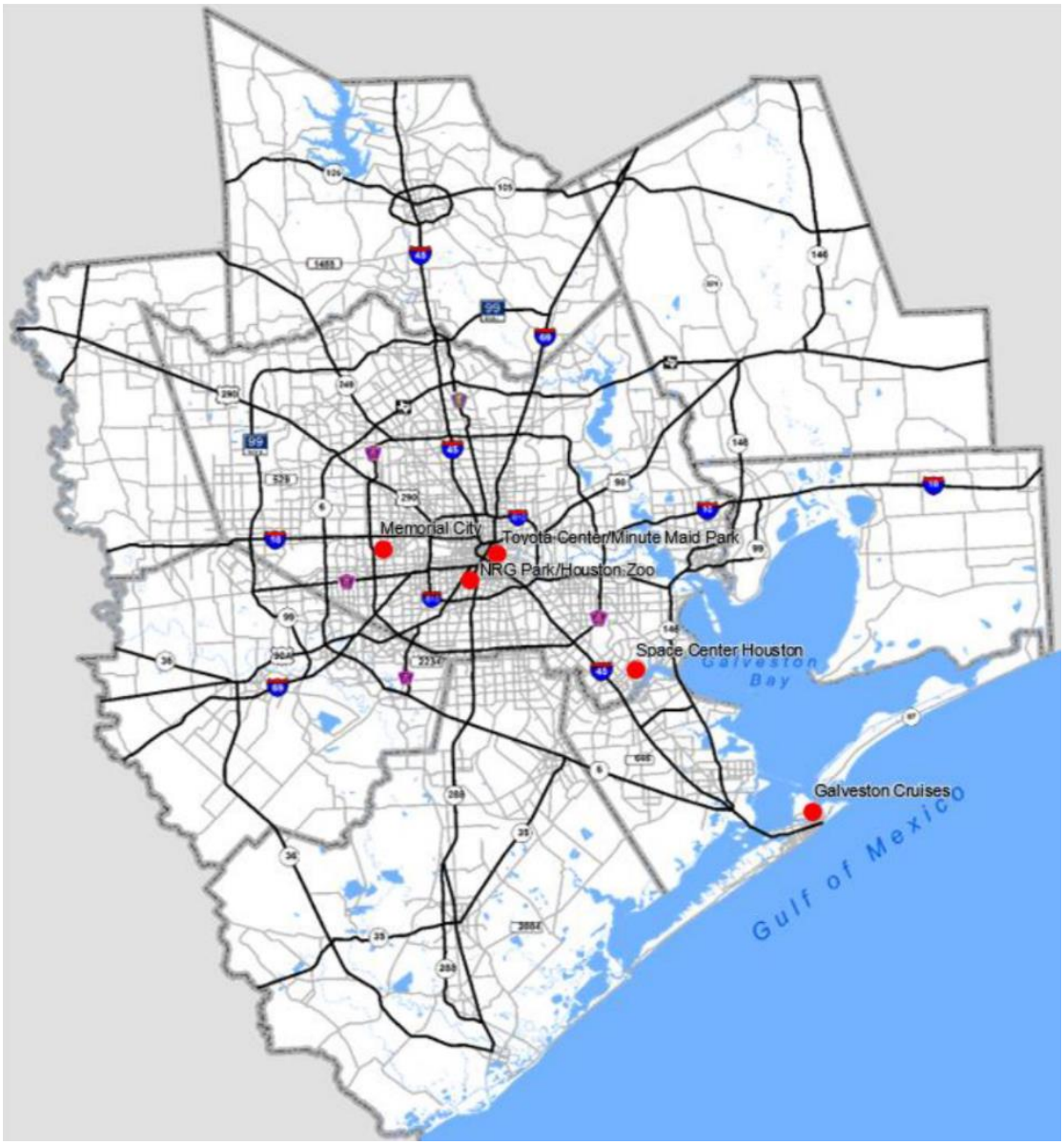


Figure B-5: Local Travel and Tourism Destinations

INTERCITY BUS INITIATIVES

Federal planning guidelines now require the "consideration of the role that intercity buses may play in reducing congestion, pollution and energy consumption in a cost-effective manner and strategies and investments that preserve and enhance intercity bus systems including those that are privately owned and operated".[9]

The Houston-Galveston region has been the location of an innovative intercity bus project between the Brazos Transit District and a private organization for several years. The Charles Wilson Veterans Administration (VA) Shuttle bus provided 12,389 passenger trips in 2017 for disabled veterans traveling from Lufkin, Texas to medical appointments at the VA hospital in the Texas Medical Center in Houston (Figure B-6). The veterans are transported daily along the 248 mile route (round trip) at no-cost to them.

Figure B-6: Charles Wilson VA Shuttle

Based on prior planning studies, there are several other emerging opportunities in the Houston-Galveston region to establish similar mobility options for veterans and other residents along major freeway corridors into Houston. These opportunities would involve developing new working and planning relationships with representatives of private inter-city carriers such as Greyhound and Trailways bus lines, to incorporate intermediate stops along their established routes.

Several locations within the H-GAC planning region have been identified as potential sites for intermodal terminals that could serve as those intermediate stops. One potential location is along the Interstate Highway 10 East Corridor, near State Highway 146, between the Cities of Houston and Beaumont. That location was identified in the Transit Plan for Liberty and Chambers counties as a potential site for a multi-modal transfer facility that would facilitate north-south and east-west travel patterns.[10]

Passengers through that proposed facility would be provided with options to transfer to-and-from local and express buses in addition to access to carpools, vanpools, taxis and other multimodal options.
Another potential location for an intermodal terminal was identified in the Interstate Highway 45 North Freeway corridor at the City of Huntsville. This location was recommended in the Walker County Transit Plan which envisioned moving the current Greyhound bus terminal from a small facility located near the center of historic downtown Huntsville, to a larger multimodal facility closer to the I-45 Freeway corridor.[11]

[9] [23 U.S.C. 134(i)(2)(H)]
[10] Liberty County Transit Plan, Houston-Galveston Area Council (H-GAC), 2009; Chambers County Transit Plan, H-GAC, 2009.
[11] Walker County Transit Plan, H-GAC, 2012.

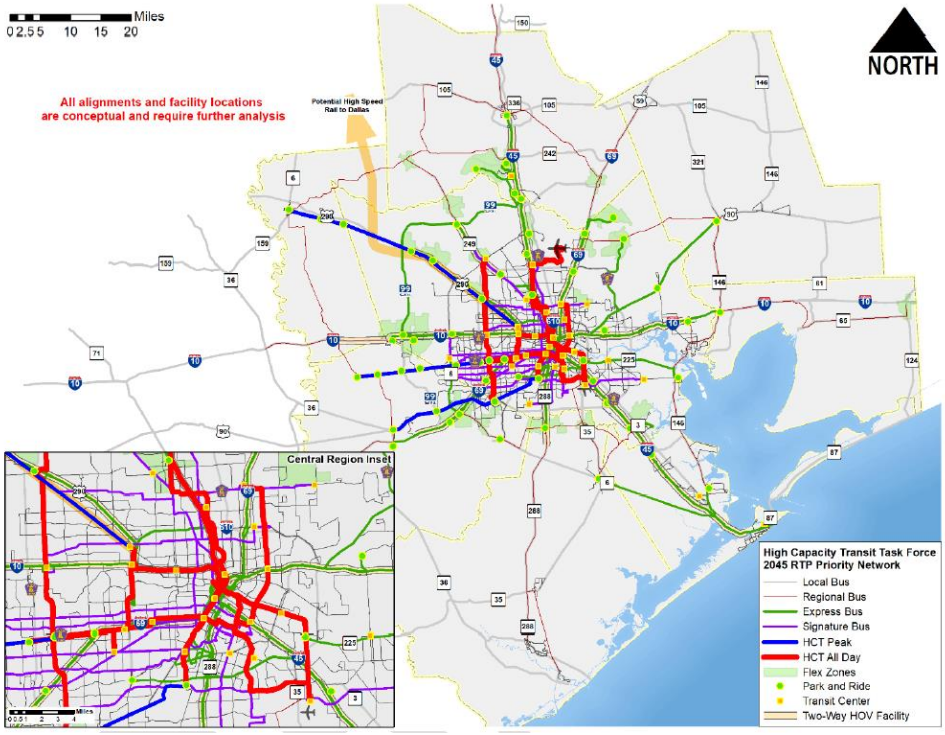
High Capacity Transit

The High Capacity Transit Task Force was created by the H-GAC Transportation Policy Council to research the need and opportunity for high capacity transit in the MPO planning region and, produced a financially constrained Priority Network for comprehensive regional transit service. The Priority Network, shown in Figure B-7 below, was incorporated into the 2045 Regional Transportation Plan as its transit element. The services specified in the High Capacity Transit (HCT) Priority Network are mode-, technology- and alignment neutral. All recommendations in the Priority Network are conceptual and are subject to further analysis and design. For more information, the High Capacity Transit Summary Report is located at http://www.h-gac.com/high-capacity-transit-task-force/default.aspx.

The Priority Network contains a variety of service types, including Express and Regional Bus services connecting outlying communities to the region's core as well as to each other. These Express and Regional services are intended to provide transit service to all eight counties in the H-GAC metropolitan planning area. Eventually, those express bus or cross-county routes could be designed to provide feeder bus services to larger multimodal terminals along the interstate highway system.

In addition to the proposed multimodal facilities and feeder bus routes, another option for future planning considerations would develop a regionally coordinated fare system. Under the coordinated fare system, potential customers for the intercity bus services could pre-purchase their fares for each segment of their trip from origin to destination. The concept of a coordinated or seamless fare system could include travel options for more than one service provider or more than one mode of transportation.

Figure B-7: High Capacity Transit Task Force Priority Network



PERFORMANCE MEASURES SYSTEM EVALUATION REPORT

The Moving Ahead for Progress in the 21st Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Act legislations introduced Transportation Performance Management into the Federal Highway Program, addressing challenges that face the transportation system on a national level, including:

- Improving safety
- Maintaining infrastructure condition
- Reducing traffic congestion
- Improving the efficiency of the system and freight movement
- Protecting the environment

The objective of transportation performance management is to focus federal funds on the achievement of national goals, increase accountability and transparency, and improve investment decision-making through performance-based planning and programming of transportation projects. The federal rulemaking requires metropolitan planning organizations and state departments of transportation to set targets for several performance measures and to periodically report on the progress made towards achieving those targets. H-GAC has the administrative responsibility for performance measures in the key areas of Safety, Pavement and Bridges, Reliability, Congestion, Air Quality and Transit Asset Management.

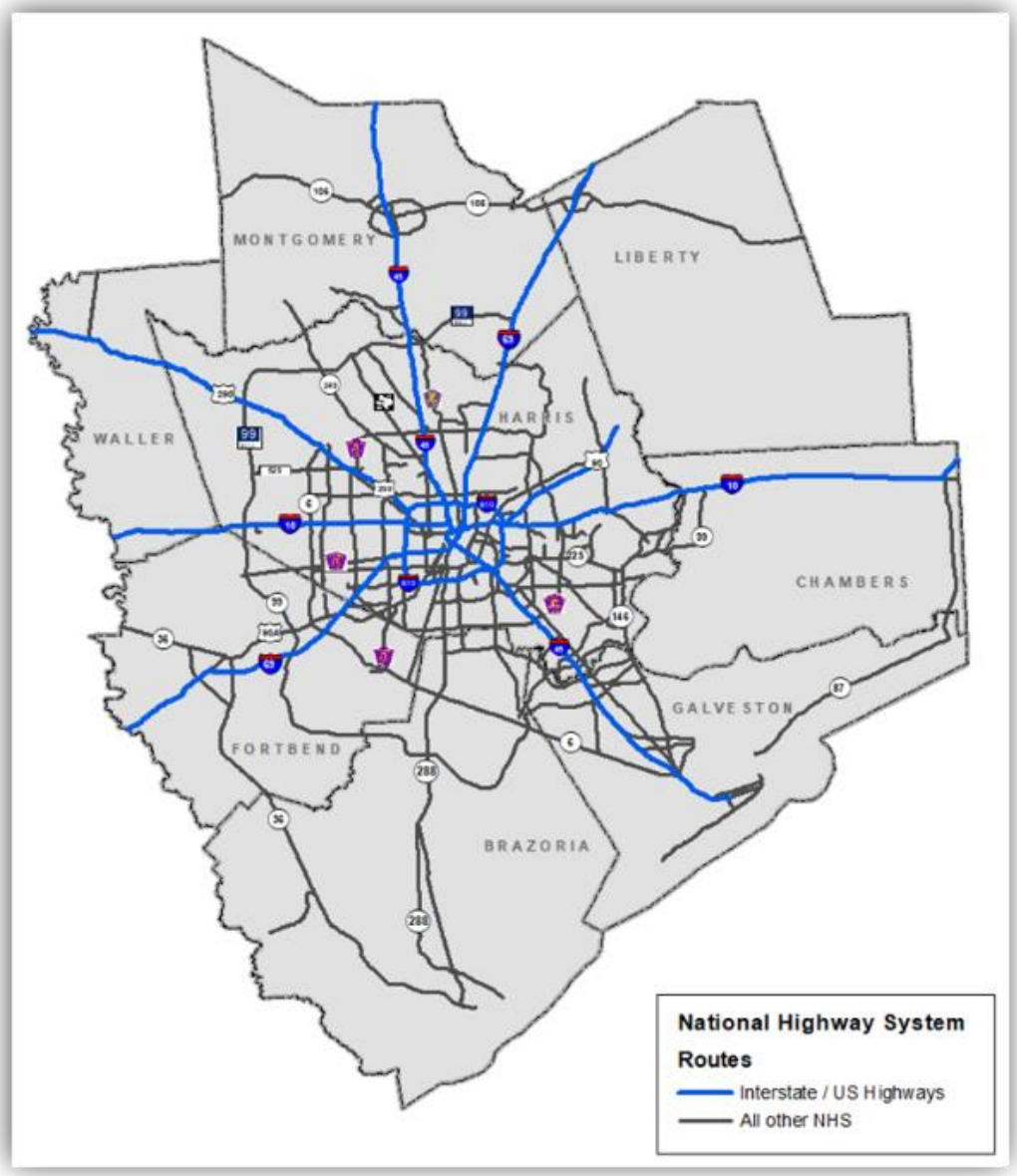
The final planning rules for the metropolitan planning process and the Regional Transportation Plan implementing the Fixing America's Surface Transportation (FAST) Act became effective on May 27, 2018. The FAST Act builds on changes made by MAP-21 to address challenges facing the U.S. transportation system – including provisions to make surface transportation more streamlined, performance-based, and multimodal. Under these rules, metropolitan planning organizations may support the state targets or establish their own regional targets. In 2018, H-GAC adopted performance targets with the performance-based planning process required by FHWA. The final set of performance targets were adopted on October 26, 2018. During the formulation of the planning targets, extensive collaboration occurred between the Texas Department of Transportation, public transportation providers and H-GAC.

Transportation Performance Management (TPM) is not a new concept to H-GAC. Many of the federal performance measures align with and complement H-GAC's existing performance measures. Performance management is a powerful analytical tool for tracking regional performance over time and can illustrate how the greater Houston region compares to other regions nationwide. Target setting, tracking and reporting of performance measures are conducted in a relatively short timeframe: from one to four years. TPM gives transportation planners the opportunity to link the short-term performance to long-range priorities for the region. One of the positive outcomes of performance management tracking is that it generates a heightened awareness in the transportation planners and fosters a renewed focus by on key performance areas that will likely remain at the forefront of planning practice for years to come. Additionally, the requirement to report the progress made towards achieving the performance measures improves accountability and transparency of the planning agencies.

Emphasis on the National Highway System

The federal performance measures place a strong emphasis on the National Highway System (NHS). The NHS is a network of highways that are considered critical to the nation's economy, defense and mobility, and include those assets that link major airports, ports, public transportation facilities, rail and truck intermodal terminals. The H-GAC 2045 Regional Transportation Plan is focused on maintaining all major roads of the metropolitan planning region's transportation network and not just those on the National Highway System. However, as many as 8,784 lane-miles of highways in the H-GAC metropolitan planning region are on the national highway system.

Figure B-8: The National Highway System in the H-GAC Planning Region



TRANSPORTATION PERFORMANCE MEASURES AND THE 2045 RTP

As discussed earlier, the federal government passed two transportation bills, the Moving Ahead for Progress in the 21st Century (MAP-21) in 2012 and the Fixing Surface Transportation in the 21st Century (FAST Act) in 2015, which together have substantially changed the milieu of transportation planning practice. Among other things, the bills require Metropolitan Planning Organizations (MPOs) to establish performance-based planning routines. In order to comply with MAP-21 changes, MPOs across the country adopted and implemented programs and performance targets, and set priorities based on performance measures. The FAST Act reaffirms this requirement.

According to the laws, performance will be judged on a system-wide level and should be tied to project prioritization. As such, the 2045 RTP proposes certain performance measures to represent this principle at a regional level (Figure B-9). Because MAP-21 requires that transportation system challenges be addressed through a data driven, performance-based approach, measures selected were chosen mainly because they were focused on system performance and assets, sensitive to various transportation modes, and had a nexus to the established goals.

Several challenges exist for some of the performance measures, such as the lack of available, useable or consistent data. H-GAC and TxDOT are addressing these deficiencies by improving data collection methods and expanding collection efforts to obtain data suitable to accurately set performance targets. For example, TxDOT is adapting its pavement collection methods to align with the federal criteria. Additionally, H-GAC is exploring new data collection for the System Performance measures. As required by the federal rules, H-GAC will periodically review, analyze performance measure data, and will report how target progress has been achieved by the MPO for the target years of 2020 and 2022.

The following section describes each performance measure, detailing the way it is measured and describing the desired outcome. The performance measures include factors like asset management, congestion, safety, environment, and economic competitiveness, which are intended to help the assessment of progress towards meeting the 2045 RTP plan's vision and goals. While the desire is to see a dramatic improvement in each performance measure area, limited funding and other factors that influence system utilization may work in such a way that selected performance measures might not always be reduced in absolute terms.

Figure B-9: 2045 RTP Vision, Goals, and Performance Measures

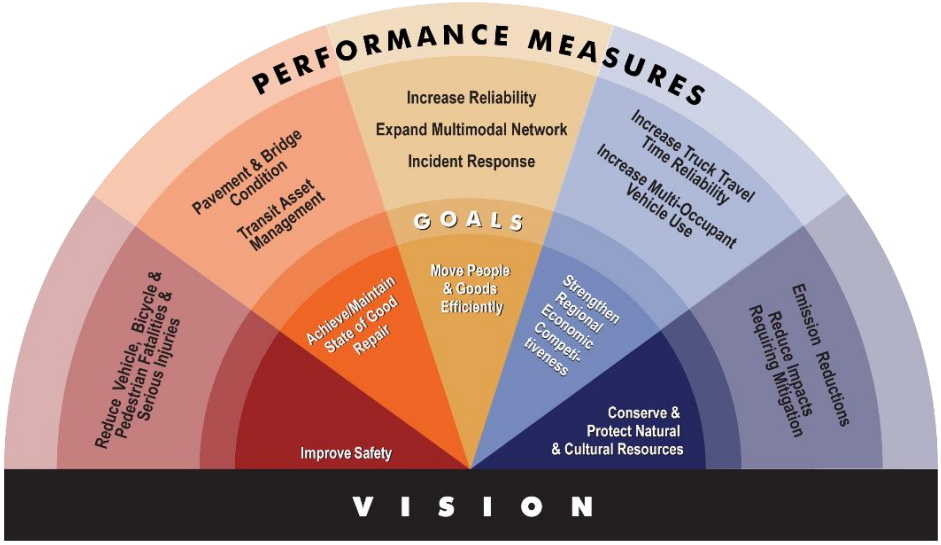


Table B-3: Highway and Transit Performance Measures

Category	Performance Measure	Applicability	Reporting Frequency
Highway Safety	Number of fatalities	All public roads	Annually
	Rate of fatalities		
	Number of serious injuries		
	Rate of serious injuries		
	Number of non-motorized fatalities and serious injuries		
Pavement and Bridge Condition	Percentage of pavements of the Interstate System in Good condition	Interstate System	Biennially with four-year performance periods
	Percentage of pavements of the Interstate System in Poor condition		
	Percentage of pavements of the non-Interstate NHS in Good condition	Non-Interstate NHS	
	Percentage of pavements of the non-Interstate NHS in Poor condition		
	Percentage of NHS bridges classified in Good condition	National Highway System (NHS)	
	Percentage of NHS bridges classified in Poor condition		
Highway System Performance	Percent of the person-miles traveled on the Interstate that are reliable (Level of Travel Time Reliability)	Interstate System	Biennially with four-year performance periods
	Percent of the person-miles traveled on the Non-Interstate NHS that are reliable (LOTTR)	Non-Interstate NHS	
	Truck Travel Time Reliability (TTTR) Index	Interstate System	
	Annual Hours of Peak Hour Excessive Delay Per Capita	National Highway System (NHS)	
	Percent of Trips with Non-Single Occupant Vehicles	Urbanized area	
	Total Emissions Reduction	Urbanized area	
Transit Asset Management	Rolling Stock - percentage of revenue vehicles that exceed the Useful Life Benchmark (ULB)	Region's transit providers who are recipients and subrecipients of federal transit assistance and H-GAC	Annually
	Equipment - percentage of non-revenue service vehicles that exceed the ULB		
	Facilities - percentage of facilities that are rated less than 3.0 on the Transit Economic Requirements Model (TERM) Scale		
	Infrastructure - percentage of rail track segments (by mode) that have performance restrictions	METRO	
Transit Safety	Fatalities - total amount and rate of fatalities per total vehicle revenue miles	Region's transit providers who are recipients and subrecipients of federal transit assistance and H-GAC	Annually
	Injuries - total amount and rate of injuries per total vehicle revenue miles		
	Safety Event - total amount and rate of safety events per total vehicle revenue miles		
	System Reliability (State of Good Repair) – mean distance between major mechanical failures		

The investments identified in the 2040 RTP were guided by a vision and supported by the goals and strategies. This framework articulated the regional needs and priorities in four key areas of transportation investments.

Mobility - Alternative Modes - Air Quality - Planning

The 2045 RTP Vision, Goals, and Strategies were established by the Transportation Policy Council (TPC), Technical Advisory Committee (TAC), and relevant TPC and TAC subcommittees. Building on the investment area structure established in the 2040 RTP, the TPC established 21 investment categories aligned with the 2045 RTP goals and strategies, as priority areas of investments. Table B-4, shown below, illustrates the linkage between the 2040 RTP Investment Type, 2045 RTP Investment Strategy, 2045 RTP Investment Categories and the performance measures and targets they directly contribute towards achieving.

Table B-4: Relationship Between Investment Type, RTP Strategy, Investment Category and Performance

Investment Type	RTP Strategy	Investment Category	Performance Measures					
			Safety	Pavement & Bridge	Reliability	Freight (Truck Travel Time)	Congestion/ Air Quality	Transit Asset Management
Mobility. Alternative Modes, Air Quality	Expand, Manage, Maintain	Major Investments	●	●	●	●	●	●
Mobility	Expand	Roadway Added Capacity/New Construction	●	●	●	●		
		Innovative Freight Movement	●	●	●	●	●	
	Manage	Incident Management (Towing)	●		●	●	●	
		Incident Management (MAP)	●		●	●	●	
		Access Management/Safety/Grade Separations	●	●	●	●	●	
		Intelligent Transportation System Infrastructure	●	●	●	●	●	
	Maintain	Infrastructure Resiliency	●				●	
		Roadway Reconstruction and Rehabilitation	●	●				
Alternative Modes	Expand, Manage, Maintain	Active Transportation	●				●	
	Expand	Transit Expansion (Vehicle Purchase)	●		●	●	●	●
		Transit Passenger Facilities	●		●	●	●	●
	Manage	Transit Priority Infrastructure	●		●	●	●	
		Transit Regional Fare Collection	●		●	●	●	
	Maintain	Transit Passenger Facility State of Good Repair	●		●		●	●
Air Quality	Expand	Regional ITS (TranStar)	●		●	●	●	
		Pilot Commuter Transit			●	●	●	
		Regional Vanpool			●	●	●	
	Manage	Commute Solutions			●	●	●	
	Maintain	Clean Cities/Clean Vehicles					●	
Planning	Expand, Manage, Maintain	Sub-Regional Planning						

Out of twenty-one Investment categories, nine categories were recommended to be programmed and funded annually for the 10-year period from FY 2019 through FY 2028, identified in Table B-5. This was approved in a cooperative consultative process involving the local governments. and state transportation agencies, the Transportation Policy Council, the Technical Advisory Committee, and relevant subcommittees.

Table B-5: RTP Investment Categories in the H-GAC 10-Year Plan (2019-2028)

2040 RTP Investment Type	2045 RTP Strategy	2045 RTP Investment Category
Mobility	Manage	Incident Management (Towing)
		Incident Management (MAP)
Alternative Modes	Manage	Transit Regional Fare Collection
Air Quality	Expand	Regional ITS (TranStar)
		Pilot Commuter Transit
		Regional Vanpool
	Manage	Commute Solutions
	Maintain	Clean Cities/Clean Vehicles

2018 Call for Projects Evaluation Criteria:

The 2018 Call for Projects evaluation and selection criteria were developed in a cooperative manner by consulting with local agencies, the Transportation Policy Council (TPC) , the Technical Advisory Committee, and relevant subcommittees. All projects submitted through the 2018 Call for Projects (2018 CFP) were evaluated based on 50% score (100 points) given to its benefit/cost ratio and 50% score (100 points) given to various planning factors. The benefit cost analyses were calculated within a spreadsheet template that evaluated the project's benefits in three major areas:

- Safety – reduction in crashes
- Delay – reduction in travel delay
- Emissions – reduction of on-road vehicle emissions

The remaining 50% of the score was based on multiple planning factors with a direct linkage to performance measures and the RTP goals and strategies and relative to each investment category. Planning factors for highway and transit projects include, but are not limited to, the improvement to multimodal level of service; freight system priority/evacuation route, life cycle maintenance strategies, corridor level of travel time reliability, reduction in vehicle miles traveled, connectivity to employment, transit reliability, transit vehicle and facility life cycle maintenance strategies.

The 2018 Call for Projects application submittal period began on September 4th and concluded on October 31, 2018. During this period, H-GAC received a total of 193 applications from various local partners and TxDOT. Out of 193 project applications, a total of thirty-six (36) projects in various investment categories were recommended for funding for the 10- year period, between FY 2019 and FY 2028. The TPC approved

projects across thirteen Investment Categories, listed in Table B-6, through the competitive Call for Projects process.

Table B-6: TPC Approved Projects Across Investment Categories

2040 RTP Investment Type	2045 RTP Strategy	2045 RTP Investment Category
Mobility, Alternative Modes, Air Quality	Expand, Manage, Maintain	Major Investments
Mobility	Expand	Roadway Added Capacity/New Construction
		Innovative Freight Movement
	Manage	Access Management/Safety/Grade Separations
		Intelligent Transportation System Infrastructure
	Maintain	Infrastructure Resiliency
		Roadway Reconstruction and Rehabilitation
Alternative Modes	Expand, Manage, Maintain	Active Transportation
	Expand	Transit Expansion (Vehicle Purchase)
		Transit Passenger Facilities
	Manage	Transit Priority Infrastructure
	Maintain	Transit Passenger Facility State of Good Repair

Transportation Improvement Program and the Project Selection Process

The project selection process utilized during development of the 2021-2024 TIP assessed major investment-level applications based on the 2045 RTP's five goals and performance measures. By incorporating 2045 RTP goals into short-range programming activity, the performance measures have achieved a strong coordination between the region's vision for the future and the investments made today.

HIGHWAY SAFETY

Safety is a top regional priority. Although motorists are the largest group of system users injured or killed in crashes, pedestrians and cyclists are also at risk. Addressing this goal will not only benefit regional health, but the community's quality of life and economic competitiveness. A safe regional transportation system operates reliably, delivers goods and services on time, and returns users home at the end of their trip.

The Houston-Galveston Regional Safety Plan sets a baseline for safety crash data, analyzes regional trends, and is used to inform performance target setting. The report data serves as a baseline for subsequent years to measure whether there was significant improvement compared to previous years. The Texas Strategic Highway Safety Plan estimates the probable number of fatalities and serious injuries for the target year of 2022. Federal rulemaking requires Metropolitan Planning Organizations to either support state targets or establish their own specific targets for the five safety performance measures for all public roads in the MPO planning area, within 180 days after the State establishes statewide targets. The MPO then reports targets to the State, when requested. Statewide, when at least four out of five targets are met or the outcome for the performance measure is better than the baseline performance for the year prior to the target year, a determination of significant progress will be made.

During safety target setting discussions of the Transportation Policy Council (TPC) and the Transportation Advisory Committee, aspirational goals for the long-term were expressed. While the H-GAC region is forecasted to experience a high level of economic and population growth, subsequently, it results in a rise in travel, crashes and fatalities. For the purposes of short-term target setting, the targets were set to reflect the probable amount of fatalities and serious injuries. However, the increasing trends in fatalities and crashes do not reflect the intent and commitment of the TPC to improve traffic safety in the Houston-Galveston region. H-GAC has committed to participate in advancing crash reduction strategies through the Regional Safety Plan and will annually assess progress on Safety Performance Measures. H-GAC's Transportation Policy Council approved a resolution to support the State's adopted safety targets for the five performance measures. H-GAC set targets that represent a two percent (2%) reduction from the trend line projection in the five (5) safety performance measures for the period from 2017 to 2022 (See Table B-7). The decline is expected to begin gradually in 2018 and progress to the two percent (2%) reduction by the target year 2022.

Table B-7: H-GAC Safety Target Performance Measures

Performance Measures	2017	2018	2019	2020	2021	2022
Number of Fatalities	0.0%	0.4%	0.8%	1.2%	1.6%	2.0%
Rate of Fatalities (per 100 million Vehicle Miles Traveled)						
Number of Serious Injuries						
Rate of Serious Injuries (per 100 million VMT)						
Number of Non-Motorized Fatalities & Serious Injuries						

Fatalities

Figure B-10: Fatalities Performance Measure Statistics

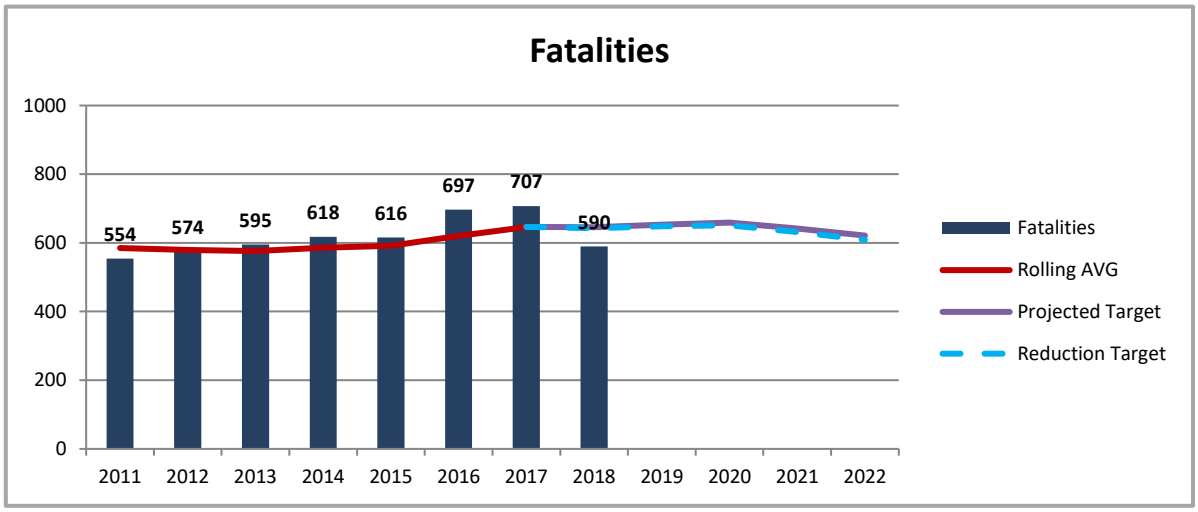
Measure – Five-year rolling averages of the number and rate of vehicular fatalities in the H-GAC region.

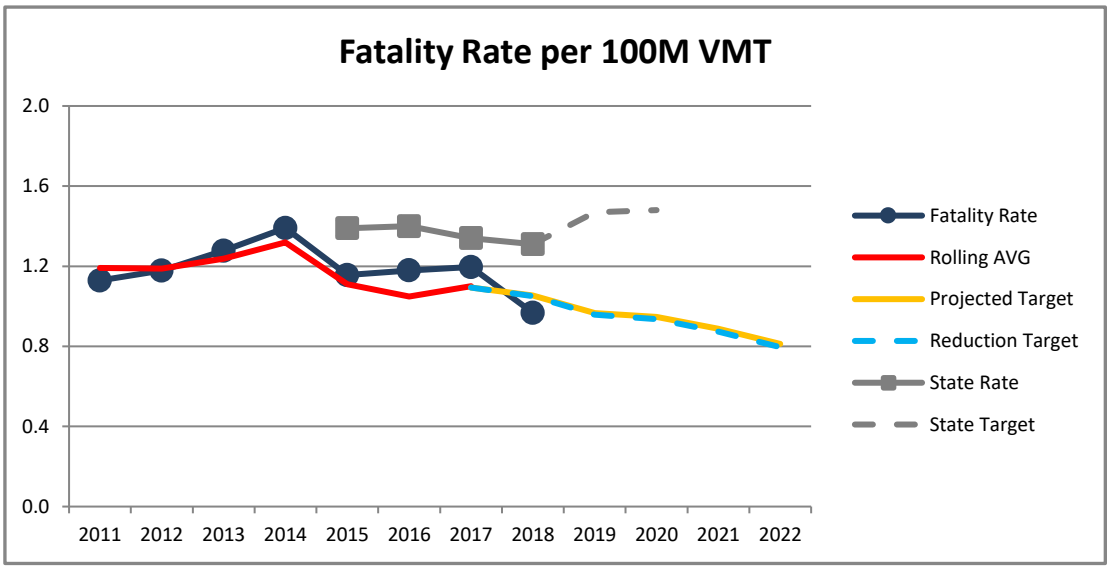
Methodology – Fatality numbers and rates are obtained from the national Fatality Analysis Reporting System (FARS). Fatality rates are calculated per 100 Million Vehicle Miles Traveled in the region.

Applicability – All public roads and highways

Reporting Frequency - Annually

Condition and Targets – H-GAC adopted the State's safety targets for the number and rate of fatalities. The target is a 2% reduction from the trend line projection over a 5-year period. The values in the chart are statistics for the 8-county H-GAC region.





Serious Injuries

Figure B-11: Serious Injuries Performance Measure Statistics

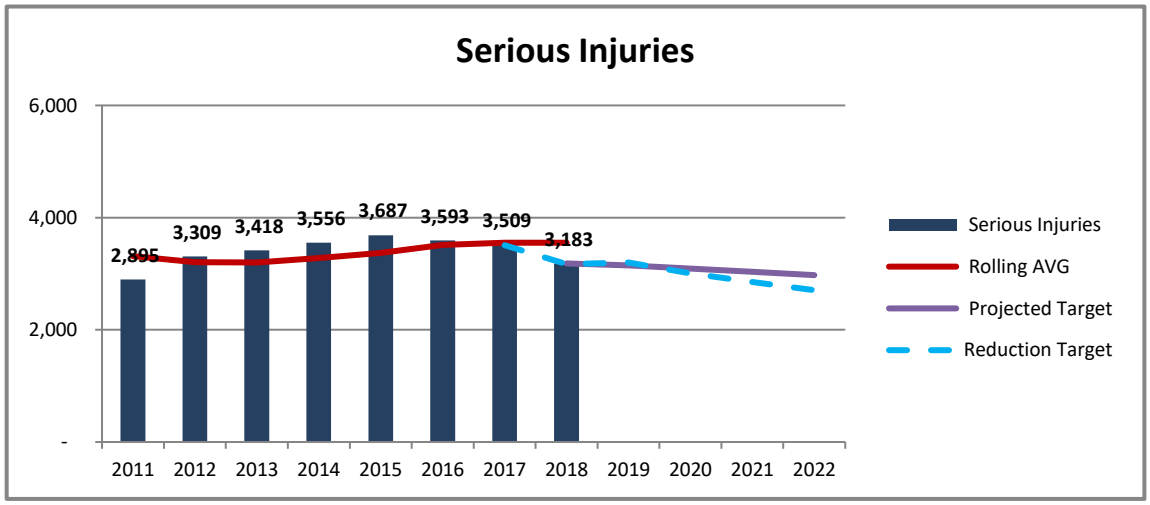
Measure – Five-year rolling averages of the number and rate of vehicular serious injuries in the H-GAC region.

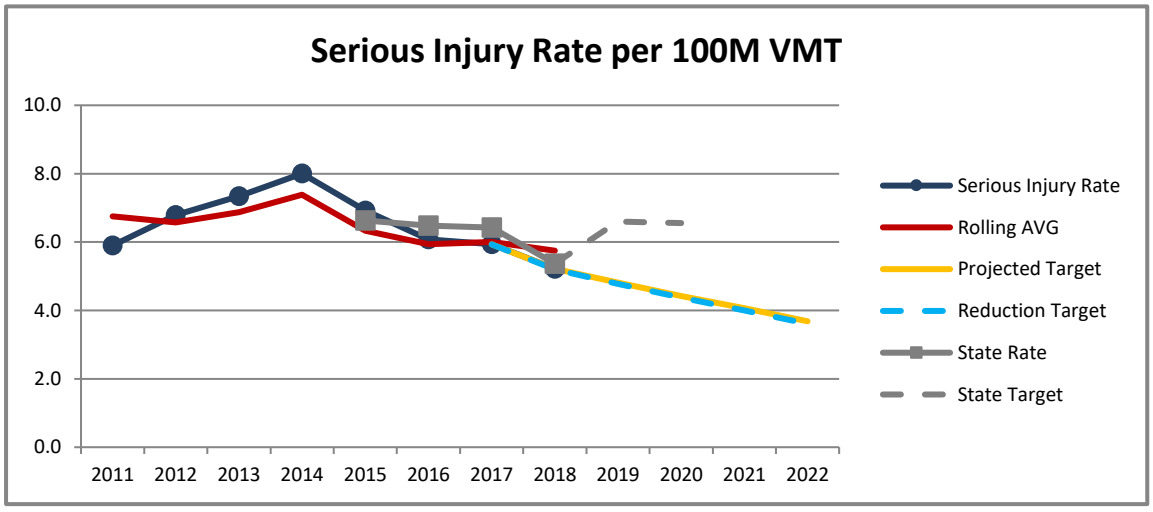
Methodology – Serious injury numbers and rates are obtained from the Texas Crash Records Information System (CRIS) databases. Serious injury rates are calculated per 100 Million Vehicle Miles Traveled (VMT) in the region.

Applicability – All public roads and highways

Reporting Frequency – Annually

Conditions and Targets - H-GAC adopted the state's safety targets for the number and rate of serious injuries. The target is a 2% reduction from the trend line projection over a 5-year period. The values in the chart are statistics for the 8-county H-GAC region.





Non-Motorized Fatalities and Serious Injuries

Figure B-12: Non-Motorized Fatalities and Serious Injuries Performance Measure Statistics

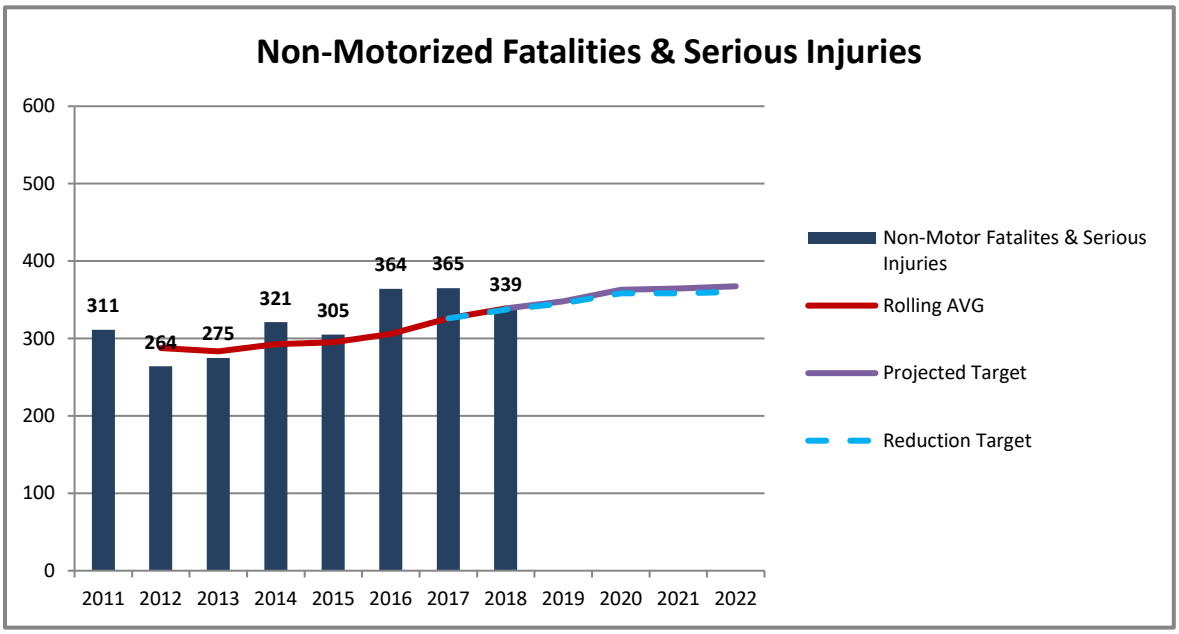
Measure – Five-year rolling average of the number non-motorized fatalities and non-motorized serious injuries for bicyclists and pedestrians in the H-GAC region.

Methodology – Serious injury numbers and rates are obtained from the national Fatality Analysis Reporting System (FARS) and the Texas Crash Records Information System (CRIS) databases.

Applicability – All public roads and highways

Reporting Frequency – Annually

Conditions and Targets - H-GAC adopted the State's safety targets for the number of non-motorized serious injuries. The target is a 2% reduction from the trend line projection over a 5-year period. The values in the chart are statistics for the 8-county H-GAC region.



Integrating Safety Performance Measures into the Transportation Planning Process

"The Regional Safety Plan was developed as a comprehensive plan that addresses the region's safety issues and offers feasible solutions. It serves as a framework for strategies and implementation actions to leverage safety programs and resources to the greatest extent possible. The performance measure targets in this plan are tangible goals for the region to work towards to support the State of Texas' crash reduction efforts, and its strategies support the State Highway Safety Plan and federal safety initiatives." *(Source: 2018 HGAC Regional Safety Plan)*

Adopted in 2018, the Regional Safety Plan identifies five traffic safety focus areas. These focus areas were crash types with the highest percentage of fatalities in the region. The Transportation Safety Committee has been charged with developing implementation plans to address the focus areas over the next four

years. The MPO will continue to publish an annual State of Safety Report to assess progress toward reducing the number of crashes, fatalities, and serious injuries throughout the region. In addition, the PO will launch a series of intersection safety audits at high crash frequency intersections to identify crash characteristics and develop low-cost recommendations to address traffic safety issues at each location. The MPO will continue to coordinate its efforts with federal, state, and local partners to leverage resources and maximize results to enhance traffic safety in the Houston-Galveston area.

H-GAC incorporates performance measures into its programming activities by designating safety as one of the five foundational goals of the Regional Transportation Plan. Furthermore, H-GAC integrates the safety targets in the form of quantifiable strategies and goals within the regional transportation planning process. The primary method for the programming of projects is the Call for Projects issued by H-GAC. Embedded in the Call for Projects (CFP) selection criteria, the safety benefit cost analysis template indicates the number of crashes that will be reduced for each CFP project. Linking the programming of projects to quantifiable performance targets validates the success of performance-based planning.

2021 – 2024 TIP and 2045 RTP transportation investments targeting safety improvements

H-GAC, along with state and local government partners, has made significant investments in transportation infrastructure improvements through the 2021-2024 Transportation Improvement Program (TIP) and the 2045 Regional Transportation Plan. H-GAC adopted the Regional Safety Plan in 2018 to recommend crash reduction strategies. Additionally, a total of 72 projects are programmed with Category 8 Safety funding at a cost of $58,590,574 from FY 2021 to 2024 by the Texas Department of Transportation Houston and Beaumont Districts.

In 2018, H-GAC developed a Regional Safety Plan that identifies traffic safety focus areas, recommends crash reduction strategies and countermeasures. The fiscally constrained 2045 RTP recommends a significant level of investments in ITS and safety projects and programs. This combined effort of planning, programming of projects, implementation of the safety plan, and critical transportation investments are expected to support and contribute to achieving the safety performance targets while greatly enhancing traffic safety for the region. The fiscally constrained 2045 RTP recommended approximately $579 million of investments in ITS and Safety projects and programs. These investments are not part of the Corridor-based Major Investments of the 2045 RTP.

Table B-8: 2045 RTP Investments in ITS and Safety Programs

RTP 2045 STRATEGIES	STRATEGY 1 MANAGE [System Management and Operations]	STRATEGY 2 MAINTAIN [Asset Management]	STRATEGY 3 EXPAND [Transportation Network Capacity]	TOTAL
REGIONAL INVESTMENT PROGRAMS				
ITS/Safety: *(Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management)*	$517,457,158	$62,269,438	NA	$579,726,596

Safety Resources
Highway Safety Improvement Program https://safety.fhwa.dot.gov/hsip/
Strategic Highway Safety Plan https://www.texasshsp.com/
Regional Safety Plan http://www.h-gac.com/transportation-safety-program/default.aspx
Transportation Safety Committee http://www.h-gac.com/taq/transportation-committees/RSC/default.aspx

PAVEMENT CONDITIONS

Ensuring the preservation of pavements and bridges is critical to safety, the movement of goods and people, economic development. While the demand on the transportation system is greater than ever, pavements and bridges are steadily deteriorating due to traffic, weather and time. In effect, this highlights the importance for an emphasis on asset management and the preservation of pavement. "Pavement preservation programs and activities employ a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet road user expectations." *(source: PL 112-141, Moving Ahead for Progress in the 21st Century Act.)*

Implementing pavement asset management, along with performance target setting, provides an opportunity for moving the transportation system to a state of good repair, protects our investments in the transportation roadway system and stretches taxpayer dollars, as far as possible. An asset management program can improve system resiliency in the aftermath of extreme weather events, such as Hurricanes Harvey and Ike, changing climate conditions, and shifts in the regional economy.

Roadways on the National Highway System, (NHS) are mostly owned, maintained, and operated by the Texas Department of Transportation; however, a portion of the NHS is under the jurisdiction of cities, counties, and toll authorities. Federal Performance Asset Management prescribes the establishment of pavement targets for all roadways on the interstate and non-interstate highway system, regardless of ownership. While the federal performance measures are focused on National Highway System, H-GAC is concerned with the conditions of all pavements and bridges. In the state of Texas, there are 69,000 National Highway System lane miles; approximately, 12% are located in the H-GAC region.

Pavement condition data is a critical component of any pavement management system. TxDOT is responsible for collecting the necessary measurements and inspections to determine the conditions ratings defined by the federal performance measures rules. The federal criterion bases the pavement condition on the International Roughness Index (IRI), rutting, cracking and faulting. Essentially, the IRI is the overall ride quality of a roadway. The pavement analysis is based on distress ratings and ride quality measurements. TxDOT used historical measurements of pavement and bridge conditions to establish statewide targets.

Federal transportation bills require TxDOT to implement transportation asset management practices and set performance targets to a desired condition. The federal performance measures place a high priority on maintaining the good pavements and on raising the pavements in poor condition to a state of good repair. A good condition pavement rating suggests that no major investment is necessary, and conversely, a fair condition suggests that major reconstruction of the pavement is needed.

The pavement condition thresholds applicable to Interstate System roadways are shown in the table below.

Table B-9: Pavement Condition Ratings

Interstate System Rating Thresholds			
	Good	Fair	Poor
IRI (in/mile)	< 95	95 - 170	> 170
Cracking %	< 5	5 - 10	> 10
Rutting (in)	< 0.2	0.2 - 0.4	> 0.4
Faulting (in)	< 0.05	0.05 - 0.15	> 0.15

The calculations of the pavement performance for Interstate System roadways are explained in the table below.

Table B-10: Rating the Interstate National Highway System

Rating the Interstate National Highway System			
	Pavement Types		
Overall Condition Rating	3 metric ratings ACO - (IRI, Cracking, Rutting) JCP - (IRI, Cracking, Faulting)	2 metric ratings CRCP - (IRI and Cracking)	Measures
Good	All three metrics rated "Good"	Both metrics rated "Good"	% Lane Miles in "Good" Condition
Fair	All other combinations	All other combinations	% Lane miles in "Fair" Condition
Poor	≥ 2 Metrics rated "Poor"	Two metrics rated "Poor"	% Lane miles in "Poor" Condition

Key= Asphaltic Concrete Overlay (ACO), Joint Concrete Pavement (JCP), Continuously Reinforced Concrete Pvmt.(CRCP)

The historical pavement condition data from the Texas Department of Transportation's Pavement Management Information System (PMIS) were translated into the corresponding pavement condition measures for MAP-21/FAST Act requirements. The data was used to develop the historical trends for pavement condition measures. A five-year moving average was used to calculate the performance targets.

The calculations of pavement condition for the Non-Interstate National Highway System roadways are defined in the table below. Unlike the Interstate System, when rating the condition of Non-Interstate NHS roadways, only the International Roughness Index (IRI) is measured.

Table B-11: Rating the Non-Interstate National Highway System

Rating the Non-Interstate National Highway System			
	Good	Fair	Poor
IRI (in/mile)	< 95	95 - 170	> 170
Measure	Percent Lane Miles in "Good" Condition	Percent Lane Miles in "Fair" Condition	Percent Lane Miles in "Poor" Condition

The historical pavement condition data from TxDOT's Pavement Management Information System (PMIS) was used to develop the historical trends for pavement measures. A five-year moving average was used to develop the performance targets. Despite the fact that historical trends indicate pavement conditions are declining over time, H-GAC chose to adopt flat targets with the goal of maintaining current conditions and a desire for aspirational goals that indicate improvement of pavement conditions in the long-term.

For the pavement measures, States and MPOs must establish two and four-year targets and may adjust targets at the Mid-Performance Period Progress Report due in October 2020. The first performance period began January 1, 2018 and ends on December 31, 2021 and is for the Calendar Years (CY) of 2018 - 2021.

Pavement Conditions – Interstate and Non-Interstate National Highway System

Figure B-13: Pavement Conditions Performance Measure Statistics

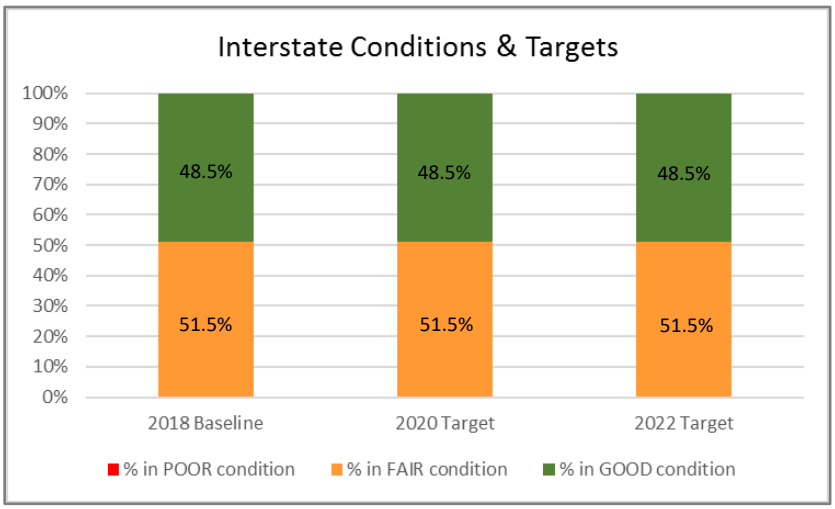
Measure – Percentage of pavements of the interstate and non-interstate National Highway System with a condition rating of "good" and "poor" relative to the ride quality.

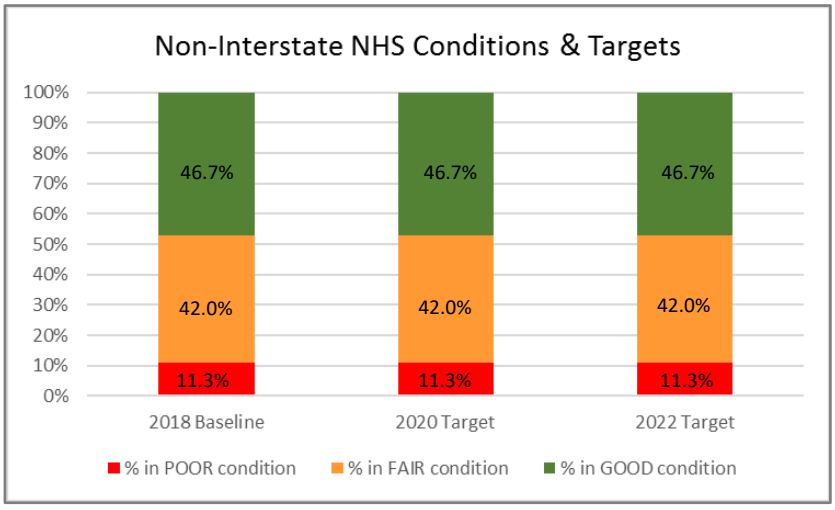
Methodology – Pavement conditions are based on the evaluation scores of the International Roughness Index (IRI), rutting, faulting and cracking. The condition scores are obtained from the Highway Performance Monitoring System (HPMS) and TxDOT's Pavement Management Information System (PMIS) databases.

Applicability – Interstate highways and Non-interstate highways of the National Highway System

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions – While the historical trends indicate pavement conditions are expected to decline by the year 2022, H-GAC chose to adopt flat targets. For Interstate highways, H-GAC adopted targets of 48.5% in good condition and 0.0% in poor condition for the years 2020 and 2022. For the Non-Interstate National Highway System (NHS), H-GAC adopted 46.7% in good condition and 11.3% in poor condition for the years 2020 and 2022. The values in the chart below reflect the statistics for the 8-county H-GAC region.





BRIDGE CONDITIONS

Asset management seeks to optimize lifecycle costs by setting and sustaining a desired target condition with the goals of improving the durability and extending the life of the region's bridges.

Performance measures and targets are applicable to all bridges on the National Highway System (NHS), which include on and off-ramps connected to the NHS within a State, and bridges carrying the NHS that cross a State border, regardless of ownership. A portion of the NHS system is under the jurisdiction of cities, counties, and toll authorities. For the approximately 2,500 bridges in the H-GAC region, 88% are owned by TxDOT and 12% are owned by other entities. The consideration of bridge performance targets should be determined from asset management analyses to achieve a state of good repair over the life cycle of assets.

Bridge conditions are based on the National Bridge Inventory evaluation ratings for the bridge's deck, superstructure, substructure and culvert. The condition rating of good, fair or poor are determined by the lowest rating of the deck, superstructure, substructure or culvert. For example, if the lowest rating of one or more of the four bridge components is less than or equal to four, the bridge's classification is rated as poor.

Table B-12: Bridge Inventory Ratings

	Good	Fair	Poor
Bridge Inventory Rating	≥ 7	< 7 and > 4	≤ 4

The bridge targets are expressed in the percent of total bridge deck area. Deck area is computed using the structure length and deck width. For culverts, the deck area is calculated using the approach roadway width and structure length.

The historical pavement condition data was gathered from the Texas Department of Transportation's (TxDOT) Bridge Inventory. TxDOT surveys all bridges on the National Highway System and reports the conditions to the National Bridge Inventory. Historical bridge condition trends are based on a trend-line analysis. While the historical trends indicate bridge conditions are slowly declining, H-GAC chose to adopt flat targets for the years 2020 and 2022. Due to the lengthy lead time associated with environmental clearance, right of way purchase, design and the construction of a bridge, any new bridge being considered right now will have little or no influence on bridge conditions for the next three to five years. Despite the fact that historical trends indicate bridge conditions are declining in the future, H-GAC chose to adopt flat targets with the goal of maintaining current conditions and a desire for aspirational goals that indicate improvement of bridge conditions in the long-term.

For the bridge measures, States and MPOs must establish two and four-year targets and may adjust four-year targets at the Mid-Performance Period Progress Report due in October 2020. The first performance period begins January 1, 2018 and ends on December 31, 2021 and is for the Calendar Years (CY) of 2018 - 2021.

Figure B-14: Bridge Conditions Performance Measure Statistics

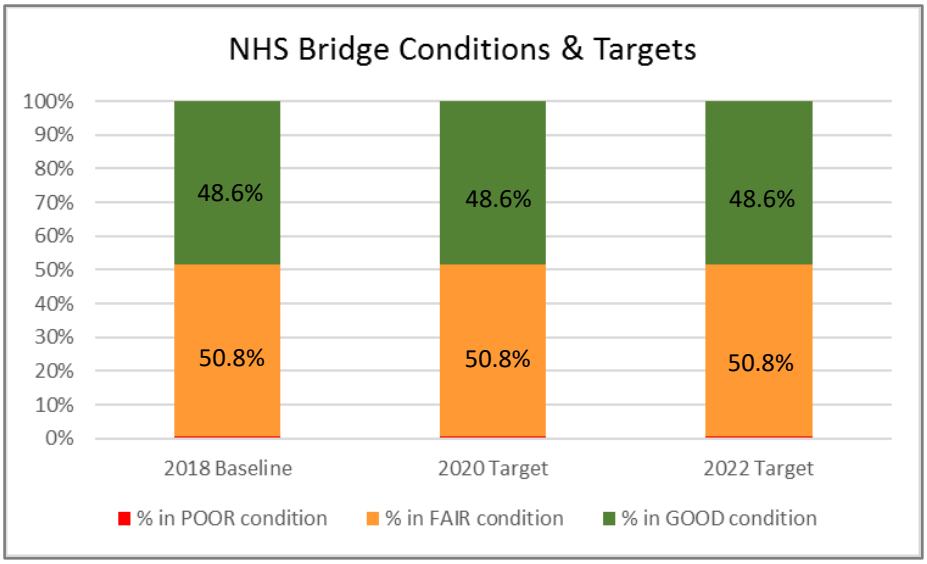
Measure – Percentage of bridge deck area of the National Highway System with a condition rating of "good" and "poor".

Methodology – Bridge deck conditions are based on the evaluation scores of the National Bridge Inventory.

Applicability – Bridges on the National Highway System

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions – While the straight-line trend historical data indicates bridge conditions are expected to decline by the year 2022, H-GAC chose to adopt flat targets of 48.6% of bridges in good condition and 0.6% in poor condition for the years 2020 and 2022. The values in the chart below reflect the statistics for the 8-county H-GAC region.



Integrating Pavement and Bridge Performance Measures into the Transportation Planning Process

Both the short and long-range planning processes afford the opportunity for advancing the transportation system to a State of Good Repair. One of the core strategies of the Call for Projects is Maintain Asset Management: to improve and preserve the condition of existing transportation infrastructure at the least practicable cost through the application of sound asset management techniques. The RTP 2045 project evaluation system was designed to be performance-based when prioritizing projects for the region. To highlight the significance of maintaining pavement and bridge infrastructure, the Call for Projects designated a separate category for Rehabilitation and Reconstruction aimed at improving the State of Good Repair for the region's infrastructure. Additionally, investments in the RTP investment category, Infrastructure Resiliency, will contribute to improved conditions of the transportation system.

Given the fiscal constraints of transportation funding, performance-based planning can help identify the best cost-effective projects to so the investment decisions in our transportation system will be allocated to the highest priorities of the pavement or bridge asset preservation program. In addition to designated reconstruction and rehabilitation projects, every added capacity, new construction, Complete Street,

grade separation and access management project will contribute to achieving the pavement and bridge performance targets. As a result, the projects programmed in the RTP 2045 are expected to have a positive impact on achieving the pavement and bridge performance targets.

The challenge with transportation asset management is that H-GAC has the responsibility to report progress, but MPOs don't control the management of the transportation assets. Not all NHS roadways are owned and maintained by the TxDOT. For the non-interstate NHS roadways, 66% are owned by TxDOT and 34% are owned by other agencies. For the interstates, 100% are state-owned. H-GAC is coordinating NHS pavement data sharing between TxDOT and Non-TxDOT agencies

H-GAC facilitates the dialogue and discussion between TxDOT and local agencies to serve as the conduit for information sharing. In addition, H-GAC is facilitating the coordination with other agencies, data sharing, understanding how each agency measures and collects data, discussing uniform data collection, and understanding the future investment plans for NHS roadways with TxDOT. Currently, the TxDOT is committed to expanding their data collection to align with the federal measures. One of the positive outcomes of Transportation Asset Management is that it affords the opportunity is to focus and collaborate with all agencies responsible for the maintenance of our critical transportation network.

Of particular challenge, the tremendous increase in population and truck traffic, expected in the Houston-Galveston region over the next twenty-five years, will add additional wear and tear will impact the targets for pavements and bridges.

2021 – 2024 TIP and 2045 RTP transportation investments targeting pavement and bridge improvements

H-GAC, along with state and local government partners, has made significant investments in transportation infrastructure improvements through the 2040 Regional Transportation Plan and the 2021-2024 Transportation Improvement Program (TIP) and the 2045 Regional Transportation Plan. The investments of new roadways, roadway expansions, preventive maintenance, rehabilitation, and bridges are expected to contribute towards achieving the Pavement and Bridge Performance Targets. A combined effort of planning, programming of projects, collaborative data sharing, and critical transportation investments are expected to support and contribute to achieving the asset management targets for pavement and bridge while moving the system to a State of Good Repair. In the 2021-2024 TIP, a total of $604,369,876 is programmed for Category 1, Preventive Maintenance and Rehabilitation and a total of $329,376,549 is programmed for Category 6, Structures Replacement and Rehabilitation by the Texas Department of Transportation Houston and Beaumont Districts.

H-GAC has made strategic investments in transportation infrastructure improvements through the 2045 RTP. The fiscally constrained 2045 RTP recommends a significant level of investments in pavement and bridges. The fiscally constrained 2045 RTP recommended approximately $48 billion of investments for State of Good Repair projects and programs. Other types of projects, such as new roadways and highways, thoroughfare expansions, reconstructions, Complete Streets and other improvements are expected to make additional contributions toward the State of Good Repair.

Table B-13: 2045 RTP Asset Management Investments

RTP 2045	Strategy 2 - MAINTAIN [Asset Management]
Corridor-Based Major Investments & Regional Investment Programs	$48,464,706,593

Pavement and Bridge Resources

Condition of Texas Pavements: Pavement Management Information System (PMIS) Annual Report - https://library.ctr.utexas.edu/Presto/content/Detail.aspx?ctID=UHVibGljYXRpb25fMTE2MTA=&rID=MjcwODU=&ssid=c2NyZWVuSURfMTQ2MDk=

Texas Transportation System Performance Results: Pavement Condition - https://www.txdot.gov/inside-txdot/division/federal-affairs/preliminary-performance/pavement-conditions.html

Texas Transportation System Performance Results: Bridge Condition - https://www.txdot.gov/inside-txdot/division/federal-affairs/preliminary-performance/bridge-conditions.html

Texas Transportation Plan 2040 - https://www.txdot.gov/inside-txdot/division/transportation-planning/statewide-plan/2040/plan.html

National Bridge Inventory - https://www.fhwa.dot.gov/bridge/nbi.cfm

SYSTEM PERFORMANCE

The System Performance Group contains a set of performance measures aimed at evaluating and improving the overall performance of the National Highway System. These measures focus on personal travel, as well as freight, reducing congestion and tailpipe emissions, and increasing multi-occupant vehicle use. Improving the system performance of the transportation network means there will be more reliable and less congested roadways, an increased use of alternative transportation modes and an increase in multi-occupant commuting vehicles, resulting in less vehicle emissions.

Reliability

One of the goals of System Performance Measures is to assess the reliability of the National Highway System. Travel reliability is when the travel time on a roadway remains consistent. Reliability measures the difference of travel time across hour and day for both personal travel and freight and examines peak travel over a year. Essentially, the measure of travel reliability compares a bad day of traffic to a normal day.

Three travel time reliability performance measures are:

- Personal travel time on the interstate
- Personal travel time on the non-interstate roadways of the National Highway System
- Truck travel time on the interstate

The Reliability measures utilize two metrics:

- Level of Travel Time Reliability (LOTTR) ratio for personal travel. LOTTR measures the difference of travel time across hour and day. Expressed as a ratio, LOTTR is the ratio of travel time in a bad condition in relationship to the travel time in an average condition. LOTTR ratios below a 1.50 threshold are labeled as "reliable". The measure is calculated separately for the interstate and the non-interstate segments of the National Highway System.
- Truck Travel Time Reliability Index (TTTR) for truck travel on the interstate highways.

PERSONAL TRAVEL

Figure B-15: Level of Time Reliability (LOTTR) Performance Measure Statistics

Measure (LOTTR) – Percentage of person-miles traveled on the National Highway System that are reliable, as defined by the measure, the Level of Travel Time Reliability (LOTTR). LOTTR is a ratio of the 80th percentile (bad day of traffic) to the 50th percentile (normal) travel time for a roadway segment. A ratio below 1.5 is considered to be "reliable"; and a ratio of 1.5 or greater are "unreliable".

Reporting is divided into four time periods:

- Weekdays 6 a.m. to 10 a.m.
- Weekdays 10 a.m. to 4 p.m.
- Weekdays 4 p.m. to 7 p.m.
- Weekends 6 a.m. to 8 p.m.

If the roadway segment is unreliable during any one of the four time periods, the roadway segment is labeled as "unreliable".

Methodology – Reliable person-miles are calculated using data from the National Performance Management Research Data Set (NPRMDS) which contains travel time by roadway segment every 15 minutes. The average occupancy value used for the Houston-Galveston region is 1.69.

Developed in collaboration with the twenty-five Texas Metropolitan Planning Organizations, the Texas Transportation Institute (TTI) calculated Level of Travel Time Reliability (LOTTR) targets for the entire state. Their methodology is based on an assumed growth of regional travel demand, but does not consider potential travel time improvements from upcoming projects in the Transportation Improvement Program and the Regional Transportation Plan, such as added capacity projects, the Tow & Go Program and TranStar. The methodology assumes that anything close to being unreliable now is expected to be unreliable in the future. The NPRMDS data was collected by HERE Technologies from 2014 to 2016. In 2017, FHWA changed the vendor to INRIX which created data inconsistencies for target setting.

The range for reliable is 0% to 50% and unreliable is 51% or greater (times than average). For example, for a trip that normally takes 60 minutes, on a bad day of traffic, it will take 90 minutes or more (60 mins. x 50% = 90 mins.), therefore, the trip is considered to be unreliable. Based on the TTI methodology used across the state, for the Houston region, currently, 63% of person-miles traveled on the Interstate are reliable and is forecasted to be 50% reliable by 2022, with less reliability. As illustrated in the table below, the Non-Interstate National Highway System roadways in the region are more reliable than the Interstate. The higher the percentage, the more reliability there is.

Applicability – All roadways on the National Highway System

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions (LOTTR) - Despite the fact that the TTI methodology indicates that reliability conditions for personal travel are worsening, H-GAC chose to adopt flat targets with a desire for aspirational goals that indicate better reliability in the long-term.

Performance Measure	Baseline	2020 Target	2022 Target
Percent of Person-Miles traveled on the Interstate that are Reliable / (LOTTR)	63%	63%	63%
Percent of Person-Miles traveled on the Non-Interstate NHS that are Reliable / (LOTTR)	73%	73%	73%

For the reliability measures of personal travel and truck travel, States and MPOs must establish two and four-year targets and may adjust four-year targets at the Mid-Performance Period Progress Report due in October 2020. The first performance period begins January 1, 2018 and ends on December 31, 2021 and is for the Calendar Years (CY) of 2018 - 2021.

FREIGHT

Freight movement is assessed by the Truck Travel Time Reliability (TTTR) Index on the interstate. The truck reliability measure considers factors that are unique to the freight industry, such as the use of the transportation system during all hours of the day and the need to consider impacts to the system in planning for on-time deliveries and arrivals. Recognizing the importance of on-time deliveries, this measure assesses the reliability of freight movement on the interstate with a high standard of making on-time deliveries, 95% of the time.

Figure B-16: Travel Truck Time Reliability Performance Measure Statistics

Measure (TTTR) – Truck Travel Time Reliability ratio is calculated by dividing the 95th percentile travel time (very bad day of traffic) by the 50th percentile (normal) travel time for each roadway segment of the interstate. The TTTR index is generated by multiplying each segment's largest ratio of the five time periods by its length, then dividing the sum of all length-weighted segments by the total length of the interstate.

Reporting is divided into five time periods:

- Mondays through Fridays:
  - Morning peak 6 a.m. to 10 a.m.
  - Mid-Day 10 a.m. to 4 p.m.
  - Afternoon peak 4 p.m. to 8 p.m.
- Weekends
  - 6 a.m. to 8 p.m.
- Overnights for all days
  - 8 p.m. to 6 a.m.

Methodology – The TTTR index is calculated using data from the National Performance Management Research Data Set (NPRMDS) which contains travel time by roadway segment every 15 minutes.

Developed in collaboration with the twenty-five Texas Metropolitan Planning Organizations, the Texas Transportation Institute (TTI) calculated Truck Travel Time Reliability targets for the entire state. The methodology is based on an assumed 2% annual growth of truck unreliability, but does not consider potential travel time improvements from upcoming projects in the Transportation Improvement Program and the Regional Transportation Plan, such as added capacity projects, the Tow & Go Program and TranStar. The NPRMDS data was collected by HERE Technologies from 2014 to 2016. In 2017, FHWA changed the vendor to INRIX which created data inconsistency problems for target setting.

Based on the TTI methodology used across the state, for the Houston region, the baseline for Truck Travel Time Reliability (TTTR) index is 2.1. The truck index is the amount of time a truck driver needs to add to a median trip length to arrive on-time, 95% of the time. For example, for a truck trip of 30 minutes, using the regional baseline of 2.1, a total time of 63 minutes would need to be scheduled for the truck to arrive, on-time, 95% of the time. (30 mins x 2.1 baseline = 63 mins)

Applicability – Interstate highways

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions - Despite the fact that the TTI methodology forecasts freight reliability conditions are worsening, H-GAC chose to adopt flat targets with the goal of maintaining current conditions and a desire for aspirational goals that indicate better truck reliability in the long-term. Better estimates and targets may be updated after two years when improved datasets are available.

Performance Measure	Baseline	2020 Target	2022 Target
Truck Travel Time Reliability Index on the Interstate	2.1	2.1	2.1

Congestion

FHWA established two performance measures to assess traffic congestion applicable to metropolitan planning organizations who receive Congestion Mitigation Air Quality (CMAQ) funding.

- Annual Hours of Peak Hour Excessive Delay Per Capita
- Percent of Non-Single Occupancy Vehicle Travel

Annual Hours of Peak Hour Excessive Delay (PHED) – This measure refers to the additional time spent in congested traffic, in addition to the regular peak hour congestion, based on an established speed threshold. The federal threshold for excessive delay on a roadway is 60% of the speed limit. On a segment with a speed limit of 60 mph, the excessive delay (60% of 60 mph) would be 36 mph. Peak periods are defined as Monday through Friday 6:00 a.m. to 10:00 a.m. and 3:00 p.m. to 7:00 p.m.

Figure B-17: Annual Hours of Peak Hour Excessive Delay (PHED) Performance Measure Statistics

Measure (PHED) – Annual Hours of Peak Hour Excessive Delay (PHED) per capita - This is the number of extra travel time spent in peak traffic, under excessive delay conditions, annually.

Methodology – The PHED is calculated using all vehicle data from the National Performance Management Research Data Set (NPRMDS) which contains travel time by roadway segment every 15 minutes, with volumes in the Highway Performance Monitoring System (HPMS) and occupancy factors.

TxDOT enlisted the Texas Transportation Institute (TTI) to establish a statewide methodology and recommend future year targets for all MPOs in the state for the System Performance Group. TTI calculated the base-year measurement from observed data and formulated future year targets. The TTI methodology does not include estimates for the impact of project investments and congestion mitigation projects that H-GAC is implementing at a regional level.

Applicability – National Highway System in urbanized areas

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions - Based on the feedback received by TAC members during the October 2, 2018 TAC Workshop, staff has proposed to use the TTI methodology for the baseline and set targets for 2020 and 2022 to be same as the 2018 baseline numbers for Percent of Trips that are Non-Single Vehicle Occupancy Travel. H-GAC adopted flat targets. Better estimates and targets may be updated after two years when improved data sets are available.

Congestion Performance Measure	Baseline	2020 Target	2022 Target
Annual Hours of Peak Hour Excessive Delay per capita	14	14	14

For Peak Hour Excessive Delay, States and MPOs are not required to establish a two-year target, yet are required to establish a four-year target, and may adjust the four-year target at the Mid-Performance Period Progress Report due in October 2020. The first performance period begins January 1, 2018 and ends on December 31, 2021 and is for the Calendar Years (CY) of 2018 - 2021.

Percent of Trips that are in Non-Single Occupancy Vehicles (Non-SOV) – The goal of this measure is focused on reducing congestion by increasing the number of work trips where commuters are sharing a ride with others. In the H-GAC region, 78.9% of commuters drive alone and 21.1% of commuters are sharing a ride, such as carpooling, using regional vanpool, riding public transportation, walking, bicycling and other means.

Figure B-18: Percent of Trips that are Non-SOV Performance Measure Statistics

Measure (Non-SOV) – Percent of Trips that are Non-SOV, based on work commute types

Methodology – Percent of Trips that are Non-SOV is calculated from H-GAC's travel demand model and compared with the U.S. Census American Community Survey data.

Applicability – All roadways in the urbanized areas of the 8-county H-GAC region.

Reporting Frequency – Biennially with four-year performance periods

Targets and Conditions – Based on the feedback received by TAC members during the October 2, 2018 TAC Workshop, staff considered using the TTI methodology for the baseline and set targets for 2020 and 2022 to be same as the 2018 baseline numbers for the Percent of Trips that are Non-Single Vehicle Occupancy Travel. For the Percent of Non-Single Occupancy Vehicle measure, staff utilized the H-GAC travel demand model for target setting. Based on the model data and calculations, staff projected the mode share for Non-SOV to grow due to strategies implemented at the regional level. In light of the H-GAC region's forecast of high levels of economic and population growth, resulting in more travel and commuters, H-GAC chose to adopt targets with a desire for aspirational goals that indicate an increase in multi-occupant vehicle use in the long-term.

Congestion Performance Measure	Baseline	2020 Target	2022 Target
Percent of Trips that are Non-Single Vehicle Occupancy Travel	20.1%	21.1%	22.1%

For Percent of Trips that are Non-Single Vehicle Occupancy Travel, States and MPOs are required to establish a two-year and four-year targets and may adjust four-year targets at the Mid-Performance Period Progress Report due in October 2020. The first performance period begins January 1, 2018 and ends on December 31, 2021 and is for the Calendar Years (CY) of 2018 - 2021.

Air Quality / On-Road Mobile Source Emissions Measures

FHWA established air quality performance measures to assess vehicle emissions with a goal of reducing emissions resulting in better air quality. Metropolitan Planning Organizations (MPO) with a population over 1,000,000 that receive Congestion Mitigation Air Quality (CMAQ) funding are required to set targets for on-road mobile source emission reductions and to develop a CMAQ Performance Plan. The reporting period is biennially, with four year performance periods.

Due to new requirements springing from the FAST Act, MPOs that receive Congestion Mitigation and Air Quality Improvement (CMAQ) funds must work with state DOTs to develop performance management targets for the Nitrogen Oxide (NOx) and Volatile Organic Compound (VOC) emissions reduced by projects programmed with CMAQ funding. For the Houston-Galveston region, this includes targets for NOx and

VOC emissions. In response to this requirement, the Texas Department of Transportation reached out to the MPOs in Texas nonattainment regions for collaboration in the development of emissions reduction estimates. Through consultations with H-GAC and two other nonattainment MPOs, an alternative methodology was developed. The baseline and performance targets shown in the table below were developed using current projects and their actual emissions from projects in the 2021-2024 Transportation Improvement Program. The baseline and targets are documented in the CMAQ Performance Plan, located at http://www.h-gac.com/transportation-improvement-program/project-resources.aspx. The four-year emission reduction target from CMAQ funded projects is a conservative estimate, as once the 2018 Call for Projects are submitted and approved, more CMAQ funded projects are likely to be added which will increase the expected emissions reduced.

Figure B-19: Emission Reduction Baseline and Performance Measure Targets

Targets and Conditions – H-GAC adopted the emission reduction baseline and performance targets for Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC), expressed in kilograms per day.

On-Road Mobile Source Total Emission Reductions

Performance Measure	2018 Baseline	2020 2-Year Target	2022 4-Year Target
Emission Reductions NO_x (kg/day)	453.741	1,419.426	1,883.294
Emission Reductions VOC (kg/day)	66.850	169.301	200.809

For the Total Emissions Measure, States and MPOs are required to establish two-year and four-year targets and may adjust four-year targets at the Mid-Performance Period Progress Report due in September 2020. The first performance period began October 1, 2017 and ends on September 31, 2021 and is for the Federal Fiscal Years of 2018 - 2021.

Integrating System Performance Measures into the Transportation Planning Process

Moving People and Goods Efficiently and Strengthen Regional Economic Competitiveness are two of the five foundational goals of the Regional Transportation Plan, H-GAC is integrating the System Performance targets in the form of quantifiable strategies within the regional transportation planning process. H-GAC incorporates performance measures into its programming activities through the core strategy, Manage, as related to system management and operations.

The RTP 2045 project evaluation system was intended to be performance-based for prioritizing projects for the region. The primary method for the programming of projects is the Call for Projects. Fifty percent of the project's score is calculated from benefit cost analyses in three key areas: reduction of travel delay, on-road vehicle emissions reductions, and safety improvements to reduce crashes. With a heightened focus on the improving the performance of the transportation system, the benefit cost analysis types have a direct linkage to the reliability, congestion and air quality performance measures.

2021 – 2024 TIP and 2045 RTP transportation investments targeting improvements to System Performance

H-GAC, along with state and local government partners, have made strategic investments in transportation infrastructure and programs through the 2045 RTP. The fiscally constrained 2045 RTP recommends a significant level of investments for System Performance. A combined effort of planning, programming of projects, improved data collection, and critical transportation investments are expected to support and contribute to achieving the targets for System Performance.

Reliability and Congestion – The fiscally-constrained 2045 RTP recommended approximately $37 billion of investments of Corridor-based Major Investments and Regional Investment Programs from the 2045 RTP Strategy 1, Manage for addressing Reliability and Congestion, as shown in the table below.

Table B-14: 2045 RTP Corridor-Based Major Investments/Regional Investment Programs

RTP 2045	Strategy 1 - MANAGE [System Management and Operations]
Corridor-Based Major Investments & Regional Investment Programs	$37,004,441,916

Additionally, a total of $ 6.7 billion is programmed in the 2021 – 2024 Transportation Improvement Program which is expected to contribute towards achieving the Reliability and Congestion targets.

Table B-15: 2021-2024 TIP Funds Programmed Towards Achieving Reliability and Congestion Targets

2021 – 2024 Transportation Improvement Program	
Category 2 – Metropolitan and Urban Area Corridor Projects	$1,553,068,000
Category 4 – Statewide Connectivity Corridors Projects	$677,543,000
Category 5 – Congestion Mitigation and Air Quality Improvement	$468,954,019
Category 7 – Surface Transportation Block Group	$588,232,535
Category 12 – Strategic Priority	$1,663,600,000
Total	**$4,951,397,554**

Air Quality – Total Emission Reductions - The fiscally-constrained 2045 RTP recommended approximately $46.7 billion of investments of in the categories of ITS/Safety, Local High Capacity Transit, Pedestrian/Bicycle, Transit Capital Program and Air Quality projects and programs for improving air quality and achieving the performance targets, as described in the table below. These investments are not part of the Corridor-based Major Investments of the 2045 RTP.

Table B-16: 2045 RTP Air Quality - Total Emission Reduction Investment

RTP 2045 STRATEGIES	STRATEGY 1 MANAGE [System Management and Operations]	STRATEGY 2 MAINTAIN [Asset Management]	STRATEGY 3 EXPAND [Transportation Network Capacity]	TOTAL
REGIONAL INVESTMENT PROGRAMS				
Air Quality Related	$254,598,000	NA	NA	$254,598,000
ITS/Safety: (Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management)	$517,457,158	$62,269,438	NA	$579,726,596
Local High Capacity Transit: (Includes non-corridor light rail, park and ride, transit centers, demand management strategies)	$15,908,231,556	$99,598,227	$13,790,549,267	$29,798,379,050
Pedestrian/Bicycle: (Includes on-street facilities, hike and bike trails and paths, and reconstruction)	$130,247,249	$51,178,297	$1,626,470,674	$1,807,896,220
Transit Capital: (Includes all other new or expanded facilities, services, and vehicles)	$4,272,120,809	$2,404,429,566	$7,669,280,587	$14,345,830,962
TOTAL	**$20,082,654,772**	**$2,617,475,528**	**$23,086,300,528**	**$46,786,430,828**

Air Quality

Additionally, a total of $ 553.2 million is programmed in the 2021 – 2024 Transportation Improvement Program which is expected to contribute towards achieving the air quality targets.

Table B-17: 2021-2024 TIP Investments Towards Achieving Air Quality Targets

2021 – 2024 Transportation Improvement Program	
Category 5 – Congestion Mitigation Air Quality (CMAQ)	$468,954,019
Category 9 – TAP/TASA (Grouped Projects)	$65,991,209
Total	**$534,945,228**

TRANSIT ASSET MANAGEMENT

The Moving Ahead for Progress (MAP-21), Final Rule 49 USC 625 established a strategic and systematic process of operating, maintaining, and improving public capital assets effectively through their entire life cycle. This rule became effective October 2016 and includes the definition of "Transit Asset Management Plan" (TAM) and "State of Good Repair". Additionally, the rule establishes performance measures for equipment, rolling stock, infrastructure, and facilities asset categories to assist when making investment decisions. Transit providers that receive federal funds and either own, operate or manage capital assets used in providing public transportation are required to develop and implement TAM Plans and submit performance measures, annual condition assessments, and targets to the National Transit Database. Sub-recipients and Tier II providers (that operate one hundred or fewer vehicles) have the option to develop a group TAM Plan with the Texas Department of Transportation (TxDOT) or develop their own plan.
Transit Asset Management Plans contain the capital asset inventories for rolling stock, equipment, non-revenue vehicles, facilities and rail infrastructure. Rail infrastructure applies to METRO only. Investment prioritizations, decision support tools, as well as, risk mitigation, maintenance, acquisition and renewal strategies are the core activities of the TAM Plans.

The majority of the assets in our region belong to Tier I provider METRO. The Tier II providers that receive FTA Section 5307, 5310 & 5311 funding can either set their own targets, as direct recipients, or opt to be included in TxDOT's Group Plan. Colorado Valley Transit was the only provider that opted to be included with TxDOT's Group Plan. H-GAC collaborated with TxDOT, Tier I, and Tier II providers to set regional targets, as required by the Final Rule.

Tier I transit providers:

- METRO (Harris County Metropolitan Transit Authority)

Tier II transit providers:

- Brazos Transit District
- Colorado Valley Transit
- Connect Transit
- Conroe Connection Transit
- Fort Bend County Transit
- Galveston Island Transit
- Harris County Transit
- The Woodlands Transit

The Regional Transit Coordination Committee held meetings during 2017 and 2018 to discuss the process required to formulate TAM Plans and targets. In May 2018, the Transportation Policy Council (TPC) approved an interagency Memorandum of Understanding between the region's transit operators, TxDOT, and H-GAC to facilitate regional collaboration and promote a performance-based planning process.

H-GAC led the coordination efforts for target setting and TAM Plan development with the Regional Transit Coordination Subcommittee (RTCS) in 2018. The RTCS established a TAM Plan Working Group with the objective of developing H-GAC regional targets and to promote State of Good Repair of capital assets. The working group formulated a methodology for the regional targets in the four areas of rolling stock, equipment, facilities, and infrastructure. The TAM Plan Working Group endorsed a methodology for setting the region's targets based on a weighted average of asset management scores for Tier I and Tier II transit providers for their rolling stock, equipment, facilities and rail infrastructure.

Based on the weighted average method, the regional targets were presented and approved by the Regional Transit Coordination Subcommittee. The Technical Advisory Committee and the Transportation Policy Council approved H-GAC's regional transit targets, as described in the following table.

Table B-18: Transit Asset Management Performance Measures and Targets by Asset Category

Asset Category & Performance Measures	FY 2018	FY 2020	FY 2022
Rolling Stock – Revenue Vehicles - Age % of revenue vehicles that have met or exceeded their ULB			
Tier I Target	10%	10%	10%
Tier II Target	19%	16%	17%
TxDOT Target	15%	15%	15%
Regionwide Target	11%	11%	11%
Equipment – Non – Revenue Vehicles – Age % of non-revenue vehicles that have met or exceeded their ULB			
Tier I Target	46%	46%	46%
Tier II Target	0%	0%	0%
TxDOT Target	15%	15%	15%
Regionwide Target	46%	46%	46%
Facilities – All buildings/Structures – Condition- % of facilities have a condition rating below 3.0 TERM			
Tier I Target	54%	54%	54%
Tier II Target	75%	67%	60%
TxDOT Target	15%	15%	15%
Regionwide Target	55%	55%	54%
Infrastructure – Fixed Rail Guideway, tracks, signals & systems - % of rail infrastructure with performance (speed) restrictions, by mode			
Tier I Target	0%	0%	0%
Regionwide Target	0%	0%	0%

Note: Useful Life Benchmark (ULB) is the expected lifecycle of a capital asset for a transit provider's operating environment, or the acceptable period of use in service for a transit provider's operating environment. Transit Economic Requirements Model (TERM) Scale: Facility condition assessments reported to the NTD have one overall TERM rating per facility. TERM Rating –Excellent – (4.8-5.0); Good – (4.0-4.7); Adequate – (3.0-3.9); Marginal – (2.0-2.9); Poor (1.0-1.9)

Transit Safety

On July 19, 2018, the Federal Transit Administration (FTA) published the Public Transportation Agency Safety Plan (PTASP), Final Rule, which requires transit providers who are recipients and subrecipients of federal transit assistance under FTA's Urbanized Area Formula Grants (5307) to develop safety plans and Safety Management Systems focused on protecting passengers and employees. The objective of Safety Management Systems is to create a collaborative approach for management and labor to work together to control risk, identify risk and allocate resources to mitigate risk.

The requirements of a PTASP/Safety Plan include:

- Processes and procedures to implement Safety Management Systems
- Safety performance targets
- Employee Reporting Program
- Emergency Preparedness Plan (applies to rail agencies)

Table B-19: Transit Safety Plan Performance Targets

Measure	Metric	Applicability	Reporting Frequency
Fatalities	Total amount and rate of fatalities per total vehicle revenue miles	Transit providers who receive Federal Transit Administration Urbanized Area Formula Grants (5307)	Annually
Injuries	Total amount and rate of injuries per total vehicle revenue miles		Annually
Safety Event	Total amount and rate of safety events per total vehicle revenue miles		Annually
System Reliability	Mean distance between major mechanical failures		Annually

Transit operators must certify they have a safety plan in place meeting the requirements of the FTA Final Rule and set safety performance targets by December 31, 2020. The plan must be updated and certified by the transit agency annually. As the Metropolitan Planning Organization (MPO), H-GAC is required to set an initial transit safety target by June 20, 2021. FTA suggests that MPOs identify one region-wide target for each of the four asset types for all transit providers. The goal is to enable the MPO to assess progress towards region-wide attainment of transit State of Good Repair and better determine how funding decisions support regional targets. In addition, the FTA Final Rule establishes new requirements for MPOs to coordinate with transit providers, set performance targets, and integrate those performance targets and performance plans into their planning documents.

Integrating Transit Asset Management Performance Measures into the Transportation Planning Process

Both the short and long-range planning processes afford the opportunity for advancing the transportation system to a state of good repair. Two the core strategies of the Call for Projects applicable to Transit Asset Management are: 1). Maintain Asset Management: to improve and preserve the condition of existing transportation infrastructure at the least practicable cost through the application of sound asset management techniques; and 2). Expand Multimodal Network Capacity: add capacity across all modes of travel with a focus on the interconnections between different networks and services that provide users with greater choices. The RTP 2045 project evaluation system was designed to be performance-based when prioritizing projects for the region. To highlight the significance of managing the assets of the transit programs, the Call for Projects designated four transit investment categories: Transit Priority Infrastructure, Transit Facility State of Good Repair, Transit Passenger Facilities, and Transit Expansion for vehicle purchases. The Transit Investment Strategies for the RTP 2045 are highlighted in Table B-20.

Table B-20: Transit Investment Strategies

Transit Investment Strategies		
MANAGE *System Management & Operations*	**MAINTAIN** *Asset Management*	**EXPAND** *Transportation Network Capacity*
• Regional Fare Collection • Transit Priority Infrastructure	• Vehicle Replacement and Overhaul • Facility State of Good Repair	• Passenger Facilities (Park & Ride/Pool, Transfer Points, Super Stops, Shelters) • Vehicle Purchase

Given the fiscal constraints of transportation funding, performance-based planning can help identify the best cost-effective projects to so the investment decisions in our transportation system will be allocated to the highest priorities of the Transit Asset Management (TAM) program. As a result, the projects programmed in the RTP 2045 are expected to support and contribute towards achieving the TAM performance targets.

2021 – 2024 TIP and 2045 RTP transportation investments targeting improvements to Transit Asset Management

Regional transit provider's TAM Plans summarize revenue rolling stock vehicles, including buses and light rail vehicles, non-revenue service vehicles, light rail track maintenance right of way assets, public facilities, and operating facilities. TAM Plans have outlined how each provider will monitor, update and evaluate the TAM plan to ensure continuous improvement. On an annual basis, transit providers will track their agency's progress toward the targets, report on their progress, and have the option to revise their targets, if needed.

Funding will be used to focus on transit asset management and planning, life cycle and safety of equipment, vehicles and other assets and infrastructure used by transit agencies, such as buses and vans, building and other rail assets. Through the implementation of TAM Plans, each of the region's transit providers are carefully evaluating their funding for projects that will contribute to achieving their individual transit asset management performance targets. As a result, TAM Plans are expected to have a significant impact toward achieving the Transit Asset Management targets.

H-GAC, along with state and local government partners, have made strategic investments in transit projects and programs through the 2045 RTP. The fiscally constrained 2045 RTP recommends a significant level of investments for transit operations and asset management. A combined effort of collaborative planning, programming of projects, and critical investments in the region's transit system are expected to support and contribute to achieving the targets for Transit Asset Management. The fiscally constrained 2045 RTP recommended approximately $14 billion of investments in the Transit Capital category to achieve a State of Good Repair over the life cycle of transit assets. These investments are not part of the Corridor-based Major Investments of the 2045 RTP.

Table B-21: 2045 Regional Transportation Plan Transit Capital Investments to Achieve a State of Good Repair

RTP 2045 STRATEGIES	STRATEGY 1 MANAGE [System Management and Operations]	STRATEGY 2 MAINTAIN [Asset Management]	STRATEGY 3 EXPAND [Transportation Network Capacity]	TOTAL
REGIONAL INVESTMENT PROGRAMS				
Transit Capital: (Includes all other new or expanded facilities, services, and vehicles)	$4,272,120,809	$2,404,429,566	$7,669,280,587	$14,345,830,962

Additionally, a total of $108.8 million is programmed in the 2021 – 2024 Transportation Improvement Program which is expected to contribute towards achieving the Transit State of Good Repair performance targets.

Table B-22: 2021-2024 Transportation Improvement Program Investments to AchieveTransit State of Good Repair Performance Targets.

2021 – 2024 Transportation Improvement Program	
FTA Section 5337 – State of Good Repair	$61,453,703
FTA Section 5339 – Bus & Bus Facilities	$47,381,476
Total	**$108,835,179**

2020 PERFORMANCE MEASURES REPORT

Federal legislation introduced Transportation Performance Management to address challenges facing the transportation system. As a Metropolitan Planning Organization for the greater Houston area, H-GAC sets targets and reports on the progress toward targets. The Transportation Performance Measures webpage can be viewed at: http://www.h-gac.com/transportation-performance-measures/default.aspx. H-GAC has the responsibility for these federal performance measures in a variety of key performance areas:

- **Safety -** with goals to reduce fatalities and serious injuries for vehicles, pedestrians and bicyclists.
- **Pavement & Bridges** – maintaining good condition of transportation infrastructure assets is critical to safety, the movement of goods and people and economic development.
- **Reliability** – making travel more reliable for personal travel and trucks moving freight.
- **Congestion** – assess and measure hours of peak hour excessive delay and plan for an increase in multi-occupant vehicle use or ridesharing to reduce congestion.
- **Air Quality** – the goal is to reduce tailpipe emissions by funding CMAQ-eligible projects, resulting in better air quality for the region.
- **Transit Asset Management** – preserving the conditions of public transportation vehicles and facilities for moving to a State of Good Repair is a priority. Ultimately, these assets support a multi-modal network that the region can depend on.

THE PROCESS FOR MEASURING PERFORMANCE

H-GAC gathers data of current conditions, formulates a quantitative forecast, sets targets for improving the performance of the transportation system, then, over time, monitors the conditions and reports if the goals were reached. Performance management is a powerful analytical tool for tracking regional performance over time and can illustrate how we are meeting the regional goals for improved performance of the transportation system. Performance measurement is not a new concept to H-GAC. Many of the federal performance measures align and compliment H-GAC's existing performance measures found in the Regional Mobility Report.

BENEFITS OF PERFORMANCE MANAGEMENT

Implementing performance targets setting, along with asset management, provides:

- an opportunity for moving the transportation system to a State of Good Repair
- improvement of the transportation network's performance means there will be more reliable and less congested roadways, resulting in better air quality for the region.
- protects our investments in the transportation roadway system and stretches taxpayer dollars, as far as possible
- improve system resiliency in the aftermath of extreme weather events, such as Hurricanes Harvey and Ike, changing climate conditions, and shifts in the regional economy

PERFORMANCE REPORTING AND SCORECARDS

In 2018, at the beginning of the first four-year performance period (2018-2022), the Transportation Policy Council approved federal performance targets in the areas of safety, pavement and bridge, congestion, air quality and transit asset management. Biennial reporting is required at the mid-point (2020), and at the end (2022) of the four-year performance period.

For each of the performance areas, the 2020 progress of meeting the targets are detailed in the scorecard tables below. For all measures, the 2020 actual conditions are based on the latest available data, as of July 1, 2020, which is the mid-point of the performance period, therefore, the actual conditions reported in the scorecards may contain 2019 or 2018 data sets.

The performance measure targets and progress reporting have been developed in coordination and with input from various subcommittees (Traffic Safety Committee, Transportation Improvement Program Subcommittee, Technical Air Quality Committee and Regional Transit Coordination Subcommittee), local governments, the Texas Department of Transportation, the Transportation Advisory Committee, and the Transportation Policy Council (TPC). The TIP Subcommittee and the RTP Subcommittee recommend the draft targets and 2020 Performance Report contingent upon a supplemental letter stating that the safety forecasts reported to FHWA in February 2020 do not reflect the intent and commitment of the TPC to improve traffic safety in the Houston–Galveston region. H-GAC has aspirational goals for safety to further reduce traffic fatalities and injuries beyond the safety targets. On September 25, 2020, the Transportation Policy Council formally approved the targets, this 2020 Performance Measures Report, the 2020 Congestion Mitigation Air Quality Performance Plan Mid Performance Period Progress Report, and a supplemental safety letter.

PUBLIC COMMENT PERIOD

A public comment period for the Performance Measures targets and performance reporting was held from July 8 to August 8, 2020. Five comments were received during the public comment period. The comments can be viewed at the Transportation Performance Measures webpage, along with H-GAC staff's responses to the public comments.

PERFORMANCE REPORTING

The performance of the five safety performance measures is illustrated in the table below:

SAFETY PEFORMANCE						
Measure	2013-2017 Baseline (5-yr. rolling average)	2018 Targets *	2018 Actuals *	2018 Target achieved?	2019 Targets *	2020 Targets *
Number of Fatalities	646	671	655	**Yes**	699	728
Rate of Fatalities	1.2	1.0	1.0	**Yes**	1.0	1.1
Number of Serious Injuries	3,553	3,578	3,183	**Yes**	3,568	3,293
Rate of Serious Injuries	6.9	5.6	4.8	**Yes**	5.1	5.0
Number of Non-motorized Fatalities & Serious Injuries	326	348	339	**Yes**	306	269

* The target values in the table above were reported to FHWA in February 2020 and do not reflect the intent and commitment of the Transportation Policy Council to improve traffic safety in the Houston–Galveston region. H-GAC has aspirational goals for safety to reduce traffic fatalities and injuries in our Region.

Assessment of Progress

Five out of the five safety performance measure targets were met. The number of fatalities has been declining recently after rising for three straight years. This decrease coincides with H-GAC's launch of the regional incident management program Tow and Go. Crash reduction strategies of the Regional Safety Plan may have contributed to this decline. The increase in the non-motorized category are concerning as this measure has increased over the past five years and is forecast to continue increasing in the near future. These increases are due, in part, to several factors. First, more people are seeking alternative modes of travel, people are exercising in greater numbers, and bicycle and pedestrian infrastructure is absent or inadequate.

H-GAC and other regional partners are responding with a variety of initiatives meant to reduce the number of non-motorized fatalities and serious injuries. These efforts include public outreach campaigns, intersection safety audits, and funding of various active transportation infrastructure. Increasing trends in fatalities and crashes do not reflect the intent and commitment of the TPC to improve traffic safety in the Houston-Galveston region and significantly reduce fatalities and serious injuries. In 2019, the Texas Transportation Commission adopted The Road to Zero with a goal of reducing traffic deaths on Texas roadways to zero by 2050. The Transportation Policy Council has previously agreed to support the State in achieving its safety measures. In September 2020, the Traffic Safety Subcommittee approved a Vision Zero policy. The new policy will be considered for approval by the Transportation Advisory Committee and the Transportation Policy Council in October 2020. H-GAC plans to utilize the Texas Department of Transportation's (TxDOT) The Road to Zero methodology to tabulate its safety targets starting with the safety reporting due in February 2021.

Adjustments to 2021 Targets for Safety

The safety performance measures are reported annually in February. In the fall of 2020, H-GAC plans to utilize the state's Road to Zero methodology to tabulate its safety targets starting with the 2021 reporting.

PERFORMANCE REPORTING

The performance of the pavement and bridge conditions is illustrated in the table below:

PAVEMENT & BRIDGE CONDITIONS						
Measure	2018 Baseline	2020 Targets	2020 Actuals	2020 Target achieved?	2022 Targets	2022 Target Adjustments
Interstate pavements in good condition	48.5%	48.5%	42.1%	**No**	48.5%	42.1%
Interstate pavements in fair condition	51.5%	51.5%	57.8%	**No**	51.5%	57.8%
Interstate pavements in poor condition	0.0%	0.0%	0.1%	**No**	0.0%	0.1%
Non-Interstate pavements in good condition	46.7%	46.7%	34.4%	**No**	46.7%	34.4%
Non-Interstate pavements in fair condition	42.0%	42.0%	40.8%	**No**	42.0%	40.8%
Non-Interstate pavements in poor condition	11.3%	11.3%	24.8%	**No**	11.3%	24.8%
National Highway System bridge deck area in good condition	48.6%	48.6%	49.1%	**Yes**	48.6%	49.1%
National Highway System bridge deck area in fair condition	50.8%	50.8%	49.7%	**No**	50.8%	49.7%
National Highway System bridge deck area in poor condition	0.6%	0.6%	1.2%	**No**	0.6%	1.2%

Assessment of Progress

Target achievement is based upon the actual conditions derived from the latest available data collected through the mid-point of the performance period, July 2020.

Interstate Pavement Conditions

The interstate pavement condition targets for 2020 were not met. The target for pavements in good condition was missed by 6.4 percentage points, the targets for fair condition was missed by 6.3 percentage points and the target for pavements in poor condition was narrowly missed by 0.1 percentage points. Since 2018, interstate pavement conditions are worsening, very slightly, however, pavements in the poor condition category are holding steady.

Non-Interstate Pavement Conditions

The non-interstate pavement condition targets for 2020 were not met. The target for pavements in good condition was missed by 12.3 percentage points, the target for fair condition was missed by 1.2 percentage points, and the target for poor condition was missed by 13.5 percentage points. This is due to 1,900 off-system lane miles that were mistakenly omitted when the original targets were set in 2018. Future targets have been adjusted to include the correct on-system and off-system lane miles of the non-interstate pavements. It is important to note that calculating the two-year target progress from 2018 to 2020 for on-system lane miles exclusively would have resulted in missing the targets for good, fair and poor condition by 3.3, 2.7 and 0.7 percentage points respectively.

Bridge Conditions

Overall, for the three bridge performance measures, there was very little change in NHS bridge conditions from 2018 to 2020. The 2020 target for bridge deck area in good condition was met. Due to some of the bridges moving down from the fair into the poor category, the target for bridge deck area in fair condition was missed by 1.1 percentage points, and the poor condition target was narrowly missed by 0.6 percentage points.

Adjustments to 2022 Targets for Pavement and Bridge

H-GAC staff recommended the adjustment of the 2022 targets to reflect the 2020 actual pavement and bridge conditions as show in the table above. H-GAC staff will continue to monitor how the August 2020 submittal of amendments to the National Highway System (the addition of 113 miles and the removal of 116 miles) may impact the 2022 pavement targets.

PERFORMANCE REPORTING

Understanding the Target Values for Reliability and Congestion

Percent of Person-miles traveled (Interstate and Non-Interstate NHS) that are Reliable –

The range for reliable is zero to 50% and unreliable is 51% or greater (times than average). For example, a trip that normally takes 60 minutes, on a bad day of traffic, when it takes 90 minutes or more, the trip is considered to be unreliable. In the H-GAC region, for the baseline and target, in the region, 63% of person-miles traveled on the interstate are reliable, and 74% of person-miles traveled on the non-interstate National Highway System (NHS) are reliable. The higher the percentage, the more reliable they are.

Truck Travel Time Reliability Index (Interstate only) –

There is no official standard for reliable and unreliable in this measure. Unlike the previous reliability measure, the truck reliability measure is an index. The truck index is the amount of time a truck driver needs to add to a median trip length to arrive on-time, 95% of the time. For example, for a truck trip of 30 minutes, using the regional baseline of 2.1, a total time of 63 minutes would be needed to be scheduled for the truck to arrive, on-time, 95% of the time.

Annual Hours of Peak Hour Excessive Delay –

This is the number of extra travel time spent in peak traffic, annually. The federal threshold for excessive delay on a roadway is 20 mph or 60% of the speed limit, whichever is greater. On a segment with a speed limit of 60 mph, the excessive delay (60% of 60 mph) would be 36 mph. For the region, annually, per person, the baseline and targets are 14 hours of excessive delay.

Percent of Trips that are Non-Single Vehicle Occupancy Travel –

The goal of this measure is focused on reducing congestion by increasing the number of work trips where commuters sharing a ride with others. In the region, 78.9% of commuters drive alone and 21.1% of commuters are sharing a ride, such as carpooling, using regional vanpool, riding public transportation, telecommuting, walking, bicycling and by other means.

The performance of reliability and congestion measures is illustrated in the table below:

RELIABILITY & CONGESTION						
Measure	2018 Baseline	2020 Targets	2020 Actuals	2020 Target achieved?	2022 Targets	2022 Target Adjustments
Interstate Reliability of Person Miles Traveled	63%	63%	69%	**Yes**	63%	69%
Non-Interstate Reliability of Person Miles Traveled	73%	73%	80%	**Yes**	73%	80%
(An increased value indicates improvement.)						
Interstate Truck Travel Time Reliability Index	2.1	2.1	2.2	**No**	2.1	2.2
Peak Hour Excessive Delay	14	14	14	**Yes**	14	14
(A decreased value indicates improvement.)						
Non-Single Occupant Vehicle Trips	20.1%	21.1%	21.1%	**Yes**	22.1%	20.0%
(An increased value indicates improvement.)						

Assessment of Progress

Four out of the five reliability and congestion 2020 targets were achieved. While the reliability of person miles traveled is gradually improving over time, truck reliability is getting worse. Although the HGAC region failed to meet the Truck Travel Time Index 2020 target, it narrowly missed the target by only 0.1. H-GAC has been working and with the Texas Transportation Institute to better understand why this inverse trend is occurring and is continuing its research of underlying causes. This trend is not unique to the H-GAC region, other large metropolitan areas in Texas are reporting a similar trend. Roadway construction and congestion affect travel reliability. After years of construction, the opening of US 290 and other major corridors in the 8-county region contributed to better reliability. Peak Hour Excessive Delay is holding steady at 14 hours for 2018 and 2020. The conditions for the Non-Single Occupant Vehicle measure increased 1 percentage point from 2018 to 2020.

Peak Hour Excessive Delay

While H-GAC achieved the 2020 performance target for Peak Hour Excessive Delay (PHED), it is important to identify issues with the underlying data used to calculate the performance and achievement. Methods for calculating this measure are prescribed in federal guidance. The paragraphs that follow detail some of the data issues with measuring peak hour excessive delay.

The Texas Department of Transportation contracts with the Texas A&M Transportation Institute (TTI) to calculate the conditions of Peak Hour Excessive Delay (PHED). TTI used the National Performance Management Research Data Set (NPMRDS) roadway segments defined as Traffic Message Channel (TMC) segments for their estimation of the PHED. These TMC roadway lengths are updated periodically by the NPMRDS vendor INRIX; these changes can have significant impacts on the PHED. The TMC length changes were the results of INRIX changing its base map when switching from TomTom to HERE Technologies.

The TMC roadway segments for the years of 2017-2018 and 2018-2019 were compared to determine if there were any changes. This comparison showed that between 2017 and 2018, approximately 1% of the TMC segments changed by +/- 10%, however, during that time, the Annual Average Daily Traffic (AADT) assigned to TMCs changed by over 20%. The important point is that between 2018 and 2019, over 80% of the TMC segment lengths changed by +/- at least 10%, and a minimum of 20% of the AADT assigned to TMCs changed by at least +/- 10%.

Generally, one of the two inputs to personal-miles of travel (the variable combined with speed data to calculate delay) changed between 2017 and 2018. However, both variables (length and AADT) changed significantly between 2018 and 2019, consequently amplifying the effects. When the lengths of the TMC roadway segments or AADT change, this alters the person-miles of travel assigned to the TMC. As a result, these changes can modify the speeds that are captured inside the shorter or longer TMC segments causing the TMCs to have completely different characteristics across the years. Currently, the data is not consistent enough to be able to monitor Peak Hour Excessive Delay (PHED) of the transportation system. The analysis of data changes shows that PHED estimates are highly variable and meeting PHED targets may be problematic in the future. H-GAC will continue working with Texas Transportation Institute staff to review future changes to the input data and monitor the performance of excessive delay.

Non-Single Occupant Vehicle

The conditions and targets for the percent of the Non-Single Occupant Vehicles are based on the Houston-Galveston Area Council travel demand model mode choice model output and the American Community Survey. Mode choice predicts the choices that individuals or groups make in selecting their transportation modes: single occupant vehicles, carpool, transit, and non-motorized. An important objective of the model is to predict the share of trips attracted to public transportation. Other factors considered for mode choice include socio-economic or household characteristics, travel time, travel cost and access to mass transit options. H-GAC staff will continue to monitor the performance of mode choice.

<u>Adjustments to 2022 Targets for Congestion and Reliability</u>

The COVID-19 pandemic of 2020 has drastically impacted reliability and congestion performance. The full impacts of the pandemic on traffic have yet to be realized. As a result, it's unclear what the outcomes are going to be in future years and may cause achieving future targets problematic. In conclusion, H-GAC staff will continue to work with the Texas Transportation Institute, the Texas Department of Transportation, and other partners to monitor and understand the performance of the background data used to calculate reliability and congestion measures. This is expected to result in the best possible target projections and achievements.

For this set of measures, H-GAC staff recommended the adjustment of the 2022 targets for Personal Travel Reliability to reflect the 2020 actual conditions, no adjustment to the 2022 target for Peak Hour Excessive Delay measure, and adjusting the 2022 target for the Non-Single-Occupant measure to 20% due expected impacts from the pandemic.

PERFORMANCE REPORTING

The performance of the on-road mobile source emission reductions is illustrated in the table below:

CONGESTION MITIGATION AIR QUALITY						
On-Road Mobile Source Emission Reductions						
	2018 Baseline	2020 Targets	2020 Actuals	2020 Target achieved?	2022 Targets	2022 Target Adjustments
Reporting Years		2019 - 2020	2019 - 2020		2019 - 2022	2018-2021
Emission Reductions of NOx (kg/day)	453.741	1,419.426	158.319	**No**	1,883.294	1,429.077
Emission Reductions of VOC (kg/day)	66.850	169.301	52.010	**No**	200.809	234.604

Nitrogen Oxides (NOx)
Volatile Organic Compounds (VOC)

Assessment of Progress

Emission Reductions Conditions

There has been significantly less progress on the initial 2020 two-year target than was anticipated when the targets were initially set in 2018. As a result, the Houston region was unable to meet the two-year emission reductions targets for Nitrogen Oxide (NOx) and Volatile Organic Compounds (VOC). This can be attributed to several factors:

- Early Letting Date: Due to the formulation of the performance measures, all emission reductions are counted in the year the project is initially obligated. As a result of this, approximately 825 kg/day of targeted NOx and 22.9 kg/day of targeted VOC were lost due to projects being unexpectedly let in 2018. The largest of these rescheduled projects is H-GAC's Clean Vehicles Program, which accounts for 822.66 kg/day of NOx and 22.46 kg/day of VOC emission reductions and was obligated in 2018 rather than the anticipated 2019.
- Project Delays: Similarly, one of H-GAC's Transportation Improvement Plan projects was delayed until a later year which removed it from this analysis. This accounted for 0.07 kg/day of NOx emissions reductions and 0.02 kg/day of VOC emissions reductions.
- Funding Category Changes and Project Cancellations: Finally, a small portion of the emissions reduction decreases are the result of four projects that were either moved to a separate, non-CMAQ funding category or were canceled altogether by the project's sponsor. This set of projects resulted in 0.04 kg/day of NOx reductions and 0.01 kg/day of VOC reductions.

Following the completion, TPC approval, and submission of the initial two- and four-year targets by H-GAC in September 2018 to meet the federal deadline, FHWA released guidance in January 2019 to assist with the development of CMAQ targets. This guidance recommended that MPOs and state DOTs should use the time

frame of 2018 through 2021 rather than 2019 through 2022 as H-GAC utilized in the initial target estimates. Using the revised time frame recommended in the guidance would result in a significant increase in emissions attributable to progress toward meeting the two-year performance target. Calculating the two-year target progress from 2018 through 2021 would have resulted in two-year progress of 919.445 kg/day of NOx and 68.570 kg/day of VOC.

Adjustments to 2022 Targets for CMAQ Air Quality

Due to lower than expected progress toward meeting the two- and four- year targets, it is recommended to revise our initial four-year targets downwards to reflect possible outcomes. First, this revision will revise the time frame for the remainder of the performance period to include the years 2018 through 2021 to match the range recommended by the FHWA guidance that was not available during the initial 2018 development of the targets. Rather than base this revised four-year target on a direct accounting of planned projects as was done initially in 2018, H-GAC is using a revised methodology that was devised in conjunction with the Texas Department of Transportation and other Metropolitan Planning Organizations within Texas. This new methodology takes the variability of regional transportation projects into account. The revised four-year target uses a combination of verified project outcomes derived from 2018 and 2019, as reported to the FHWA's CMAQ Public Access System over the last four full fiscal years (2016 through 2019). This annual average was then doubled to determine an estimate of CMAQ emissions reductions for fiscal years 2020 and 2021. Finally, this two-year average is scaled down by approximately 65% to account for anticipated annual improvement due to fleet turnover in the H-GAC region, based on EPA's Motor Vehicle Emission Simulator (MOVES) methodology. MOVES is the emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gasses, air toxics.

H-GAC staff recommended the adjustments of the 2022 CMAQ cumulative targets of 1,429.077 kg/day of NOx and 234.604 kg/day of VOC, as shown in the table above.

TRANSIT ASSET MANAGEMENT

The Moving Ahead for Progress (MAP-21), Final Rule 49 USC 625 established a strategic and systematic process of operating, maintaining, and improving public capital assets effectively through their entire life cycle. This rule became effective October 2016 and includes the definition of Transit Asset Management Plan (TAM) and State of Good Repair. Transit Asset Management Plans contain the capital asset inventories for rolling stock, equipment, non-revenue vehicles, facilities and rail infrastructure. Rail infrastructure applies to METRO and Island Transit. Investment prioritizations, decision support tools, as well as, risk mitigation, maintenance, acquisition and renewal strategies are the core activities of the TAM Plans. The overarching goal of TAM is to improve the conditions of the region's transit vehicles and facilities and move the assets to a State of Good Repair.

The majority of the assets in our region belong to Tier I provider METRO. The Tier II providers that receive FTA Section 5307, 5310 & 5311 funding can either set their own targets, as direct recipients, or opt to be included in TxDOT's Group Plan. Colorado Valley Transit was the only regional provider that opted to be included with TxDOT's Group Plan.

Tier I transit providers:

- METRO (Harris County Metropolitan Transit Authority)
- Island Transit (Galveston)

Tier II transit providers:

- Brazos Transit District
- Colorado Valley Transit
- Connect Transit
- Conroe Connection Transit
- Fort Bend County Transit
- Harris County Transit
- The Woodlands Township Transit

In 2018, to promote State of Good Repair of capital assets, the Transportation Policy Council approved the methodology and targets for 2020 and 2022 based on a weighted average of the asset condition scores for the region's transit providers for the categories of rolling stock, equipment, facilities and rail infrastructure.

<u>Understanding the Target Values for Transit Asset Management</u>

There are four transit asset categories: rolling stock, equipment, facilities, and infrastructure. The age and condition of these assets are measured with a focus on the capital assets that have passed their Useful Life or are in the poorest of conditions. Target values with lower percentages are more desirable because this represents that a smaller percentage of the transit assets are in poor condition. A lower percentage indicates better conditions of the transit assets. Inversely, target values with higher percentages indicate a larger percentage of the transit assets are in poor condition.

PERFORMANCE REPORTING

The performance of the transit assets is illustrated in the table below:

TRANSIT ASSET MANAGEMENT – H-GAC REGIONAL TARGETS						
Measure	2018 Baseline	2020 Targets	2020 Actuals	2020 Target achieved?	2022 Targets	2022 Target Adjustments
Rolling Stock (revenue vehicles)	11%	11%	10%	**Yes**	11%	10%
Equipment (non-revenue vehicles)	46%	46%	46%	**Yes**	46%	46%
Facilities (buildings and structures)	55%	55%	55%	**Yes**	54%	54%
Infrastructure (rail tracks, signals & systems)	0%	0%	0%	**Yes**	0%	0%
Note: A lower percentage indicates better conditions of the transit assets.						

Assessment of Progress

Target achievement is based upon the actual conditions derived from the region's public transit providers, as reported in Transit Asset Management Plans, as of July 2020. Targets were achieved for all four transit asset performance targets.

To evaluate the performance of transit assets and evaluate target achievement, updated TAM Plans were used. Since 2018, four transit providers, Connect Transit, Conroe Connection, Harris County Transit, and Brazos Transit updated their Transit Asset Management Plans. Harris County Transit increased their vehicle count based on increased service on the Eastern Harris County "Harvey- funded" routes. Lowered percentages of vehicles that had passed their useful life were another result. Brazos Transit shows an increase of three in cutaway vans passed their useful life in the Montgomery -Liberty- Walker County Service Area. Connect Transit had an obvious modernization of their cutaway fleet in their report since vehicles passed their useful life plummeted from 14 to 5. Other vehicle types remained unchanged. Conroe Connection Transit submitted a 2019 report that did not change their information from their 2018 TAM Plan.

Future Vehicle and Facility Improvements

The upcoming improvements are expected to improve the conditions of the region's transit vehicles and facilities and move the region toward a State of Good Repair. In the short term, Fort Bend County Transit and Island Transit will be adding new vehicles to their fleets. There are new transit facilities slated for Fort Bend Transit, Conroe Connections and Connect Transit. These investments are expected to move the region to a better State of Good Repair.

Adjustments to 2022 Targets for Transit Asset Management

H-GAC staff recommended the adjustment of the 2022 targets to reflect the 2020 actual transit asset conditions and adjusting Rolling Stock from 11% to 10% that indicates a slightly improved State of Good Repair, as shown in the table above. No adjustments to the 2022 targets are recommended for the other transit measures.