

Chapter 5

RECOMMENDATIONS AND FISCAL CONSTRAINT

A cost-feasible set of prioritized transportation improvements is essential to satisfy the Houston metropolitan region’s growing travel demand and to provide a reliable transportation network for all road users. The 2045 RTP was developed to guide transportation investments for the region through the next twenty-five years.

H-GAC incorporates federal performance measures and planning factors into its programming activities by integrating them into the five foundational goals of the Regional Transportation Plan. Based on the performance measures, the 2045 RTP goals provide a context for guiding transportation project development and investments. The five 2045 RTP Goals were developed to:

- Improve Safety
- Achieve and Maintain a State of Good Repair
- Move People and Goods Efficiently
- Strengthen Regional Economic Competitiveness
- Conserve and Protect Natural and Cultural Resources

The primary method for the programming of projects is the “Call for Projects” issued by H-GAC. In order to evaluate transportation projects submitted, the goals from the 2045 RTP were translated into three major strategies:

- ❖ **MANAGE** [System Management and Operations]
- ❖ **MAINTAIN** [Asset Management]
- ❖ **EXPAND** [Multimodal Network Capacity]

These three RTP strategies and the related twenty-one investment categories were developed in consultation with regional partners and utilized to evaluate candidate projects. Evaluation criteria for the investment categories consisted of a safety, delay and emissions benefit cost analysis and an assessment of the planning factors. The criteria were designed to demonstrate linkages to the RTP’s goals and strategies. The evaluation criteria and planning factors are detailed in Chapter 2 and are referenced in federal regulations 23 CFR §450.306, 23 CFR §409 and 490, and 49 CFR §625.

Individual projects for capital investments exceeding \$100 million were considered under the Major Investments strategy. These projects enhance regional economic competitiveness by improving the transportation network—especially the region’s freight network— through the construction of new roadways and/or the large-scale expansion of existing critical facilities. They improve safety and enhance roadway network efficiency through design and operational improvements, incident management programs, and new or expanded facilities. Additionally, major investment projects were required to support all RTP goals to be eligible for funding.

In addition to purported safety and delay benefits, Major Investment projects were evaluated based on the following planning factors:

- Enhancing or providing intra/inter-regional mobility and/or enhancing or providing direct connections to the freight networks or evacuation routes;
- Improving multimodal levels of service for automobile, transit, bicycle, and pedestrian travel modes;
- Improving transportation resiliency or includes flood mitigation strategies, such as elevating facility above flood level, additional storm water detention, flood warning devices, or other control measures;
- Asset management strategies that will ensure the facility's state of good repair and reduce maintenance and operations costs; and
- Anticipated tangible economic benefits including increased property values, or job creation or retention, etc.

MANAGE [SYSTEM MANAGEMENT AND OPERATIONS]

- ❖ **A strategy to maximize the efficiency and effectiveness of the transportation system through data, technology and policy solutions focused on reliability, continuity and the transparent dissemination of information.**

The Manage strategy focuses on programs and projects aimed at improving system management and enhancing transportation operations. Projects that implement this strategy would, for example, address congestion and safety through the reduction of vehicle crashes, quick and safe removal of stalled vehicles, improved intersection operations, bottleneck removal, and the reduction in regional vehicular travel through increased use of transit and other alternate commute solutions. System management strategies are expected to reduce crash rates by enabling the more efficient use of existing roadway facilities and improving travel reliability. It will increase reliability by utilizing more available facilities through projects such as signal timing and dynamic traffic alerts. Less congestion and more reliable travel will limit the damage to current facilities and extend their useful life.

Access management techniques and safety treatments improve thoroughfare safety and operational efficiency through driveway consolidation, installation raised medians, dedicated turn lanes, roundabouts and innovative intersections, road diet/reconfiguration, associated bicycle and pedestrian accommodations, and improvements to circulation and connectivity between land uses along major thoroughfares among other improvements. Pedestrian safety treatments, such as midblock crossings and First Mile/Last Mile improvements greatly enhance safer access to fixed route transit, bike share and employment. Grade separations substantially reduce motor vehicle crashes by eliminating congestion and conflicting vehicle movement through physical separation of roadway facilities and/or construction of direct connectors.

The deployment or enhancement of intelligent transportation systems (ITS) is another investment category of the Manage strategy. ITS improves transportation network operational efficiency using traveler information systems such as dynamic message signs, warning systems, real-time transit vehicle location and next-bus arrival information, active parking management, and automated ramp/gate operations, signage.

Transit Priority Infrastructure projects improve operational efficiency of transit services within H-GAC’s eight-county planning area by implementing a regional fare collection and transit priority infrastructure. The various project types for this investment category include, but are not limited to, transit bus pullouts, queue jump lanes, stop consolidation, transit-related ITS systems, and signage.

Autonomous and Connected Vehicle Infrastructure is another category of projects that are beginning to show promise for improve travel efficiency. The equipment and systems for this technology are constantly evolving as greater knowledge is gained about how this technology can improve public and private travel choices. It is likely that future calls for projects will include proposals to deploy this type of infrastructure in the region. Examples of project recommendations that support the Manage strategy are listed in Table 5-1.

Manage Recommendation Examples	
Roadway	
	Improve access management on roadways (Project Listing - FM 2920 Access Management Project)
	Manage congestion through the construction of grade separations (Project Listing - SH 288/Rodeo Palms Pkwy Grade Separation Project)
Freight	
	Develop a Concept of Operations for a Freight ITS Program (Regional Goods Movement Study)
	Improve flow of containers through a virtual container yard to reduce truck trips (Ports Area Mobility study - underway)
Transit	
	Universal Accessibility of safe, barrier-free access to transit services for all users, regardless of ability (High-Capacity Transit Taskforce Report)
	Build Regional Fare Collection System (Regionally Coordinated Transportation Plan)
Active Transportation	
	Collect, analyze, and share data on crashes involving people walking, biking, and rolling (2045 Active Transportation Plan)
ITS/Operations	
	Conduct regional incident management (Tow and Go Program)
	Improve traffic signal operations (Regional ITS Plan)
Safety	
	Conduct safety audits at high frequency intersection crash locations (Regional Safety Plan)

Table 5-1: Examples of Projects that Support the Manage Strategy

The Congestion Management Process

The Congestion Management Process (CMP) is the systematic process of identifying congestion and its causes, applying congestion mitigation strategies to improve transportation system performance and reliability, and evaluating the effectiveness of the strategies implemented. The goals of the H-GAC CMP are to:

- Reduce the rate and severity of crashes for all system users;
- Improve transportation system reliability across all modes and systems of travel in the region;
- Reduce the impacts of incidents on traffic flow;
- Increase opportunities for travelers to use regional and local transit services and participate in Transportation Demand Management (TDM) programs to provide more travel choices;
- Improve system operational efficiency and accessibility to accommodate freight movement within the region: and
- Reduce emissions through congestion management.

MAINTAIN [ASSET MANAGEMENT]

- ❖ **A strategy to improve and preserve the condition of existing transportation infrastructure at the least practicable cost through the application of sound asset management techniques.**

Maintaining high quality and updated roadways and transportation facilities will ensure the basic safety needs of the traveling public by deploying the most current technology and construction practices. The Maintain strategy includes project types that ensure the existing roadway network is kept in good operational condition. These strategies also ensure that timely maintenance and rehabilitation are performed on critical infrastructure, such as principal arterials, National Highway System roadways, and the First Mile/Last Mile of intermodal connectors. There are three investment categories under the Maintain strategy.

The first, and perhaps most critical category, is rehabilitation and reconstruction of roadway pavements and structures, including bridges, to ensure state of good repair and operational efficiency of the network. Asset management extends the life and ensures the safety of current facilities at a fraction of the cost of constructing new ones. Maintaining the ADA compliance of sidewalks and ramps is critical to both pedestrian network and transit access.

Infrastructure Resiliency addresses the vulnerabilities of highways and regional thoroughfares to extreme weather, sea level change and changes in environmental conditions through the implementation of eligible construction investments. Such projects will elevate or harden roadways on corridors that have required multiple emergency repairs, experience regular inundation, and are critical to evacuation plans. Projects in this category also include construction of roadways that serve as alternate routes for roadways impacts by extreme weather events.

Finally, keeping transit systems in good condition is very important for maintaining a true multimodal transportation network. Accordingly, Transit Facility State of Good Repair is an investment category under the Maintain strategy. These projects seek to improve the safety and operational efficiency of transit services within H-GAC's eight-county planning area by supporting the replacement or overhaul of transit passenger and vehicle maintenance facilities that have exceeded their Useful Life Benchmark, and the construction of

new transit maintenance facilities, consistent with each transit provider’s adopted Transit Asset Management Plan and performance targets. Typical projects in this category include vehicle replacement and overhaul; improvements of warning beacons, real time passenger information system, and Electric charging stations; and reconstruction of transit passenger facilities including Park & Ride lots, multi-route transfer locations, bus stops and passenger shelters. For METRO Rail, the asset management of rail track segments, signals and the systems will protect the transportation investments and ensure a State of Good Repair. Examples of project recommendations that support the Maintain strategy are listed in Table 5-2.

Maintain Recommendation Examples	
Roadway	
	Maintain and improve roadways (Project Listing -IH 45/SH 242 Intersection Improvements Project)
	Maintain and improve roadways (Project Listing -SH 105/SH 321 Intersection Improvements Project)
Freight	
	Work with partners to mitigate short-term deficiencies on the freight-significant network (Regional Goods Movement Study)
Transit	
	Store and maintain vehicles of multiple providers at a single operations and maintenance facility with providers sharing the capital cost of a passenger facility at a location where transfers between multiple providers will occur (High-Capacity Transit Taskforce Report)
Active Transportation	
	Maintain and improve the existing network of walkways and bikeways in the region and coordinate regional data collection for active transportation infrastructure (2045 Active Transportation Plan)
ITS/Operations	
	Maintain and coordinate on rural and urban ITS deployments (Regional ITS Plan)
Safety	
	Conduct intersection improvements at high crash locations (Regional Safety Plan)

Table 5-2: Examples of Projects that Support the Maintain Strategy

EXPAND [MULTIMODAL NETWORK CAPACITY]

- ❖ **A strategy designed to 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 regional demographic and growth trends forecasted in the 2045 RTP clearly show the transportation network will need to grow to accommodate more people and vehicles in the future. The primary purpose of the RTP is to ensure that transportation network growth adequately addresses future needs. The Expand strategy's investment categories address transportation network growth in a multimodal fashion. The categories include expansion of not only roadways, but transit services and facilities as well. This multimodal approach ensures the regional residents have viable choices for their travel needs.

The first investment category under this strategy seeks to improve accessibility and mobility of people and goods on the regional thoroughfare network through the addition of roadway capacity. Network expansion could reduce crashes and improve incident response providing travel alternatives to currently congested facilities. Projects include roadway widenings, new roadway construction, with pedestrian/bicycle/transit accommodations, and drainage improvements related to the roadway. Projects must be consistent with H-GAC's congestion management process.

Innovative Freight Movement is another investment category of the Expand strategy to improve transportation safety and operational efficiency of the regional freight network through the deployment of innovative intermodal freight transfer technologies. Vital to the region's economic competitiveness, heavy cargo movement projects include capital equipment, and the construction and installation costs, and intermodal transfer equipment.

Unlike the Transit Facility State of Good Repair category under the Maintain strategy, the Transit Passenger Facilities investment category seeks to increase transit usage within H-GAC's 8-county planning area by supporting the construction of new or expanded passenger facilities, such as Park & Ride, transfer points, super stops, and transit vehicle purchases. The same types of transit facilities are eligible under this investment category.

Likewise, the Transit Expansion investment category is intended to increase transit usage by supporting the purchase of additional revenue vehicles for transit providers demonstrating ridership growth, as documented in reporting to FTA's National Transit Database (NTD).

The High Capacity Transit Task Force (HCTTF) was created by the Transportation Policy Council in the spring of 2017 charged with investigating the need and opportunity for high capacity transit in the Houston-Galveston region. The Task Force's charge is to: *"Coordinate with regional stakeholders to identify regional benefits, funding solutions and policy considerations to advance High Capacity Transit throughout the region."* As the result of a two-year planning process, the HCTTF Priority Network was created. The services indicated in the HCTTF Priority Network are mode-, technology- and alignment neutral. All recommendations in the HCTTF Priority Network are conceptual and are subject to further analysis and design. Examples of project recommendations that support the Expand strategy are listed in Table 5-3.

Expand Recommendation Examples	
Roadway	
	Expand roadway network to improve capacity and connectivity (Project Listing - State Highway 99 Widening Project)
	Expand roadway network to improve capacity and connectivity (Project Listing - US 90 Grade Separations Project)
Freight	
	Provide access to growing economic centers outside of the urban core (Regional Goods Movement Study)
Transit	
	Expand local bus services in areas indicating high transit need that do not currently have service (High-Capacity Transit Taskforce Report)
Active Transportation	
	Build interconnected networks of walkways and bikeways in Focus Areas and between regional hubs like employment and population centers and tourist destinations (2045 Active Transportation Plan)
ITS/Operations	
	Provide redundancy to the ITS systems and build Regional ITS network (Regional ITS Plan)
Safety	
	Promote design practices to improve safety and reduce speeds on new roadways (Regional Safety Plan)

Table 5-3: Examples of Projects that Support the Expand Strategy

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FISCALLY CONSTRAINED 2045 RTP

Fiscal constraint analysis is performed to exercise caution in planning for the future transportation network. Revenues for future investments are not limitless and proper governance requires a conservative fiscal approach when considering which improvements are necessary and in what timeframe. Federal and state regulations require every RTP be fiscally constrained. H-GAC estimated revenues and expenditures through the year 2045, including federal, state, and local revenue sources.

Estimating Revenue and Expenditure

Reasonably available revenue is estimated by annual financial reports from local agencies, relevant TxDOT data and projections, and trends related to debt financing and regional revenues. Federally, the main source of funding is provided by the Highway Trust Fund—supported primarily by the federal gas tax, currently set at fixed rate of 18.4 cents per gallon of gasoline and diesel fuel sold. At the state level, revenues are derived from the State Highway Fund supported by a fixed-rate tax of 20 cents per gallon, and two voter-approved constitutional amendments—Proposition 1 and Proposition 7. Locally, revenues are estimated based on future capacity of local municipalities, counties, transit agencies, toll road authorities, and other qualified public entities to invest in regional transportation by providing a local match, or share thereof, in sponsorship of the recommended projects and transportation programs presented in the 2045 RTP.

Over the time frame of the 2045 RTP, the total estimated revenues are forecasted to be \$147 billion, as expressed in year of expenditure dollars (Figure 5-1). In terms of transportation investment expenditures, the 2045 RTP recommends \$132 billion in year of expenditure dollars (Figure 5-2). The anticipated revenues are more than is needed to cover the expenditures of the 2045 RTP. Year-of-expenditure dollars are included in Appendix D to conform to more official expectations and certain regulatory requirements.

2045 RTP Revenue by Source
Total: \$147 Billion

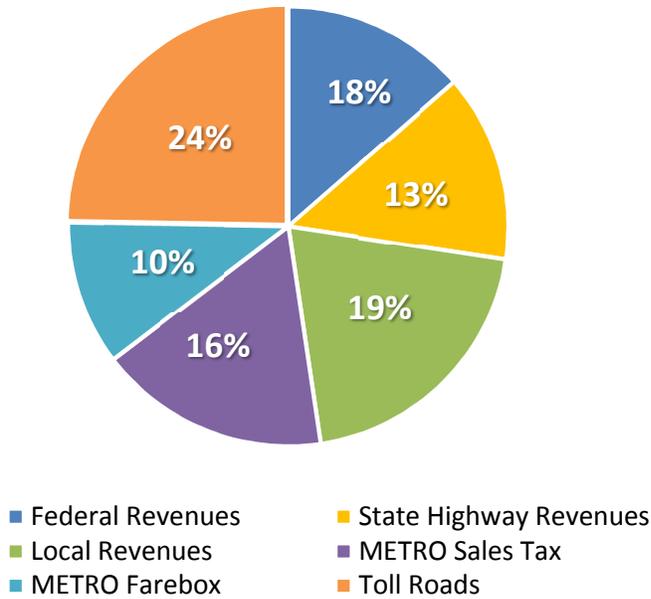


Figure 5-1: Revenue by Source

2045 RTP Expenditures by Strategy
Total: \$132 Billion

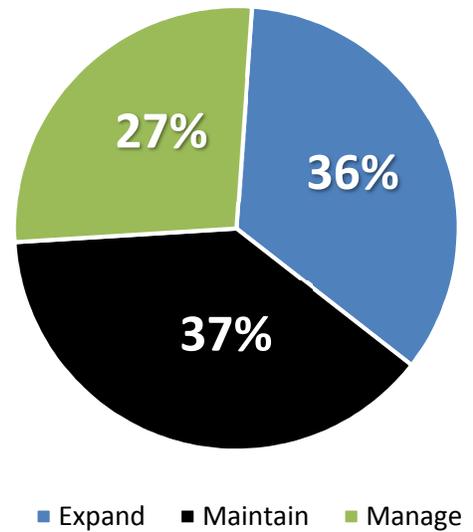


Figure 5-2: Expenditures by Strategy

The 2045 RTP strategies: Maintain, Manage, and Expand recommend an overall total of \$132 billion in transportation investments encompassing more than 950 individual projects and programs. Figure 5-3 shows the major transportation corridors assigned with investments. To summarize the total investments of the 2045 RTP, Table 5-4 identifies the corridor-based major investments and the regional investment programs along with their project descriptions. The summarized costs shown have been estimated on the previous history and total project estimates submitted by project sponsors.

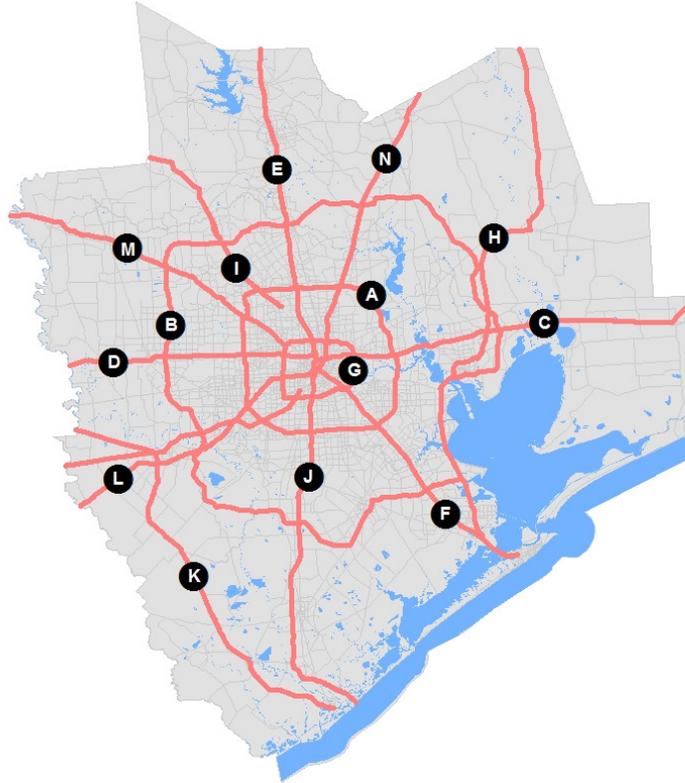


Figure 5-3: Corridor-Based Major Investments

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	STRATEGY 1 MANAGE [System Management and Operations]	STRATEGY 2 MAINTAIN [Asset Management]	STRATEGY 3 EXPAND [Transportation Network Capacity]	TOTAL
CORRIDOR - BASED MAJOR INVESTMENTS				
A. BW 8	\$171,060,455	NA	\$92,210,650	\$263,271,105
B. GPW	\$3,039,631,514	\$17,358,361	\$804,832,838	\$3,861,822,713
C. IH 10E	\$480,448,759	\$17,961,814	NA	\$498,410,573
D. IH 10W	\$350,305,370	\$96,450,000	\$661,472,604	\$1,108,227,974
E. IH 45 North of IH 10	\$425,207,762	NA	NA	\$425,207,762
F. IH 45S	\$93,658,303	\$122,000,000	\$747,950,000	\$963,608,303
G. IH 610	\$297,405,625	\$96,545,811	NA	\$393,951,436
H. SH 146	\$13,915,000	\$15,787,734	\$595,409,960	\$625,112,694
I. SH 249	\$3,295,380	NA	\$290,528,541	\$293,823,921
J. SH 288	\$261,000,000	NA	\$372,371,428	\$633,371,428
K. SH 36	\$17,167,217	NA	\$764,510,618	\$781,677,835
L. SOUTHWEST CORRIDOR	\$110,900,000	NA	\$286,053,077	\$396,953,077
M. US 290	\$3,485,844,309	\$53,100,000	\$707,533,709	\$4,246,478,018
N. US 59N	NA	NA	\$211,765,982	\$211,765,982
REGIONAL INVESTMENT PROGRAMS				
Air Quality Related	\$254,598,000	NA	NA	\$254,598,000
Freight: <i>(Includes roadwork on the Freight Significant Network; freight rail, intermodal terminals, grade separations)</i>	\$376,779,567	NA	\$84,818,432	\$461,597,999
ITS/Safety: <i>(Includes certain roadway improvements, installation of computerized traffic control systems, Incident Management)</i>	\$517,457,158	\$62,269,438	NA	\$579,726,596
Land Use/Transportation Planning: <i>(Includes Subregional Plans)</i>	\$5,900,000	NA	NA	\$5,900,000

Local High Capacity Transit: <i>(Includes non-corridor light rail, park and ride, transit centers, demand management strategies)</i>	\$15,908,231,556	\$99,598,227	\$13,790,549,267	\$29,798,379,050
North Houston Highway Improvement Project <i>(Includes IH 45 N projects between IH 10 and BW 8)</i>	\$267,845,342	\$4,767,316,457	\$3,434,648,479	\$8,469,810,278
Other Major Roadway Improvements: <i>(Non-Corridor improvements on Major Roadways)</i>	\$391,092,183	\$708,236,636	\$2,940,572,454	\$4,039,901,273
Pedestrian/Bicycle: <i>(Includes on-street facilities, hike and bike trails and paths, and reconstructions)</i>	\$130,247,249	\$51,178,297	\$1,626,470,674	\$1,807,896,220
Regional Roadway Expenditures: <i>(Includes administration, and management/operations estimates)</i>	\$6,000,000,000	\$16,706,054,886	\$5,017,941,370	\$27,723,996,256
Thoroughfare Development: <i>(All other roadway improvements)</i>	\$107,920,880	\$746,961,935	\$6,448,737,588	\$7,303,620,403
Transit Capital <i>(Includes all other new or expanded facilities, services, and vehicles)</i>	\$4,272,120,809	\$2,404,429,566	\$7,669,280,587	\$14,345,830,962
Transit Other: <i>(Includes non-capital transit expenditures)</i>	\$22,409,478	\$99,594,550	\$427,352,346	\$549,356,374
Transit O & M: <i>(Includes all Transit Operations and Management expenditures)</i>	NA	\$22,399,862,881	NA	\$22,399,862,881
TOTAL	\$37,004,441,916	\$48,464,706,593	\$46,975,010,604	\$132,444,159,113

Table 5-4: Corridor-Based Major Investments and Regional Investment Programs

Corridor-Based Major Investments

The project listing shows investments based on the region's chief transportation corridors – and amount to approximately \$15 billion in year of expenditure dollars, 11% of the total cost of the 2045 RTP. These improvements will be among the most impactful and costly the region undertakes in the next few decades.

Regional Investment Programs

The remainder of the fiscally constrained 2045 RTP expenditures do not fit into one of the above corridors, and are represented in programs such as ITS, safety, thoroughfare development, suburban connectors, freight, pedestrian/bicycle improvements, transit, local high capacity transit and land use coordination – with descriptions accompanying each program.

Some transit expenditures fall within this category as well, including, the regional vanpool program, ADA accessible and paratransit service; preventative maintenance, facility maintenance, transit centers and Park & Rides, bus and rail systems.

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RECOMMENDATIONS

High Capacity Transit

The construction of new and ever wider highways cannot by itself support the expected growth of the region. Nor will a “highway only” mobility solution serve the travel needs of a geographically, economically, demographically and culturally diverse region. A solution that can move large numbers of people within relatively limited rights-of-way is required.

High Capacity Transit (HCT) is any form of public transportation that can move large volumes of people typically within a dedicated, if not exclusive right of way. It can do this through a combination of larger vehicles, shorter frequencies and higher speeds. HCT capacity transit can be any technology (bus or rail) or alignment (at-grade, elevated or underground), but it generally has an exclusive guideway, such as a rail line, busway, or high-occupancy vehicle lane that is separated from other traffic, thereby allowing it to operate unimpeded by normal traffic congestion. High capacity transit currently exists in the form of METRO’s light rail network, and the suburban park and ride network which uses express buses in High Occupancy Vehicle (HOV) or managed lanes. Another form of HCT, Bus Rapid Transit where buses utilize bus only express lanes both within an existing major thoroughfare and in separate exclusive lanes along the IH 610 freeway.

The High Capacity Transit Task Force report identifies the need and opportunity for HCT in the region. To create a financially-constrained transit network for inclusion in the 2045 RTP, elements of the HCT Vision Network were selected for inclusion in the HCT Priority Network. The services indicated in the Priority Network are mode, technology and alignment neutral. Significant features of the Priority Network include service to all eight counties in the H-GAC transportation planning region with new local, high capacity transit and other express bus services, particularly those that will expand access to “suburban” employment centers.

The High Capacity Transit (HCT) Task Force’s recommendations are to:

- Include the projects from the HCT Priority Network in the 2045 RTP;
- Encourage the concepts and policies that support the increased use of transit, such as a Regional Fare; System, Universal Accessibility and First Mile/Last Mile connections;
- Examine HCT opportunities, set priorities and develop new funding sources; and
- Recommend Phase II of the HCT Task Force effort.

Automated and Connected Vehicles

The region’s transportation system is nearing capacity limits as traffic congestion levels remain high despite billions of dollars of investments in new or expanded highways. To sustain regional mobility, new convenient and accessible options for travel must be developed. Emerging technologies like autonomous and connected vehicles (AV/CV) have great potential to affect and influence the regional transportation system. Additionally, the emergence of private on-demand providers, such as Uber and Lyft, has fostered the development of new technologies and opportunities for the expansion of AV/CV vehicles. The effects of these new technologies are still being investigated.

H-GAC’s Vision for autonomous and connected vehicles is to lead local governments and stakeholders in maximizing the benefits of automated and connected vehicle technology to improve quality of life across our region. H-GAC supports its partners in planning for sustainable integration of Connected and Automated Vehicles

that move people and goods with greater safety, reliability and efficiency. Benefits will be achieved through the following action steps:

- Develop an integrated multimodal transit system with focus on first-last mile connections which makes maximum application of Connected and Automated Vehicle technology, especially with combination of Connected and Automated Vehicle Microtransit connecting to Connected and Automated Vehicle high capacity transit, thereby expanding traveling mode choice options;
- Educate public officials and the public about Connected and Automated Vehicle deployment benefits;
- Develop and promote a strategic plan by engaging public and private partners;
- Identify opportunities to leverage investment in existing services and infrastructure for early deployment of Connected and Automated Vehicles;
- Identify public/private opportunities to reduce operating costs for all transportation modes, particularly those delivering freight and demand-response transit; and
- Seek public/private partnerships which open new economic development opportunities along or near Connected and Automated Vehicle routes.

Active Transportation

The Active Transportation vision is “Pedestrians and bicyclists of all ages and abilities can travel conveniently and comfortably in all communities using connected and well-maintained networks of walkways and bikeways.”

Recommendations from the Active Transportation Plan are to:

- Achieve the vision for our regional active transportation network, we developed a set of strategies for each of the five recommendations;
- Improve safety for people walking, biking, and rolling;
- Ensure that all people – regardless of age, ability, or location within the region – have access to walkways and bikeways that are safe, convenient and comfortable;
- Build interconnected networks of walkways and bikeways in Focus Areas and between regional hubs like employment and population centers and tourist destinations;
- Maintain and improve the existing network of walkways and bikeways in the region and coordinate regional data collection for active transportation infrastructure; and
- Encourage and incentivize the use of walkways and bikeways to mitigate congestion, improve air quality, and increase physical activity.

Freight

The Houston-Galveston region is served by an intermodal network of road, rail, water, air, and pipeline facilities. Ports are major generators of freight, thus requiring a reliable roadway and rail network with capacity to handle this traffic. The growing economy, population, and freight capacity of the region’s ports will only increase the demand placed on the regional transportation network.

Recommendations to address the freight needs of the region include:

- Collaborate with regional partners to mitigate short-term deficiencies on the freight-significant network;
- Develop a concept of operations for a freight ITS program;
- Improve flow of containers through a virtual container yard to reduce truck trips; and
- Provide access to growing economic centers outside the urban core.

Resiliency

According to the FHWA’s definition, “Resilience” is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.” Due to its low-lying coastal geography and semi-tropical climate, the Houston-Galveston region is vulnerable to extreme weather events like heat, drought, tropical storms, and flooding. The risk of these extreme events impacting the region’s population, economy, and transportation infrastructure is expected to worsen because of the amplification of related stressors – land use changes, population growth, congested transportation systems, and climate change

The 2045 RTP’s recommendations to focus on resiliency include:

- Conduct a Transportation Vulnerability Assessment Study
 - Form a transportation resiliency working group to develop a multi-year strategy
 - Contribute to Texas Resiliency and Planning workshops
 - Participate in the Cedar Bayou Initiative

Air Quality

Current State of Regional Air Quality

The U.S. Environmental Protection Agency (EPA) has established national air quality standards for several pollutants known to have negative effects on human health and the environment. Under these rules, the region does not meet the federal standard for ground-level ozone. Ground level ozone is produced through a photochemical reaction between nitrogen oxides (NOx) and volatile organic compounds (VOCs). Over half of the NOx produced in the region is emitted by mobile source vehicles and equipment.

For decades, H-GAC and regional stakeholders have worked to develop projects to improve regional air quality, resulting in significant reductions of ozone. Current efforts to reduce regional ozone concentrations focus on cutting the NOx emissions at their source, applying two broad strategies: (1) replacing or retrofitting older vehicles and engines; and (2) reducing the vehicle miles traveled within the region by expanding commute alternatives. It’s imperative that H-GAC continue to fund these programs for the foreseeable future and continue to reach for new ways to reduce emissions and improve air quality for the health of all of our region’s residents.

Recommended Air Quality programs include:

- **Vehicle Retrofit and Replacement Programs**
H-GAC developed several voluntary programs aimed at reducing emissions by retrofitting and replacing high-emitting heavy-duty diesel vehicles or engines with newer or alternative fueled models. These programs work to improve the region’s air quality while helping local governments, businesses, and school districts save money through improved fuel economy and lower

maintenance costs. These programs include the Clean Vehicles Program, Regional Heavy-Duty Vehicle Project, the Drayage Truck Project and the Clean School Bus Program. <http://www.h-gac.com/clean-vehicles/default.aspx>.

- **Commute Alternatives**

To reduce traffic and improve air quality in the Houston-Galveston region, H-GAC continually promotes travel alternatives through the Commute Solutions program. Alternatives to driving alone such as carpooling, transit, walking, biking, teleworking, and working a compressed workweek not only improves the air, but also makes the region more livable, accessible, and economically competitive. <http://www.h-gac.com/commute-solutions/default.aspx>.

Commuter and Transit Services Pilot Program

While our region has an extensive transit network that serves millions of riders annually, many transit service gaps still exist in areas where services are needed and are potentially feasible, but not tested. H-GAC uses the Commuter and Transit Services Pilot Program to support the development of new transit services within the region.

- **Houston-Galveston Clean Cities Coalition**

Networking efforts by this coalition work to connect regional stakeholders and businesses with manufacturers of alternative fuels and refueling sources and to provide information about funding availability, case studies and success stories to assist fleets better understand the benefits of alternative fuels. <http://www.h-gac.com/clean-cities/default.aspx>

Environmental Justice

Effective and equitable transportation decision-making depends on understanding and properly addressing the unique needs of all residents from different socio-economic groups – including the traditionally underserved. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Established as federal policy in 1994 through Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” the law is administered under the non-discrimination umbrella of Title VI of the Civil Rights Act of 1964.

To be the focal issue it is intended to be, environmental justice principles must permeate the transportation planning process and be embraced as an issue of regional interest. The strategies that follow are offered as possible approaches to elevate and advance the federal environmental justice and non-discrimination directives more purposefully in the transportation programs.

The recommendations for Environmental Justice include:

- Increase environmental justice awareness within the transportation management area.
- Enhance sensitivity to Title VI and environmental justice in transportation investment decisions.
- Support local efforts to improve transportation service in the underserved communities.
- Improve safety in the environmental justice communities.
- Increase public involvement by the underserved population.