2019 – 2022

Transportation Improvement Program

Appendix B

FAST Act Compliance

Performance Measures - System Evaluation Report

Updated May 2019

Fixing America's Surface Transportation Act

Fixing America's Surface Transportation Act's (FAST Act) final planning rules for the Metropolitan Planning Process and the Metropolitan Transportation Plan (MTP) will become effective on May 27, 2018. The FAST Act builds on the changes made by MAP-21 including provisions to make surface transportation more streamlined, performance-based, and multimodal, and 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 for the 2040 Regional Transportation Plan include inclusion of new planning factors, consideration of intercity bus connections, transit asset management, and federally required performance targets. H-GAC adopted performance measure targets with the performance-based planning process within the time constraints required by FHWA. As a data clearinghouse, H-GAC will provide regional data to the Texas Department of Transportation when updates become available.

New Planning Factors

Improve Resiliency and Reliability of transportation system and reduce or mitigate storm water impacts of surface transportation

H-GAC has ongoing resiliency planning efforts which propose strategies to mitigate the effects of flooding and other extreme weather impacts, and processes in place to regularly update reports.
Resiliency is defined as: "The ability of transportation infrastructure to maintain operations and be able to recover from disaster".

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 22 of Houston's major bayous spilled over their banks, with some exceeding 10 ft. above the channel banks. Additionally, Houston's two major reservoirs, Addicks and Barker, were quickly inundated by rainfall and their levels reached the top of their emergency

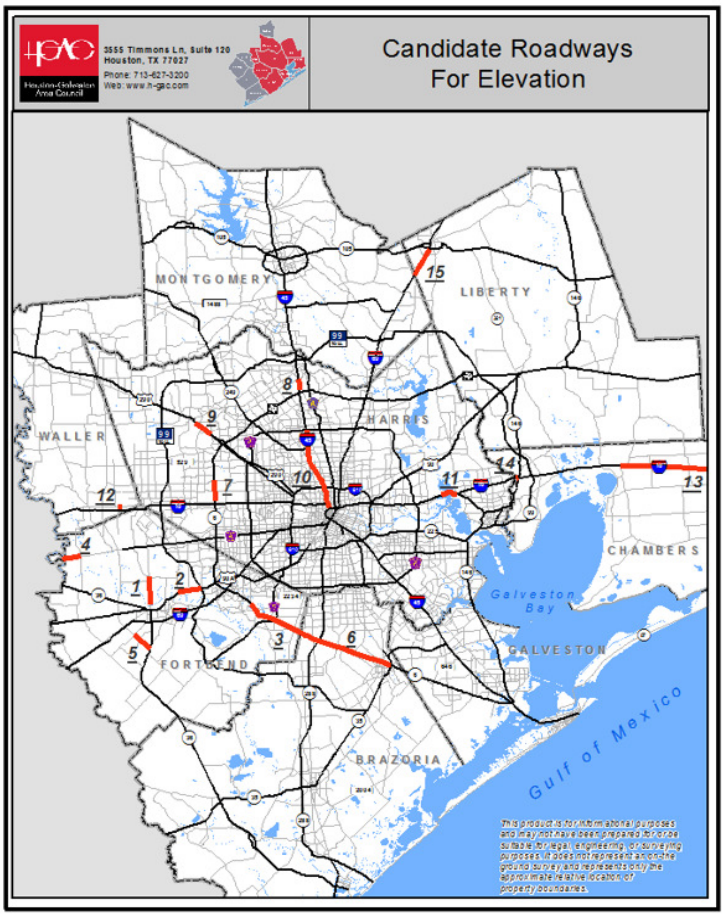

Figure 1 - Possible Roadway Elevation Segments

spillways. The Brazos River in Fort Bend County, which drains an area larger than 45,000 square miles, quickly entered major flood stage as its water level exceeded the previous record stage by almost 2 ft and flooding along the Brazos River in Ft. Bend County overwhelmed protective levees in some areas. North of the city, the San Jacinto River also flooded [xviii].

Because of their importance to public safety, mobility and the state and region's economy, TxDOT and local governments have identified a list of roadways which should be considered for additional flood mitigation (shown in Table 1 (TxDOT) and Table 2 (City of Houston)). Many of these roadways were also flooded by one or more recent flood events (Tax Day flood, Memorial Day Flood, Hurricane Ike, Tropical Storm Allison, etc.). Figure 1 shows state roadway segments in need of elevation above flood levels (note: project numbers do not correspond to priority).

The cost estimates shown in Table 1 reflect the potential cost to elevate the identified state roadway segments above flood levels. At a value of almost $2.6 billion, it should be noted that roadway elevation may not be the only, best or preferred strategy for mitigation of flooding on these critical roadways. Improved capacity for regional and/or localized flood detention, improvements to reservoir capacity, reservoir management and other flood control strategies may be examined as well.

State Roadways Identified by TxDOT as Candidates for Repair, Elevation or Other Flood Prevention Treatments

Proj #	County	Roadway	Limits	Estimates	Description
1	Fort Bend	FM 723	Brazos River to FM 359	100,000,000	elevate pavement
2	Fort Bend	US 90 A	FM 359 to SH 99	50,000,000	elevate pavement and replace bridges
3	Fort Bend	SH 6	Fort Bend County Line to FM 1092	250,000,000	elevate pavement and replace bridges
4	Fort Bend	FM 1093	Brazos River to FM 1489	75,000,000	elevate pavement
5	Fort Bend	Spur 10	SH 36 to Cottonwood School	60,000,000	elevate pavement
6	Brazoria	SH 6	SH 35 to Fort Bend County Line	450,000,000	elevate pavement and replace bridges
7	Harris	SH 6	Addicks Dam to Clay Road	200,000,000	bridge roadway through reservoir
8	Harris	I 45 N	Cypresswood to Parramatta	250,000,000	elevating pavement and rebuild two intersections
9	Harris	US 290	Skinner Road to Telge Road	200,000,000	elevating pavement and rebuild two intersections
10	Harris	I 45 N	I 10 to BW 8	TBD	elevate pavement and replace bridges
11	Harris	I 10 E	Monmouth to Spur 330	2,000,000	elevate pavement and replace bridges
12	Waller	I 10	1000' East and West Petterson Road	75,000,000	replace and build urban intersection
13	Chambers	I 10	SH 61 to FM 1406	635,000,000	elevate pavement and replace bridges
14	Chambers	I 10	0.75 mi West of SH 146 to SH 146	32,000,000	elevate pavement

15	Liberty	US 59	SL 573 to Montgomery Co/L	180,000,000	elevate pavement and replace bridges
			Total Estimate	$2,559,000,000	
	Source: Texas Department of Transportation Houston and Beaumont Districts				

Table 1 – State Roadways Identified by TxDOT as Candidates for Repair, Elevations or Other Flood Prevention

Roadways Identified by City of Houston as Candidates for Repair, Elevation or Other Flood Prevention Treatments					
Project #	**County - City**	**Roadway**	**Limits**	**Estimates**	**Description**
1	Harris - Houston	Gellhorn	IH-10 to IH-610	$5,700,000	Mitigation effort to maintain accessibility to food distribution centers
2	Harris - Houston	IH-610 @ Stella Link	at 610 intersections	TBD	Mitigation effort for underpass to remain accessible during rain events
3	Harris - Houston	IH-610 @ Kirby	at 610 intersections	TBD	Mitigation effort for underpass to remain accessible during rain events
4	Harris - Houston	IH-610 @ Fannin	at 610 intersection	TBD	Mitigation effort for underpass to remain accessible during rain events
5	Harris - Houston	Normandy	at Greens Bayou	$2,400,000	Bridge elevation over Greens Bayou
6	Harris - Houston	Woodforest	at Greens Bayou	$9,600,000	Bridge elevation over Greens Bayou, and causeway or other mitigation to remove roadway from 100-year floodplain
7	Harris - Houston	Kress	at I-10	TBD	Connection for freight mobility during rain events
8	Harris - Houston	I-10 @ Patterson	at I-10	TBD	Mitigation effort for Transportation Operations Facility to remain accessible during rain events (issue on I-10 feeder)
9	Harris - Houston	Katy Road	at Railroad underpass	TBD	Mitigation effort for TranStar to remain accessible during rain events
10	Harris - Houston	Navigation and 75th	Intersection	TBD	Mitigation effort to provide access for industry and freight mobility
11	Harris - Houston	Oates Road	I-10 to 90A	$6,528,000	Mitigation effort to remain accessible during rain events or elevate roadway out of 100-year floodplain

12	Harris - Houston	Will Clayton Blvd	Kenswick to Airport Terminal	$14,400,000	Causeway or other mitigation effort for IAH to remain accessible during rain events
13	Harris - Houston	Greens Road	John F. Kennedy Blvd to US 59	$24,000,000	Causeway or other mitigation effort for IAH to remain accessible during rain events
14	Harris - Houston	Main Street	Holcombe intersection	$360,000	Flood Warning System
15	Harris - Houston	Elgin	Railroad intersection	$360,000	Flood Warning System
16	Harris - Houston	Allen Parkway	Montrose intersection	$360,000	Flood Warning System
17	Harris - Houston	Allen Parkway	Waugh intersection	$360,000	Flood Warning System
18	Harris - Houston	Fannin	Holcombe intersection	$360,000	Flood Warning System
19	Harris - Houston	6514 Jensen	Railroad intersection	$360,000	Flood Warning System
20	Harris - Houston	1700 Jensen	Railroad intersection	$360,000	Flood Warning System
21	Harris - Houston	3500 Kelley	Railroad intersection	$360,000	Flood Warning System
22	Harris - Houston	5800 Elysian	Railroad intersection	$360,000	Flood Warning System
23	Harris - Houston	7506 Hardy	Railroad intersection	$360,000	Flood Warning System
24	Harris - Houston	5405 Mesa	Railroad intersection	$360,000	Flood Warning System
25	Harris - Houston	4899 Old Galveston Road	Railroad intersection	$360,000	Flood Warning System
26	Harris - Houston	Houston Ave	Memorial Drive intersection	$360,000	Flood Warning System
27	Harris - Houston	Shepherd Drive	Memorial Drive intersection	$360,000	Flood Warning System
28	Harris - Houston	Houston Ave	Railroad intersection	$360,000	Flood Warning System
29	Harris - Houston	North Main St.	Railroad intersection	$360,000	Flood Warning System
30	Harris - Houston	Clinton Drive	Railroad intersection	$360,000	Flood Warning System
31	Harris - Houston	Yale Street	Railroad intersection	$360,000	Flood Warning System
32	Harris - Houston	Lawndale	Railroad intersection	$360,000	Flood Warning System
33	Harris - Houston	Broadway	Railroad intersection	$360,000	Flood Warning System
34	Harris - Houston	75th Street	Railroad intersection	$360,000	Flood Warning System
35	Harris - Houston	Harrisburg	Railroad intersection	$360,000	Flood Warning System
36	Harris - Houston	Forest Hill	Railroad intersection	$360,000	Flood Warning System

37	Harris - Houston	Wayside	Lawndale intersection	$360,000	Flood Warning System
38	Harris - Houston	Polk	Railroad intersection	$360,000	Flood Warning System
39	Harris - Houston	Franklin	Commerce Underpass	$360,000	Flood Warning System
40	Harris - Houston	Old Spanish Trail	Railroad intersection	$360,000	Flood Warning System
41	Harris - Houston	Studemont	Railroad intersection	$360,000	Flood Warning System
Total Estimate				**$72,708,000**	
	Source: City of Houston Public Works Engineering				

Table 2 –Roadways identified by City of Houston as candidates for repair, elevations or other flood prevention

City of Houston identified roadways for flood prevention, repair and elevation are estimated to cost approximately $73 million.

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. Major recent rainfall events such as Hurricane Harvey in 2017 demonstrate the region's susceptibility to flooding. Severe heat and drought also become an issue for transportation assets during the summer. Tide or tropical system-related erosion pose an issue along the coastlines and inland waterways. It is expected that due to a changing climate, weather events will intensify and occur with greater frequency.

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

To address aspects of resiliency and reliability that include preparedness and evacuation, the "Together Against the Weather[ii]" outreach campaign was initiated. As a web clearinghouse, it provides service providers, emergency management officials, churches, and healthcare providers with materials to help at-risk populations in the event of a major landfalling hurricane. Available resources include preparedness information, evacuation route maps, and Office of Emergency management links. A goal of preparedness for natural disasters is also found in the Comprehensive Economic Development Strategy (CEDS[iii]) and emphasizes less expensive approaches to reducing vulnerability such as using natural landscape for absorbing floodwaters and storm surge and making wiser decisions regarding building locations. For protecting key assets, the recommended approach is one that carefully targets structural solutions to 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. 2) displaying critical facilities including transportation, high-density areas, and vulnerable populations.

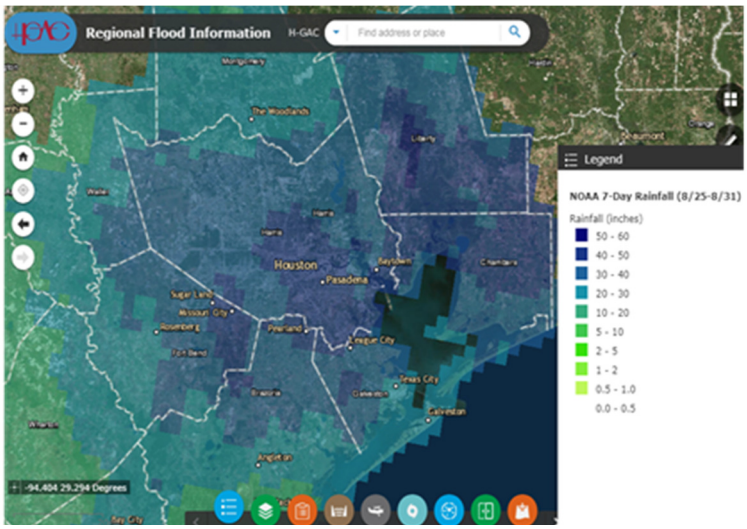

Figure 2 – 7-Day Rainfall Totals from Harvey

H-GAC also administers the Homeland Security Planning program[iv] that 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 issues. H-GAC is working closely with individual counties in the development of Hazard Mitigation Plans and will continue to aid and assist in the process of updating these plans.

Using FHWA's Vulnerability Assessment Framework tool, H-GAC will assess the vulnerability and risk of the region's transportation system to extreme weather impacts and other current and future environmental conditions. This process will ensure that vulnerable infrastructure and climate variables are categorized, provide a method of updating previous resiliency and reliability planning, and promote inclusion of resiliency and reliability strategies and investment priorities into the RTP. Other primary objectives of the current effort include:

Data Collection

- Compile and gather information from previous and ongoing resiliency planning efforts in the region including but not limited to regional hazardous mitigation plans, and emergency management plans, Our Great region 2040, H-GAC Foresight Panel on Environmental Effects, etc.
- Collect relevant data on vulnerability of transportation infrastructure, climate variables, regional environmental hazards and impacts
- Make projections for the extent of climate impacts
- Identify vulnerabilities in transportation infrastructure

Assessment

- Use FHWA's Climate Data Processing Tool and Sensitivity Matrix to assess criticality in Transportation Adaptation Planning and vulnerability level of critical transportation assets
- Define Critical Regional Transportation Assets
- Use FHWA Vulnerability Assessment Scoring Tool (VAST) to score all critical transportation assets
- Analyze and prioritize adaptation options based on the results of VAST scores

- Prepare a Vulnerability Assessment Summary Report summarizing information from the Data Collection and Assessment activities

Strategy Development

- Develop strategies to maintain and improve vulnerable transportation assets based on existing status and future projections
- Develop recommendations to integrate resiliency planning to inform project identification and selection in the Transportation Improvement Program, Regional Transportation Plan, and other planning documents as appropriate
- Update H–GAC Foresight Panel on Environmental Effects Report

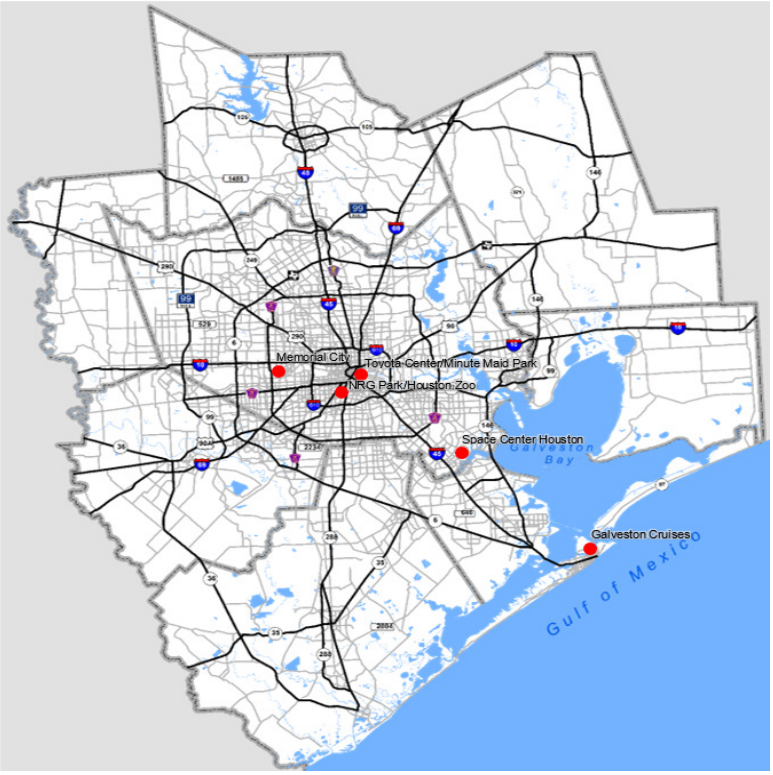

Figure 3 – Travel and Tourism Destinations

Information Dissemination

- Disseminate vulnerability assessment findings and options to regional stakeholders
- Create and disseminate a final report through website
- Deliver at least four presentations to relevant H-GAC committees

Enhance Travel and Tourism

The H-GAC MPO participated in a consortium to develop the "Our Great Region 2040" plan which included a 24-partner coordinating committee, government advisory committee, members of the public, local leaders and regional workgroups. Transportation strategies related to tourism travel for the H-GAC MPO to lead in implementing include[v]:

- 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.

Tourism is a robust industry across the Houston-Galveston Region. On an annual basis, the Metropolitan Statistical Area attracts 14.8, million visitors which generates $1.1 billion in local and state tax revenue. Travelers are primarily local and visit arts, festivals, sports and cuisine as well as to special attractions such as the Kemah Boardwalk, Houston Zoo, Brazoria National Wildlife refuge, George R. Brown Convention Center, museums, shopping malls, NASA space center, and Galveston Cruise Terminals (see Figure 3). Galveston Island saw 6.5 million visitors in 2016 and almost 14 percent of these were cruise travelers, an increase of 5 percent from the previous year.[vi] Travel originating from outside of 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 alone employed 129,000 in 2015.[vii]

The CEDS and "Our Great Region 2040" plan regard tourism as regional needs and provide strategies and recommendations for further travel and tourism improvements. The CEDS identified tourism as a "Medium Priority" regional need. This is inclusive of eco, coastal and traditional tourism.[viii] The region has 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.[ix] Programs are being implemented by the City of Houston, Bay City, Columbus, Conroe, Dayton, Galveston, and others.

An engagement process soliciting the feedback of public officials and members of the public was utilized to form a SWOT analysis, helping to shape the goals and strategies of the CEDS.[x] These goals have been aligned with the "Our Great Region 2040", including the preservation of natural resources – especially along waterways – to promote, among others, recreation and tourism opportunities. One of the strategies supporting natural resource preservation recommends the creation of a regional campaign to promote eco-, coastal and wildlife tourism options across the region.[xi] Another strategy encourages developing a regional toolkit to capitalize on future growth sectors including tourism.[xii]

(Website links to the References i through xv can be found on page 34 of this document.)

Transit

Intercity Buses The Regional Transit Framework Study analyzed the regional intercity bus network and identified the level of priority for connections to intercity buses within public and private transit service areas. Intercity buses connect Houston to Texas and Louisiana cities including Austin, San Antonio, Dallas and New Orleans. Bus terminals are located in all TMA counties except for Liberty, including several in Downtown. Findings and recommendations for intercity bus connectivity will be incorporated into the 2045 RTP[xiii].

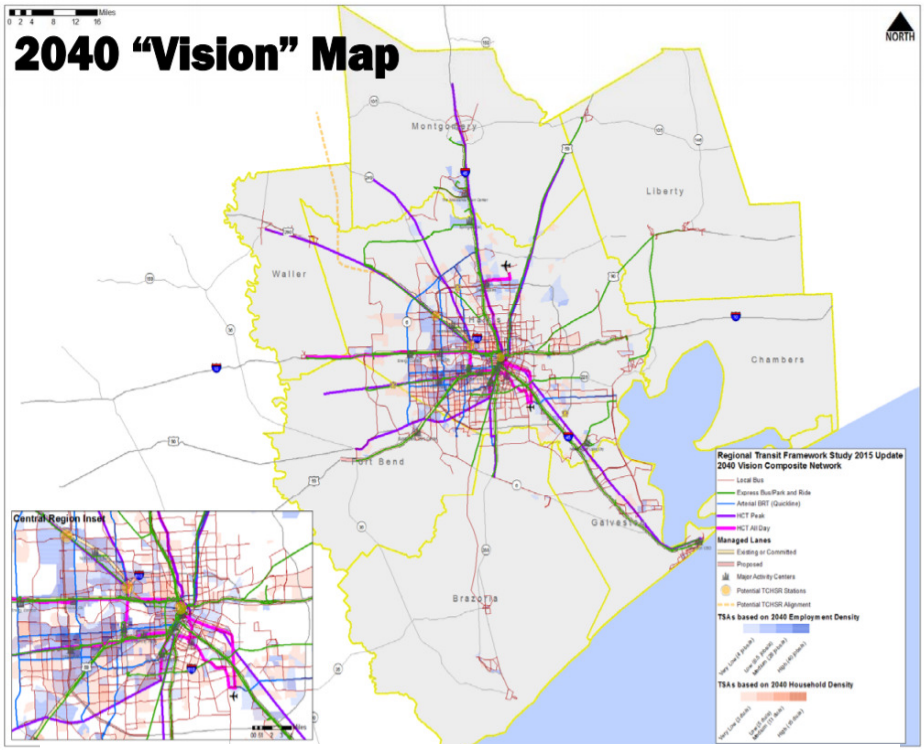

Figure 4 – Regional Vision Map, Transit Framework Study

Two service providers have been identified as providing intercity bus service within their service areas.[xiv] These include: the Brazos Transit District (BTD), located in the City of Conroe and The Woodlands, and Colorado Valley Transit District (CVTD), located in Austin, Colorado, Waller and Wharton Counties. In BTD, Greyhound operates routes through the transit area and makes connections to BTD service. In the CVTD, four private intercity bus companies: Arrow Trailways of Texas, Kerrville Bus Company, Greyhound, and Valley Transit Company, operate routes within the service area.[xiv] Travel patterns across the region include commuter trips from the Woodlands, Conroe, Galveston and Katy into employment centers located within Loop 610. These factors have helped determine a 2040 Vision for transit which includes High-Capacity Transit (HCT) along corridors with the highest traffic projections.

The RCTP gap analysis produced four recommendations to address transit service gaps which consider factors such as: median household income, persons with disabilities, households without automobiles, and population density. One recommendation calls for enhancing regional and intercity connectivity of transit service to improve mobility for all riders travelling to and between locations throughout the Gulf Coast Region.[xv]

In addition to the RCTP analysis, the Regional Transit Framework Study analyzed the region's transit connectivity. The effort resulted in short and long-term recommendations for transit; one category in the consensus recommendations is intercity bus connectivity enhancement between

providers. Figure 4 illustrates a composite service network of local, express, bus rapid transit (BRT), and High-Capacity Transit (HCT).

Performance Measures – System Evaluation Report

The federal legislation Fixing America's Surface Transportation Act, or FAST Act requires states and MPOs to monitor the transportation system using specific performance measures to address the national goals. Table 1 lists specific measures in various performance areas for transportation system. MPOs are required to either support the state targets or establish their own specific targets for all performance measures in the MPO planning area within 180 days after the State establishes each target. H-GAC worked cooperatively with TxDOT to establish targets for the performance areas listed in Table 3.

Category	Performance Measure	Applicability	MPOs Set Targets By	LRSTP, RTP, STIP, and TIP
FHWA Safety	Number of fatalities	All public roads	February 27, 2018	Updates or amendments on or after May 27, 2018
	Rate of fatalities	All public roads		
	Number of serious injuries	All public roads		
	Rate of serious injuries	All public roads		
	Number of non-motorized fatalities and non-motorized serious injuries	All public roads		
FHWA Infrastructure	Percentage of pavements of the Interstate System in Good condition	The Interstate System	No later than 180 days after the state(s) sets targets	Updates or amendments on or after May 20 ,2019
	Percentage of pavements of the Interstate System in Poor condition	The Interstate System		
	Percentage of pavements of the non-Interstate NHS in Good condition	The non-Interstate NHS		
	Percentage of pavements of the non-Interstate NHS in Poor condition	The non-Interstate NHS		
	Percentage of NHS bridges classified as in Good condition	NHS		
	Percentage of NHS bridges classified as in Poor condition	NHS		

FHWA System Performance	Percent of the person-miles traveled on the Interstate that are reliable	The Interstate System	No later than 180 days after the state(s) sets targets	Updates or amendments on or after May 20, 2019
	Percent of the person-miles traveled on the non-Interstate NHS that are reliable	The non-Interstate NHS		
	Truck Travel Time Reliability (TTTR) Index	The Interstate System		
	Annual Hours of Peak Hour Excessive Delay Per Capita	The NHS in urbanized areas with a population over 1 million for the first performance period and in urbanized areas with a population over 200,000 for the second and all other performance periods that are also in nonattainment or maintenance areas for ozone (O3), carbon monoxide (CO), or particulate matter (PM10 and PM2.5)		
FHWA System Performance (continued)	Percent of Non-SOV travel	The NHS in urbanized areas with a population over 1 million for the first performance period and in urbanized areas with a population over 200,000 for the second and all other performance periods that are also in nonattainment or maintenance areas for ozone (O3), carbon monoxide (CO), or particulate matter (PM10 and PM2.5)		
		All projects financed with funds from the 23 U.S.C. 149 CMAQ program apportioned to State DOTs in areas designated as nonattainment or maintenance for ozone (O3), carbon monoxide (CO), or particulate matter (PM10 and PM2.5		
	Total Emissions Reduction		No later than 180 days after the state(s) sets targets	Updates or amendments on or after May 20, 2019

FTA Transit Asset Management	Rolling Stock	The percentage of revenue vehicles (by type) that exceed the useful life benchmark (ULB)	No later than 180 days after the state(s) sets targets	Updates or amendments on or after October 1, 2018
	Equipment	The percentage of non-revenue service vehicles (by type) that exceed the ULB		
	Facilities	The percentage of facilities (by group) that are rated less than 3.0 on the Transit Economic Requirements Model (TERM) Scale		
	Infrastructure	The percentage of track segments (by mode) that have performance restrictions		

Table 3 – FHWA/FTA Performance Measures

The 2019 - 2022 Transportation Improvement Program (TIP) continues to build upon the goals and strategies articulated in the 2040 Regional Transportation Plan (RTP). The performance measures included in the 2040 RTP were crafted in accordance with the federal surface transportation legislation, Moving Ahead for Progress in the 21st Century or MAP-21. The 2019 - 2022 TIP utilizes the progress already achieved to support decisions on transportation investment aligned with the following 2040 RTP goals:

1. Improve Safety
2. Manage and Mitigate Congestion
3. Ensure Strong Asset Management and Operations
4. Strengthen Regional Economic Competitiveness
5. Conserve and Protect Natural and Cultural Resources

The project selection process utilized during development of the 2019-2022 TIP assessed major investment-level applications based on the 2040 RTP's five goals and performance measures. By incorporating 2040 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.

SAFETY

The Regional Safety Plan sets a baseline for safety crash data and analyzes regional trends to inform performance target setting. Report figures serve as a baseline for subsequent years to measure whether there was significant improvement in Safety Performance Management compared to the previous year.

The Safety Performance Management (PM) Final Rule established the following five performance measures to carry out the Highway Safety Improvement Plan (HSIP): the five-year rolling averages for: (1) Number of Fatalities, (2) Rate of Fatalities per 100 million VMT, (3) Number of Serious Injuries, (4) Rate of Serious Injuries per 100 million VMT, and (5) Number of Non-Motorized Fatalities and Non-Motorized Serious Injuries.

The Texas Strategic Highway Safety Plan estimated the probable number of fatalities for 2022, the target year. Based on the probable number, targets were set at a 2% reduction for all performance measures. FHWA requires MPOs to either support state targets or establish their own specific targets for the same five safety performance measures for all public roads in the MPO planning area, within 180 days after the State establishes statewide targets. The MPO will then report targets to the State when requested, and determination about making significant progress statewide will be made when at least four out of five targets are met or the outcome for the performance measure is better than the baseline performance the year prior to the target year.

H-GAC's Transportation Policy Council (TPC) approved a resolution to support the State's safety targets for the five performance measures as adopted by the State. However, the increasing trends in fatalities and crashes do not reflect the intent and commitment of the TPC to improve traffic safety in the H-GAC region. The TPC has aspirational goals for safety to reduce traffic fatalities and injuries in the region. The TPC is committed to achieve those through the implementation of the Regional Safety Plan and safety program.

In February 2018 and 2019, the TPC approved safety targets that support the States' performance targets for safety. The following tables and charts show the baseline and targets for the five safety measures. H-GAC set safety targets, endorsing the State's 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, as identified in Table 4. The decline is expected to begin gradually in 2018 and progress to the two percent (2%) reduction to the target year 2022.

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 travelled)						
Number of Serious Injuries						
Rate of Serious Injuries (per 100 million VMT)						
Number of Non-motorized Fatalities & Serious Injuries						

Table 4 – H-GAC Regional Safety Performance Targets

The values in the following bar charts identify the statistics and performance targets for the 8-county H-GAC region.

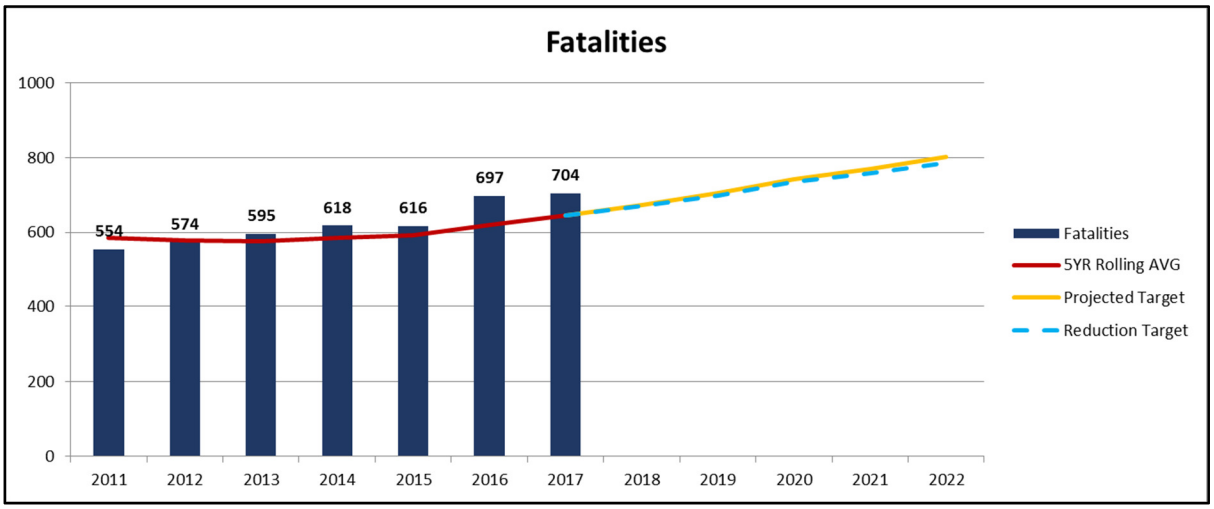

Chart 1 – Federal Safety Performance Measure Regional Statistics

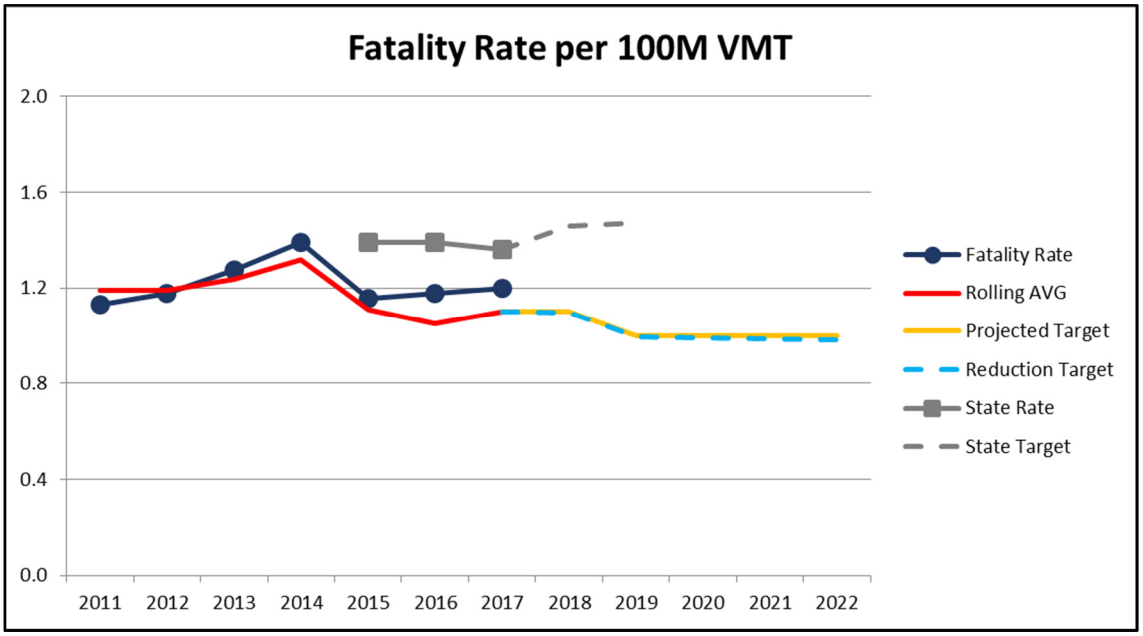

Chart 2 – Federal Safety Performance Measure Regional Statistics

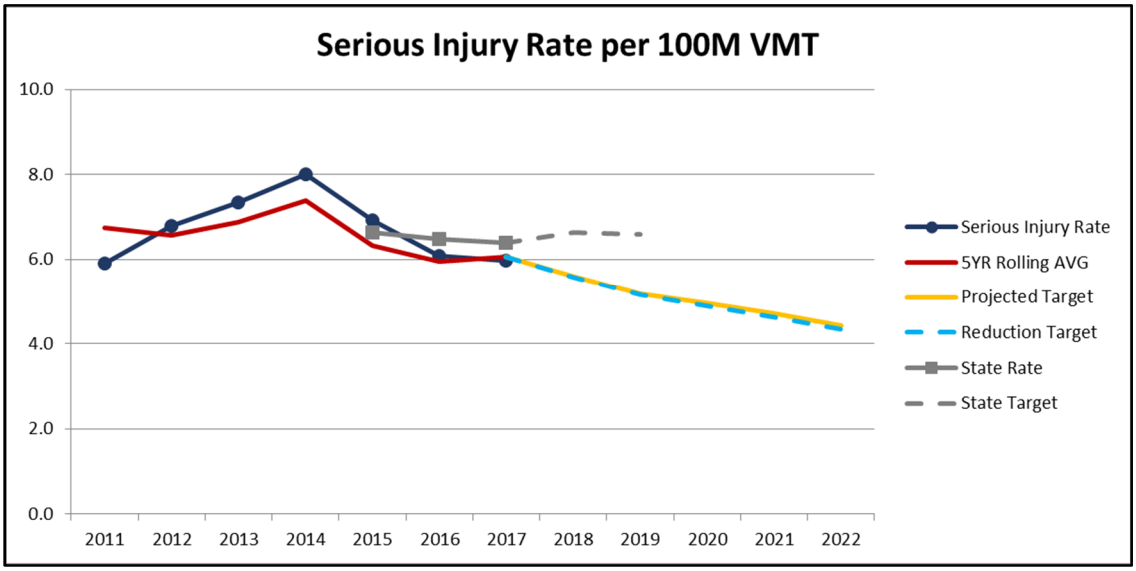

Chart 3 – Federal Safety Performance Measure Regional Statistics

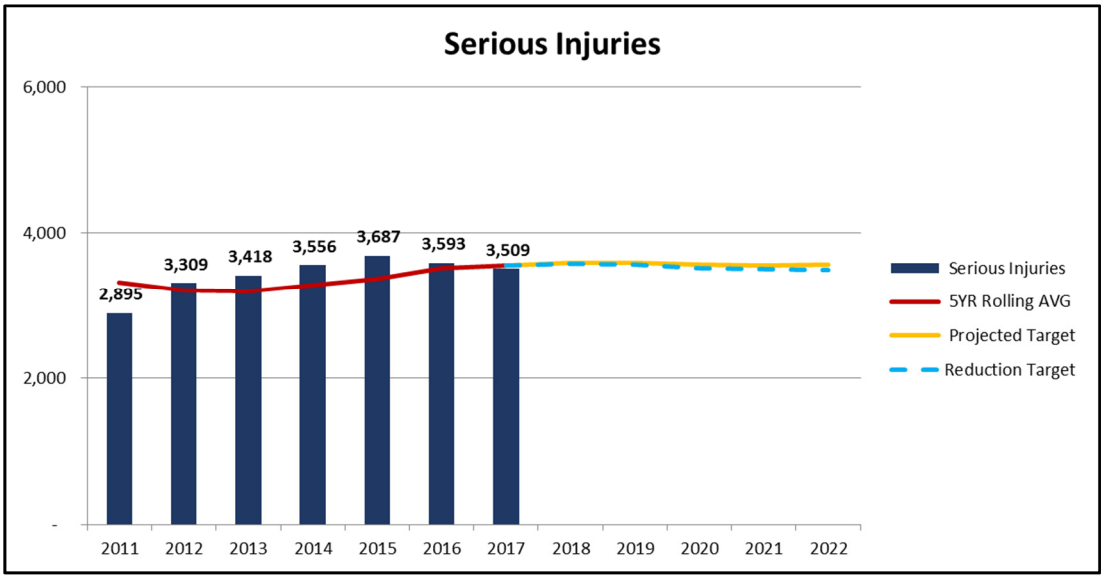

Chart 4 – Federal Safety Performance Measure Regional Statistics

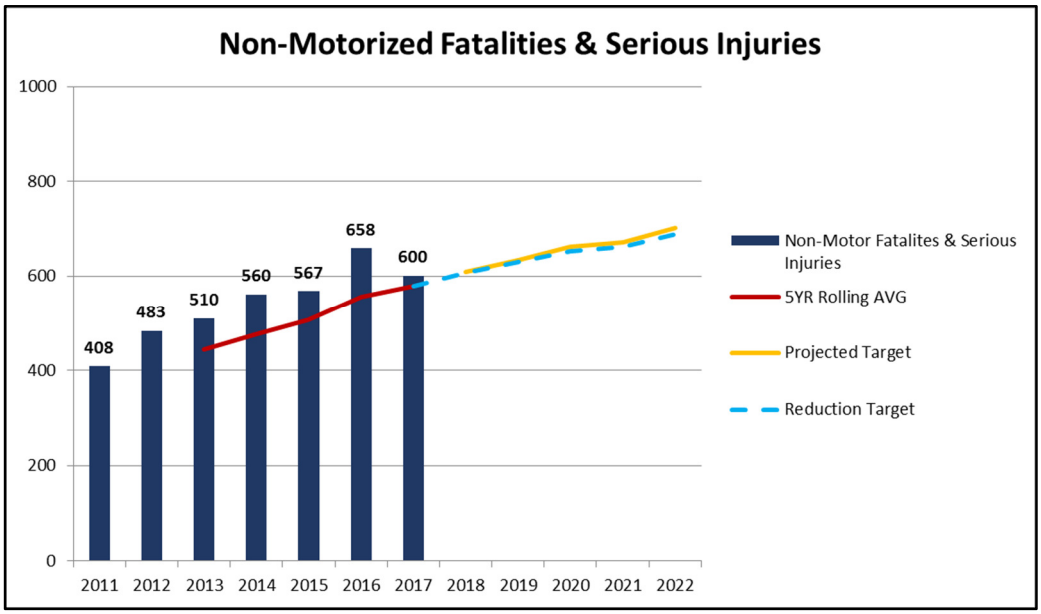

Chart 5 – Federal Safety Performance Measure Regional Statistics

Integrating Safety Performance Measures into the Transportation Planning Process

H-GAC is committed and is participating in advancing crash reduction strategies through the Regional Safety Plan, the actions of the Transportation Safety Committee and is annually assessing the progress on the safety performance measures. H-GAC will undertake a regional planning study and conduct Intersection Safety Audits at high crash locations and recommend strategies to improve safety. In terms of reporting progress achieved by H-GAC, preliminary data for the first year of safety performance management was reviewed and analyzed by H-GAC and TxDOT, however, the NHTSA Annual Fatality Report isn't expected to be finalized in mid-2019. The first year of data is identified in Table 5.

Performance Measure	2012-2016 Baseline (5YR Rolling AVG)	2017 Actual	CY 2018 Outcome	CY 2019 Outcome
Fatalities	620	704*	671	699
Fatality Rate	1.0	1.1	1.0	1.0
Serious Injury	3,512	3,509	3,578	3,568
Serious Injury Rate	5.9	6.1	5.6	5.1
Non-Motorized Fatal & SI	555	600	607	629
**NHTSA Annual Fatality Report. Number of fatalities not final*				

Table 5 – H-GAC Safety Performance Outcomes

H-GAC incorporated safety performance measures in the 2040 RTP Vision, Goals and Strategies. During the formulation of the 2045 RTP, safety was retained within the long-range plan's Vision, Goals and Strategies. Emphasis on safety performance was expanded and incorporated as one of three major areas for the benefit cost analysis in the 2018 Call for Projects selection process.

H-GAC, along with state and local government partners, has made significant investments in transportation infrastructure improvements through the 2019-2022 Transportation Improvement Program (TIP) as well as the 2040 Regional Transportation Plan. H-GAC adopted the Regional Safety Plan in 2018 to recommend crash reduction strategies. Additionally, a total of 68 projects were approved by the TxDOT Traffic Operations Division at a cost of $39.2 million (Safety Funds) from FY 2019 to 2022.

The fiscally-constrained 2040 RTP recommended approximately $692 million of investments in ITS and Safety projects and programs. These investments are not part of the Corridor-based Major Investments of the 2040 RTP.

RTP 2040 STRATEGIES	STRATEGY 1 SYSTEM MANAGEMENT AND OPERATIONS	STRATEGY 2 STATE OF GOOD REPAIR	STRATEGY 3 MULTIMODAL NETWORK EXPANSION WIDENING	STRATEGY 3 MULTIMODAL NETWORK EXPANSION CONSTRUCTION	STRATEGY 4 DEVELOPMENT COORDINATION	TOTAL
REGIONAL INVESTMENT PROGRAMS						
ITS/Safety *Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management*	$679,082,552	$13,033,372	N/A	N/A	N/A	$692,115,924

Table 6 – RTP 2040 Investments

PAVEMENT AND BRIDGE

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 (TxDOT); 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 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.

Similar to pavement, bridge 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's 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 the Texas Department of Transportation (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.

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 TxDOT's 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.

States and MPOs must establish two and four-year targets for pavement and bridges 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.

The Pavement and Bridge performance targets are identified in Table 7 and were approved by the Transportation Policy Council on October 26, 2018.

Pavement and Bridge Performance Measure Targets

Performance Measure	2018 Baseline	2020 Target	2022 Target
Percentage of Pavements of the Interstate in Good condition	48.5%	48.5%	48.5%
Percentage of Pavements of the Interstate in Poor condition	0.0%	0.0%	0.0%
Percentage of Pavements of the Non-Interstate NHS in Good condition	46.7%	46.7%	46.7%
Percentage of Pavements of the Non-Interstate NHS in Poor condition	11.3%	11.3%	11.3%
Percentage of Bridge Deck Area of the NHS in Good condition	48.6%	48.6%	48.6%
Percentage of Bridge Deck Area of the NHS in Poor condition	0.6%	0.6%	0.6%

Table 7 – Pavement and Bridge targets

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 2018 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 pavement 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 2045 RTP 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. In the H-GAC region, not all National Highway System (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 regional agencies, data sharing, understanding how each agency measures and collects data, discussing uniform data collection and understanding local agency's future investment plans for NHS roadways. Currently, TxDOT is committed to expanding their data collection to align with the federal measures. One of the positive outcomes of Performance 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, and will impact the targets for pavements and bridges.

Transportation investments, programs and planning efforts 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 2019-2022 Transportation Improvement Program (TIP). 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.

The fiscally-constrained 2040 RTP recommended approximately $17.54 billion of investments for State of Good Repair projects and programs. Additionally, a total of $1.3 billion is programmed in the 2019 – 2022 Transportation Improvement Program which is expected to contribute toward achieving the pavement and bridge targets. Other types of projects, such as new roadways and highways, thoroughfare expansions, reconstructions, Complete Streets and other improvements are expected to contribute toward the State of Good Repair.

RTP 2040	Strategy 2 - State of Good Repair
Corridor-Based Major Investments & Regional Investment Programs	$17,538,497,096

2019 – 2022 Transportation Improvement Program	
Category 1 - Preventive Maintenance and Rehabilitation	$12,512,997
Category 6 - Structures	$1,313,750,000
Total	$1,326,262,997

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 place 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

The goal of System Performance measures is to assess the reliability of the National Highway System (NHS). Travel reliability is when the travel time of 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's time. Essentially, the measure of travel reliability compares a bad day of traffic to a normal day.

The three (3) 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 good 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.

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. The higher the percentage, the more reliable it is. 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.

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. Targets were adopted by the Transportation Policy Council on October 26, 2018.

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%

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.

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 inconsistencies 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. Targets were adopted by the Transportation Policy Council on October 26, 2018.

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.

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 - 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 flat targets for Peak Hour Excessive Delay with a desire for aspirational goals that indicate a reduction in excessive delay in the long-term. Targets were adopted by the Transportation Policy Council on October 26, 2018.

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

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.

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 2nd TAC Workshop, staff initially 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 Occupancy Vehicle (Non-SOV) travel. Instead, staff utilized the H-GAC travel demand model for Non-SOV target setting. Based on the model data and calculations, staff projects the mode share for Non-SOV to grow due to strategies implemented at the regional level. H-GAC adopted flat targets with the goal of maintaining current conditions and a desire for aspirational goals that indicate increased levels of Non-SOV in the long-term. Better estimates and targets may be updated after two years when improved data-sets are available. Targets were adopted by the Transportation Policy Council on October 26, 2018.

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

Air Quality / On-Road Mobile Source Emissions Measures

FHWA established air quality performance measures to assess vehicle emissions with a goal of reducing emissions and 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 resulting in 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 the 2019-2022 Transportation Improvement Program. Baseline and future air quality performance targets are documented in the CMAQ Performance Plan. http://www.h-gac.com/transportation-improvement-program/documents/resources/CMAQ-Performance-Plan-Report-2018.pdf The four-year emission reduction target from CMAQ-funded projects is a conservative estimate. 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.

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 September 28, 2018, as shown in the following table.

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

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.

Building on the performance measures in the 2040 Regional Transportation Plan (RTP), the 2045 RTP project evaluation system was performance-based for prioritizing projects for the region. The primary method for the programming of projects is the Call for Projects conducted in 2018. 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 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.

2040 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 2040 RTP. The fiscally-constrained 2040 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 2040 RTP recommended approximately $70.64 billion of investments of Corridor-based Major Investments and Regional Investment Program from the 2040 RTP Strategy 1 and Strategy 3 for addressing Reliability and Congestion, as shown in the table below.

RTP 2040	Strategy 1 System Management & Operations	Strategy 3 Multimodal Network Expansion Widening	Strategy 3 Multimodal Network Expansion Construction	Total
Corridor-Based Major Investments & Regional Investment Programs	$39,940,863,160	$22,571,070,369	$8,128,278,301	$70,640,211,830

Additionally, a total of $4.71 billion is programmed in the 2019 – 2022 Transportation Improvement Program which is expected to contribute towards achieving the Reliability and Congestion targets.

2019 – 2022 Transportation Improvement Program	
Category 2 – Metropolitan and Urban Area Corridor Projects	$1,725,452,254
Category 4 – Statewide Connectivity Corridors Projects	$745,580,000
Category 5 – Congestion Mitigation and Air Quality Improvement	$250,960,503
Category 5 – CMAQ Flex	$30,949,000
Category 7 – Surface Transportation Block Group	$900,655,399
Category 12 – Strategic Priority	$1,058,020,000
Total	$4,711,617,156

Air Quality - Total Emission Reductions

The fiscally-constrained 2040 RTP recommended approximately $9.95 billion of investments in the categories of ITS/Safety, Local High Capacity Transit, Air Quality, Pedestrian/Bicycle, and Transit Capital Program projects and programs for improving air quality and achieving the performance targets. These investments are not part of the Corridor-based Major Investments of the 2040 RTP.

RTP 2040 STRATEGIES	STRATEGY 1 SYSTEM MANAGEMENT AND OPERATIONS	STRATEGY 2 STATE OF GOOD REPAIR	STRATEGY 3 MULTIMODAL NETWORK EXPANSION WIDENING	STRATEGY 3 MULTIMODAL NETWORK EXPANSION CONSTRUCTION	STRATEGY 4 DEVELOPMENT COORDINATION	TOTAL
REGIONAL INVESTMENT PROGRAMS						
ITS/Safety *Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management*	$679,082,552	$13,033,372	N/A	N/A	N/A	$692,115,924
Local High Capacity Transit *Includes non-corridor light rail, park and ride, transit centers, demand management strategies*	$593,457,524	$31,441,623	$3,938,403,019	N/A	$41,329,486	$4,604,631,652
Air Quality Related	$310,065,000	N/A	N/A	N/A	N/A	$310,065,000
Pedestrian/Bicycle *Includes on-street facilities, hike and bike trails and paths, and reconstructions*	$21,393,516	$39,074,940	$129,437,651	$67,109,263	$131,523,775	$388,539,145
Transit Capital – *includes all other new or expanded facilities, services, and vehicles*	$273,830,784	$3,553,124,603	$102,102,580	$8,267,379	$20,800,000	$3,958,125,346
TOTAL	$1,877,829,376	$3,636,674,538	$4,169,943,250	$75,376,642	$193,653,261	$9,953,477,067

Table 8 – RTP 2040 Investments

Air Quality

Additionally, a total of $39.6 billion is programmed in the 2019 – 2022 Transportation Improvement Program which is expected to contribute towards achieving the air quality targets.

2019 – 2022 Transportation Improvement Program	
Category 5 – Congestion Mitigation Air Quality (CMAQ)	$250,960,503
Category 5 Flex – CMAQ	$30,949,000
Category 9 Flex – TAP/TASA	$77,647,277
Total	$359,556,780

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 definition of Transit Asset Management Plan (TAM) and State of Good Repair (SGR). It establishes performance measures for equipment, rolling stock, infrastructure, and facilities asset categories. These requirements included the performance measure to be reported to National Transit Database (NTD). The resulting information of the NTD is intended to help any level of government make investment decisions. The Final Rule requires all transit agencies that are designated recipients and subrecipients of federal funds to develop initial State of Good Repair targets in January 2017 and complete a TAM Plan by October 1, 2018. The Final Rule also requires H-GAC to set a regional target by October 1, 2018.

Transit providers that receive federal funds as recipients or as sub-recipients and either own, operate or manage capital assets used in providing public transportation are required to develop and implement TAM Plan and submit performance measures, annual condition assessments and targets to NTD by October 1, 2018. Sub-recipients and Tier II providers (that operate one hundred or fewer vehicles) have the options to develop a group TAM Plan with TxDOT/ H-GAC or develop their own plan. Participants must coordinate to determine their specific roles and responsibilities and complying with the rule.

The majority of the assets in our region belong to Tier I provider METRO who develops their own TAM Plan and targets. The Tier II providers that receive urban funding (5307) can either set their own targets because they are direct recipients or could opt to be under TxDOT's Group Plan. The additional Tier II providers in our region (5311 and 5310), have a choice to set their own or participate with TxDOT. H-GAC collaborated with TxDOT and Tier I and Tier II providers to set regional targets. H-GAC has 180 days after the date on which the relevant TxDOT or providers of public transportation establish its performance targets.

Tier I transit providers:

- METRO (Harris County Metropolitan Transit Authority)

Tier II transit providers:

- Brazos Transit District
- 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 approved an interagency Memorandum of Understanding between the region's transit operators, the TxDOT and H-GAC to facilitate regional collaboration and promote a performance-based planning process. (MOU link: https://www.h-gac.com/transportation-policy-council/meeting-agendas/documents/2018/may/ITEM-09-Interagency-MOU.pdf) Transit agencies across the region and TxDOT submitted preliminary agency-level targets for FY 2018, 2020 and 2022 to H-GAC staff. H-GAC staff led the coordination efforts for target setting and TAM Plan development with the Regional Transit Coordination Subcommittee (RTCS). The RTCS established a TAM Plan Working Group with the objective of developing H-GAC regional targets and promote State of Good Repair of capital assets. The working group formulated a methodology for the regional targets in the four (4) areas of rolling stock, equipment, facilities, infrastructure. While the working group was developing the methodology in August 2018, H-GAC staff presented TAM informational updates to the Technical Advisory Committee (TAC) and the Transportation Policy Council (TPC). The TAM Plan Working Group endorsed a methodology for target setting based on a weighted average of asset management scores for Tier I and Tier II transit providers for their rolling stock, equipment, facilities and infrastructure. Based on the weighted average method, the draft regional targets were presented and approved by the Regional Transit Coordination Subcommittee on September 6th. The TAC and the TPC provided final approval of H-GAC's regional transit targets in September 2018, as described in Table 9.

The H-GAC regional Transit Asset Management Targets, along with Tier I, Tier II and TxDOT's targets are identified in Table 9. The Transit TAM targets were approved by the Transportation Policy Council on September 28, 2018.

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			
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)

Table 9 – Transit Asset Management targets

Tier I and Tier II transit providers in the H-GAC region created their Transit Asset Management (TAM) Plans by the October 1, 2018 federal deadline. TAM Plans contain 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.

Addressing the federal requirements of the Transit Asset Management Plans, federal, state and local funding has been identified in the 2019 – 2022 Transportation Improvement Program (TIP). 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. Projects programmed in the 2019-2022 TIP that address State of Good Repair requirements reflect an overall investment of approximately $803 million for the region's transit providers.

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. Should transit providers in the H-GAC region revise their targets, H-GAC may revise its regional targets, as well.

The fiscally-constrained 2040 RTP recommended approximately $3.96 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 2040 RTP.

RTP 2040 STRATEGIES	STRATEGY 1 SYSTEM MANAGEMENT AND OPERATIONS	STRATEGY 2 STATE OF GOOD REPAIR	STRATEGY 3 MULTIMODAL NETWORK EXPANSION WIDENING	STRATEGY 3 MULTIMODAL NETWORK EXPANSION CONSTRUCTION	STRATEGY 4 DEVELOPMENT COORDINATION	TOTAL
REGIONAL INVESTMENT PROGRAMS						
Transit Capital – *includes all other new or expanded facilities, services, and vehicles*	$273,830,784	$3,553,124,603	$102,102,580	$8,267,379	$20,800,000	$3,958,125,346

Additionally, a total of $ 74.2 million is programmed in the 2019 – 2022 Transportation Improvement Program which is expected to contribute towards achieving the Transit State of Good Repair performance targets.

2019 – 2022 Transportation Improvement Program	
FTA Section 5337	$29,170,384
FTA Section 5339	$45,000,281
Total	$74,170,665

ADDITIONAL REFERENCES TO FAST ACT COMPLIANCE

FAST Act Code	FAST Act Requirement	Website link
23 CFR §450.316(a)	The Public Participation Plan was updated on July 28, 2017 to incorporate new stakeholders (public ports and private providers of transportation, including intercity bus operators, employer-based commuting programs such as carpool and vanpool programs, transit benefit program, parking cash-out program, shuttle program or telework program), for compliance with the FAST Act federal regulations cited to the left.	http://www.h-gac.com/transportation-public-outreach/documents/h-gac-public-participation-plan.pdf
23 CFR §450.314 (h)	The Memorandum of Understanding was executed between H-GAC, TxDOT and transit providers on May 25, 2018.	https://www.h-gac.com/transportation-policy-council/meeting-agendas/documents/2018/may/ITEM-09-Interagency-MOU.pdf

[i] Regional Hazard Mitigation Plan: http://www.h-gac.com/community/community/hazard/hazard_mitigation_plan.aspx
[ii] Together Against Weather campaign: http://www.togetheragainsttheweather.com
[iii] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf
[iv] Homeland Security Planning program http://www.h-gac.com/safety/homeland-security/default.aspx
[v] http://www.ourregion.org/download/OurGreatRegion2040-FINAL.pdf (page 30 and 31)
[vi] https://www.chron.com/neighborhood/bayarea/news/article/Galveston-hits-record-high-tourism-revenues-11175775.php
[vii] http://www.houstontx.gov/council/c/committee/20150625/tourismmasterplan.pdf
[viii] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf (page 17)
[ix] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf (page 16)
[x] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf (page 19)
[xi] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf (page 23)
[xii] https://www.h-gac.com/gulf-coast-economic-development-district/documents/CurrentCEDS.pdf (page 20)
[xiii] https://www.h-gac.com/technical-advisory-committee/regional-transit-coordination-subcommittee/agendas/documents/october-2015/Presentation%20toTransit%20Coordination%20Subcom%20100815.pdf (page 10)
[xiv] http://www.h-gac.com/regionally-coordinated-transportation-plan/default.aspx (page 20)
[xv] http://www.h-gac.com/regionally-coordinated-transportation-plan/default.aspx (Page 6)