



High Capacity Transit Task Force for the 2045 Regional Transportation Plan

DRAFT SUMMARY REPORT



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Houston-Galveston Area Council

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H-GAC Staff Contacts for this Summary Report and its Attachments:

Alan Clark, Director, Transportation Department
Thomas Gray, AEP, Principal Planner, Transportation Department
Sharon Ju, Senior Planner, Transportation Department

High Capacity Transit Task Force Report

Executive Summary

Introduction – The Problem

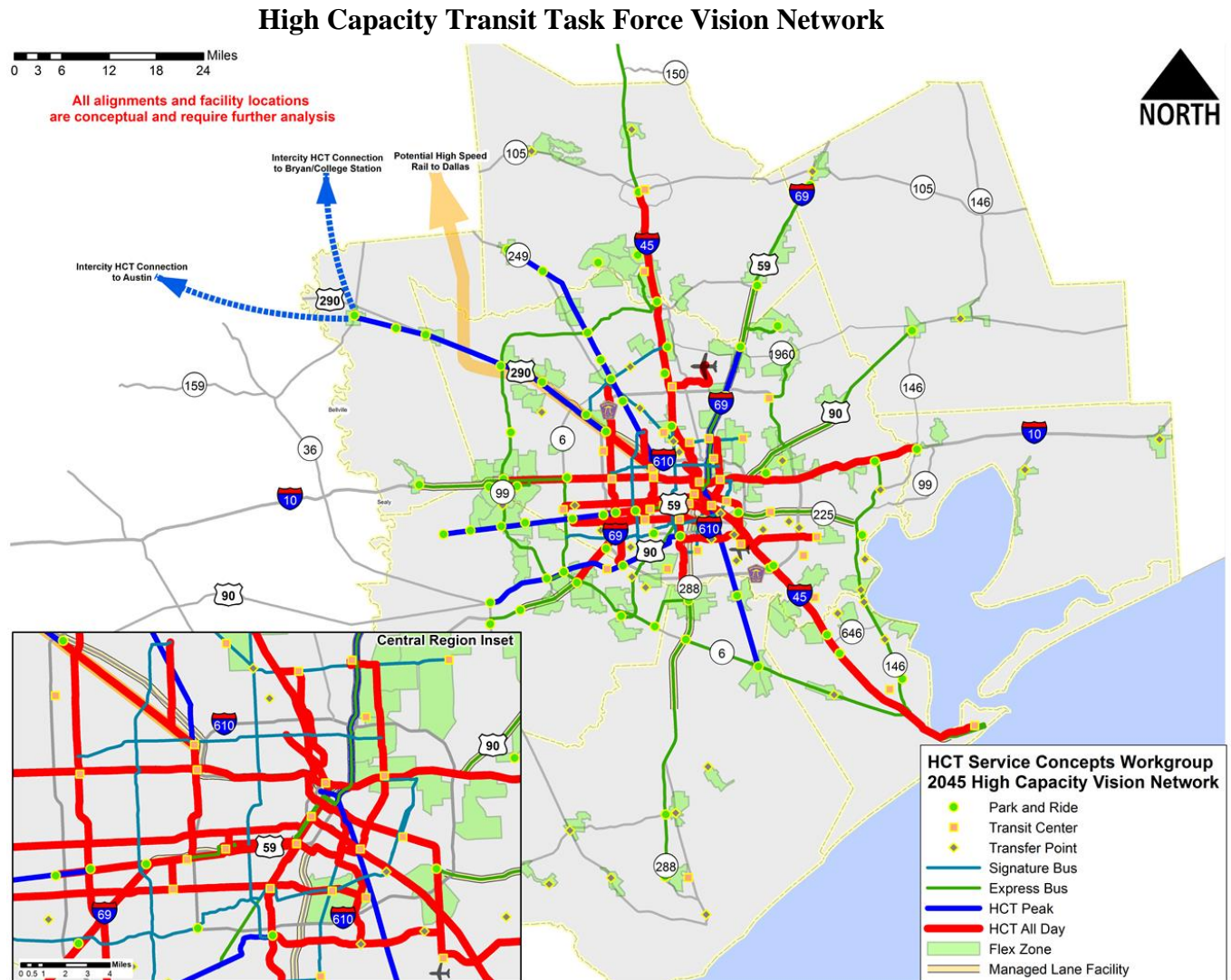
With an anticipated additional 4.2 million people being added to the 8 county Houston-Galveston region over the next 25 years, the construction of new and ever wider highways cannot by itself support the expected growth of the Houston-Galveston region. Nor will a “highway only” mobility solution adequately serve all the travel needs of such a geographically, economically, demographically and culturally diverse region. If possible and affordable, a “highway only” solution would require three times the number of highway lanes miles as exist today.

An accessible solution that can connect to many residents and their destinations while moving large numbers of travelers within relatively limited rights-of-way is required. Accordingly, the Transportation Policy Council (TPC) created the High Capacity (HCT) Transit Task Force to *“identify regional benefits, funding solutions and policy considerations to advance High Capacity Transit throughout the region, and to provide recommendations that could be included in the 2045 RTP.”* Therefore, the High Capacity Transit Task Force has worked to (1) identify a transit vision for 2045; (2) identify the costs associated with a range of transit options; (3) identify the economic impacts on the region of these options; and (4) identify a Priority Network for 2045 Regional Transportation Plan. The findings of the High Capacity Transit Task Force reveal that substantial investment high capacity transit today will lead to substantial increases in personal income, job growth, gross regional product and regional output.

Methodology

The HCT Task force created three work groups to identify transit service needs and concepts, economic impacts and financial options. It created a Vision plan serving all eight counties and estimated the costs associated with both the Vision Plan (the highest level of capital investment) and 3 successively lower cost investment scenarios. For each scenario, the Task Force estimated economic impacts including travel time savings, value of increased safety, increased personal income as well as increased jobs, Gross Domestic Product and regional output.

A High (Vision) Scenario, a Medium High Scenario, a Medium Low Scenario and a Low Scenario were created to depict the range of high capacity transit options by cost and by various factors such as grade separation and use of the light rail and bus rapid transit, for example. A full snapshot of the assumptions made with these options are included in the full report.



Economic Impacts

In order to make prudent decisions pertaining to investments in high capacity transit, economic impacts were estimated for each scenario using H-GAC's regional travel forecasting tools in conjunction with the Regional Economic Modeling Inc.'s (REMI) econometric model. Compared to today's regional transit ridership, the highest level of capital investment in the Vision Network yielded an almost a **tenfold** increase in today's patronage and over **one half Trillion** dollars in direct benefits to travelers based on travel time savings, reduced vehicle crashes and increased personal income. Economic impacts included additional annual average job growth of over **94 thousand jobs**, almost **\$19 Billion** in additional regional **GDP** and **\$40 Billion** in increased **regional output**.

All four of the capital expenditure scenarios generate regional economic impacts substantially greater than their investment costs. For **each dollar invested** in the Vision (or High) High Capacity Transit scenario, **\$3.37 would be returned** to users in travel time savings, improved safety and person income. Similarly, each dollar invested in the Vision scenario would generate **\$3.25 in increased Gross Domestic Product** and almost **\$7 in increased output**. On the other hand, there is a “cost of doing nothing” if the region does not expand its transit network. The “No Build” scenario showed **\$84 Billion in additional travel costs** and **lost income** to travelers in the region, further reinforcing the need for additional highway and transit investment.

Funding

The Task Force identified several strategies for additional transit funding including: federal discretionary funding for “New Starts” high capacity transit; private sector participation through joint development opportunities; and various value capture strategies. Other longer-range options include various forms of local option funding or state funding support that would require state enabling legislation and local voter support. Allowing transit projects to “compete” for eligible highway funding based on performance criteria established by TPC is also recommended.

No single revenue source will account for the additional funding that is needed to implement the large-scale expansion of HCT services in the region; multiple funding strategies are required.

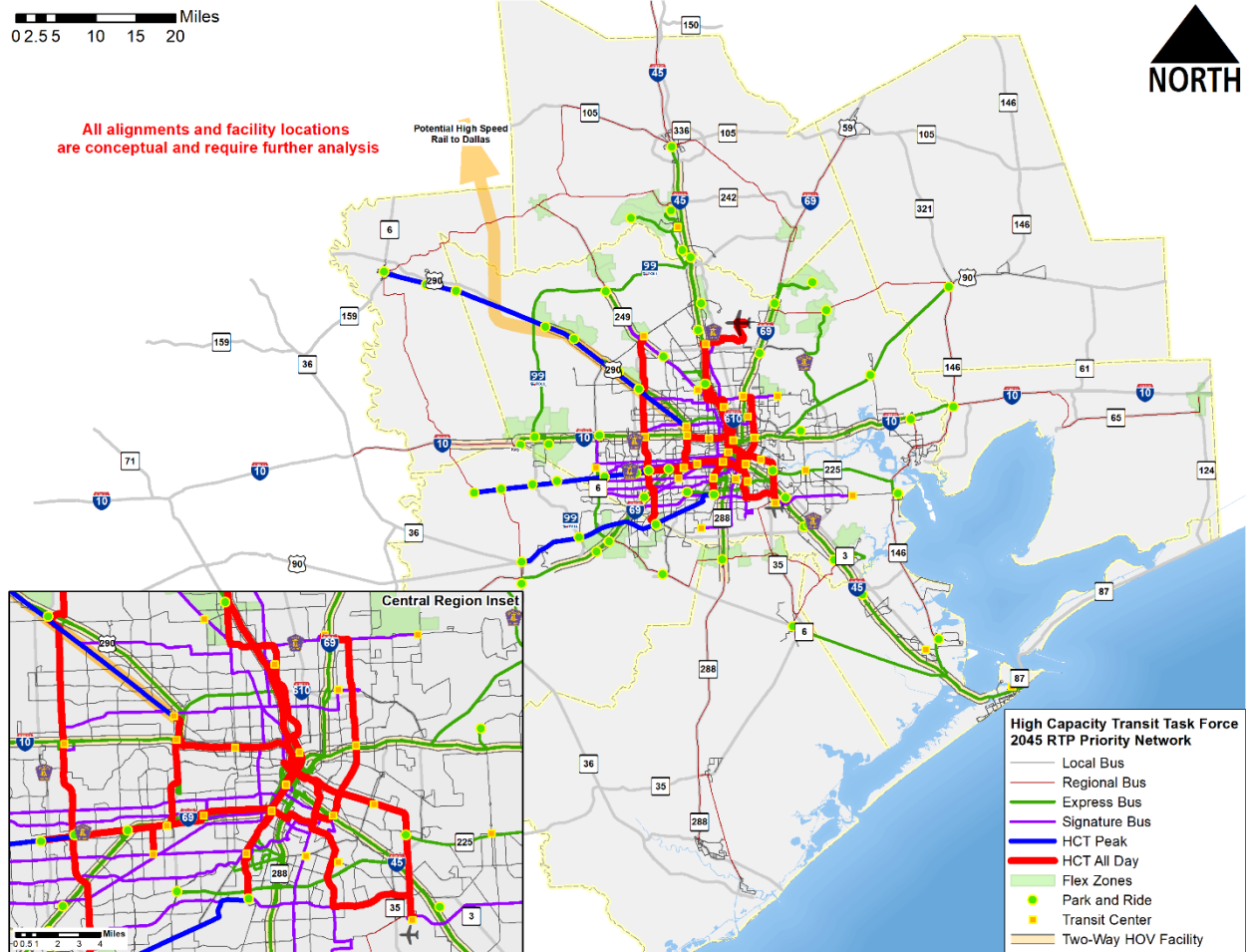
The Priority Network

To create a financially-constrained transit network for inclusion in the 2045 RTP, elements of the Vision Network were selected for inclusion in the “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 capital components of the Priority Network are estimated to cost about **\$21.7 Billion** (2018 dollars), with an annual operating and maintenance cost of **\$1.14 Billion** (2018 dollars) at full build-out. Travel demand analysis of the Priority Network indicates that the network satisfies a service demand representing over a three-fold increase in the number of fixed-route boardings the region’s transit network carried in 2017 and 216 percent increase in passenger miles traveled.

As a direct **benefit to travelers** in the region, the total travel time savings, value of reduced vehicle crashes and increased personal income totaled over **\$520 billion**. The average annual increase in employment is approximately **65 thousand jobs**. With an estimated total investment of \$73.3 Billion, the benefit cost ratio is slightly greater than 7.

High Capacity Task Force 2045 Priority Network



Lessons Learned

The Task Force began its work by investigating relevant examples and practices from other regions of the country and world. Like our region, many of these areas saw their economic success and quality of life dependent on successful implementation of new transportation and development solutions, including increased transit services. Other regions are expanding transit using both traditional and non-traditional funding sources, including public-private partnerships.

Building successful regional support for the investment in expanded transit services required building a diverse coalition using an inclusive process rather than a top-down approach; creating confident and expansive plans (“fortune favors the bold”); and using changing demographics and household economics which translate into greater preference for expanded transit services and less dependence on personal auto travel.

Recommendations of the Task Force

1. In light of the anticipated growth in our region and in order to make our region as economically viable as possible (e.g. job growth, personal income, regional output, gross regional product), substantial investment in high capacity transit must be made.
2. Given current funding constraints, a prioritized level of investment in transit service contained in the HCT Task Force Priority Network, which includes services to all eight counties in the region, is recommended for inclusion in the 2045 RTP.
3. Concepts and policies that support the increased use of transit, such as those related to regional fare or Universal Accessibility, should be encouraged across the region.
4. Every investment in transportation that is made by the Transportation Policy Council should be viewed as an opportunity to advance high capacity transit concepts, either in support of transit priority on freeways and thoroughfares, or new transit services along freeways and tollways.
5. Development of any new transit service requires additional public engagement and planning, including that for financing and implementation.
6. Regional HCT Requires regional cooperation; the region must work together to examine opportunities, set priorities, develop new funding sources and “speak with one voice” when discussing its needs with decisionmakers at the state and federal level.
7. A Phase II of the High Capacity Transit Task Force effort is recommended, to continue examining in further detail issues related to regional transit priorities, implementation and funding.

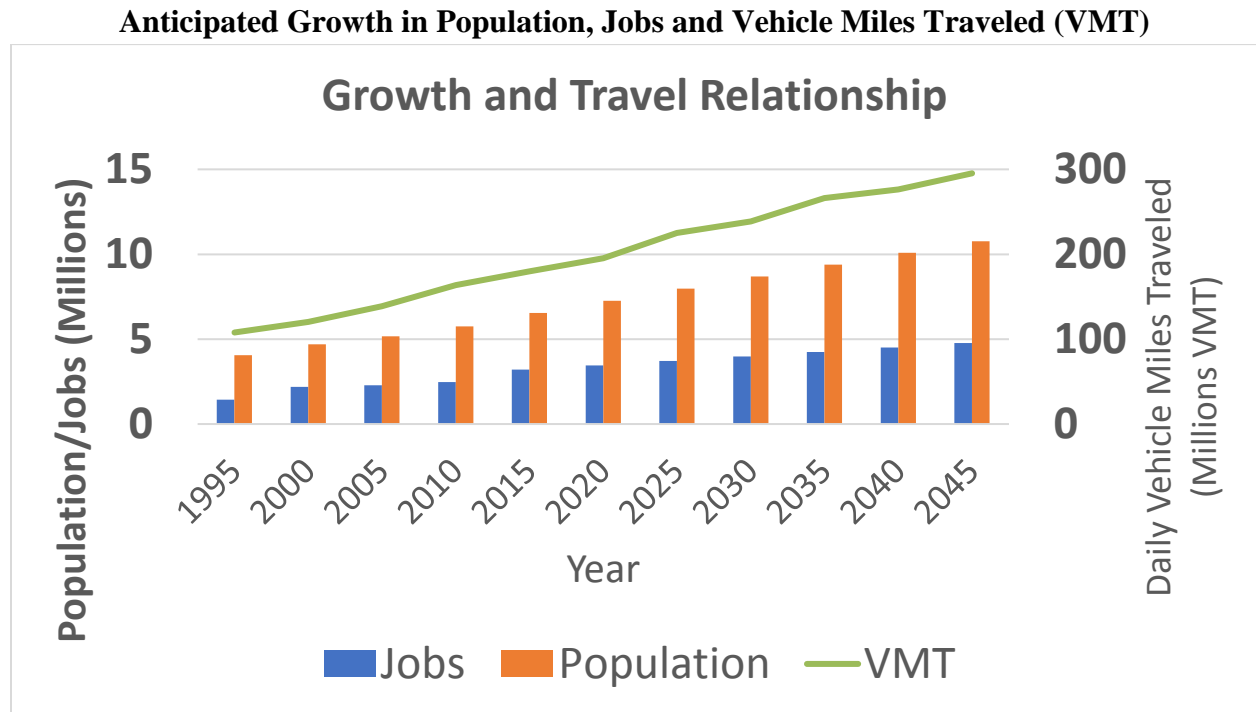
*“Make no little plans; they have no magic to stir men’s blood and
probably themselves will not be realized.”*

-Daniel Burnham

Introduction

As the Metropolitan Planning Organization for Harris and the adjacent seven counties, the Houston-Galveston area's Transportation Policy Council is charged with collaboratively establishing priorities for state and federal transportation investment through a long range, multi-modal Regional Transportation Plan (RTP). Now under review, the current 2040 Regional Transportation Plan envisions reconstruction and capacity improvements to many of the region's thoroughfares, freeways and toll roads. However, future growth in the region's population and driven by its vibrant economy will result in increased personal and freight travel expected to surpass our ability to meet regional mobility needs solely with increased roadway capacity.

Significant improvements to the operation and safety of our roadway network with selective expansion of its capacity will continue to be a regional priority. Vehicle automation may play a transformative role in reducing vehicle crashes and the congestion created by them. As the region grows from seven to almost eleven million residents over the next twenty-five years, it will, however, be essential to create convenient, effective transit alternatives to travelling alone in individual vehicles.



Logically, the economic success of our communities and the region will depend on transit services focused on moving large numbers of travelers. To do so, such a system must be easily accessible to a large percentage of the region's population and to desired trip destinations while providing safe, reliable, competitive travel times.

To that end, the Transportation Policy Council (TPC) created the High Capacity Transit Task Force to “*identify regional benefits, funding solutions and policy considerations to advance High Capacity Transit throughout the region, and to provide recommendations that could be included in the 2045 RTP.*”

What Is High Capacity Transit and Why Is It Needed?

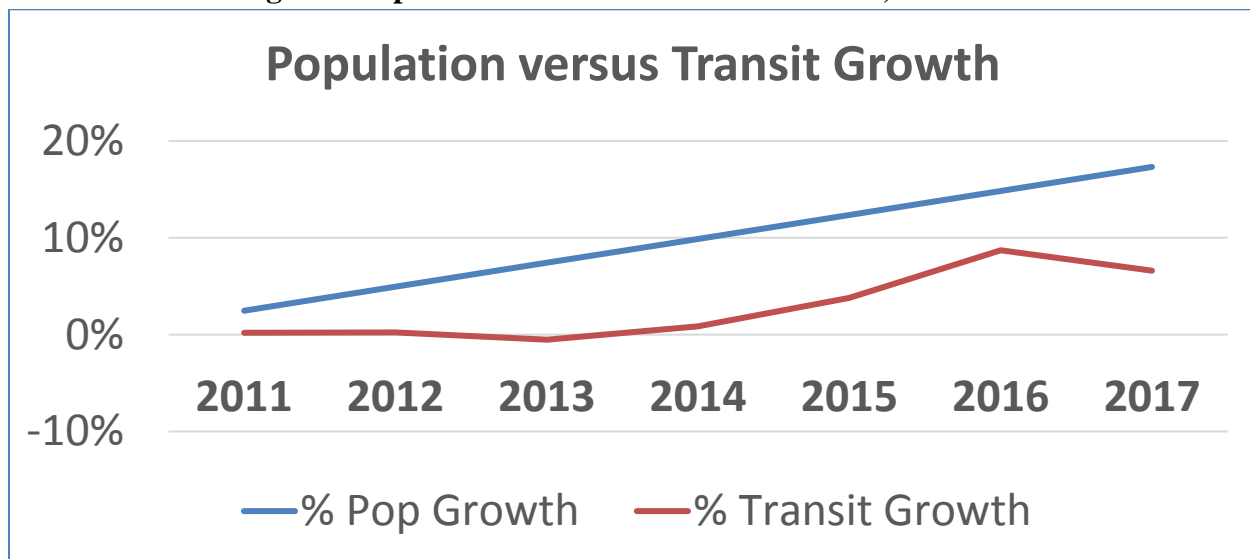
High capacity transit is any form of public transportation that can move large volumes of people typically within an dedicated if not exclusive right of way. It can do this through a combination of larger vehicles, shorter frequencies (headways) and higher speeds. High capacity transit can be any technology (e.g. bus or rail) or alignment (e.g. 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 region in the form of METRO’s light rail network (vehicle shown here) as well as the regional suburban park and ride network which uses express buses that travel in in High Occupancy Vehicle (HOV) or lanes managed to operate with limited vehicular congestion through pricing mechanisms. Another from of HCT, Bus Rapid Transit (BRT), is currently under construction along Post Oak Boulevard in the Galleria area. There buses will utilize bus only express lanes both within an existing major thoroughfare and in sepreate exclusive lanes along the IH 610 freeway.

The region requires additional high capacity transit services because widening highways cannot, by itself, be expected to handle the population and employment growth (an additional 4.2 million people and 1.6 million jobs, respectively) that is expected to occur between now and 2045. A solution that can move large numbers of people within relatively limited rights-of-way is required. This is especially true because the region’s existing transit service is not keeping up with regional growth.

Regional Population Growth vs Transit Growth, 2010-2017



Source: National Transit Database, US Census Bureau

Population and employment growth is occurring in areas of the region not served or with limited access to transit and the region's transit network still favors "traditional" commute patterns to the region's core even as a growing number of regional workers engage in "reverse" or suburb-to-suburb commutes.

Purpose and Makeup of the High Capacity Transit Task Force

The High Capacity Transit Task force was created by the Transportation Policy Council in the spring of 2017 and given the task of investigating the need and opportunity for high capacity transit in the Houston-Galveston region. Building on previous transit planning work conducted by H-GAC and other agencies, the Task Force was assigned with answering the following questions:

1. What is the importance of high capacity transit to the region's future? How will it support regional mobility, growth and quality of life?
2. What current and future travel corridors would benefit most from new high capacity transit services?
3. What are the opportunities to obtain additional federal, state or other funds that could be used to develop and sustain high capacity transit projects?

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."

The High Capacity Transit Task Force is comprised of members of the Transportation Policy Council (TPC), transit providers, and other key stakeholders. It is directed by the following officers:

Task Force Officers:

- Rusty Senac, Commissioner, Chambers County
- Amanda Edwards, Councilmember at-Large, City of Houston
- Carrin Patman, Chairman, Metropolitan Transit Authority of Harris County, Texas

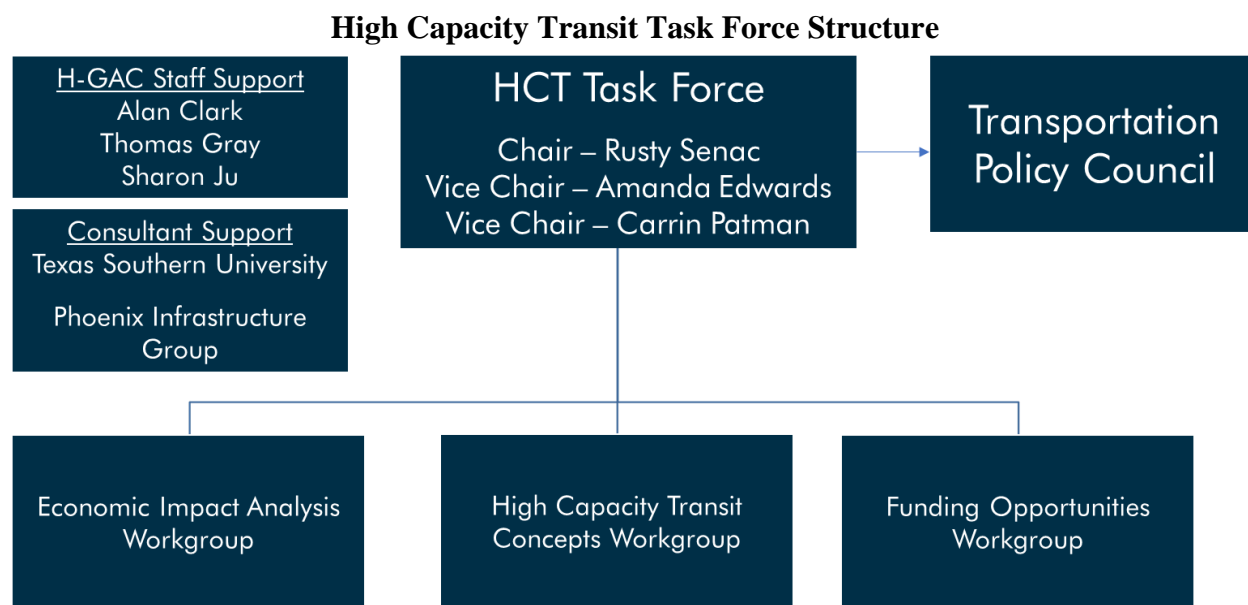
The Task Force includes three Workgroups, which were charged with investigating in detail three key components of the effort:

- **Economic Impact:** What are the potential costs and benefits?
- **Service Concepts:** Based on our travel needs, what services are needed, where and at what level of service?
- **Funding Opportunities:** What potential funding and financing mechanisms are available?

Task Force Workgroup Leaders are:

- Economic Impact: Bob Eury, President, Downtown Houston Management District
- Service Concepts: Amanda Edwards, Councilmember at-Large, City of Houston
- Funding Opportunities: Tom Lambert, President and CEO, Metropolitan Transit Authority of Harris County, Texas

The Task force was supported by both agency staff and contractors as shown below.



Example Regions and Workgroup Findings

The Task Force effort began with its three component Workgroups investigating relevant examples and practices from other regions of the country and world. A list of twelve “example cities” in the United States, Canada and the United Arab Emirates was developed, based on whether they had one or more characteristics in common with Houston/Galveston Region. Transit service and ridership data and other criteria relating to the service, funding and economic impact of high capacity transit in those cities were surveyed and reported back to the full Task Force. A list of the Example Regions is shown below, and a complete summary of those findings is available in **Attachment One: Phase I Analysis and Deliverable** appended to this document.

Example Regions Investigated by the Task Force Workgroups

Country	City or Region	Economic Impact	Service Concepts	Innovative Funding
	Atlanta	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Austin		<input checked="" type="checkbox"/>	
	Cleveland	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Dallas/Fort Worth	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Denver	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	Los Angeles		<input checked="" type="checkbox"/>	
	Miami		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Seattle	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	Washington, DC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Ottawa			<input checked="" type="checkbox"/>
	Vancouver		<input checked="" type="checkbox"/>	
	Dubai		<input checked="" type="checkbox"/>	

Key overall findings of the three Workgroups from this review of peer cities/regions are as follows:

- Continued economic success and quality of life requires new transportation and development solutions.
- Residents within these cities/regions developed very high demand for increased transit access (expanded access to transit) and improved quality of transit service (frequency, speed, etc.).

- Economic benefits may be identified for individual citizens, employers, and the community at large.
- These and other regions are expanding transit using both traditional and non-traditional funding sources, including public-private partnerships.

In addition to the Example cities/regions exercise, the Task Force received input regarding the experiences of other communities expanding their high capacity transit services when it hosted a panel of speakers organized by Rail~Volution in August of 2018. Speakers from Minneapolis, Los Angeles, Denver and Atlanta shared their experiences in seeking approval for and implementing High Capacity Transit solutions in their respective regions. Some key takeaways from that panel were:

- The need to build diverse coalitions (using an inclusive process rather than a top-down approach),
- The value of creating confident and expansive plans (“fortune favors the bold), and
- That changing demographics and household economics are translating into greater preference for expanded transit services and less dependence on personal auto travel, which can be used to a region’s advantage when seeking to promote high capacity transit.

The three Workgroups then took an inventory of the challenges, needs and opportunities regarding the provision of High Capacity Transit (HCT) in the H-GAC region, which can be summarized as follows:

Economic Impact:

- There are three types of economic benefit: individual/social, business, and regional/community benefits, and
- Residents and businesses must acknowledge that this region is going to “pay” for growth/congestion through increased travel costs, higher living costs (and more limited living choices) or can choose to invest in alternatives like high capacity transit that improve residents’ quality of life and the region’s economic vitality.

Service Concepts:

- Significant demand for HCT exists today or will soon exist in all eight counties;
- Don’t focus only on HCT services when speaking with residents and businesses about the transit need;
- People also need to get to transit (have accessible transit service) in order to be able to use it; and
- Equity is a critical consideration as the different transit needs of communities within the region need appropriate transit services. The type of transit service should not control or determine its priority.

Funding Opportunities:

- Any significant expansion of HCT in the region will require revenue sources that do not currently exist;
- Every transportation investment should be viewed as a potential opportunity to expand transit accessibility, remove barriers to transit services and advance the Regional High Capacity Transit vision;
- No single revenue source is a “magic bullet” – multiple strategies are required; and
- The region must “speak with one voice” to lawmakers.

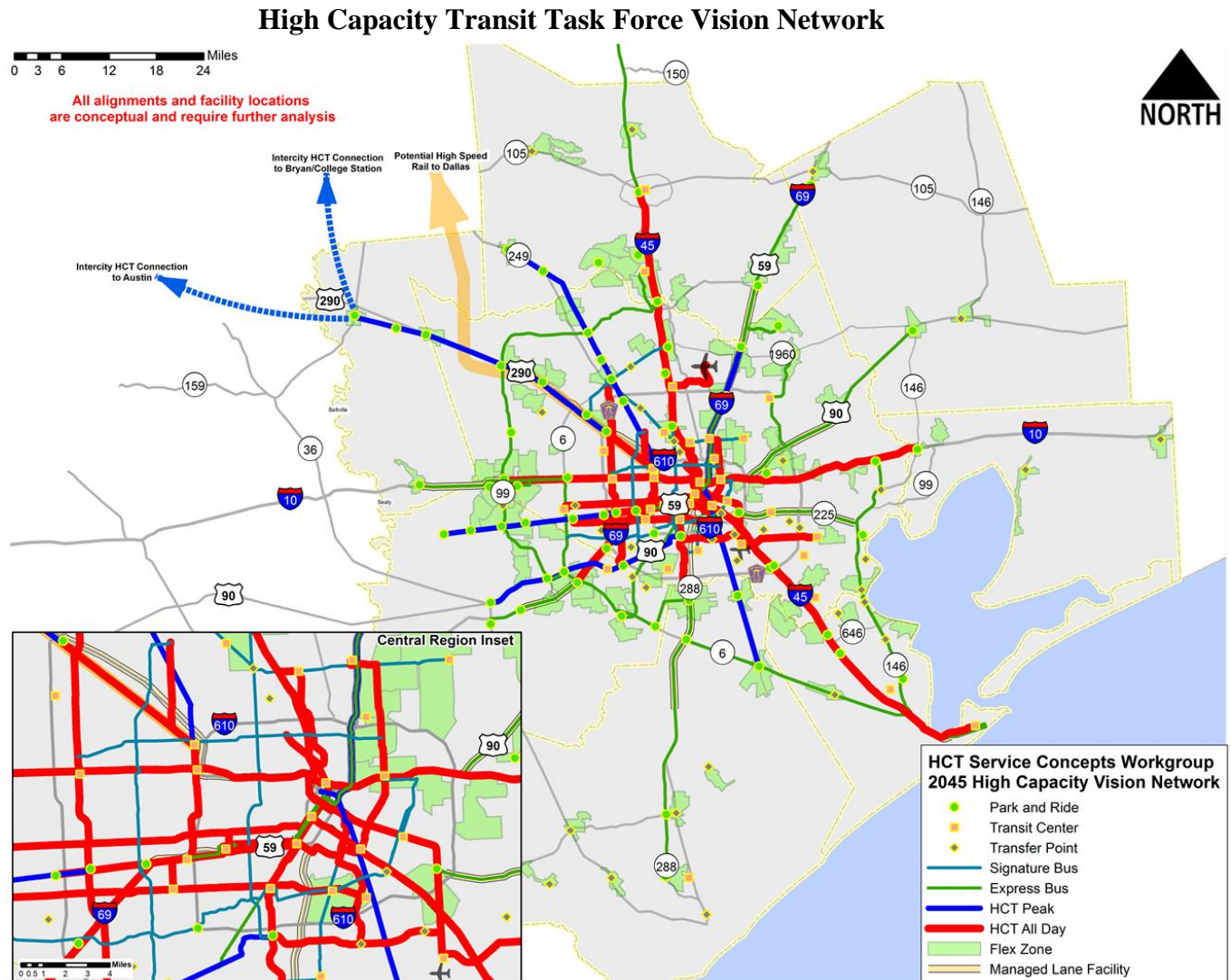
The Vision Network

The Vision Network was developed by the Service Concepts Workgroup and presented to the full Task Force for input and concurrence. The Vision Network, shown on the following page, is a comprehensive, financially-unconstrained network aimed at meeting all the region’s forecasted transit needs by the year 2045. It incorporates planning efforts undertaken by other agencies, such as the METRONext Vision Plan under development by METRO. This network could be used to identify priorities for potential inclusion in the 2045 RTP as well as provide a basis for coordination with regional transit providers on long-range planning efforts and funding.

The network contains a variety of HCT service types, including peak-focused, “all-day,” and express services. These services types are a refinement of a service typology originally created by the Service Concepts workgroup, as shown in the table below. HCT services are assumed to operate along a dedicated guideway, such as exclusive bus lanes or railways. In addition to its HCT elements, the Vision network contains a supportive background of local and regional bus routes, on-demand services, park and ride and transit center facilities, and operating and maintenance facilities. While the services shown in the Vision Network are intended to be mode, technology- and alignment-neutral, potential technologies that could apply to the listed service types are indicated in the following table:

Service Types and Potential Technologies of the HCTTF Vision Network

Vision Map	Service Concepts Workgroup	Potential Technologies
Flex Zone	District Circulator First Mile/Last Mile	Deviated Fixed Route; Demand Response
Local and Regional Bus	Local Circulation and Connectivity	Local Fixed-route Bus; Deviated Fixed Route; Bus Rapid Transit (arterial)
Signature Bus		
Express Bus	Regional Commuter/Express	Express/Limited-stop Bus; Bus Rapid Transit; Light Rail DMU, Heavy Rail, Commuter Rail
HCT Peak		
HCT All Day	Sub-Regional Corridor and Internodal Service	Bus Rapid Transit; Light Rail; Heavy Rail; ATS



Services in the Vision network include:

HCT All Day (also known as Sub-Regional Corridor and Internodal Service): these are high capacity services that operate frequently throughout the day along high-demand corridors between major trip generation centers. They have stations spaced less than three miles apart. Services could include extensions of existing METRORail corridors, new lines along high-volume corridors such as Bellaire, Gessner or Westheimer, and services along the region's freeways that could be realized by converting existing one-way, reversible HOV lanes to a two-way, all-day network that featuring additional passenger facilities.

HCT Peak (also known as Regional Commuter/Express Service): these are longer distance express services (station spacing greater than 3 miles) that operate between population centers and high employment/activity centers. They generally operate more frequently during the morning and afternoon peak periods with a lower level of service at midday and evening.

Services could include lines connecting residential communities in Fort Bend, Montgomery, Waller and Brazoria Counties to the region's core.

Express Bus (also a subtype of Regional Commuter/Express Service): like HCT Peak services, Express Bus focuses on longer-distance, peak-focused travel, albeit along lower-volume corridors. While HCT Peak service generally requires an exclusive right-of-way, Express Bus can operate along the region's existing roadway system (although it would use HOV and managed lane facilities to the extent possible). Express Bus services envisioned in the network include those from emerging population centers in eastern Harris County, Liberty County, southern Waller County, and southern Brazoria County to the urban core, additional services into Galveston, and "suburb-to-suburb" services connecting Pearland to Alvin and Galveston, Sugar Land to the Energy Corridor, or the Energy Corridor to The Woodlands. These "suburb-to-suburb" commute patterns are becoming more commonplace as the region continues to grow.

Signature Bus (also known as Local Circulation and Connectivity Service): this is an "enhanced bus" service operating along high-volume corridors. It operates at higher speeds than standard local bus by taking advantage of limited stops and other time-saving measures such as signal priority systems, multiple-door boarding, semi-exclusive lanes, and off-board fare collection. Signature Bus provides a higher level of service along heavily-traveled arterials, which in the Vision network include Bingle, Braeswood, Hillcroft, Kirby, Tidwell and Old Spanish Trail.

Additional Services: a successful transit vision cannot focus exclusively on high capacity service but must also must have a supporting structure of local services that provide access to and distribution from the high capacity system. The Vision network includes these additional elements:

- Expanded local bus services, especially in areas indicating high transit need that do not currently have service, such as Pasadena, Channelview, northwest Harris County, northeast Fort Bend County, and NASA/Bay Area.
- Regional bus services, which are lower-volume, lower-frequency routes that connect outlying communities to each other as well as the urban core.
- Flex Zones, which are geographically-defined demand response zones serving suburban communities, small towns and other areas where there is transit need but where traditional fixed-route bus is not appropriate. Flex Zone services are shared-ride and are arranged in advance by calling a dispatcher or using a smartphone app; they can provide first mile/last mile service to and from high capacity transit stations.

In addition to the Vision network, itself the Task Force also recommended that the region consider a set of supporting policies and concepts that would increase the usability and effectiveness of the network. These policies and concepts include:

- Regional fare, which allows transit users to pay a single fare to travel throughout the region and use the services of multiple providers;
- Regional marketing campaign aimed at conveying the benefits of regional transit to existing and potential transit users;
- Universal Accessibility, which focuses on the availability of safe, barrier-free access to transit services for all users, regardless of ability; this includes ADA-accessible sidewalks, crosswalks and ramps, bicycle infrastructure, lighting and other elements that allow people to safely access transit services. In fact, new transit services should not be provided to places where there is not adequate access, as people can't use what they can't reach;
- First Mile/Last Mile, which relates to the ability for transit users to get to the transit station from their origin, or from the transit station to their ultimate destination; and
- Transit-supportive land use and urban design, which prioritizes the creation of walkable, transit-friendly spaces.



Examples include “Complete Streets” that allow the safe use of all modes (such as College Street in Toronto, Canada, shown here) and Transit-Oriented Development (TOD).

A detailed listing of these supportive policies and concepts is available in **Attachment Two: Policy Recommendations**, which is taken from Chapter 13 of the *Regional Transit Framework Study 2017 Interim Report*, an internal H-GAC planning document that was one of the previous studies upon which the HCT Task Force effort was based.

Finally, the Task Force considered the potential effects of automated vehicles on the Vision network. Automated vehicles (aka “driverless cars”) are currently in advanced stages of testing and are expected to become a reality in the region by the year 2045. Their arrival will create opportunities and challenges; on one hand, these new technologies could substantially reduce cost of providing transit service as well as expand access to it. On the other hand, the potential proliferation of driverless vehicles for ride-sharing and delivery could worsen congestion. The

region must monitor new technologies and be prepared for the effects of its implementation, especially as they relate to transit (High Capacity or otherwise).¹

Design Criteria for of the Vision Network

Concurrent with its development of the Vision Network, the Service Concepts Workgroup generated a list of evaluation or design criteria by which the conceptual applications of technologies and modes will be developed for the network's regional transportation corridors, urban centers and major activity centers. These criteria have not been established as "pass" or "fail" criteria, but rather as points of consideration, and are as follows:

1. Does the proposed option improve access and mobility to and from major activity centers such as:
 - Workplaces/Employment Centers?
 - Health and Education Centers?
 - Economic Centers?
 - High Capacity Transit Hubs?
2. Does the proposed option present the best travel alternatives to heavily congested freeways and roadways?
3. Does the proposed option contribute to the economic development of the region or its standing as an international City/Hub?
4. Does the proposed option enhance the full spectrum of livability (live, work, play; see H-GAC Livable Centers studies) for people of all incomes, abilities and ages?
5. Does the proposed option allow sufficient flexibility to change service patterns as warranted by evolving demand?
6. Does the proposed option provide connectivity for an integrated multimodal HCT system with system-wide, cohesive connections from start-to-finish (for the maximum span of service hours possible)?
7. Does the proposed option make the transit system more resilient in the event of extreme demand or catastrophe?
8. Does the proposed option allow transit users and non-users to travel safely?

¹ J. Sam Lott, who was a consultant for the HCT Task Force, has developed an opinion paper regarding challenges and opportunities related to high-capacity transit and automation, the executive summary of which is available as **Appendix A: High Capacity Transit for the Houston Region – Creating a Multimodal System Approach for the 21st Century**. The concepts and opinions included in the paper do not represent the work of the Task Force or its recommendations but are nevertheless valuable to consider as the H-GAC region faces the twin prospects of the need for more High Capacity Transit and the advent of vehicle automation.

9. Does the proposed option contribute to emissions reductions?

Travel Demand Modeling

The Vision Network was modeled using travel demand modeling software to determine the potential demand for the included services. The model was run using H-GAC's own population and employment forecasts for 2045 by traffic analysis zone (TAZ). The modeling software uses a variety of assumptions to determine transit demand, including those related to travel time (speed), roadway congestion, fare and parking costs. It produced forecasted boardings (unlinked trips) fixed route services only; demand response, ADA paratransit and vanpool services are beyond the modeling software's capabilities and estimates for their boardings were based on the region's current ratio of demand response and vanpool boardings to fixed-route boardings, according to the most recent National Transit Database data. The results are as follows:

Annual Boardings, Fixed Route:	804,957,050
Annual Boardings, Demand Response and ADA Paratransit:	20,928,883
Annual Boardings, Vanpool:	26,904,099
Annual Boardings, Total:	852,790,031

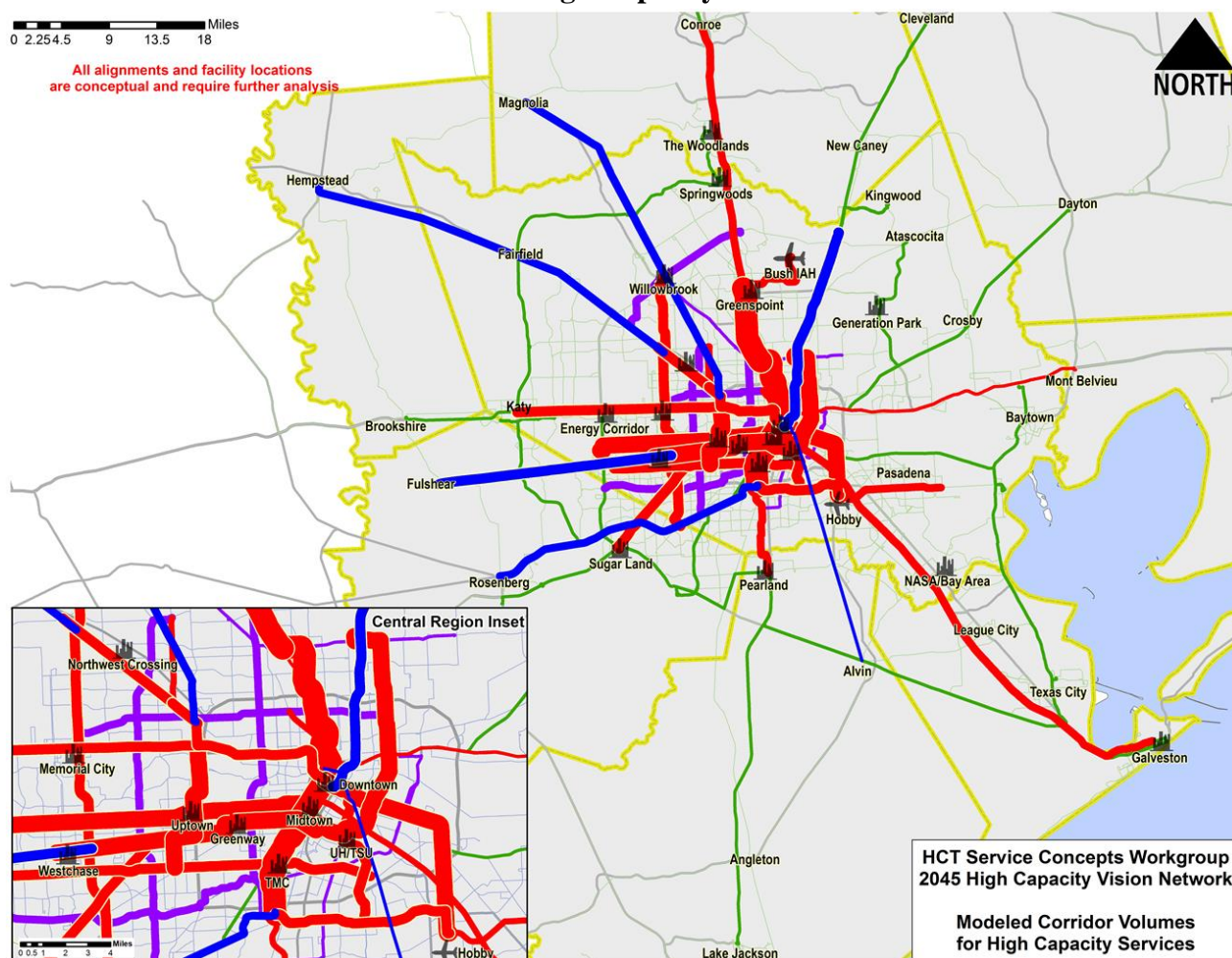
For purposes of comparison, the region's transit network carried 90,447,627 boardings (for all services) in 2017, the most recent year for which Nation Transit Database data is available². The modeled demand indicates that the services included in the High Capacity Transit Task Force 2045 Vision Network could result in almost a tenfold increase in regional transit ridership.

It should be noted that these numbers are not capacity constrained; that is, they do not consider a maximum number of passengers a given service might be able to accommodate due to vehicle capacity and availability constraints. Capacity constraints were considered in when alternate capital scenarios for the Vision Network were developed, as explained below.

The results from the travel demand model can further be broken down by route; this provides the ability to see which individual services in the network are carrying the highest amount of boardings. Relative demand for the HCT services included in the Vision Network, where thicker lines indicate greater demand, is shown in the illustration below. The model results show significant boardings on both existing (e.g. the existing Main Street METRORail Line) and proposed HCT services within the region's core, with significant amounts of travel in both the north-south and east/west directions.

² 2017 NTD reports for all ten of the region's transit providers can be found in **Appendix B** of this document.

Relative 2045 Corridor Demand of the High Capacity Transit Task Force Vision Network

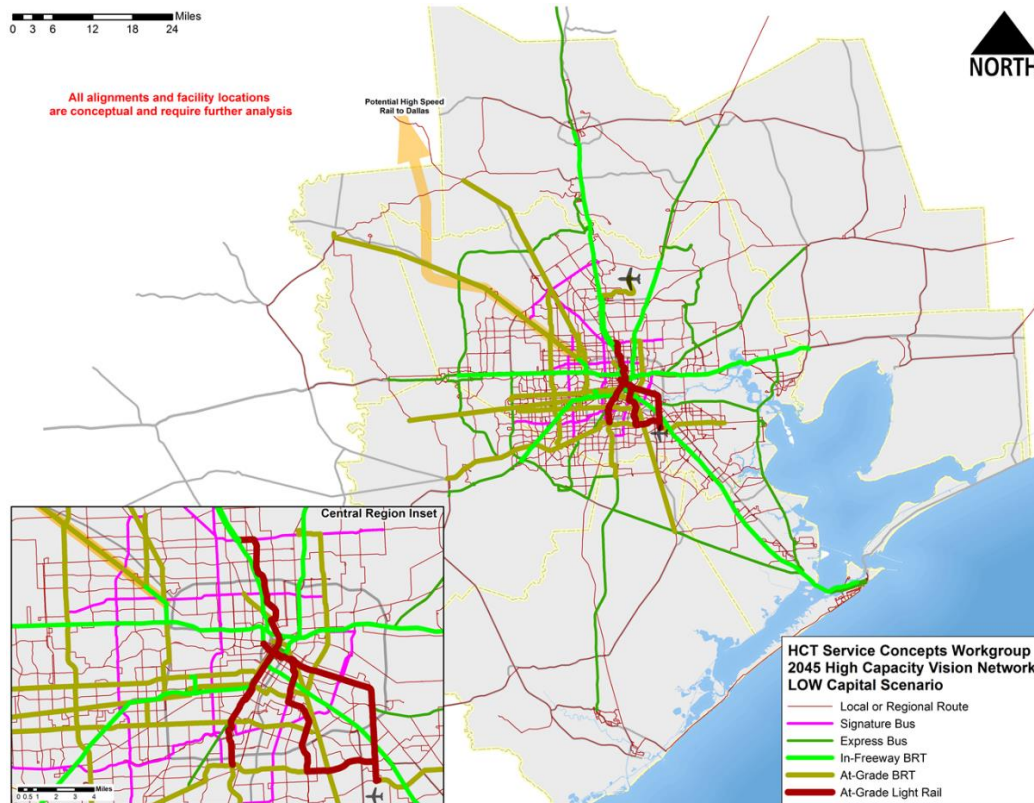


Capital Expenditure Scenarios

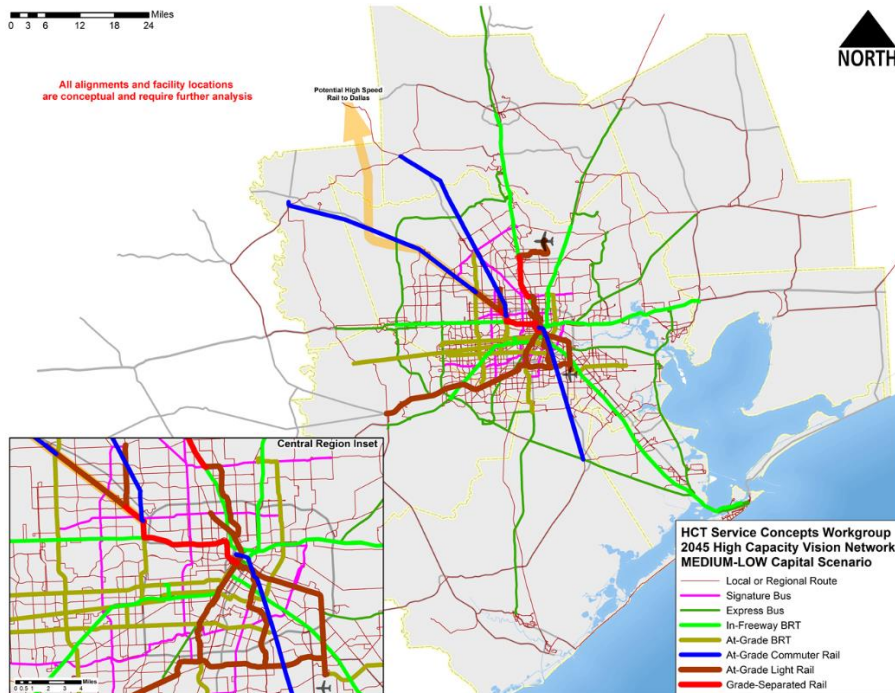
While the Vision Network is intended to be mode- and technology-neutral, it is important to consider what the costs and ridership of the network might be if certain assumptions about mode and technology were made. This is because a higher level of capital investment (e.g. rail instead of bus, grade-separated guideway rather than at-grade) is likely to result in faster speeds, more capacity, more reliability and greater safety, and therefore provide more benefit than a network with a lower level of capital investment. To test this theory, several capital expenditure scenarios were developed for the Vision Network. Capital costs were calculated using the same unit costs as the METRONext long-range planning effort and are in 2018 dollars. Passenger facility, O&M facility, and fleet costs (non-HCT) were the same across all scenarios, and all scenarios include allowances for State of Good Repair and Universal Accessibility. Tables providing more details about the capital assumptions of the four scenarios, as well as the unit costs used for calculating the estimated costs for each scenario, can be found in **Attachment Three: HCTTF Vision Plan Capital Cost Scenarios**, which is appended to this summary.

Here are brief descriptions and illustrations of each of the four scenarios:

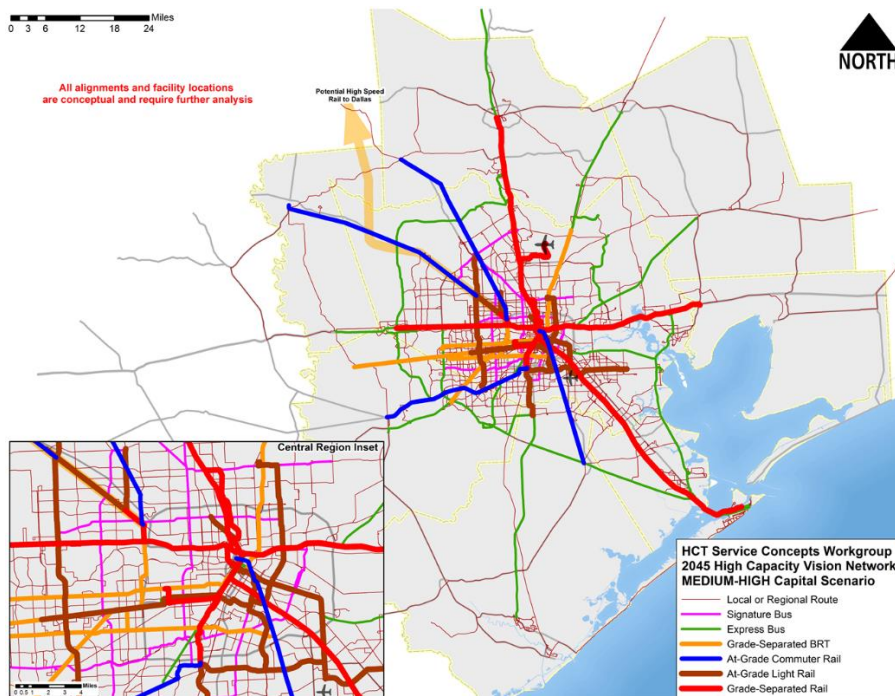
- **Low:** Assumes at-grade or in-freeway bus rapid transit on all HCT Peak and HCT All-Day corridors other than extension of existing METRORail corridors. Total capital cost: \$34.675 Billion.



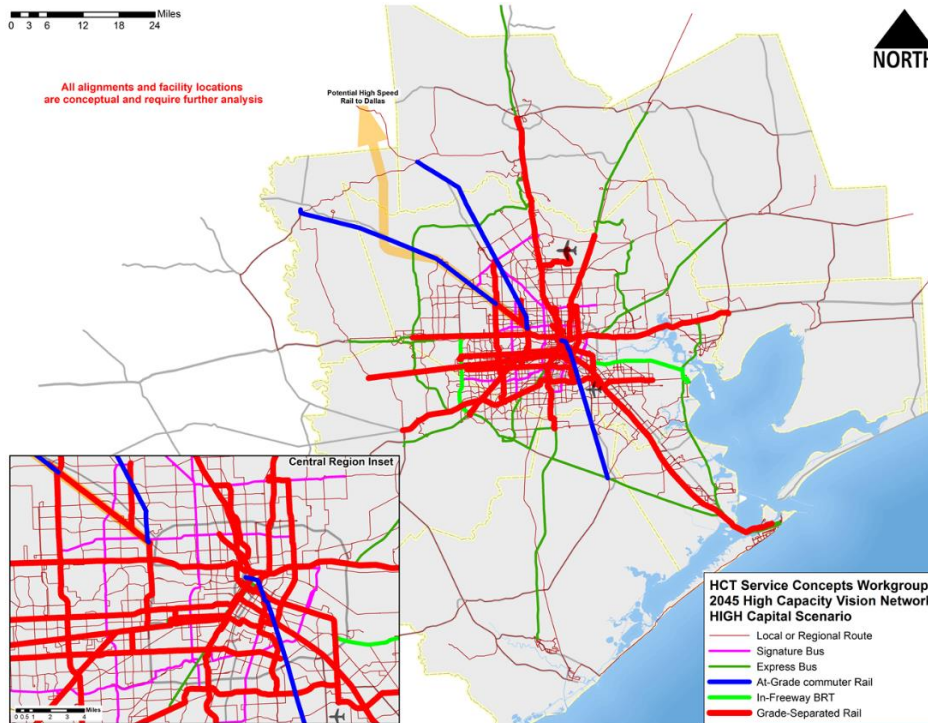
- **Medium-Low:** Assumes a mix of at-grade or in-freeway bus rapid transit, at-grade light rail, and at-grade commuter rail on most HCT corridors. Total capital cost: \$42.239 Billion.



- **Medium-High:** Assumes a mix of grade-separated rail, grade-separated BRT, at-grade light rail and land at-grade commuter rail on most HCT corridors. Total capital cost: \$81.326 Billion.



- **High:** Assumes grade-separated rail on almost all HCT corridors, including the replacement of the existing at-grade Main Street METRORail line with a subway from north of downtown to south of the Texas Medical Center and the promotion of some Express Bus services to true BRT. Total capital cost: \$100.402 Billion.



The four scenarios were then run through travel demand modeling software, with the model adjusted to assume slower speeds for at-grade services and capacity constraints for vehicle sizes and consist lengths. The original, unconstrained model results for the Vision Network were used for the High capital scenario, as it was assumed to be capable of carrying the full travel demand of the network. The travel demand modeling results, and other selected characteristics, for the four scenarios are show in the table below.

Selected Ridership and Cost Characteristics of the Capital Expenditure Scenarios

	HCTTF Vision Low	HCTTF Vision Medium Low	HCTTF Vision Medium High	HCTTF Vision High
Annual Boardings, All Services	515,153,585	542,678,428	636,250,959	852,790,031
Fixed Route	492,028,257	518,317,506	607,689,550	804,957,050
Demand Response, Paratransit and Vanpool	23,125,328	24,360,923	28,561,409	47,832,982
Annual Passenger Miles, All Services	2,700,696,565	2,967,766,399	3,699,973,053	5,563,669,897
Annual Passenger Hours, All Services	155,304,181	164,686,091	176,399,017	251,235,482
Annual Transit Vehicle Revenue Miles, All Services	220,063,071	220,063,071	220,058,813	220,058,813
Annual Transit Vehicle Revenue Hours, All Services	13,293,913	13,293,913	12,962,273	12,939,654
Capital Cost, Cumulative 2020-2045	\$ 34,675,017,500	\$ 43,238,367,500	\$ 81,325,517,500	\$ 100,402,027,500
Annual Net O&M Cost, All Services, Full Buildout	\$ 1,408,788,116	\$1,408,788,116	\$ 1,358,961,265	\$ 1,358,495,074
Boardings/revenue mile	2.3	2.5	2.9	3.9
Boardings/revenue hour	38.8	40.8	49.1	65.9
Net cost/boarding	\$2.73	\$2.60	\$2.14	\$1.59
Transit Mode Share: Home-Bound Work Trips	11.5%	12.3%	14.2%	20.2%
Comparable City/Metro (per US Census ACS Data)	Chicago	Boston	Washington, DC	2nd only to NYC

Note that the higher capital investment scenarios are more efficient than the lower scenarios in terms of operating costs, boardings per revenue mile and hour, and cost per boarding. This is to be expected because a higher level of capital investment results in higher speeds and capacities, and therefore more passenger throughput. Also note that all four scenarios significantly increase the percentage of commute trips (home-bound work) made by transit to mode shares seen in cities with significant existing transit infrastructure. For purposes of comparison, the H-GAC's region current work commute mode share is 2.3%. This, once again, is simply due to the fact that the current transit network is not adequate serving much of the region's employment centers.

In addition to these four High Capacity Transit scenarios, two no-build scenarios (one assuming no new highway or transit expansion between now and 2045, and another assuming highway but no transit expansion between now and 2045) were created for purposes of comparison. A table including these additional scenarios, as well as current (2017) NTD data for the region, and additional cost and ridership statistics is appended to this summary as **Attachment Four: Scenario Comparison Table**.

Benefit-Cost Analysis and Economic Impact

The economic benefits and costs of the four High Capacity Transit scenarios (as well as the “no-build” and “highway only” scenarios) were estimated using the REMI benefit/cost analysis tool and are summarized in Table 2. Compared to a no build or “do nothing” scenario, substantial benefits in excess of costs were found for all scenarios investing in additional high capacity transit infrastructure and services.

The user benefits and costs of each capital expenditure scenario include cumulative capital as well as operating costs for both transit and highway networks. The impact benefit/cost ratio includes both user benefits and personal income as shown in Table 2.

As expected, the most limited level in transit investment (Low) yielded the highest cost benefit ratio. However, the benefit/cost ratio does not capture the magnitude of benefits which could arise from higher levels of high capacity transit investment. Although the “HCT Low” investment scenario has a impact Benefit/Cost ratio of 7.6 and the “HCT High” is 6.0, both are quite high and the additional \$64 Billion contained in the “High” scenario yields an additional \$242 Billion in benefits.

Description of Benefits

Benefits can be broadly categorized into two classes: societal (user) benefits such as emission reduction, safety improvement, vehicle operating cost, and value of time; and economic impacts such as employment, personal income, output, regional product, property value, and productivity.

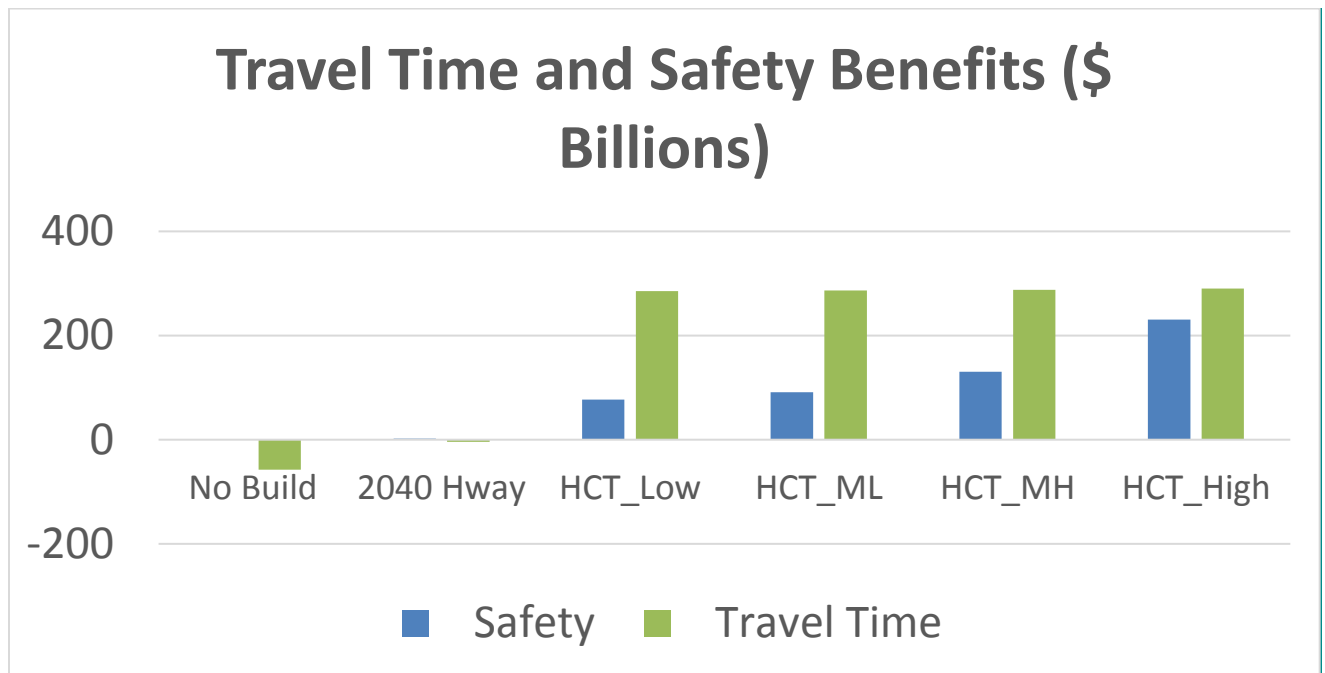
Societal Benefits

Societal (user) benefits measured include:

- **Travel Time Savings** represent the present value of user benefits from changes in travel time and delay. A positive value represents a decrease in travel time and delay and a negative value indicates an increase in travel time and delay. Travel time benefits include not only the time saved by the travelers, but also include changes in costs to employers for travel time associated with business trips or commerce (delivery of goods).

Travel efficiency benefits accrue both to transit users and non-users. Transit riders benefit from transit improvements reducing their door-to-door trip time. Increasing transit ridership also reduces highway traffic (vehicle miles and vehicle hours traveled). As more transit services are provided and used in the various scenarios (Low, Medium-Low, Medium High, and High), remaining highway users enjoy less congested facilities as more and more auto trips move to transit.

- **Safety Benefits** have been estimated based on the present value of changes in the number or severity of crashes. Safety benefits include changes in medical, property, and legal costs associated with accidents as well as monetary value assigned to fatalities and injuries. Vehicle crashes are also one of the leading factors in increased traffic congestion. The congestion related benefits from crash reduction were not included in the analysis shown below.

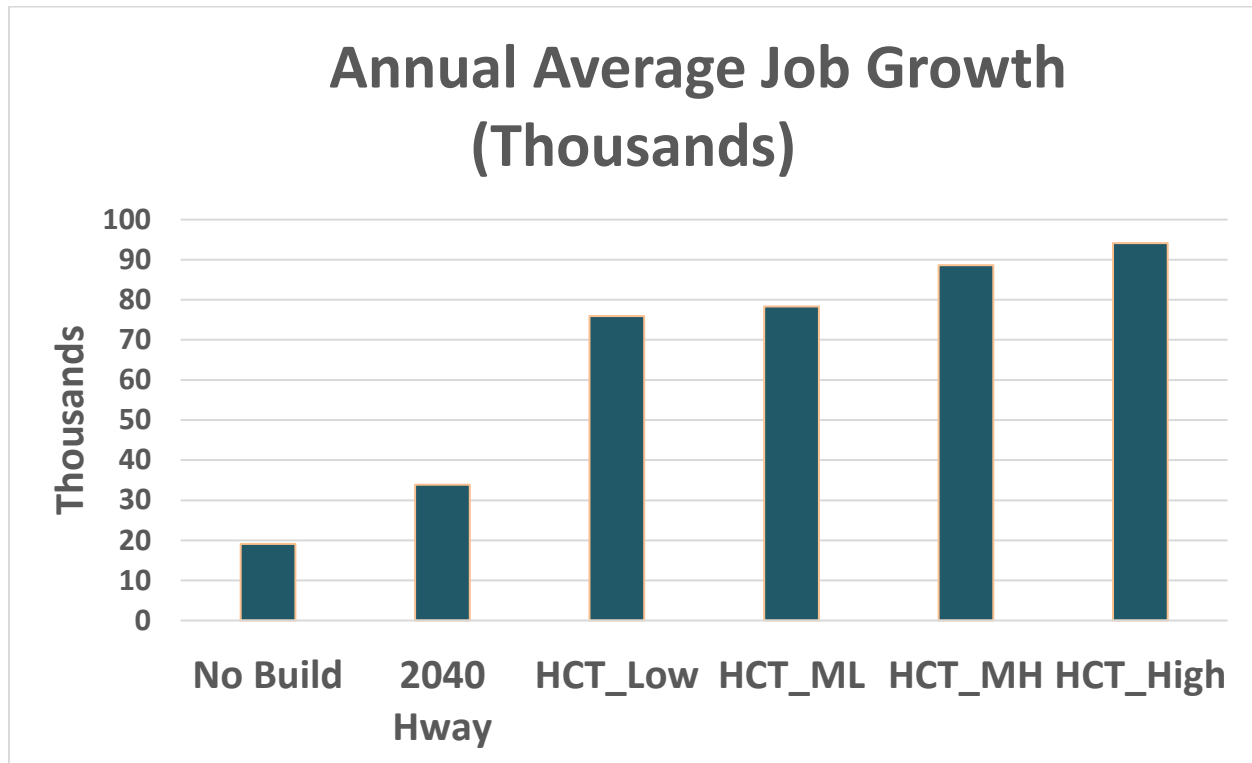


Economic Impact

The Vision Network is expected to create economic impacts for the region because it provides better access to markets and labor force, reduces the cost of delay, and increases productivity. These economic impacts can be measured using four different criteria:

- **Total Employment:** comprises estimates of the number of jobs, full-time plus part-time, by place of work. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included.
- **Gross Regional Product (GRP):** is a monetary measure of the market value of all final goods and services produced in a region or subdivision of a country in a period (quarterly or yearly) of time.
- **Output:** is the “quantity” of goods or services produced in a given time period, by a firm, industry, or country, whether consumed or used for further production.

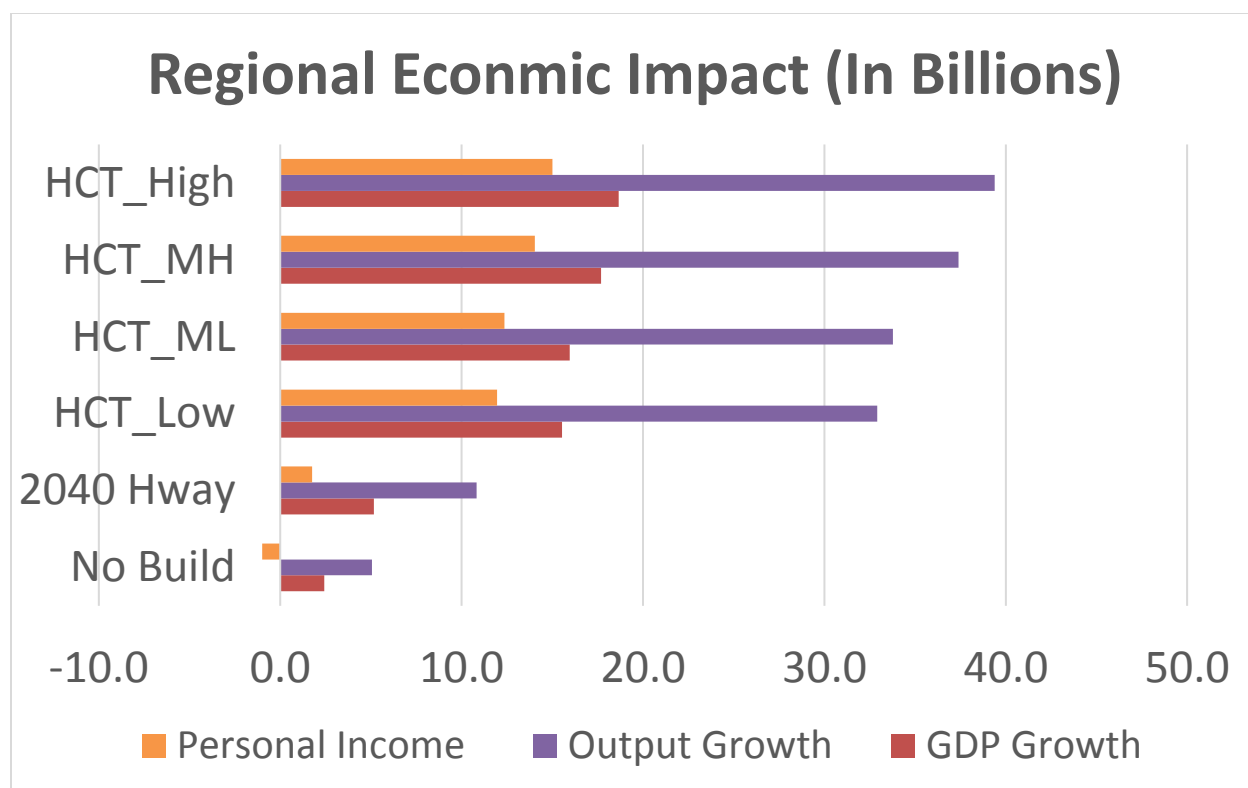
- **Personal Income:** refers to an individual’s total earnings from wages, investment enterprises, and other ventures. It is the sum of all the incomes received by all the individuals or households during a given period. Personal income is often monitored as one of the many key economic indicators used to gauge the overall state of the economy.



The REMI tool estimated the economic impacts that are expected to be generated by the four capital expenditure scenarios; these are shown in the table below.

As was the case with the societal benefits and costs, all four of the High Capacity Transit capital expenditure scenarios generate regional economic impacts substantially greater than either the no-build scenarios. Combined, the societal benefits and the economic impacts estimated to be created by any of the four capital expenditure scenarios suggest that investment in a comprehensive high-capacity transit network for the region will pay dividends for the region’s economic competitiveness and quality of life. On the other hand, there is a “cost of doing nothing” if the region does not expand its transit network.

A more detailed presentation of benefit/cost analysis and an explanation of the REMI analysis tool is appended to this report as **Attachment Five: Economic Impact Analysis for HGAC’s High Capacity Transit (HCT) Project**.



Potential Funding Sources

Currently, the only transit provider in the H-GAC region with a dedicated funding source (a one-percent sales tax, 25% of which is diverted to General Mobility projects) is the Metropolitan Transit Authority of Harris County, Texas. The region’s other transit providers rely on discretionary apportionments from local and county general revenue funds, as well as federal and in some cases state grants, to operate and maintain their services. Securing a dedicated revenue source for non-METRO providers is not possible because almost every regional municipality has reached the 8.25% statutory local sales tax cap.

As was noted previously, the Funding Opportunities Workgroup determined that any significant expansion of transit service in the region, let alone high capacity transit, will require revenue sources that do not currently exist. It is furthermore recognized that finding additional funding for regional HCT investment may require contentious political decisions at the local and state level, however, it must be emphasized that there is also a “cost of doing nothing” if the region does not expand its high capacity transit network to accommodate the coming growth and provide alternatives to increased congestion.

The Funding Opportunities Workgroup considered several potential strategies regarding additional funding for transit in the region. Potential base strategies that the Workgroup identified for consideration include:

- Private sector participation, for example through Public-Private Partnerships (P3s). The Federal Transit Administration (FTA) has encouraged private-sector participation in transit by recently issuing new guidance regarding Private Investment Project Procedures (PIPP) intended to “address impediments to the greater use of public-private partnerships and private investment in public transportation capital projects.” However, not all transit projects will be eligible or appropriate for P3s, and private-sector participation is oftentimes “the last dollar in the bucket” as opposed to the first.
- Federal discretionary funding for “New Starts” high capacity transit investments, through the FTA’s 5309 Capital Investment Grants program.
- Federal loan programs, such as Transportation Infrastructure Finance Innovation Act (TIFIA) and Railroad Rehabilitation and Improvement Financing (RRIF), both of which provide federally-secured credit assistance for qualified transportation projects.
- Value Capture Strategies, including impact fees, Special Assessment Districts, Tax Increment Financing, parking and station revenues, naming rights, and joint development/TOD.

Potential local funding strategies identified include:

- Allowing transit projects to compete for highway funding based on performance criteria established by TPC.
- Increasing municipal and county funding support for transit outside METRO service area.

Strategies that would require Legislative action include:

- Increasing transit projects’ eligibility for state funding
- Implementing a local/regional option tax
- Raising 8.25% local sales tax cap
- Implementing congestion pricing programs

The Funding Opportunities Workgroup recognized that no single revenue source will account for the additional funding that is needed to implement the large-scale expansion of HCT services in the region, and that multiple strategies are required.

A comprehensive list of these and additional traditional and innovative funding and financing tools, including their characteristics and their current legal applicability in Texas, is appended to this report as **Attachment Six: List of Financing Tools**.

The Priority Network

To create a financially-constrained transit network for inclusion in the 2045 RTP, elements of the Vision network were selected for inclusion in the “Priority” Network. The Priority Network consists of transit services and elements identified to meet the region’s most significant transit needs by the year 2045. These services and elements were selected through a variety of means, including travel demand modeling, the Transit Need Index (TNI) analysis undertaken by the Regionally Coordinated Transportation Plan, and other long-range planning activities such as the Metropolitan Transit Authority’s METRONext plan.

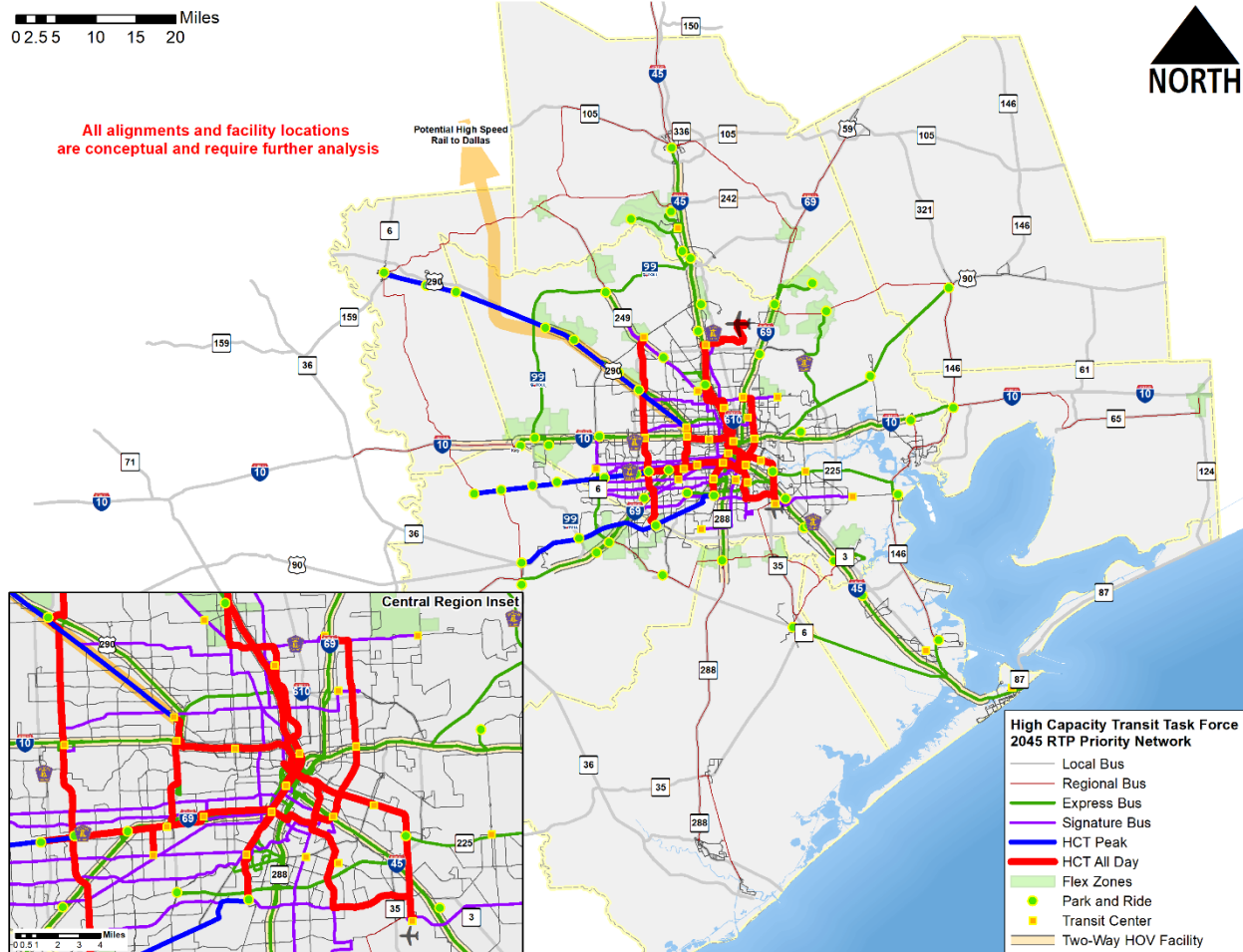
The Priority network contains a variety of HCT service types, including peak-focused, “all-day,” and express services. HCT services are assumed to operate along a dedicated guideway, such as exclusive bus lanes (for Bus Rapid Transit) or railways (for light rail or commuter rail), or otherwise enjoy some sort of treatment that allows the service to avoid congestion, such as HOV lanes for Express Bus services or bus priority measures for Signature Bus services. In addition to its HCT elements, the Priority network contains a supportive background of local and regional bus routes, on-demand services, park and ride and transit center facilities, and operating and maintenance facilities. The policies and concepts supporting greater transit use across the region, described above and detailed in Attachment Two, are also considered to be part of the Priority Network.

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. A map of the Priority Network is shown on the following page.

Significant features of the Priority Network include:

- Service to all eight counties in the H-GAC transportation planning region;
- New All-Day HCT services along Major north-south and east-west corridors, including Westpark/Richmond, Westheimer, East Bellfort, Gessner, Lockwood and Broadway;
- An expansion of HCT services to intermodal hubs such as Bush Intercontinental Airport, Hobby Airport, and the proposed Texas Central High-Speed Rail terminal;
- New Peak HCT services to rapidly-growing communities in western Harris, Fort Bend and Waller Counties;
- Filling the “Inner Katy Gap” in the region’s HOV network (IH-10 West between downtown and Loop 610) with new HCT and HOV service;
- Conversion of all regional HOV facilities from one-way reversible service to two-way, all-day service, to better facilitate “reverse” commute patterns;
- New commuter services along corridors such as SH 288 from Pearland, SH 249 from Tomball, SH 225 from La Porte and US 90 from Crosby and Dayton;
- “Suburb-to-suburb” commuter services, including between Sugar Land and the Energy Corridor and the Energy Corridor and The Woodlands;

High Capacity Task Force 2045 Priority Network



- Enhanced bus services (known as “Signature” or “BOOST” service) along multiple arterial corridors, featuring frequent service and bus priority treatments;
- New local bus services, especially in areas that exhibit high transit need;
- New Regional Bus services, which connect outlying communities to each other as well as to the urban core;
- An expansion of “Flex Zones,” which are geographically-focused demand-response services (known as “community Connectors” within the METRO Service Area);
- An expansion of passenger facilities, such as park and rides and transit centers, necessary to support these new services;
- New operating and maintenance (O&M) facilities necessary to support the expanded services (locations to be determined); and
- Capital cost inclusions for State of Good Repair (SOGR) and Universal Accessibility.

Table 1 compares the components of the 2045 Priority Network to the region’s current transit network to demonstrate the extent of service expansion proposed:

Table 1: 2045 Priority Network Compared to Today's Transit Network

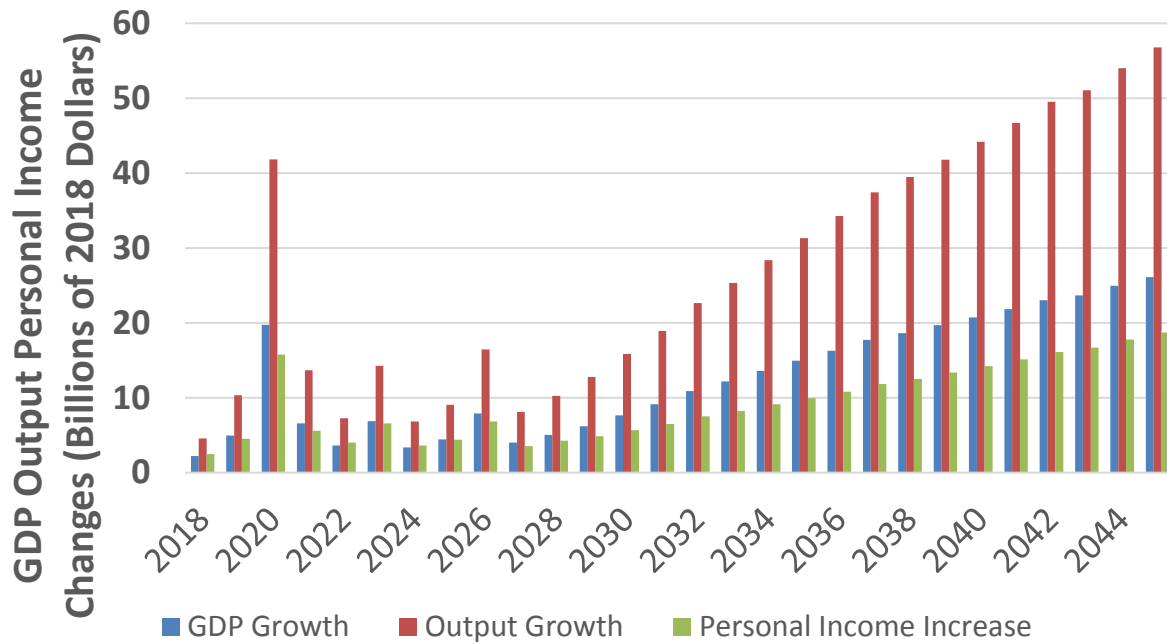
	Today	2045 Priority
Routes	157	244
Local	114	140
Regional	2	22
Signature	1	14
Express	37	57
HCT Peak	0	3
HCT All Day	3	8
Flex Zones	2	35
Park and Rides	36	59
Transit Centers	22	32
Miles of HCT Guideway	27.6	222.7
HCT Peak	0	93.1
HCT All Day	27.6	129.6
Miles of Signature Bus Service	8	270.8
Miles of Two-way HOV	67.5	210.8

The capital components of the Priority Network are estimated to cost about \$21.7 Billion (2018 dollars), inclusive of new operating and maintenance facilities, fleet expansion and replacement, and allowances for State of Good Repair and Universal Accessibility. Detailed information about the capital projects and costs included in the Priority Network is provided in **Attachment Seven: Capital Components of HCT Task Force 2045 Priority Network** appended to this summary. The annual operating and maintenance cost for the Priority Network is estimated to be about \$1.138 Billion (2018 dollars) at full build-out.

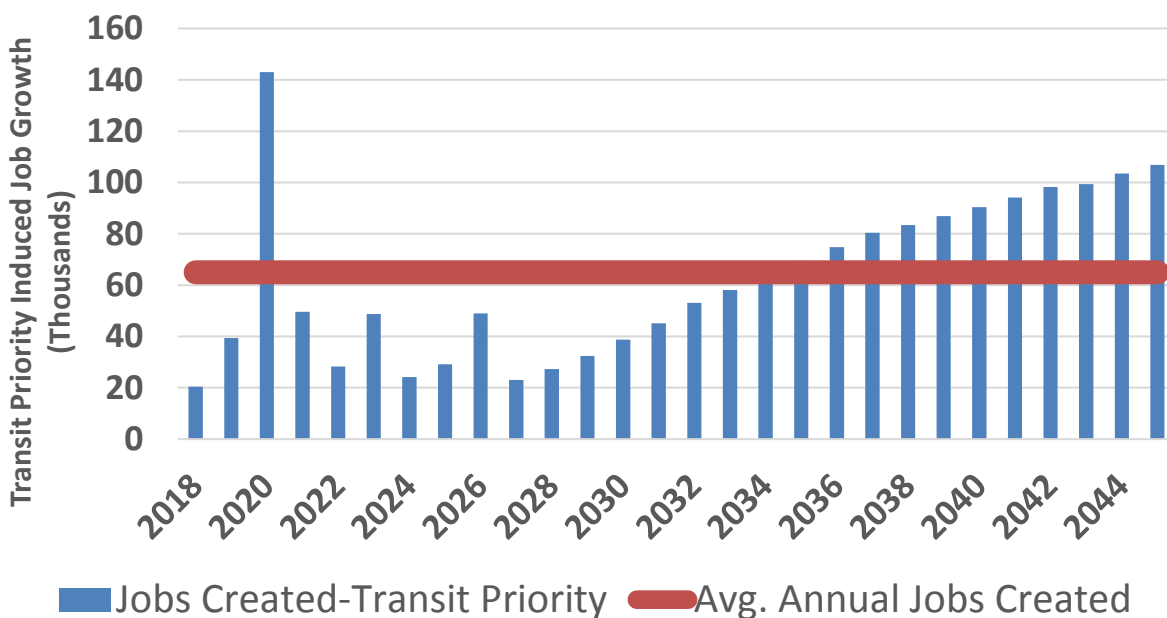
Travel demand analysis of the Priority Network indicates that the network produces a demand of 277 million boardings serving patrons with 1.878 billion passenger miles traveled annually across all services (capacity-constrained), including fixed-route, demand response/ADA paratransit and vanpool. This represents over a three-fold increase in the number of fixed-route boardings the region's transit network carried in 2017 and 216 percent increase in passenger miles traveled. These and other figures for the Priority Network are included in **Attachment Four**, which allows comparison to the region's current transit profile as well as the four Vision Network capital expenditure scenarios.

As a direct benefit to travelers in the region, the total travel time savings, value of reduced vehicle crashes and increased personal income totaled over \$520 billion. The average annual increase in employment is approximately 65 thousand jobs. With an estimated total investment of \$73.3 Billion, the benefit cost ratio is slightly greater than 7. Please note these values (as are all other transit investment scenarios shown earlier) are inclusive of highway investments included in the 2040 Regional Transportation Plan.

Transit Priority Network Economic Impact Analysis



Transit Priority Networks Induced Employment Growth



Findings and Recommendations

The overall findings of the High Capacity Transit Task Force can be summed up as follows:

1. Roughly half of the work-related trips in the eight-county region cannot be effectively served by transit today. If transit service is not expanded, that percentage will only continue to grow over time.
2. Substantial demand for high capacity transit as well as expanded local transit exists in all parts of the eight-county region.
3. Substantial benefits in terms of travel time savings, vehicle crashes avoided, and personal income growth can be realized through the development of a comprehensive, region-wide high capacity transit network, and these benefits outweigh the costs of constructing, operating and maintaining that network.
4. Positive impacts to the region's economic in terms of employment, GDP and output can be expected from investment in a comprehensive high capacity transit network. Conversely, failing to invest in the region's transit infrastructure will lead to unacceptable levels of congestion that could decrease the region's economic competitiveness.
5. Expansion of high capacity transit in the region must be accompanied by expansions in other transit services including local fixed routes, demand response and first mile/last mile options.
6. Increasing levels of investment in high capacity transit will result in a modest reduction of regional vehicle miles traveled (VMT), but significant reduction in regional vehicle hours traveled (VHT), as people are able to travel with less delay and at higher speeds.
7. The HCT Task Force Vision Network represents a desired level of investment in high capacity and local transit service, given its tremendous benefits to both transit users as well as those who choose to remain in their automobiles.
8. Implementation of the HCT Task Force Vision Network would require finding new sources of capital funding but would allow leveraging of increased federal discretionary funding in our region.

The High Capacity Transit Task Force's recommendations to the Transportation Policy Council are as follows:

1. Given current funding constraints, a prioritized level of investment in transit service contained in the HCT Task Force Priority Network, which includes services to all eight counties in the region, is recommended for inclusion in the 2045 RTP.

2. Concepts and policies that support the increased use of transit, such as those related to regional fare or Universal Accessibility, should be encouraged across the region.
3. Every investment in transportation that is made by the Transportation Policy Council should be viewed as an opportunity to advance high capacity transit concepts, either in support of transit priority on freeways and thoroughfares, or new transit services along freeways and tollways.
4. Development of any new transit service requires additional public engagement and planning, including that for financing and implementation.
5. Regional HCT Requires regional cooperation; the region must work together to examine opportunities, set priorities, develop new funding sources and “speak with one voice” when discussing its needs with decisionmakers at the state and federal level.
6. A Phase II of the High Capacity Transit Task Force effort is recommended, to continue examining in further detail issues related to regional transit priorities, implementation and funding.

*“Make no little plans; they have no magic to stir men’s blood and
probably themselves will not be realized.”*

-Daniel Burnham

High Capacity Transit Task Force

Chair – Hon. Rusty Senac, Chambers County Commissioner Pct. 4

Co-Chair – Hon. Amanda Edwards, Council Member, City of Houston

Co-Chair – Carrin Patman, Chair, METRO Board of Directors

Committee Members

Steve Ashy, Neighborhood Super Alliance

Rick Beverlin, City of Galveston/Island Transit

Jon Branson, Deputy City Manager, City of Pearland

Hon. Craig Brown, Council Member, City of Galveston

Karla Cisneros, City of Houston

Maureen Crocker, Assistant Director, Transportation & Drainage Planning at Houston Public Works

Jack Drake, Transportation Advocacy Group

Scott Elmer

Bob Eury, President, Central Houston

Ken Fickes, Director, Transit Services at Harris County

Felix Fraga, Vice President of External Relations, BakerRipley

Adam Jack, Director of Transportation Planning, TxDOT-Beaumont District

James Hollis, Gulf Coast Center

Tom Lambert, President & Chief Executive Officer, METRO

Chris LaRue, Senior Transit Project Manager, AECOM

Brenda Mainwaring, Asst Vice President Vice President, Union Pacific

Andrew Mao, Director, Transportation Planning, TxDOT-Houston District

Clark Martinson, Executive Director, BikeHouston

Hugh McCulley, BSNF Railroad

Hon. Pat McLaughlan, Council Member, City of Bellaire

Richard Petty, Director, National Center for Ageing and Disability (NCAD) at TIRR

Hon. Tricia Pollard, City of Bellaire

Paul W. Puente, Executive Secretary, Houston Gulf Coast Building and Construction Trades Council

Hon. Tom Reid, Mayor, City of Pearland

Hon. David Robinson, Council Member, City of Houston

Yancy Scott, County Engineer, Waller County

Kyle Shelton, The Kinder Institute of Urban Research

Paulette Shelton, Director, Public Transportation Department, Fort Bend County

Christof Spieler, Vice President and Director of Planning, Huitt-Zollars

Mike Waterman, President, Greater Houston Convention and Visitors Bureau

Jeffrey Weatherford, Deputy Director, Public Works, City of Houston

Charles Wemple, Executive Director, Houston-Galveston Area Council

Claudia Wicks, Assistant Director, Colorado Valley Transit

Hon. Joe Zimmerman, Mayor, City of Sugar Land

Economic Impact Workgroup

Emily Anderson, Halff
Rick Beverlin, City of Galveston/Island Transit
John Breeding, President, Uptown Houston District
Shawn Cloonan, Texas Medical Center
Maureen Crocker, Assistant Director, Transportation & Drainage Planning at Houston Public Works
Hon. Amanda Edwards, Council Member, City of Houston
Bob Eury, President, Central Houston
Chris LaRue, Senior Transit Project Manager, AECOM
Hon. Pat McLaughlan, Council Member, City of Bellaire
Bob Pertierra, Greater Houston Partnership
Hon. Rusty Senac, Chambers County Commissioner Pct. 4
Tom Lambert, President & Chief Executive Officer, METRO

Service Concepts Workgroup

Emily Anderson, Halff
Steve Ashy, Neighborhood Super Alliance
Katrina Bayer, Transportation Program Leader, Central Houston
Oni Blair, Executive Director, LINK Houston
Jonathan Brooks, Director of Policy and Planning, LINK Houston
Craig Brown, City of Galveston
Maureen Crocker, Assistant Director, Transportation & Drainage Planning at Houston Public Works
Perri D'Armond, Assistant Director, Fort Bend County Public Transportation
Fabiola Dagrín
Hon. Amanda Edwards, Council Member, City of Houston
Scott Elmer
Bob Eury, President, Central Houston
Ken Fickes, Director, Transit Services at Harris County
Chris LaRue, Senior Transit Project Manager, AECOM
Tom Lambert President & Chief Executive Officer, METRO
Dominic Mazoch, Citizen
Hon. Pat McLaughlan, Council Member, City of Bellaire
Clark Martinson, Executive Director, BikeHouston
Aremu Moses
Richard Petty, Director, National Center for Ageing and Disability (NCAD) at TIRR
Sirisha Pillalamarri, Transcend Engineers and Planners
Philip Salerno-Super Neighborhood Alliance
Janis Scott, Citizen
Suzanne Set, Midtown Engineers
Paulette Shelton, Director, Public Transportation Department, Fort Bend County
Christof Spieler, Vice President and Director of Planning, Huitt-Zollars
Marcello Victorino, City of Sugar Land
Jay Washington
Mike Waterman, President, Greater Houston Convention and Visitors Bureau

Jeffrey Weatherford, Deputy Director, Public Works, City of Houston
Elijah Williams, Gulf Coast Rail District
Priya Zachariah, METRO
Hon. Joe Zimmerman, Mayor, City of Sugar Land

Innovative Finance Workgroup

Steve Ashy, Neighborhood Super Alliance
Raj Basavaraju, Transcend Engineers and Planners
Maureen Crocker, Assistant Director, Transportation & Drainage Planning at Houston Public Works
Hon. Amanda Edwards, Council Member, City of Houston
Ken Fickes, Director, Transit Services at Harris County
Vinio Floris
Tom Lambert, President & Chief Executive Officer, METRO
Dr. Carol Lewis, Director of Transportation Policy, Texas Southern University
Beth Shelton, RPS Klotz Associates
Kyle Shelton, The Kinder Institute of Urban Research
Paulette Shelton Director, Public Transportation Department, Fort Bend County n,
Arthur Smiley, CFO, METRO
Christof Spieler, Vice President and Director of Planning, Huitt-Zollars
Jeffrey Weatherford, Deputy Director, Public Works, City of Houston