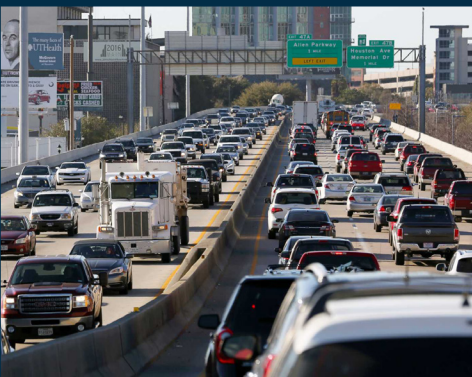


# PERFORMANCE MEASURES: System Evaluation Report

APPENDIX P

THE HOUSTON-GALVESTON METROPOLITAN PLANNING AREA



# PERFORMANCE MEASURES SYSTEM EVALUATION REPORT

## Introduction

The Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Act legislations introduced Transportation Performance Management into the Federal Highway Program addressing the challenges facing 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

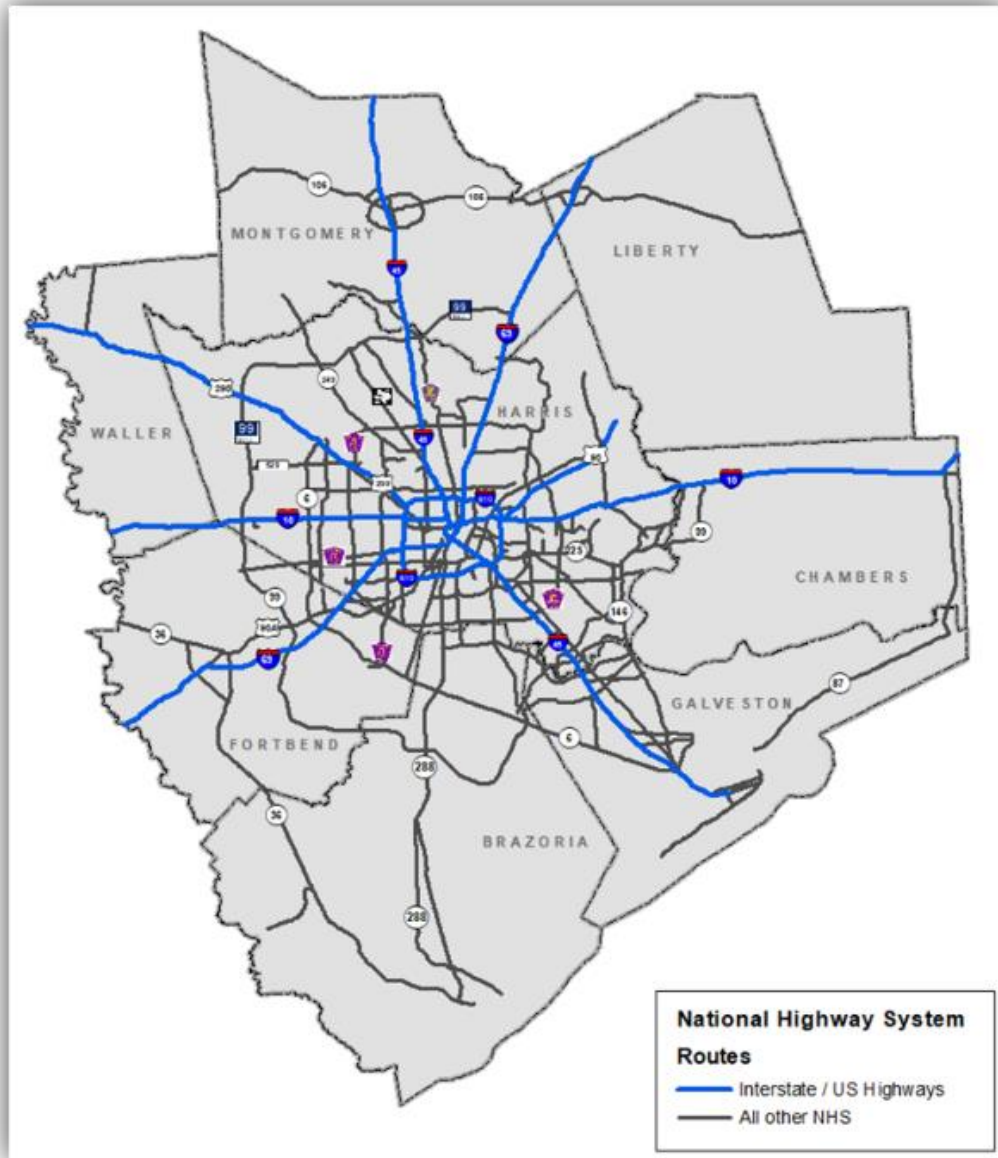
The objective of Transportation Performance Management is to focus federal funds on the achievement of national goals, increase accountability and transparency, and improve investment decision-making through performance-based planning and programming of transportation projects. The federal rulemaking requires the establishment of goals for which Metropolitan Planning Organizations, and state Departments of Transportation will be required to set targets, report on and make progress towards targets for numerous federal performance measures. H-GAC has the responsibility for these measures in a variety of key performance areas, such as Safety, Pavement and Bridges, Reliability, Congestion, Air Quality and Transit Asset Management.

Fixing America's Surface Transportation (FAST) Act's final planning rules for the metropolitan planning process and the Regional Transportation Plan (RTP) became effective on May 27, 2018. The FAST Act builds on the changes made by the Moving Ahead for Progress in the 21<sup>st</sup> Century, including provisions to make surface transportation more streamlined, performance-based, and multimodal, and to address challenges facing the U.S. transportation system. Metropolitan Planning Organizations may support the state targets or establish their own regional targets. During 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 and compliment 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 results of Performance Management is a heightened awareness by transportation planners for a renewed focus on key performance areas that will remain at the forefront for years to come. Additionally, it improves accountability and transparency when reporting to the public.

## 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 critical highways important to the nation's economy, defense and mobility that link major airports, ports, public transportation facilities, rail and truck intermodal terminals. The Regional Transportation Plan 2045 is focused on all major roads of the region's transportation system, not just the National Highway System. In the H-GAC 8-county region, there are 8,784 lane miles on the National Highway System.



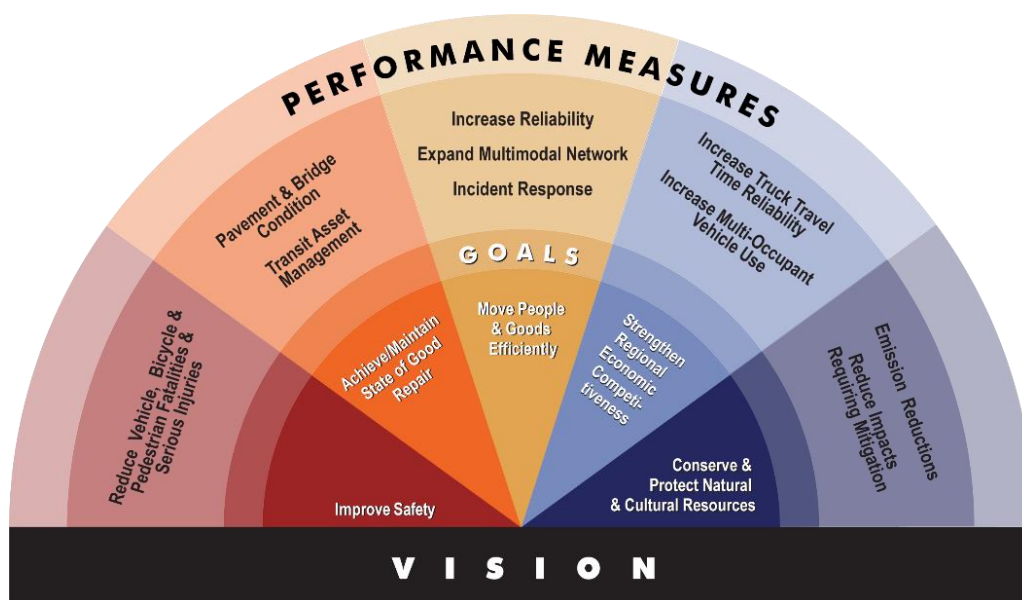
## TRANSPORTATION PERFORMANCE MEASURES AND THE 2045 RTP

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 21<sup>st</sup> Century (FAST Act) in 2015. Among other things, they require metropolitan planning organizations to establish performance-based planning practices. 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.

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. 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 to improve data collection methods and expand collection efforts to data suitable to accurately set performance targets. For example, TxDOT is adapting their 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 measures, 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 measure, the manner in which it is measured, and the desired outcome for each measure. Given the broad scope and time horizon of the plan, these performance measures identify various factors that encompass topics including asset management, congestion, safety, environment, and economic competitiveness that will help assess progress towards meeting the 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, the desired outcomes for the performance measures cannot be reduced in absolute terms.



## FHWA and FTA 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.

1. Mobility
2. Alternative Modes
3. Air Quality
4. 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 2, 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 2.

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, eight categories were recommended to be programmed and funded annually for the 10-year period from FY 2019 through FY 2028, identified in Table 3. This was approved in a cooperative process by consulting with the local governments and agencies, the Transportation Policy Council, the Technical Advisory Committee, and relevant subcommittees.

Table 3.

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	Commuter 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 4, through the competitive Call for Projects process.

Table 4.

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
		Autonomous and Connected Vehicle Infrastructure
		Intelligent Transportation System Infrastructure
	Maintain	Infrastructure Resiliency
		Roadway Reconstruction and Rehabilitation
	Alternative Modes	Expand, Manage, Maintain
Expand		Transit Expansion (Vehicle Purchase)
		Transit Passenger Facilities
Manage		Transit Priority Infrastructure
Maintain		Transit Passenger Facility State of Good Repair



## 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 (TAC), 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 analyze and assess trends and progress on Safety Performance Measures while reviewing TxDOT's annual updates to statewide targets.

In February 2017, H-GAC's Transportation Policy Council (TPC) 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. The decline is expected to begin gradually in 2018 and progress to the two percent (2%) reduction by the target year 2022.

H-GAC by resolution (Resolution 2019-05, February 22, 2019) agreed to support the State's effort to achieve its safety performance measure targets. Supporting the State's efforts includes using the same or similar methodology to set these targets. The State methodology uses a five-year rolling average to set the targets for the State safety performance measures. H-GAC has adopted a similar methodology to calculate the regional safety performance measure targets. The data used to calculate the targets is from the Texas Department of Transportation (TxDOT) Crash Record Information System (CRIS) data from 2019 to 2021 to calculate the 5-year rolling average for the 2022 targets.

In October 2020, the Transportation Policy Council approved a Vision Zero policy by resolution (Resolution 2020-26, October 23, 2020) committing to support transportation projects and programs to eliminate traffic fatalities in the region by the year 2050.

Trends and progress are reviewed and discussed by the Transportation Safety Committee. Additionally, TxDOT's annual updates to statewide targets are reviewed. Annually, H-GAC reports on the progress

toward meeting regional targets to the TPC and to TxDOT by February 25<sup>th</sup>.

As reported to TxDOT in February 2021, Table B-7 shows the H-GAC safety performance measure targets for 2021, as well as the 2019 and 2020 targets and observed totals. Table B-8 provides background on the calculations of the H-GAC 2021 safety performance measure targets. Table B-9 shows the State’s safety performance measure targets for reference.

Figure B-7: H-GAC Safety Performance Measure Results

Performance Measure	2019 Targets	2019 Actuals†	2020 Targets	2020 Actuals†	2021 Targets
Fatalities	699	661	728	710	674
Fatality Rate	1.0	1.0	1.1	1.2	1.1
Serious Injury	3,568	3,380	3,293	3,280	3,287
Serious Injury Rate	5.1	5.3	5.0	5.6	5.2
Non-Motorized Fatalities & Serious Injuries ††	581	733	537	646	648

† Actuals based on TxDOT CRIS data as of January 4, 2021; 2019 and 2020 Fatality Rates and Serious Injury Rates based on projected Annual VMT

†† Non-Motorized Fatalities and Serious Injuries Targets were incorrectly calculated for 2019 and 2020. The revised numbers represent what the 2019 and 2020 targets should have been.

Figure B-8: H-GAC Safety Performance Measure Target Calculations

Year	Target: Total Number of Traffic Fatalities		Target: Total Number of Serious Injuries		Target: Fatalities per 100 Million Vehicle Miles Traveled		Target: Serious Injuries per 100 Million Vehicle Miles Traveled		Target: Total Number of Non-Motorized Fatalities and Serious Injuries	
	Target or Actual Data	Source	Target or Actual Data	Source	Target or Actual Data	Source	Target or Actual Data	Source	Target or Actual Data	Source
2016	704	FARS	3,401	CRIS	1.1	FARS	5.3	CRIS	658	FARS-CRIS
2017	707	FARS	3,326	CRIS	1.0	FARS	4.7	CRIS	601	FARS-CRIS
2018	590	ARF	3,050	CRIS	1.0	ARF	5.0	CRIS	601	ARF-CRIS
2019†	661	CRIS	3,380	CRIS	1.0	CRIS	5.3	CRIS	733	CRIS
2020†	710	CRIS	3,280	CRIS	1.2	CRIS	5.6	CRIS	646	CRIS
2021 Target	674		3,287		1.1		5.2		648	

† 2019 & 2020 CRIS Data as of January 4, 2021; 2019 and 2020 Fatality Rates and Serious Injury Rates based on projected Annual VMT

Figure B-9: State (TxDOT) Safety Performance Measure Targets

Performance Measure	2021 Targets
Fatalities	3,687
Fatality Rate	1.33
Serious Injury	17,151
Serious Injury Rate	6.06
Non-Motorized Fatalities & Serious Injuries (NMFSI)	2,316

The safety performance measures, methodology, applicability and reporting frequency are identified below.

## Fatalities

**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

## Serious Injuries

**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

## Non-Motorized Fatalities and Serious Injuries

**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

### **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 MPO 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.

### **2045 RTP transportation investments targeting safety improvements**

H-GAC, along with state and local government partners, have made strategic investments in transportation infrastructure improvements through the 2045 RTP. 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.

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

## **Safety-related Resources**

Highway Safety Improvement Program <https://safety.fhwa.dot.gov/hsip/>

Strategic Highway Safety Plan <https://www.texasshsp.com/>

Regional Safety Plan <https://www.h-gac.com/transportation-safety/documents/2018-Draft-Regional-Safety-Plan.pdf>

Transportation Safety Committee (formerly the Regional Safety Council) <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 21<sup>st</sup> 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. In response to numerous changes to the NHS statewide in 2021, H-GAC will analyze the changes to NHS lane miles and the impacts to target achievement and future targets.

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 are shown in the table below.

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.

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

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.

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.

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 range from 2018 to 2021. Updates to H-GAC’s regional targets are formulated with the analyses of TxDOT’s statewide data and TxDOT’s revisions to statewide targets at the beginning, the mid-point and the end of the four-year performance period.

## Pavement Conditions – Interstate and Non-Interstate National Highway System

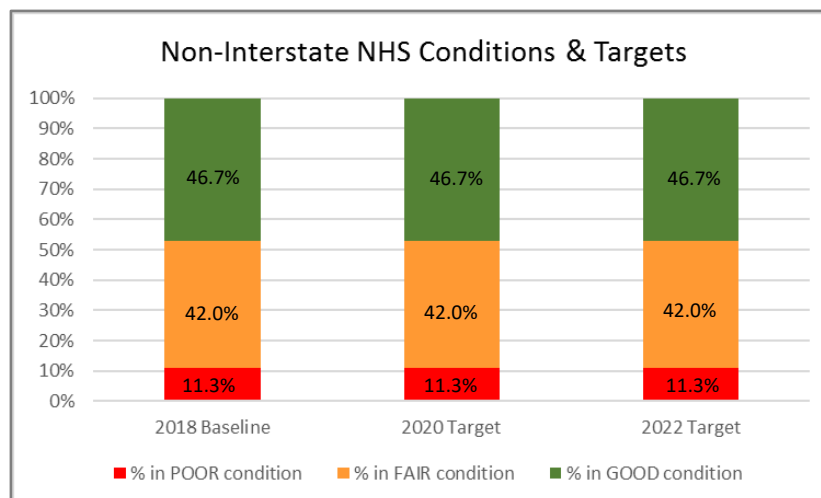
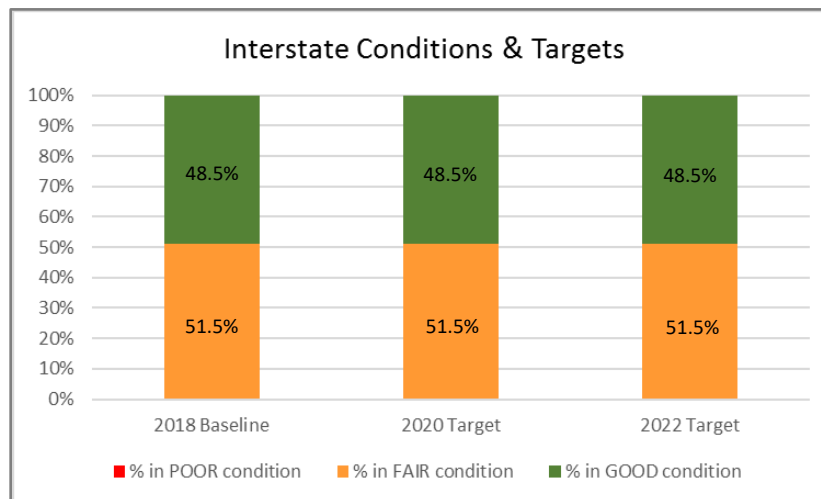
**Measure** – Percentage of pavements of the interstate and non-interstate National Highway System with a condition rating of “good” and “poor” relative to the ride quality.

**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.

	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 range from 2018 to 2021. Updates to H-GAC’s regional targets are formulated with the analyses of TxDOT’s statewide data and TxDOT’s revisions to statewide targets at the beginning, the mid-point and the end of the four-year performance period.

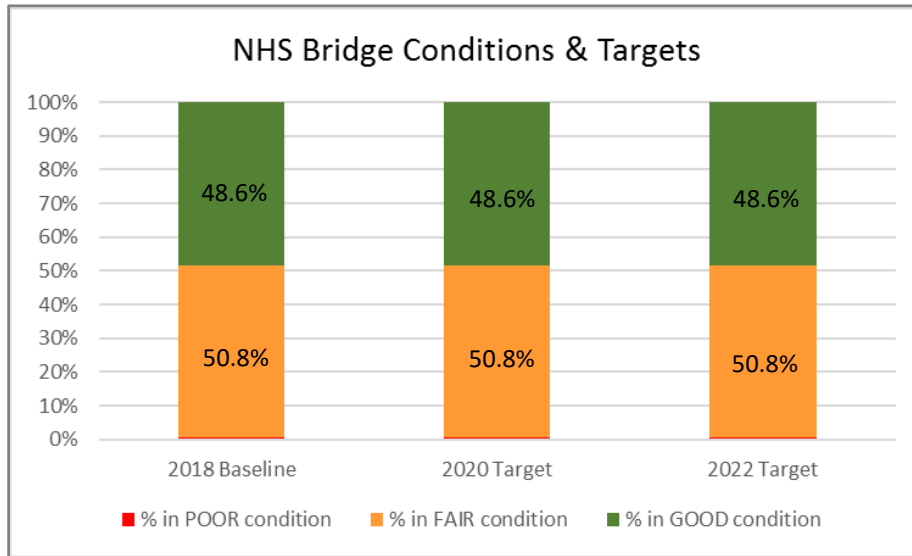
**Measure** – Percentage of bridge deck area of the National Highway System with a condition rating of “good” and “poor”.

**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.

**2045 RTP transportation investments targeting pavement and bridge improvements**

H-GAC, along with state and local government partners, have 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. 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 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.

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

**Pavement and Bridge-related 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 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.

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. Updates to H-GAC's regional targets are formulated with the analyses of TxDOT's statewide data and TxDOT's revisions to statewide System Performance targets at the beginning, the mid-point and the end of the four-year performance period.

### Reliability

One of the goals 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 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.

**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 80<sup>th</sup> percentile (bad day of traffic) to the 50<sup>th</sup> percentile (normal) travel time for a roadway segment. A ratio below 1.5 is considered to be "reliable"; and ratios 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.

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 95<sup>th</sup> percentile travel time (very bad day of traffic) by the 50<sup>th</sup> 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 data-sets 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.

**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 Annual Hours of Peak Hour Excessive Delay. 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

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 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%

## 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 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 projects in the 2019-2022 Transportation Improvement Program. Rather than base the revised four-year target on a direct accounting of planned projects as was done initially, H-GAC has used 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 outcomes from 2018 and 2019, as reported to the FHWA CMAQ Public Access System, as well as an estimate of future project outcomes derived from an average of Houston-Galveston region CMAQ projects funded over the last four full fiscal years between 2016 and 2019. This average was then doubled to determine an estimate of CMAQ-funded emissions reductions for fiscal years 2020 and 2021. Finally, the results from 2018 and 2019 were added to the averages for 2020 and 2021 to determine an estimated revised four-year target. Finally, this estimate is reduced by approximately 65% to take into account anticipated annual improvements to regional emissions due to on-road fleet turnover. The revised four-year target resulting from this analysis can be found in the table below. The full summary of setting baselines 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.

**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 <sub>x</sub> (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.

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.

### **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.

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

**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.

RTP 2045 STRATEGIES	STRATEGY 1 MANAGE [System Management and Operations]	STRATEGY 2 MAINTAIN [Asset Management]	STRATEGY 3 EXPAND [Transportation Network Capacity]	TOTAL
<b>REGIONAL INVESTMENT PROGRAMS</b>				
<b>Air Quality Related</b>	\$254,598,000	NA	NA	\$254,598,000
<b>ITS/Safety:</b> (Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management)	\$517,457,158	\$62,269,438	NA	\$579,726,596
<b>Local High Capacity Transit:</b> (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
<b>Pedestrian/Bicycle:</b> (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
<b>Transit Capital:</b> (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
<b>TOTAL</b>	\$20,082,654,772	\$2,617,475,528	\$23,086,300,528	\$46,786,430,828

## 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)
- Galveston Island Transit

Tier II transit providers:

- Brazos Transit District
- Colorado Valley Transit
- Connect Transit/Gulf Coast Transit District
- Conroe Connection Transit
- Fort Bend 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 staff 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.

Transit Asset Management Performance Measures and  
Targets by Asset Category

Asset Category & Performance Measures	FY 2018	FY 2020	FY 2022
<b>Rolling Stock – Revenue Vehicles - Age</b>			
% 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%
<b>Equipment – Non – Revenue Vehicles – Age</b>			
% 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%
<b>Facilities – All buildings/Structures – Condition- %</b>			
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%
<b>Infrastructure – Fixed Rail Guideway, tracks, signals &amp; systems - % of rail infrastructure with performance (speed) restrictions, by mode</b>			
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)

Annually, H-GAC monitors and gathers updates to the transit provider’s TAM Plans for their impact to the regional targets. Updates to H-GAC’s regional TAM targets are formulated with the analyses of the region’s transit providers.

## 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 identify risk, control risk and allocate resources to mitigate risk.

The requirements of a Public Transportation Agency Safety Plan (PTASP) 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: Public Transportation Agency Safety Plan Performance Measures

Measure	Metric
Fatalities	Total amount and rate of fatalities per total vehicle revenue miles
Injuries	Total amount and rate of injuries per total vehicle revenue miles
Safety Events	Total amount and rate of safety events per total vehicle revenue miles
System Reliability	Mean distance between major mechanical failures

Public 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. Transit operators report past performance along with setting targets for future goals. All transit agencies incorporated Vision Zero with respect to fatalities in their targets. The Public Transportation Agency Safety Plan (PTASP) must be updated and certified by the transit agencies annually. As the Metropolitan Planning Organization (MPO), H-GAC is required to set initial regional transit safety targets by June 30, 2021. FTA suggests that MPOs identify one regionwide target for each of the seven measures by transit mode. The goal is to enable the MPO to assess progress towards region-wide attainment of transit safety and a 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.

In early 2021, in coordination with the region's transit providers, the Texas Department of Transportation, the Regional Transportation Coordination Subcommittee, the Transportation Safety Committee, the TIP and RTP Subcommittees, and the Transportation Advisory Committee, H-GAC formulated and drafted its 2021 Public Transportation Agency Safety Plan (PTASP) seven performance targets as stipulated in 23 CFR 450.306 (d) (4), along with corresponding benchmarks. Consistent with FTA guidelines for Transit Asset Management, H-GAC divides transit agencies into two reporting tiers to develop aggregate targets. H-GAC developed seven performance targets for Tier I and Tier II transit agencies based on the transit agency's PTASPs. The regional PTASP targets, detailed in Tables B-20 and B-21 were approved by the Transportation Policy Council on June 25, 2021. H-GAC is required to document the methodology, benchmarks, and targets in this appendix in compliance with the June 30, 2021 deadline. The FTA requires public transportation providers to update their PTASP annually and report progress toward achieving targets. Additionally, H-GAC is required to update safety targets and report progress with each new or

update to the Transportation Improvement Program every two years and the Regional Transportation Plan (RTP) every four years.

Tier I Target Setting Methodology and Results

Tier I public transportation providers are transit agencies that operate a rail fixed guideway public transportation system or have 101 or more vehicles in revenue service during peak regular service. Tier I agencies include the Metropolitan Transportation Authority of Harris County (METRO) and Island Transit in Galveston. METRO comprises approximately 95% of all total transit vehicle revenue miles in the Houston-Galveston region. Island Transit received a waiver from the FTA from submitting a PTASP report and is excluded from the Tier I regional targets. As a result, METRO’s targets became the Tier I targets for the region, as did their benchmarks or baselines.

In alignment with the region’s goals of Vision Zero, METRO has set aspirational targets of zero fatalities related to all three modes: rail, fixed route, and demand response. Targets for injuries, safety events, and Mean Distance Between Failures (MDBF) remain consistent with their five-year rolling averages between 2015 and 2019, as submitted to FTA with its 2020 targets. In developing benchmarks and performance targets, METRO used a rate of per 100,000 vehicle revenue miles. Results are captured in Table B-20.

Table B-20: Tier I\* Regionwide Benchmarks and Targets – Public Transportation Agency Safety Plan

Rates are per 100K Vehicle Revenue Miles	MODE	METRO	
		TIER I	
		Benchmarks	2021 Targets
<b>PERFORMANCE MEASURE</b>	<b>MODE</b>	<b>Benchmarks</b>	<b>2021 Targets</b>
Fatalities	Bus	2	0
Fatality Rates		0.003	0
Injuries		194	194
Injury Rates		0.37	0.258
Safety Events		136	136
Safety Event Rates		0.258	0.258
Mean Distance Between Failures		10,084	10,084
Fatalities	Rail	4	0
Fatality Rates		0.122	0
Injuries		50	50
Injury Rates		1.466	1.466
Safety Events		121	121
Safety Event Rates		3.51	3.51
Mean Distance Between Failures		9,292	9,292
Fatalities	Paratransit	0	0
Fatality Rates		0	0
Injuries		35	35
Injury Rates		0.174	0.174
Safety Events		39	39

Safety Event Rates		0.19	0.19
Mean Distance Between Failures		22,039	22,039

\*Tier I public transportation providers operate a rail fixed guideway transportation system or have 101 or more vehicles in revenue service during peak regular service.

**Tier II Target Setting Methodology and Results**

Tier II small public transportation providers have 100 or fewer vehicles in revenue service during peak regular service and do not operate a rail fixed guideway transportation system. Five transit agencies comprise Tier II in the Houston-Galveston region. They are Fort Bend County Transit, Harris County Transit, The Woodlands Township, Gulf Coast Transit District, and Conroe Connection. H-GAC has developed seven regional performance targets for fixed route (including commuter service) and demand response service for this tier. The five agencies in Tier II used a consultant hired by TxDOT to complete their Public Transportation Agency Safety Plan reports. In alignment with the region’s goals of Vision Zero, every Tier II transit provider set aspirational targets of zero fatalities related to the two modes of fixed route and demand response. According to the most recent 2019 National Transit Database, the level of vehicle revenue miles for fixed route and demand response services of these five agencies varies considerably. As a result, a calculation of weighted averages to vehicle revenue miles among the Tier II agencies was used to develop the remaining targets and benchmarks or baselines. Results are captured in Table B-21.

Table B-21: Tier II\* Regionwide Benchmarks and Targets – Public Transportation Agency Safety Plan

Rates are Per Vehicle Revenue Mile	SMALL TRANSIT PROVIDERS		
	TIER II		
PERFORMANCE MEASURE	MODE	Benchmarks	2021 Targets
Fatalities	Fixed Route	0	0
Fatality Rates		0	0
Injuries		0.58	0.49
Injury Rates		0.0000017	0.0000008
Safety Events		0.96	0.82
Safety Event Rates		0.0000030	0.0000020
Mean Distance Between Failures		82,544	82,544
Fatalities	Demand Response	0	0
Fatality Rates		0	0
Injuries		1.34	1.34
Injury Rates		0.0000013	0.0000013
Safety Events		2.53	1.93
Safety Event Rates		0.0000019	0.0000015
Mean Distance Between Failures		386,106	386,106

\*Tier II small public transportation providers have 100 or fewer vehicles in revenue service during peak regular service and do not operate a rail fixed guideway transportation system.



## Integrating Transit Asset Management and Transit Safety 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 while improving safety and reliability. 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 that also has positive impacts on transit safety, 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:

<b>Transit Investment Strategies</b>		
<i><b>MANAGE</b></i> <i><b>System Management &amp; Operations</b></i>	<i><b>MAINTAIN</b></i> <i><b>Asset Management</b></i>	<i><b>EXPAND</b></i> <i><b>Transportation Network Capacity</b></i>
<ul style="list-style-type: none"> <li>• Regional Fare Collection</li> <li>• Transit Priority Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle Replacement and Overhaul</li> <li>• Facility State of Good Repair</li> </ul>	<ul style="list-style-type: none"> <li>• Passenger Facilities (Park &amp; Ride/Pool, Transfer Points/Super Stops, Shelters)</li> <li>• Vehicle Purchase</li> </ul>

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 and the Public Transportation Agency Safety Plans (PTASP). As a result, the projects programmed in the RTP 2045 are expected to support and contribute towards achieving the TAM and PTASP performance targets.

### **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.

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				
<b>Transit Capital:</b> (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