ENVIRONMENTAL JUSTICE

H-GAC's Strategy for Fair Treatment and Meaningful Involvement of all People

HGAC

Houston-Galveston
Area Council

ENVIRONMENTAL JUSTICE

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EXECUTIVE SUMMARY

OVERVIEW

Effective and equitable transportation decision-making depends on understanding and properly addressing the unique needs of all residents from different socio-economic groups – especially the traditionally underserved.[1] This report presents a baseline characterization of the environmental justice (EJ) population within the Houston-Galveston Areas Council (H-GAC) MPO region and offers a reference against which the region's transportation planners may assess the outcomes of policy decisions. The study assesses how well the regional transportation system links the protected population to their daily destinations and broader opportunity and proposes broad strategies to integrate environmental justice into the daily activities and decision-making of the agency and its regional transportation partners.

BACKGROUND

Presidential Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* was issued in 1994 to bring attention to the deleterious environmental and health consequences of government action on minority and low-income communities. The Executive Order directs Federal agencies to take appropriate steps to identify and address any disproportionately high and adverse effects of Federal projects on the health or environment of minority and low-income populations to the extent permitted by law. Environmental justice is implemented as a component of the Title VI/Non-Discrimination Program and aims at promoting equity in the programs, policies, and activities of all recipients of federal financial assistance.

The U.S. Department of Transportation (USDOT) has declared three fundamental principles which articulate the core objectives of environmental justice and describe a succinct pathway to implementing the vision of EO 12898. The principles are:

a. Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
b. Ensure full and fair participation by all potentially affected communities in the transportation decision-making process; and
c. Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

METHODOLOGY

The Target Population

Executive Order 12898 specifically names minority and low-income citizens as the target population for environmental justice oversight. Environmental justice sensitive zones are defined as those census block-groups where the average number of persons within the protected class exceed the average for the MPO region. Over half (53%) of the census block-groups within the planning region are EJ sensitive.[2] Greater than 60% of these EJ sensitive census-block groups are inside the Beltway 8 area – the most urbanized section of the MPO region.[3]

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[1] FHWA, Environmental Justice and NEPA in the Transportation Arena: Project Highlights (Feb. 2013).

[2] US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates. Based on minority and low-income residents.

[3] Ibid.

Concentrations of Disadvantage

To better serve the needs of the spectrum of the population for whom EJ oversight is relevant, H-GAC recognizes five "secondary" indicators of disadvantage in addition to minority and low-income status: limited English proficiency (LEP), senior status (65 years and over), limited educational attainment (LEA), carless households, and female head of households.[4] Neighborhoods with four or more of these indicators of hardship are regarded as communities with "high disadvantage." A community with high disadvantage will be less resilient to the challenges that accompany environmental disasters and social change. Almost one-fourth of all the census block-groups in the MPO region are considered EJ areas of high disadvantage. Over 80% of the census block-groups classified as highly disadvantaged are located inside the Beltway.[5]
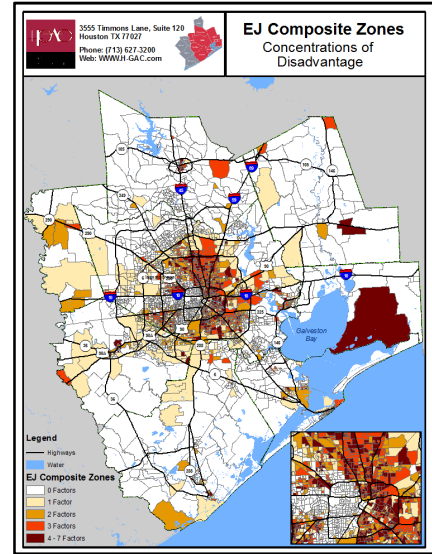
Map 1: Zones of Composite Disadvantage

Socio-Economic Characteristics

The most frequently occurring combination of indicators of hardship in communities with multiple disadvantage is minority status, low-income, low educational attainment, and limited English proficiency. Environmental justice zones with high disadvantage have a population that is mostly Hispanic. About 29% of the EJ households have an income below $25,000. Slightly over 10% of the EJ population are White residents who live at or below the poverty level.[6]

- *Where the Target Population Live*

Large concentrations of minority residents settle in concentric locales around the Houston urban core, extending as far out as SH 6 but excluding a swath from the IH 610 West Loop to the City of Katy. African American residents predominate in inner-city neighborhoods that include Third Ward, Sunnyside, South Park, Macgregor, Settegast, Homestead, Acres Home, Fifth Ward, and Kashmere Gardens, while Hispanic residents predominate in Eastwood, Lawndale, Harrisburg, Gulfton, and Sharpstown. Residents of Hispanic origin are also found interspersed in neighborhoods previously identified by other minority groups.

The Asian community is more segregated than other minority groups and reside mainly on the west side of the Houston region. They have a significant presence in the Alief - Sharpstown locale popularly known as "Chinatown." This area contains a mix of residents largely of Chinese, Vietnamese, and Korean descent.
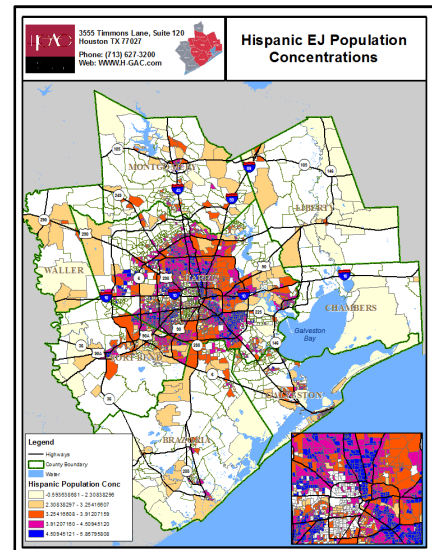
Map 2: Hispanic Concentrations

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[4] H-GAC has mapped the population of physically disabled persons for information purposes. This indicator will be added to the protected class in a future update.

[5] US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

[6] Ibid.

Low-income households are located predominantly in the Beltway zones defined as highly disadvantaged.

- *Where the Target Population Work*

Environmental justice residents make up the entire population or are a majority in the nine Travel-Analyses Sectors within the Beltway 8 region.[7] Commute data for these sectors is therefore directly applicable to EJ analysis.

Most home-based work (HBW) trips that originate from the Beltway 8 region go to Sector 11 (IH-610 Loop) - which includes the Downtown Business District, Greenway Plaza, Texas Medical Center, University of Houston, and the Texas Southern University.[8] Sector 10 (Houston Southwest) and "Out of Region" round up the top three HBW trip destinations for the Beltway 8 region. Most Beltway area workers find employment within their home sector or in a sector adjacent to their residence - possibly reflecting a conscious effort to maximize accessibility to jobs and manage the travel costs of time and money.
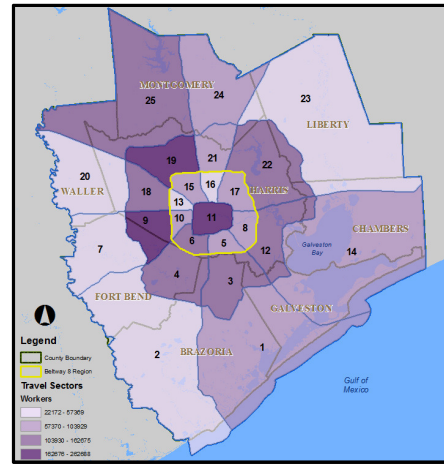
Map 3: Travel Analyses Sectors

- *Commuting Characteristics of the Target Population*

Residents of the Beltway 8 region overwhelmingly choose the automobile for their daily transportation needs. Over 75% of all HBW trips are single-occupant trips. Carpools are the next most common HBW travel mode, followed distantly by transit. Alternate commute modes are greatest within the Houston Southwest (Sector 10) and the IH-610 Loop (Sector 11).

Table 1: HBW Travel Mode from Trips Originating in Beltway 8 Region

	Drive in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
Sector 5	78.3%	10.4%	4.0%	1.5%	2.3%	3.4%
Sector 6	73.0%	12.8%	6.0%	2.1%	3.1%	2.9%
Sector 8	78.1%	15.3%	1.1%	1.8%	1.9%	1.8%
Sector 10	74.0%	12.7%	5.1%	2.7%	4.6%	0.9%
Sector 11	75.0%	9.7%	4.8%	4.6%	4.7%	1.3%
Sector 13	72.3%	17.1%	3.1%	3.5%	2.2%	1.8%
Sector 15	80.0%	11.3%	2.6%	1.7%	2.6%	1.8%
Sector 16	75.5%	11.3%	2.6%	1.7%	2.7%	6.2%
Sector 17	79.4%	12.5%	2.8%	1.4%	1.9%	2.0%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates

The most accessible zone for Beltway commuters is Sector 11 where 28.4% of all HBW trips average 15 minutes or less and as high as 70% of the HBW trips are completed within 30 minutes. The least accessible zone for the Beltway commuters is Sector 16 (Near Northside) in which about 55% of all the HBW trips last 30 minutes or longer.

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[7] Developed by H-GAC Forecast Department to study commuting patterns and regional employment.

[8] Longitudinal Employer-Household Dynamics: Origin-Destination Employment Statistics (LODES) (2014).

IDENTIFYING DISPARATE BENEFITS AND DISPROPORTIONATE COSTS

Performance measures convey how well the transportation network enables the region's residents to connect to people, places, and opportunities, and whether the target communities are equitably served or disparately impacted by the transportation policies, programs, and activities. The performance measures considered in this study suggest that the EJ population may have comparable or better access to opportunities and vital services than the non-target population but are disparately and adversely impacted in safety and in the distribution of transportation investments. Some key findings are summarized below.

1. Pattern of Transportation Investment Choices

A non-exclusive spatial review of major transportation investments and local thoroughfare investments proposed in the H-GAC 2017 - 2026 Ten-Year Plan suggest a disproportionately lower level of investments for environmental justice sensitive areas compared with the non-target areas.

- *Distributional Equity*

    ❖ Up to 78% of the local projects from the 2017 – 2026 Ten-Year Plan, (representing about 88% of the total allocated funding), were programmed for the non-target areas. In contrast, 66% of the local projects fell within an EJ sensitive area. The cost of the projects that would directly benefit the EJ neighborhoods amounted to only about 50% of the allocated funding.

    ❖ The spatial distribution of major transportation projects proposed in the 2017 – 2026 Ten-Year Plan (including tolled facilities) is patterned like the local projects and would more appreciably benefit the non-target communities than the EJ sensitive communities.
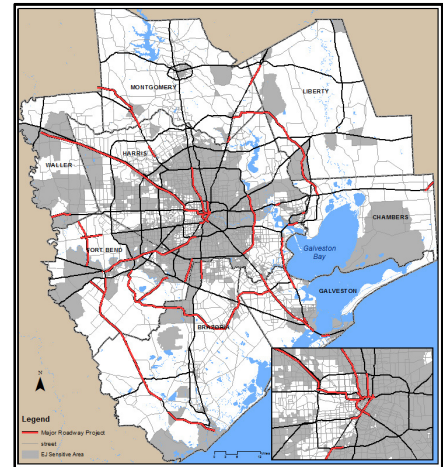
Map 4: Major Roadway Projects

2. Transportation System Performance

Both EJ sensitive and non-target communities would benefit from network-wide improvements in system performance with the construction of the regionally significant projects proposed in the Ten-Year Plan.

- *Mobility and Accessibility*

    ❖ Despite disparities in distributional equity, traffic models project that EJ communities, particularly those with high disadvantage, would potentially have accessibility to double the number of jobs as the non-target population – traveling by automobile or by transit.

Table 2: Major Projects - Accessibility to Jobs by Automobile and Transit Modes

	Number of Jobs Accessible within 30 Minutes by Automobile		Number of Jobs Accessible within 60 Minutes by Transit	
	2040 Build Network	2040 No-Build Network	2040 Build Network	2040 No-Build Network
Non-EJ Zones	793,196	772,991	1,798,243	1,750,445
EJ Zones	1,496,144	1,452,572	2,874,770	2,852,608
EJ High Disadvantage	2,264,518	2,207,636	3,432,997	3,420,487

Source: H-GAC Travel Demand Model, 2017.

❖ Roadway users from the non-target zones are projected to experience an increase in traffic speeds of over one mile-per-hour on average, travelling by automobile. Relatedly, travelers from EJ sensitive zones would also experience enhanced traffic speeds but only of about one-half mile-per-hour on average, travelling by automobile.

- *Congestion*

  ❖ Traffic model analyses predict region-wide improvements to morning peak levels-of-service for all classifications of roadways which would benefit road users from both the EJ sensitive communities and non-target communities.

- *Regional Toll Road Impact*

  ❖ Indicating disparity in access, traffic model predictions show that although more trips overall would be generated from the EJ sensitive zones, fewer toll road candidate trips[9] would originate from the EJ sensitive zones than would from the non-target zones.
  ❖ Average savings in time that would be realized by using a priced facility is greater for the non-target zones than for the EJ sensitive communities.

3. Accessibility to Public Infrastructure and Vital Services

- *Pedestrian-Bicyclist Infrastructure*

A spatial analysis shows a disproportionate level of trail development within the EJ communities compared to the non-target areas.

  ❖ About one-third of the pedestrian-bicyclists trails/infrastructure are within or adjacent to an EJ sensitive zone while the other two-third lie within the non-target area.
  ❖ Only 5% of the regional network of pedestrian-bicyclist infrastructure are within EJ zones described as having high disadvantage.

- *County Libraries*

Residents of EJ sensitive zones have greater accessibility to a county library facility than the non-target areas, assessed by automobile and transit modes.

  ❖ About 40% of the county libraries in the MPO region are in an EJ sensitive zone.
  ❖ Within the IH-610 Loop, most of the EJ sensitive zones are within biking reach of a library.
  ❖ There is greater accessibility to a library by transit from an EJ sensitive area than from the non-target zones.
  ❖ Accessibility to a library by transit is greatest for EJ zones with the highest disadvantage.
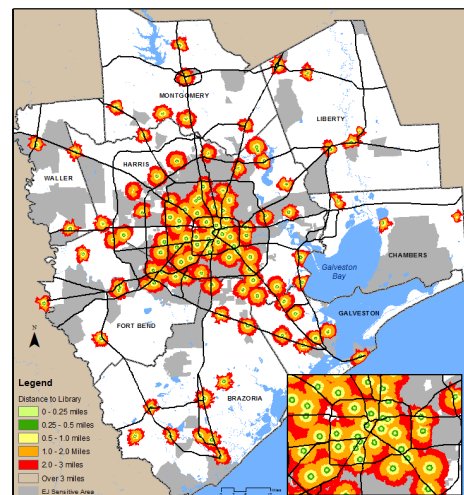
Map 5: Access to Library Facilities

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[9] "Candidate" trips are defined as trips that would benefit from savings in time by use of a tolled facility.

- *Full-Service Hospitals/High-Level Trauma Centers*

  - ❖ 95% of households in EJ sensitive area are within 15 minutes of a full-service hospital travelling by automobile, compared to 81% of households from the non-target areas.
  - ❖ 51% of households from EJ sensitive areas are within 60 minutes of a full-service hospital by transit, compared to only 25% from the non-target areas.
  - ❖ Non-target areas have better access to high-level trauma centers by automobile, but households in protected areas have better accessibility by transit.
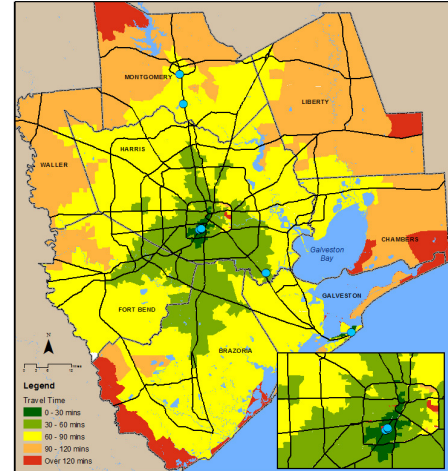
Map 6: Access to Full Service Hospitals

- *Institutions of Higher Education*

  - ❖ More households (84%) from EJ sensitive areas are within 15 minutes of an institution of higher education than households from the non-target areas (72%).
  - ❖ About 49% of environmental justice households are within 60 minutes by transit, compared with 26% of the non-environmental justice sensitive households.

- *Fixed Route Transit Service*

METRO local and express bus service is concentrated in the densely populated areas of the Houston metropolitan area but limited in the sparsely populated suburbs.

  - ❖ Transit route-miles within the EJ sensitive zones is twice as much as route-miles serving the non-target areas.
  - ❖ Routes with the best peak period headways serve central and southwest Houston - benefitting both EJ sensitive and non-EJ communities.
  - ❖ Routes with the worst peak-hour bus headway conditions run almost entirely to EJ neighborhoods in northeast Houston.
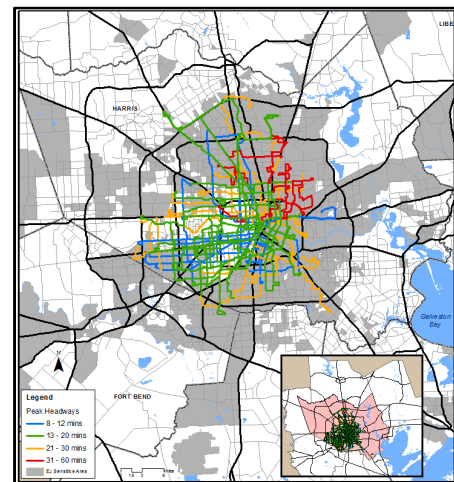
Map 7: METRO Service - Peak Headways

4. Safety

Transportation safety is a major concern for the EJ sensitive areas which are over-represented in all measured crash categories.

- *Vehicle Crashes*

  - ❖ More than 1 million vehicle crashes occurred within the MPO region between 2007 – 2016.
  - ❖ Over 60% of these vehicle crashes occurred within an EJ sensitive area.
  - ❖ EJ sensitive zones had majority of high-severity crashes and the highest crash rates per capita.
  - ❖ The number of crashes in EJ sensitive zones is rising at a faster rate than in non-target areas.
  - ❖ A disproportionate level of distracted driving crashes occurred within the EJ sensitive zones.
  - ❖ Minority residents are overrepresented in all categories of vehicle crash events.

Figure 2: Vehicle Crashes in the Eight-County TMA Region (2007 – 2016)
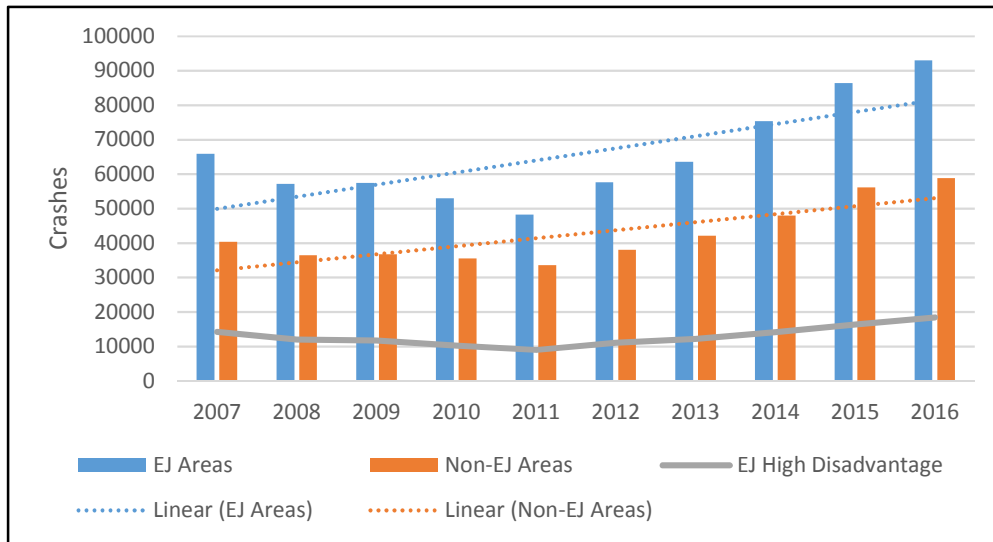
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Table 3: Motor Vehicle Crashes in the Eight-County MPO Region (2007 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
Percent of Total Population	53%	47%	19%	100%
Number of Crashes	657,538	425,812	129,717	1,083,350
% of Crash Total	61%	39%	20%	100%
Crashes per 1000 Population	205	150	212	-
Vehicle Miles Travelled (VMT)	100,879,192	69,193,733	8,775,120	170,072,925
Crashes Per 100 Million Vehicle Miles Travelled (VMT)	179	169	405	-
High Severity Crashes	13,519	10,972	2,542	24,491
% of High Severity Crash Total	55%	45%	19%	100%
High Severity Crashes per 100,000 Population	422	387	416	-

Source: Geocoded TxDOT Crash Records Information System (CRIS).   *Crash numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals.   **Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

- *Bicycle and Pedestrian Crashes*

  ❖ Over 61% of all bicycle crashes that occurred between 2007 and 2016 occurred in an EJ zone.
  ❖ Up to 58% of bicycle crashes with high severity and 55% of crash fatalities occurred within an EJ sensitive zone.
  ❖ Crash hotspots coincide with hotspots for vehicle accidents and are centered in the Houston Downtown – Midtown districts and in the minority neighborhoods of the Houston Southwest, particularly the Gulfton – Alief super neighborhoods.
  ❖ Pedestrian crash victims are predominantly from the minority population.

- *Crashes at Railroad Crossings*

  ❖ Close to two-thirds of mapped crashes at a railroad crossing occurred in an EJ sensitive zone.
  ❖ Over 70% of the crossing sites with multiple crash events[10] were within an EJ sensitive zone.
  ❖ As many as 6 out of the 7 railroad crossing sites that recorded 5 crash events within the study period was in an EJ sensitive zone.

5. The Highly Disadvantaged Environmental Justice Sensitive Zones

Most of the EJ sensitive communities characterized as highly disadvantaged are located within the Beltway 8 region. Their location close to the densely populated inner-city provide these communities with good accessibility to public amenities, vital services, and employment opportunities but also gives occasion to greater vulnerability. Characteristics of these communities include:

❖ The highest levels of accessibility to public amenities such as county library facilities, major hospitals, high-level trauma centers, and educational institutions, when travelling by automobile or by transit.
❖ The highest levels of accessibility to bus stops and transit routes.
❖ The highest measure of accessibility to jobs travelling by automobile or by transit.
❖ A high and positive correlation between race\ethnicity and poverty (r=0.7746).
❖ A strong association between the female head of households and poverty (r=0.7324).
❖ The lowest level of accessibility to the existing network of pedestrian-bicyclist infrastructure.
❖ The lowest level of transportation infrastructure investments programmed in the H-GAC 2017 – 2026 Ten-Year Plan.
❖ The highest accident rates and most severe casualties within the MPO region.

Households without an automobile show the highest levels of accessibility to public amenities and employment opportunities. This may be the outcome of a deliberate effort to compensate for the lack of a vehicle by the choice of a location near the central business district and/or proximity to transit service.

Transportation projects in the inner-city that significantly expand the existing right-of-way will inevitably result in disproportionately high and adverse impacts on the protected population. Displacing the underserved population from accessible locations and their removal to less accessible localities may introduce fresh hardships and severely impact the quality of life of the affected citizens.

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[10] Multiple crash events are defined as 3 or more crash events at a railroad crossing.

ACHIEVING ENVIRONMENTAL JUSTICE

To be the focal issue that it is intended to be, environmental justice considerations must permeate the transportation planning process. Potential strategies to promote the implementation of environmental justice and other non-discrimination mandates and regulations in the transportation programs, policies, and activities of the MPO and its planning partners include:

1. **Increase Environmental Justice Awareness**

   a. Designate February as "Title VI\Environmental Justice" awareness month and provide for activities that build community bonds, commemorate the efforts within the agency and its regional planning partners that support the underserved communities, and remind the policy makers of the significance and need for these legal protections in our diverse communities.

   b. Institute Title VI/Environmental Justice training for key staff to ensure they understand and appreciate non-discrimination mandates and how to address them within their daily work program.

2. **Enhance Sensitivity for Title VI\Environmental Justice in Transportation Investment Decisions**

   a. Encourage the flow of development funds towards underserved communities by using project benefits to these areas as scoring criteria for RTP/TIP consideration.

   b. Create a "set aside" category of funds to address specific needs within the target areas.

3. **Support Local Efforts to Improve Transportation Service in the Underserved Areas**

   a. Increase inter-agency cooperation and coordination between regional partners. This includes providing leadership, guidance, and technical assistance to program areas that impact the target population.

   b. Develop analytical tools and methodologies to effectively assess project impacts and evaluate community needs.

4. **Address Safety in Environmental Justice Sensitive Areas**

   a. Work cooperatively regionally to address the high and worsening crash rates within the target areas, including giving support to studies that identify dangerous links and intersections;

   b. Prioritize safety improvements and maintenance projects and other actions that improve transportation safety within the problem areas.

5. **Expand Methodologies to Measure Transportation Impact on Target Population**

   a. Study the needs of the protected population to understand social impacts of transportation planning decisions including how changes to their established living patterns and locational choices could affect the quality of life of the impacted residents.

   b. Introduce creative analyses that determine the social impacts of roadway projects especially in the less considered areas of public health, household economics, value of time decisions, and community cohesion.

6. **Improve Public Involvement by the Underserved Population**

   a. Overcome apathy towards public meetings and official events inherent in the communities of the low-income and minority citizens by:

      i. engaging key stakeholders such as elected officials and community leaders or other trusted intermediaries to disseminate event information;

      ii. adjusting meeting logistics including utilizing locations accessible by transit and scheduling events for hours that are convenient to the target population;

      iii. taking the message to neighborhood meetings, faith-based gatherings, community centers, community festivals, and other similar settings where the target audience may be found, thereby ensuring greater and more meaningful participation by the target population while obtaining the benefit of savings in both time and money.

   b. Present a culturally competent message that is informed about the value systems of the target population and includes language translations for the LEP population.

NEXT STEPS

- Improve regional collaboration by initiating dialogue between TxDOT Civil Rights Division, H-GAC, Metropolitan Transit Authority of Harris County (METRO), the City of Houston, Harris County, and other local government stakeholders to:
  o identify organizational policies and practices that influence equity in transportation programs.
  o examine opportunities, share experiences, coordinate efforts, and promote best practices for addressing non-discrimination and achieving environmental justice in the regional transportation planning.
  o Reiterate ongoing commitment to promoting equity in programs, policies, and activities that may affect human health and the environment or influence economic and social conditions.
- Engage key stakeholders, local elected officials, community leaders, leaders of faith-based organizations, and involved residents to:

  o identify and articulate community concerns, needs, and desires related to transportation in the underserved communities, and how best to address them.
  o create a channel of communication that enhances public participation and facilitates public outreach.
  o Encourage public education.
- Develop new solutions, investigate new models, tools, and metrics that improve the measurement of transportation's impacts on the population and expand ways to identify disproportionate harm to the protected communities.
- Implement recommendations and document lessons learned.

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INTRODUCTION

On February 11, 1994, President Bill Clinton signed Executive Order (EO) 12898: "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," in response to concerns about pervasive discriminatory practices which disproportionately burdened minority and low-income communities with investments that adversely impacted human health and degraded the environmental quality of their neighborhoods. This Executive Order established environmental justice as federal policy.

1.1   Definition of Environmental Justice

The U.S. Department of Transportation (DOT) defines environmental justice as "the fair treatment and meaningful involvement of all people, regardless of race, ethnicity, income, national origin, or educational level with respect to the development, implementation and enforcement of environmental laws, regulations and policies." Within this context, "fair treatment" means that no group of people should be made to bear a disproportional risk of negative health or environmental consequences resulting from federal, state, or local government programs, while "meaningful involvement" requires all people, particularly the disadvantaged and traditionally underserved, to have the opportunity to participate in decisions about programs that may affect their environment or personal health or that may define their access to the benefits from federally funded development activity. Thus, the concept of environmental justice blends the oversight of non-discrimination with the safeguards of environmental protection.

1.2   The Legal and Regulatory Framework

The principle of environmental justice has legal foundations in the Equal Protection Clause of the Fourteenth Amendment of the United States Constitution which articulates a fundamental right to be free from institutional discrimination. These rights are memorialized in the Civil Rights Act of 1964. Title VI of the Act states that "No person in the United States shall, on the grounds of race, color, national origin, age, sex, disability, or religion be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity receiving federal financial assistance." The non-discrimination obligation of Title VI applies broadly to every activity or program of any entity that directly or indirectly benefits from any federal funding.

Executive Order 12898 expands the non-discrimination focus of Title VI by requiring federal agencies to make achieving environmental justice a part of their core mission. The Executive Order also instructs federal agencies to work collaboratively to improve research and data collection efforts to facilitate a systematic identification of environmental justice concerns that may emanate from their program activities, and to develop solutions to address such concerns. EO 12898 further requires each federal agency to develop an agency-wide environmental justice strategic plan of action that integrates environmental justice considerations into the day-to-day operations of the agency and supports the advancement of environmental justice goals across the board. Although the nondiscrimination principles and protected class in EO 12898 overlap with the Title VI *Statute*, they remain two separate mandates with distinctive requirements. Only environmental justice addresses low-income populations. However, the H-GAC Title VI *Program* encompasses environmental justice issues and includes environmental justice achievements in its compliance assessment and reporting.

EO 12898 is also significant because it re-affirms the National Environmental Protection Act (NEPA) of 1969 which requires federal agencies to prepare a detailed statement on the effects of their actions on the environment and on human populations. NEPA represents an early attempt to protect human populations and the environment from the deleterious impacts of federal investment activity, and is the underlying regulatory basis for incorporating environmental justice review within the transportation planning and policy development process.

Environmental justice issues are inextricably linked with broader social justice and equity concerns. Equity speaks to avoiding discrimination – whether this is intentional or an inadvertent collateral consequence of the development process. Several key legislative instruments and policy statements that arise under non-discrimination principles or which directly support the goal of nationwide environmental justice are listed in Appendix A.

1.3   Houston-Galveston Area Council Mission and Roles

The mission of the Houston-Galveston Area Council (H-GAC) is to serve as an instrument of local government cooperation and to promote orderly development in the region while ensuring the safety and welfare of its citizens. Engrained within this mission statement is a commitment to achieve environmental justice for all people - including the disadvantaged and traditionally underserved population within the region. Consequently, H-GAC tries to ensure non-discrimination in all its programs and activities, whether the programs are federally funded or not.

H-GAC is a voluntary association of local governments located in the upper Texas Gulf Coast Region. The 13-county service area, which extends about 12,500 square miles, is home to over 6 million culturally diverse residents. Distinct from the Council of Governments, the Transportation Department within H-GAC serves as the federally designated Metropolitan Planning Organization (MPO) for a core of 8 of these counties, concurrently embodying a Transportation Management Area (TMA) which consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller Counties (Map 1). The MPO establishes the investment priorities of the federal transportation funds through a Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP). In fulfilling its mandate as MPO, H-GAC works collaboratively with public as well as with private non-governmental partners in a continuing, cooperative, and comprehensive process to improve mobility, promote regional economic growth, protect the environment, and enhance the quality of life of the citizens.

As MPO, H-GAC is also responsible for ensuring that all transportation programs in the region reflect a sensitivity to principles of environmental justice. This obligates the agency to identify, monitor, and alleviate any negative health and social impacts stemming from its transportation programs and activities that may disproportionately affect communities that are predominantly of minority and low-income citizens. It is the policy of H-GAC to promote environmental justice principles throughout its planning and decision-making process, and in the performance of all agency programs and activities.

1.4   A Qualitative Evaluation of Current Practice

H-GAC maintains a keen Title VI program which is integrated into the agency's planning work program. In furtherance of its environmental justice commitment, H-GAC works to engage communities

of the underserved and disadvantaged populations through an inclusive outreach program supporting the preparation of its transportation plans and other planning studies. A summary of the agency's environmental justice activity is included in the Title VI compliance report to the federal government.

This report offers a comprehensive examination of environmental justice at the Houston-Galveston Area Council. It affirms H-GAC's environmental justice methodology and applies spatial, statistical, and quantitative technics to examine how the regional transportation programs match up with the environmental justice goals of equity and opportunity. The report identifies gaps in the current environmental justice practice relative to best practices and proposes policies and action strategies to enhance H-GAC's environmental justice engagement in the Gulf Coast region, and to better integrate environmental justice and Title VI in the transportation planning process.
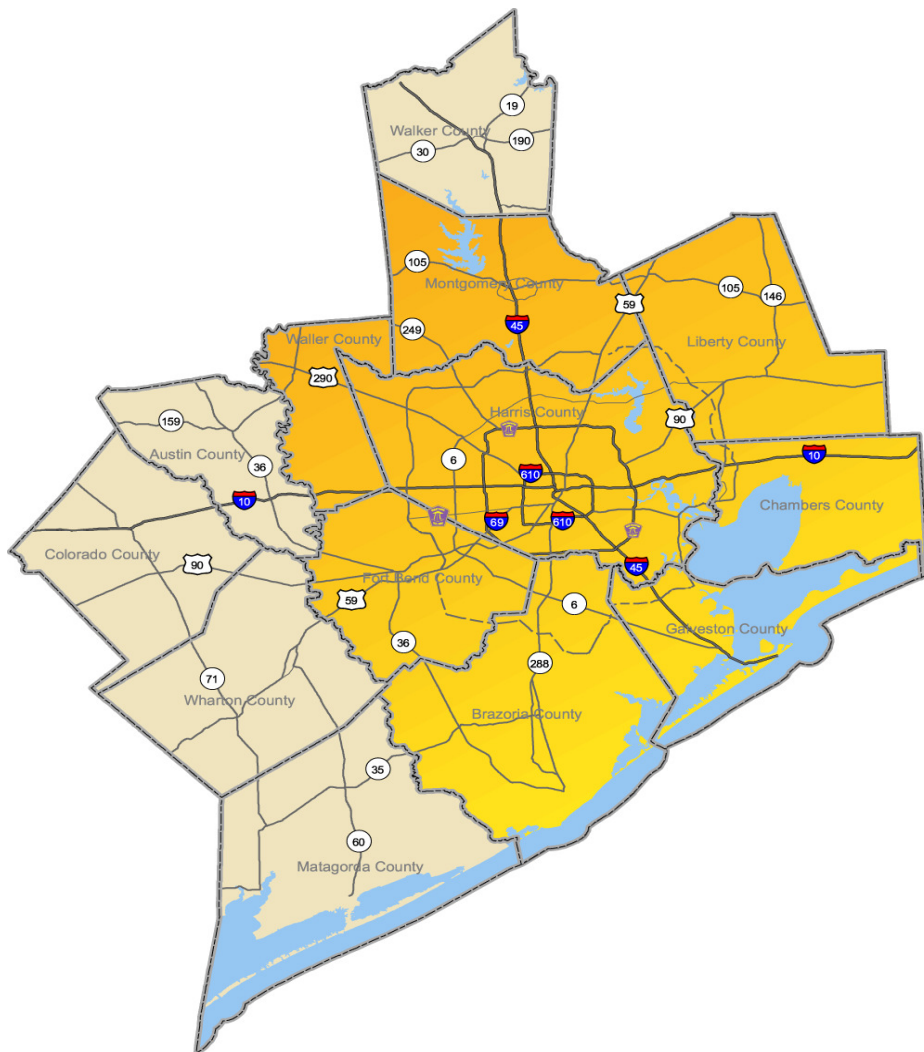
Map 1: H-GAC Region showing the Eight TMA Counties

2.0   ENVIRONMENTAL JUSTICE IN TRANSPORTATION PLANNING

2.1   Transportation and Social Equity

Transportation is an environmental justice issue because of its potential to impact social equity. As the lifeline that connects people with employment, education, medical care, housing, and recreation, the impact of transportation is felt by everyone. Transportation policies and investment choices shape landuse patterns and thereby influence the location of social and economic activity. Additionally, transportation systems facilitate manufacturing and the movement of freight, and enable the efficient distribution of goods and services. The ease of mobility by a safe and reliable transportation service ultimately promotes social cohesion and enhances the quality of life. As transportation resources improve connectivity between local communities and links them to the wider world, it enhances their economic vitality and competitiveness. Where transportation goes - opportunity goes.[1]

Despite its transformative importance to economic growth and community development, transportation policies may also produce harmful consequences for vulnerable populations. Transportation developments can have the effect of dividing, isolating, disrupting, and imposing economic, environmental, and health burdens on communities, particularly among the underserved.[2] It is documented, for instance, that the construction of the federal-aid interstate highway system through the nations' inner cities several decades ago ripped apart well-established African American communities, resulting in the displacement of multitudes of low-income and ethnic minority families and leaving behind a legacy of distrust for Government planning and public redevelopment activity.

An environmental justice concern is triggered where the burdens related to transportation plans, programs, and policies fall disproportionately on low-income or minority communities, or where these traditionally underserved and overburdened populations are not given a meaningful and fair opportunity to participate in the planning decision-making process that has the potential to radically change their lives and living environment. Environmental justice concerns may also arise when the benefits of transportation investments disparately enrich one community and not the other. These concerns are addressed by Executive Order (EO) 12898: *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which directs federal agencies to take appropriate and necessary steps to identify and address disproportionately high and adverse effects of Federal projects on the health or environment of minority and low-income populations to the greatest extent permitted by law.

2.2   Federal Transportation Environmental Justice Policy

Environmental justice took on prime significance in the field of transportation planning with the passage of Executive Order 12898 in 1994. Since then, the U.S. Department of Transportation ((U.S.DOT Order 5610.2(a)), Federal Highway Administration (FHWA Order 6640.23A), and the FTA (FTA Circular 4703.1) have issued Orders to provide guidance on the federal policy regarding environmental

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[1] Anthony Foxx, United States Secretary of Transportation 2013 – 2017.

[2] Environmental Justice and Transportation: Building Model Partnerships Community Workshop Proceedings, FHWA, 1998.

justice and to promote procedures for integrating environmental justice into their existing transportation programs. The FHWA encouraged transportation agencies to be proactive in designing initiatives that implemented environmental justice in all planning, development, and implementation activities, and suggested that when properly implemented, environmental justice principles could potentially improve transportation decision-making and produce transportation system designs that fit the communities more harmoniously. The DOT final environmental justice Order declared three fundamental principles which articulate procedural\substantive guidelines for achieving environmental justice:

   a. Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
   b. Ensure full and fair participation by all potentially affected communities in the transportation decision-making process; and
   c. Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

These three principles are the most often cited expression of the core objectives of environmental justice and describe a succinct pathway to implementing the vision of EO 12898.

In summary, environmental justice requires all agencies and sub-recipients that receive federal funds or have actions approved by the FHWA to provide access for the low-income and minority populations who may be affected by their proposed plans or programs to meaningfully participate in the process through which decisions are made concerning those actions, to evaluate the nature and extent of adverse human health or environmental impacts of the programs or activity, and to ensure that the target population will receive a proportionate share of benefits from the federal transportation investment.[3] In addition, if it is determined that a disproportionately high and adverse impact stemming from a project or action would affect an environmental justice population, that project may only be carried out if alternatives that would avoid, minimize, or more effectively mitigate the disproportionately high and adverse impacts on the protected population are not "practicable."[4]

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[3] The Coastal Region Metropolitan Planning Organization (CORE MPO), and The Chatham County - Savannah Metropolitan Planning Commission (MPC). *Environmental Justice Report of The Coastal Region Metropolitan Planning Organization*. Rep. Savannah, GA: n.p., 2002, Updated 2004, 2009, 2011, 2012, and 2015.

[4] United States Department of Transportation (DOT) Order 5610.2(a).

3.0 TRANSPORTATION PROJECTS AND PLANS IMPACTING EJ COMMUNITIES

Environmental justice is incorporated into H-GAC's transportation plans, programs, and projects in a variety of ways. H-GAC is continuously engaged in a cycle of planning efforts that produce transportation plans and initiatives which guide the development and direction of growth of the regional transportation system. Because federal funds are expended and the products of these planning and research efforts have the potential to impact the lives of the environmental justice communities, their preparation and implementation trigger an environmental justice review. The following section describes some of the active planning activities and programs within the Metropolitan Planning Area (MPA) which impact transportation and the environment, and influence the quality of life of residents in the region - especially the environmental justice community.

3.1 The Regional Transportation Plan

The Regional Transportation Plan (RTP) is a conceptual statement of a regional transportation system anticipated to meet the region's projected mobility needs over a 25-year planning horizon. The plan establishes a vision for the growth and development of the region and serves as a blueprint for prioritizing transportation funding to sustain a multi-modal transportation system, support the continuous growth of the economy, and accommodate the anticipated increase in population and resultant upsurge in vehicular traffic and the regional movement of freight. The RTP guides the major transportation investments that will bring about the realization of the vision while satisfying the checks of financial constraint and conformity with national air quality standards. H-GAC's most recent RTP plan is the 2040 RTP Update. This Plan Update is guided by five goals: (1) Improve Safety, (2) Manage and Mitigate Congestion, (3) Ensure Strong Asset Management and Operations, (4) Strengthen Regional Economic Competitiveness, and (5) Conserve and Protect Natural and Cultural Resources (Figure 1).

Figure 1: Goals and Performance Measures for the 2040 Regional Transportation Plan Update
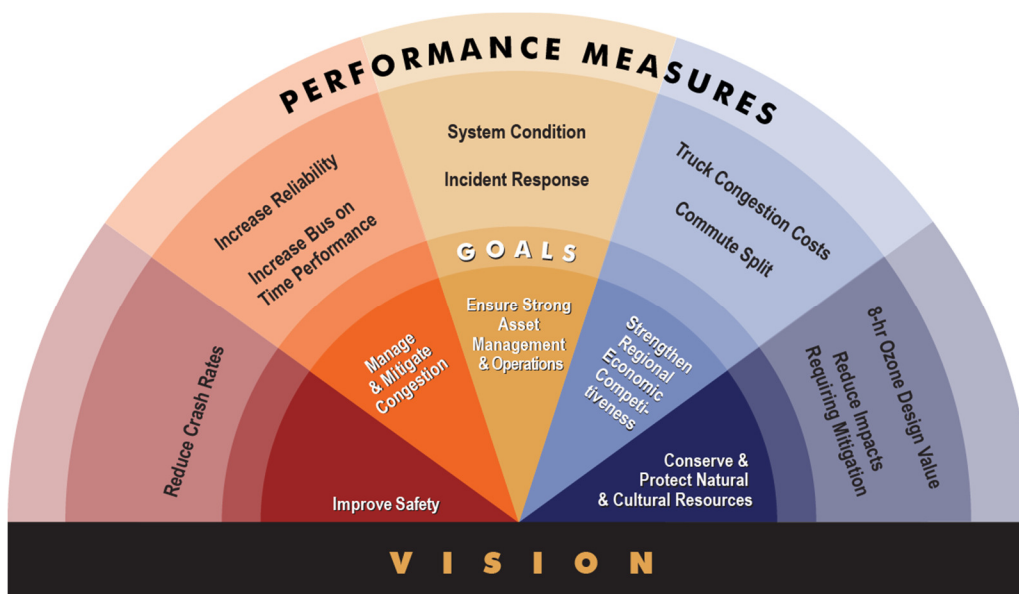
Source: H-GAC 2040 Regional Transportation Plan Update

The performance measures for each of these goals and the program strategies that they match with are described in Table 1.

Table 1: Strategies, Goals and Performance Measures for 2040 RTP Update

GOAL	STRATEGIES				PERFORMANCE MEASURES
	System Mgmt. & Operations	State of Good Repair	Expand Multi-Modal Network	Coordinate Development	
Improve Safety	Direct	Direct	Related	Related	Reduce Crash Rates in Overall System
Manage & Mitigate Congestion	Direct	Direct	Direct	Direct	Increase Travel Reliability & Bus On-Time Performance
Ensure Strong Asset Mgmt. & Operations	Direct	Direct	Related	Related	Enhance System Condition & Incident Response
Strengthen Regional Econ. Competitiveness	Direct	Direct	Direct	Related	Truck Congestion Cost; Commute Split
Conserve & Protect Natural & Cultural Resources	Direct	Direct	Related	Direct	8-hr Ozone Design Value; Reduce Impacts requiring Mitigation

Source: H-GAC 2040 RTP Update.

The 2040 RTP Update was approved and adopted in 2015 by H-GAC's Transportation Policy Council (TPC), a 28-member body that produces policy guidance and overall coordination of the transportation planning activities within the MPA. Membership on the TPC come from cities and counties, the Texas Department of Transportation (TxDOT), the Metropolitan Transit Authority (METRO), an at-large member representing cities with a population greater than 50,000, and a voting member representing the Gulf Coast Rail District.

3.2 The Ten-Year Plan

In 2015, the 84th Texas Legislature passed HB 20 which modified the planning and programming process governing the prioritization and finance of transportation infrastructure projects. HB 20 requires planning organizations to develop a 10-year transportation plan with specific details on how the funding allocated to their region would be used. The first 4 years of the plan must be consistent with the Statewide Transportation Improvement Program (STIP). In developing recommendation criteria, the Bill requires planning organizations to consider and address congestion, safety, effect of the project on economic development opportunities for area residents, available funding, air quality, and the project's impact on the underserved communities. Based on these main criteria, H-GAC's ten-year transportation plan prioritizes projects from the RTP.

3.3 The Transportation Improvement Program

The Transportation Improvement Program (TIP) is a fiscally constrained and comprehensive listing of multi-modal transportation projects drawn from and necessarily consistent with the RTP and approved for implementation within a four-year window. These projects are recognized as the highest priorities for the region and are adopted by the Transportation Policy Council (TPC) after a public hearing is held.

Upon adoption, the TIP is incorporated into the Statewide Transportation Improvement Program (STIP) which is approved by the Texas Transportation Commission.

Projects in the TIP are accurately defined and identified by the project sponsors. Any significant changes to a project in the TIP must be approved by the TPC, and new projects are added periodically. A call for new projects is conducted usually every two years.

3.4 The Unified Planning Work Program

H-GAC produces a Unified Planning Work Program (UPWP) every two years, in cooperation with the state and local agencies. The UPWP describes the transportation plans and programs, and the transportation-related air quality planning activities that will be conducted during current fiscal years, regardless of funding sources or sponsoring agencies. Many of the projects listed will result in future transportation projects. The public is give a 30-day comment period before the UPWP is adopted. This process offers another opportunity for a purposeful engagement of the environmental justice populations.

3.5 The Congestion Management Plan

The Congestion Management Plan (CMP) is an integral part of the metropolitan transportation planning process. Federal law requires all metropolitan areas with populations greater than 200,000 residents, specified as Transportation Management Areas (TMAs), to develop a CMP. The plan identifies roadways in the region that are chronically congested and proposes a range of actions and strategies to minimize the congestion and improve the flow of traffic. The multimodal strategies employed to reduce congestion under this program include operational improvement, travel demand management, policy approaches and the addition to roadway capacity.

3.6 Air Quality Conformity

The Environmental Protection Agency (EPA) has designated the eight-county Houston-Galveston-Brazoria region a non-attainment area because recorded levels of 8-hour Ozone in the area exceed the current National Ambient Air Quality Standards (NAAQS). Ground-level Ozone is formed when nitrogen oxides (NOx) combine with volatile organic compounds (VOCs) under sunlit conditions. All states with non-attainment conditions must develop a State Implementation Plan (SIP) which is an emission management program designed to reduce pollution levels to specified limits, in order to achieve a healthier and safer environment. Because NOXs are produced primarily by automobiles, off-road engines, and ocean-going vessels, all transportation plans, including the H-GAC 2040 RTP Update, must demonstrate that they conform with the State Implementation Plan (SIP). This is to ensure that these activities do not create conditions that worsen the existing air quality violations or delay the timely attainment of the National Ambient Quality Standards.

H-GAC participates in a cooperative and collaborative process with local, state, and federal agencies, and oversees the implementation several strategies to reduce vehicle emissions and to improve air quality across the region. These strategies fall under the umbrella of the "Voluntary Mobile Emissions Reduction Program" (VMEP), and include options like replacing or retrofitting old diesel vehicles and engines, and reducing the vehicle miles travelled within the region through alternate commute solutions. The emission reduction strategy also includes increasing public transit ridership, carpools, vanpools, and other rideshare services, and encouraging bike and pedestrian travel options, and telework programs,

strategies which are marketed to the whole region, including the environmental justice communities. The NOx emissions and the concentrations of ground-level Ozone have steadily declined for several years in a row since the introduction of these initiatives. The region however does not presently meet the NOx emission limits for the analysis year 2017.

3.7   Transportation and Mobility Studies

H-GAC periodically commissions or collaborates in special sub-regional mobility studies in partnership with local government entities and state agencies. These studies often support the development of a transportation plans designed to identify specific road network deficiencies and to define actionable recommendations that provide for the future mobility and access needs of the study area. The mobility study will generally include a public involvement component that guides the involvement of all stakeholders including the disadvantaged population, and ensures that the range of diverse public interests are being served.

3.7.1   The Waller County Transportation Plan

Waller County is a largely rural area located in the northwestern quadrant of the metropolitan planning area, and has the third largest minority population by proportion of all the counties in the planning region. The rapid population growth and continuous expansion of urban development from the Houston metropolitan area towards its Waller suburbs suggest that the rural character of the county would soon change. The anticipated increase in the intensity of development will mean more people and more cars, and consequently, the need for better transportation facilities to accommodate the increased demand and avoid congestion.

The Waller County Transportation study is designed by H-GAC, in partnership with Waller County, to examine the current and future transportation infrastructure needs and update the existing county Thoroughfare Plan. It is expected that at the end of the 18-month long study, a framework for improved mobility will be developed which not only provides for a safe and efficient movement of people and freight but preserves the environmentally sensitive areas, prime agricultural resources, and the historic heritage of the County.

3.7.2.   State Highway 146 Sub-Regional Study

State Highway 146 (SH 146) is an important regional corridor in Chambers County which serves as a major North-South thoroughfare, a freight pathway, and a hurricane evacuation route. The area surrounding SH 146 is a rapidly-growing part of the greater Houston-Galveston region in terms of population, employment and freight traffic. To coordinate the transportation planning efforts to guide and accommodate this growth, elected officials asked the Houston-Galveston Area Council (H-GAC) to establish a partnership with the Texas Department of Transportation (TxDOT) and the cities of Baytown and Mount Belvieu to collaboratively examine current and future mobility needs.

The purpose of the SH 146 study is to produce a Sub-Regional Mobility Plan that identifies opportunities to improve mobility, enhance safety, reduce congestion and promote economic development in the area. The year-long study will analyze current and future population, employment, and economic development conditions, and an extensive traffic data collection effort will examine the roadway network and identify existing traffic bottlenecks and roadway facilities with high congestion levels or potentially

unsafe conditions. The SH 146 Sub-Regional Mobility Plan will ultimately outline short, intermediate, and long-term transportation improvements to increase safety and traffic flow, reduce congestion, improve air quality, incorporate multi-modal mobility solutions, and enhance the aesthetics of the highway.

3.8   Regional Tollway Analysis

Inadequate and uncertain funding for transportation projects has encouraged a growing interest in tolled roadways as a strategy through which funds may be generated to maintain highway investments and to finance new projects. In addition to generating funds, roadway pricing along with managed lane strategies have also been applied to relieve traffic congestion, reduce polluting vehicle emissions, increase trip reliability, and to protect the natural environment. However, putting a price on access to transportation facilities raises social equity concerns, especially where the minority or low-income population may not have equal access or enjoy a similar level of benefits of the toll road investments as the non-protected population.

H-GAC analyzed the potential effects that the priced facilities recommended in the 2040 RTP Update would have on the environmental justice population using mobility and accessibility as primary measuring sticks. The study modelled three travel demand networks (1) The 2017 network – containing all the transportation facilities currently in the network, (2) The 2040 RTP Build network – containing all programmed RTP facilities including the priced facilities, and (3) The 2040 RTP No-Build network – containing all programmed RTP facilities except the priced elements scheduled to be built after 2017. Traffic Analysis Zones (TAZ) were chosen as the basic unit of geography for the analysis for compatibility with the travel demand model.

Findings indicated that when using the build network, both the environmental justice and non-environmental justice communities would have shorter average trip lengths, but the environmental justice neighborhoods would enjoy access to a greater number of jobs by automobile and transit modes than would the non-environmental justice neighborhoods. It was however noted that the toll roads were geographically best suited to suburban commuter trips which largely favored the non-environmental justice communities. Furthermore, a selection of the environmental justice population, specifically the low-income, were effectively excluded from using a priced facility because tolls represented an unaffordable expense. An environmental justice concern was noted for stretches of SH 99 (Grand Parkway) where there were no non-tolled alternatives to the priced roadway. Mitigating options proposed include improving transit service and facilities using some of the revenues obtained from tolled facilities. No disproportionate impact on the environmental justice communities was identified. This study is described in more detail later in this document.

3.9 Regional Transit Framework Study

The goal of the Regional Transit Framework Study (RTFS) is to design a model transit system that will meet the future needs of a complex and rapidly growing Gulf Coast region. Still in its draft stages, the ongoing study will update a previous RTFS effort which had proposed four alternative regional transit development scenarios but failed to reach a workable conclusion. This study will recommend a transit system appropriate for the Gulf Coast region, and will assist the selection of a program of investments purposed to achieve the envisioned network.

The recommended transit framework is expected to expand access and mobility for all classes of transit patrons, especially the transit dependent; increase the modal share of transit in regional trips thereby alleviating congestion and reducing automobile dependence; and encourage cooperation among the regional transit service providers, patrons, and other stakeholders, to promote efficient use of the region's transit resources, and develop a seamless service for all transit patrons. Proposed policy considerations in the RTFS include the expansion of the HOV/HOT Lane network, developing support for non-traditional commute patterns (reverse commuting and suburb-to-suburb travel), and encouraging transit-oriented development.

Guidance for the preparation of the RTFS is provided by a Steering Committee composed of H-GAC staff and representatives of several regional transit service providers and the State of Texas. When completed, the RTFS will be incorporated into the 2040 Regional Transportation Plan.

3.10   Regional Coordinated Transportation Plan

Access to convenient and reliable transit service varies widely across the Gulf Coast Planning Region. A concern exists especially for the transit dependent population who cannot afford other viable options for mobility and only have access to sporadic and generally unaccommodating transportation service, or no service at all. The purpose of the coordinated transportation plan is to provide more effective and efficient transportation services across the region and to improve the mobility options for a priority population that includes persons with disabilities, individuals aged 65 an over, individuals with lower incomes, persons with limited English Proficiency skills, youth, and veterans. This target population exemplifies the social and economic vulnerabilities that are impetus for environmental justice.

The 2017 Regional Coordinated Transportation Plan (RCTP) update process involved several public meetings, open house events, focus group studies, and survey activities. A transit inventory and stakeholder agency survey enumerated existing active transportation service providers and documented their services, fleet resources, market areas, and operating parameters. The survey tried to detect gaps in transportation services and identify obstacles and opportunities for improving regional coordination in the delivery of transportation services. Survey respondents included human service agencies, public transportation agencies, school districts, private non-profit organizations, and city/county government entities. The "Power of Transit" symposium provided a forum for panelists to discuss their expert viewpoints regarding regional partnerships and collaboration among transportation providers who could by leveraging individual services and funding, reach those populations not served by the region's major transit providers.

A key component of the RCTP development process was the Transit Need Index (TNI) and Gap Analysis study which assessed the relative levels of actual demand/need for transit service within the thirteen counties of the H-GAC Council of Governments region, and determined where existing transit service was inadequate. This peer-to-peer analysis compared transit need within a county against observed need in similar sized baseline entities and derived a score indicative of the perceived level of transit need. The higher the index value, the greater the transit needs challenge for that region. Several socio-economic factors were considered in deriving the index of transit need. The factors include population density, household income, percentage of children 6-17 years, persons with disabilities, the elderly population, and households without an automobile: reflective of some of the basic characteristics

of environmental justice populations. The results of the study were applied in deciding how to prioritize transit service improvements.

The RCTP also highlighted several challenges to providing effective transportation services especially in the rural areas in the gulf coast region, notably the lack of a dedicated transit funding source, low population densities, and the need to provide longer trips for their customers. The plan concludes with recommendations to address transit gaps and funding shortfalls.

4.0   REGIONAL DEMOGRAPHIC OVERVIEW

4.1   Changes in the Demographic Landscape

According to the Brookings Institute, non-White individuals and people of Hispanic origin accounted for 98% of the population growth within large metropolitan areas in the United States between 2000 and 2010.[5] Within the same period, as many as 42 of the largest Metro areas in the United States experienced a decline in the White population. However, the smaller Metro areas and the suburbs of the major metropolitan regions remain overwhelmingly White.[6] This pattern holds true for Greater Houston. Although the White residents are the single largest racial group within the H-GAC MPO region, studies of population growth trends in the Upper Texas Gulf-Coast indicate that a shift in the demographic characteristics of the metropolitan region is underway (Figure 2). Broken down by ethnicity, the population in the H-GAC MPO is 38% White, 36% Hispanic, 17% Black African, 7% Asian, and 2% Other (Figure 3).

Figure 2: Regional Change in Race/Ethnic Composition of the Eight-County TMA Region
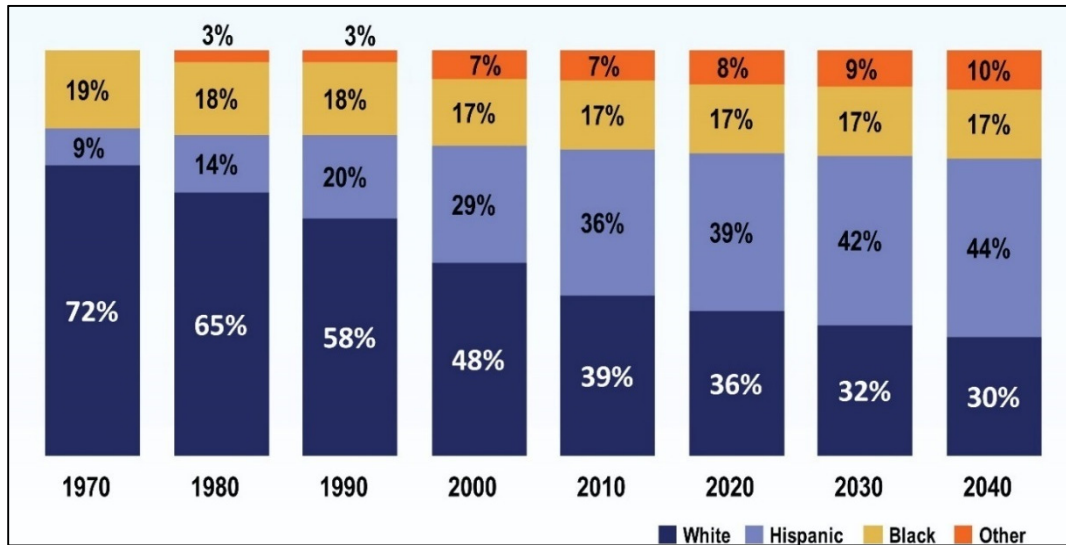
Source: H-GAC 2040 RTP Update.

The population in the H-GAC MPO eight-county region is expected to reach the 10 million mark by 2040 (Figure 4). This represents an increase of about 4.2 million residents since 2010, when the last decennial census was performed. Demographic forecasts indicate that net migration will be the most important factor in the predicted regional population growth. Most notably, the proportion of the White population is expected to decrease and persons of Hispanic/Latino heritage will become the most numerous racial/ethnic group. The Houston metro area will consequently soon be a "majority minority region." This will likely have implications for environmental justice and future transportation planning

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[5]: William Frey, "The New Metro Minority Map: Regional Shifts in Hispanics, Asians, and Black from Census 2020." The Brookings Institute (2011)

[6] Ibid.

and decision making. Table 2 presents a demographic profile of the Gulf Coast 8-County Metropolitan Planning Region.

Table 2: Demographic Profile of the Gulf Coast Eight-County MPO Region

Population by Race	Brazoria County		Chambers County		Fort Bend County		Galveston County	
	Population	% of County	Population	% of County	Population	% of County	Population	% of County
White Alone	247,806	74.7%	31,317	84.1%	345,668	52.5%	240,126	77.9%
Black/African American Alone	43,117	13.0%	2,957	7.9%	137,227	20.8%	41,017	13.3%
Indian or Alaska Native Alone	1,058	0.3%	86	0.2%	1,501	0.2%	1,107	0.4%
Asian Alone	19,735	5.9%	486	1.3%	121,050	18.4%	10,200	3.3%
Hawaiian/Pacific Islander Alone	7	0.0%	13	0.0%	200	0.0%	73	0.0%
Others	13,855	4.2%	1,4332	3.8%	35,653	5.4%	7,458	2.4%
Two or More Races	6,163	1.9%	959	2.6%	17,032	2.6%	8,182	2.7%
Total Population:	331,741	100%	37,251	100%	658,331	100%	308,163	100%
Median Age (years)	35.5	-	36.2	-	35.5	-	37.5	-

Population by Race	Harris County		Liberty County		Montgomery County		Waller County	
	Population	% of County	Population	% of County	Population	% of County	Population	% of County
White Alone	2,749,811	63.1%	62,608	80.8%	434,264	86.4%	31,627	69.0%
Black/African American Alone	821,686	18.9%	8,287	10.7%	17,809	3.5%	11,629	25.4%
Indian or Alaska Native Alone	19,522	0.4%	232	0.3%	2,750	0.5%	106	0.2%
Asian Alone	286,331	6.6%	517	0.7%	12,631	2.5%	354	0.8%
Hawaiian/Pacific Islander Alone	3,060	0.1%	15	0.0%	131	0.0%	0	0.0%
Others	380,495	8.7%	4,485	5.8%	35,001	7.0%	908	2.4%
Two or More Races	95,457	2.2%	1,342	1.8%	18,679	3.7%	1,223	2.7%
Total:	4,356,362	100%	77,486	100%	502,586	100%	45,847	100%
Median Age (years)	32.8	-	36.4	-	36.4	-	29.1	-

Source: US Census Bureau, 2011-2015 American Community Survey 5-Year Estimates.

Figure 3: Race\Ethnicity in the Eight-County TMA Region - 2015
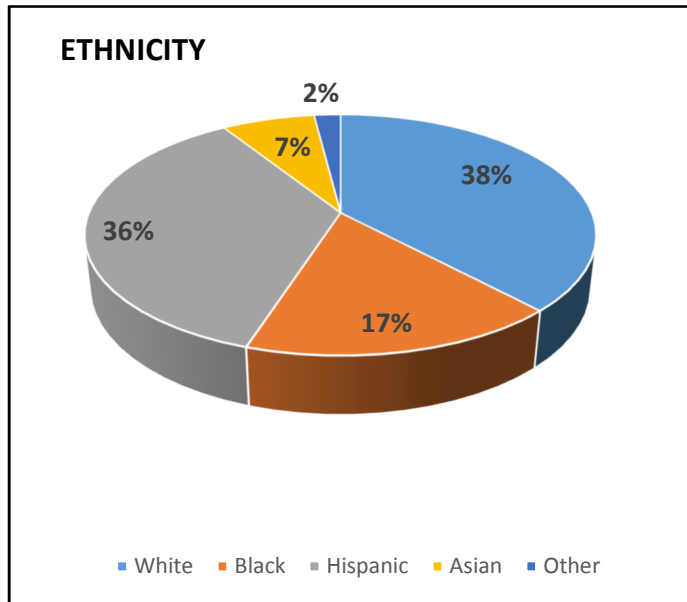
Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Figure 4: Regional Population Growth – 2010 to 2040
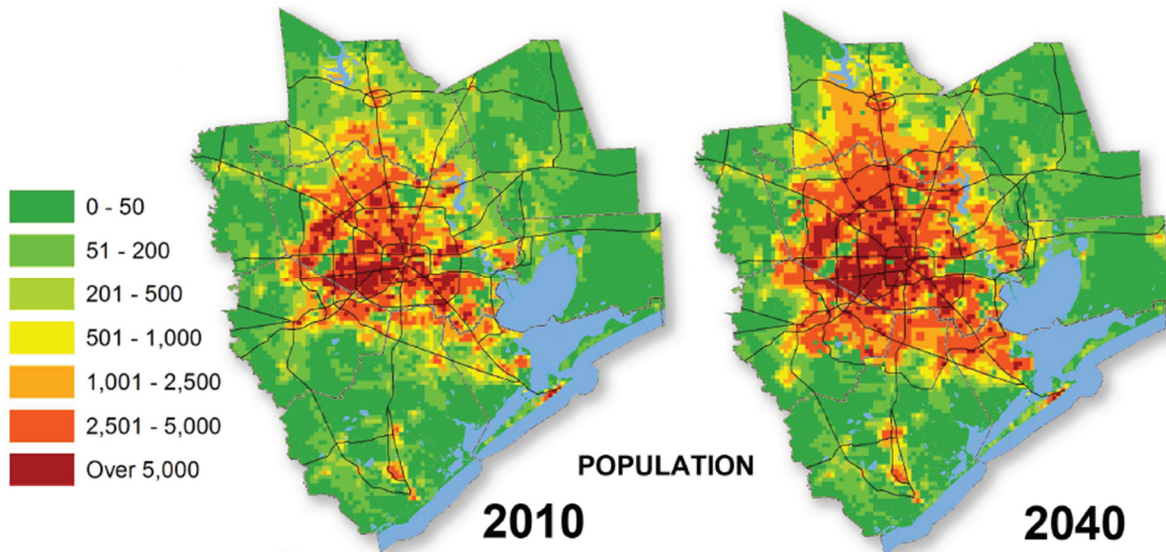
Source: Houston-Galveston Area Council Socio-Economic Forecast, 2016.

5.0   ENVIRONMENTAL JUSTICE IN THE GULF COAST REGION

In keeping with EO 12898, H-GAC strives to incorporate environmental justice into the transportation planning process. The effective environmental justice practice not only evaluates the equity of the distribution of federal investments across the planning region and how the EJ population may be affected by them, but will also integrate knowledge about past outcomes into future policy, planning, and programming efforts. Because projects come with different contextual factors, a "one-size-fits-all" approach will not be feasible for every component of the environmental justice analysis. Some adaptations or customizations may be necessary to ensure reasonable results from the evaluation.

5.1   Identifying the Protected Population

An important first step in environmental justice analysis is the identification of the protected population, generally referred to as the environmental justice community. Knowing where the protected communities are located within or near a project study area is essential to recognizing what impacts the community may exposed to from the project or action. Furthermore, knowing the character of the protected community would inform outreach efforts, and guide the choice of strategies to maximize their involvement in the decision-making process. Finally, having a good understanding of the needs and desires of the protected population will facilitate the selection of appropriate actions to avoid, minimize, or mitigate any identified potentially adverse project impacts as is demanded by the principles of environmental justice.

5.2   Analytical Tools and Methodology

H-GAC uses the geo-referencing and overlay/display capabilities of Geographical Information Systems (GIS) technology to translate demographic data into maps that identify communities of the protected populations, and to display these communities in relation to proposed transportation and other societal investments through overlays. EO 12898 specifically names minority and the low-income populations as the protected class for environmental justice considerations. These two groups of citizens are referred to as "primary indicators" in environmental justice analysis.

The FHWA and DOT Environmental Justice Orders define minority populations as including (1) Blacks: persons having origins in any of the black racial groups of Africa; (2) Hispanic or Latino: persons having of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race; (3) Asian Americans: persons having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent; (4) American Indian and Alaskan Native: persons having origins in any of the original people of North America, South America (Including Central America), and who maintain cultural identification through tribal affiliation or community recognition; and (5) Native Hawaiian and other Pacific Islanders: persons having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands. Low-income status is defined as a household income level that is at or below the prevailing poverty guidelines of the U.S. Department of Health and Human Services (HHS).

The H-GAC environmental justice basemap has been updated with demographic data from the United States Census Bureau 2011-2015 ACS 5-Year Estimates demographic dataset. This data permits analysis at various levels of spatial aggregation that include census tracts, census blocks, and census

block-groups. ACS 5-Year Estimates data for the Block-Group offers a precision that is suitable for analyzing small populations and geographies. Furthermore, this dataset is more current than the last decennial census and contains certain demographic statistical tables that are not available in other ACS datasets.

5.3   Threshold Analysis

A threshold analysis was performed to determine whether a census block-group contained a sufficient aggregation of persons from the environmental justice protected class to be considered an "environmental justice sensitive" zone. The threshold is defined by the average of the eight-county MPO region for each relevant socio-economic environmental justice indicator. However, because of the enormous size of the minority population in the Houston metropolitan region, H-GAC normalizes the threshold values by adding one standard deviation from the mean to the calculated regional average. Any census block-group that meets or exceeds the high concentration threshold for the indicator of disadvantage is considered an environmental justice sensitive zone. Environmental justice zones account for less than one-quarter of the physical area of the MPO region (24.3%) but include over half the region's population (53%) and the number of census block-groups identified as having environmental justice concerns (53%). See Table 3.

Table 3: Distribution of Census Block-Groups by Income and Minority Status

Minority Block-Groups	Percent of All Block-Groups	Low-Income Block-Groups	Percent of All Block-Groups	EJ Block-Groups*	Percent of All Block-Groups
1,557	51.9%	510	17.0%	1589	53.0%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.
* Combined minority and low-income census block-groups.

5.4   Secondary Environmental Justice Indicators

Executive Order 13166: *Improving Access to Service for Persons with Limited English Proficiency*, requires federal agencies and recipients of federal funds to provide special accommodations to persons with Limited English Proficiency (LEP). Although EO 13166 was directed at a Title VI review, the LEP disadvantage is found to be concurrent in individuals protected for environmental justice purposes. The limited ability to read, speak, write, or understand English can be a barrier to full participation in regional transportation planning and enjoying the benefits of federal transportation investments. To better serve the needs of the spectrum of the underserved and disadvantaged populations for whom environmental justice may be relevant, H-GAC recognizes additional demographic indicators for its environmental justice analysis. These secondary indicators and their relevance to environmental justice are:

1. Elderly Persons (Seniors) - (Population 65 years and over).
   Generally, mobility challenges and age are often related. The likelihood of a mobility challenge increases as people age. Furthermore, the elderly are less likely to be able to drive themselves with a personal automobile and consequently have to depend on transit services or on other persons to get around. Elderly status could be a clear disadvantage for the minority population, especially where there is poverty.

2. Limited English Proficiency (LEP) - (Individuals 5 years and over whose ability to communicate in the English language is at best, "not well").
    The inability to speak and understand English can be a barrier to accessing transportation services and other related benefits of federal investments. To ensure that linguistic isolation is not a limitation, special attention must be given to this population in the distribution of information regarding participation opportunities and at public events.

3. Carless Households - (Households without an automobile)
    While some people live without a car as a lifestyle choice, there is a population that is truly transit dependent, who out of necessity rely on public transit services for their daily travel needs. Automobile ownership is unattainable for them due to income constraints and/or disability.

4. Female Head of Households - (Households with a female head)
    A household headed by a female is often indicative of a status of poverty. The economic burdens on these households is especially aggravated by the presence of young children.

5. Limited Educational Attainment (LEA) – (Persons 25 years and over with no high school diploma).
    Persons with limited education invariably have limited career choices, and will largely end up with a poverty status. A limited educational attainment may also coincide with a limited ability to communicate effectively in the English language

Table 4 lists the threshold values that are applied for the different indicators of disadvantage within the H-GAC planning region.

Table 4: **Regional Averages and Threshold Values for Environmental Justice Indicators**

Category	Regional Average	Standard Deviation from Regional Average	Threshold of High Concentration
Minority Population	61.54%	N/A*	61.54%
Low-Income Households	16.04%	13.56%	29.60%
Elderly Population	11.07%	7.46%	18.53%
Limited Educational Attainment	20.87%	17.64%	38.51%
Zero Automobile Ownership	6.75%	8.78%	15.53%
Female Head of Households	30.12%	13.89%	44.00%
Limited English Proficiency	10.24%	11.88%	22.11%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.
*Due to a high regional average, standard deviation is not applied to avoid skewing the minority values.

Harris County surpasses the entire Gulf Coast Region and the State of Texas in the proportion of its residents represented in every category of disadvantage except the population of the elderly (Table 5). The median age for Harris County is 32 years, which is second lowest in the region. The relative youthfulness of the County is likely due to the large in-migration of persons of Hispanic/Latino descent to

the Houston metropolitan region. The Hispanic/Latino population is characterized by a high birth rate and a relatively large family size. Other notable environmental justice statistics include the large minority population within Fort-Bend County (47.5%), the large proportion of households in poverty in Waller (18.2%) and Liberty (17.6%) Counties, and the significant proportion of persons with limited education attainment in Liberty County (23.8%), Waller County (21.9%), and Harris County (20.4%).

TABLE 5: Distribution of Environmental Justice Indicators in the Eight-County Region

Region	Minority Population	Low-Income Population	Elderly Population	Limited Education Attainment	Zero Car Households	Female Headed Household	LEP Population
Texas	25.1%	17.3%	11.7%	18.1%	5.8%	14.3%	14.2%
Gulf Coast Region	34.4%	15.7%	9.3%	11.5%	5.4%	14.5%	17.0%
Brazoria County	25.3%	10.5%	10.2%	14.0%	4.2%	11.9%	7.9%
Chambers County	15.9%	10.6%	10.5%	16.9%	2.6%	7.0%	9.6%
Fort Bend County	47.5%	8.2%	8.8%	11.1%	2.3%	12.6%	13.0%
Galveston County	22.1%	13.9%	12.0%	12.5%	6.8%	13.1%	6.4%
Harris County	36.9%	18.0%	8.8%	20.4%	6.1%	15.6%	20.4%
Liberty County	19.2%	17.6%	12.1	23.8%	5.5%	11.6%	6.5%
Montgomery County	13.6%	12.0%	11.5%	13.7%	3.4%	10.7%	8.1%
Waller County	31.0%	18.2%	10.9%	21.9%	5.6%	13.4%	10.5%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Finally, the LEP population within the region (17.0%) is higher than the Texas average (14.2%). By a large margin, residents in the planning region who have limited English proficiency skills are predominantly Spanish speaking (80.5%). This has implications for outreach and public involvement efforts to the community.

The environmental justice zones identified by the primary and secondary socio-economic indicators and threshold metrics are presented in Map 2 through Map 8 following.
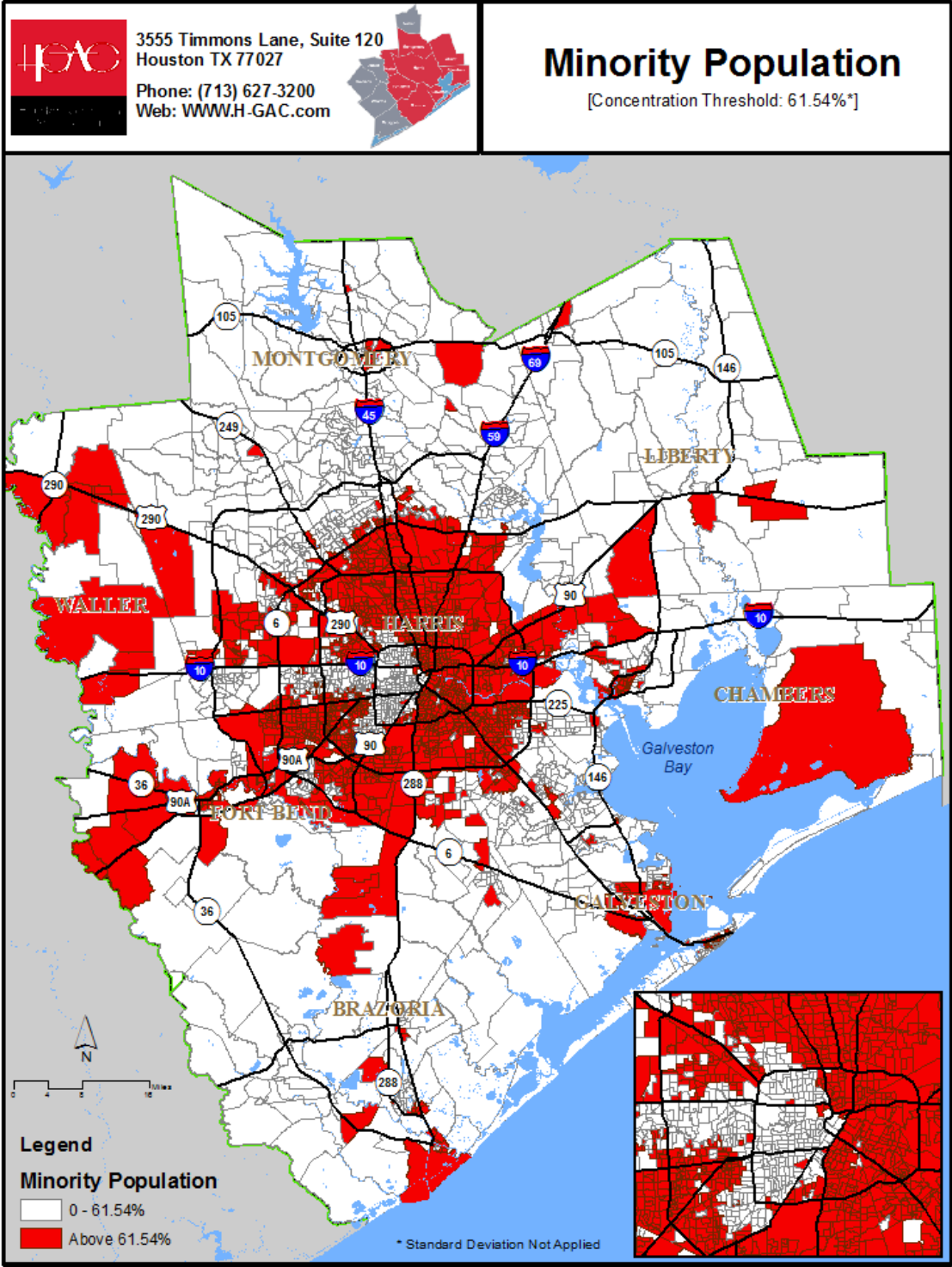
Map 2: High Concentration of Minority Population – By Census Block-Group
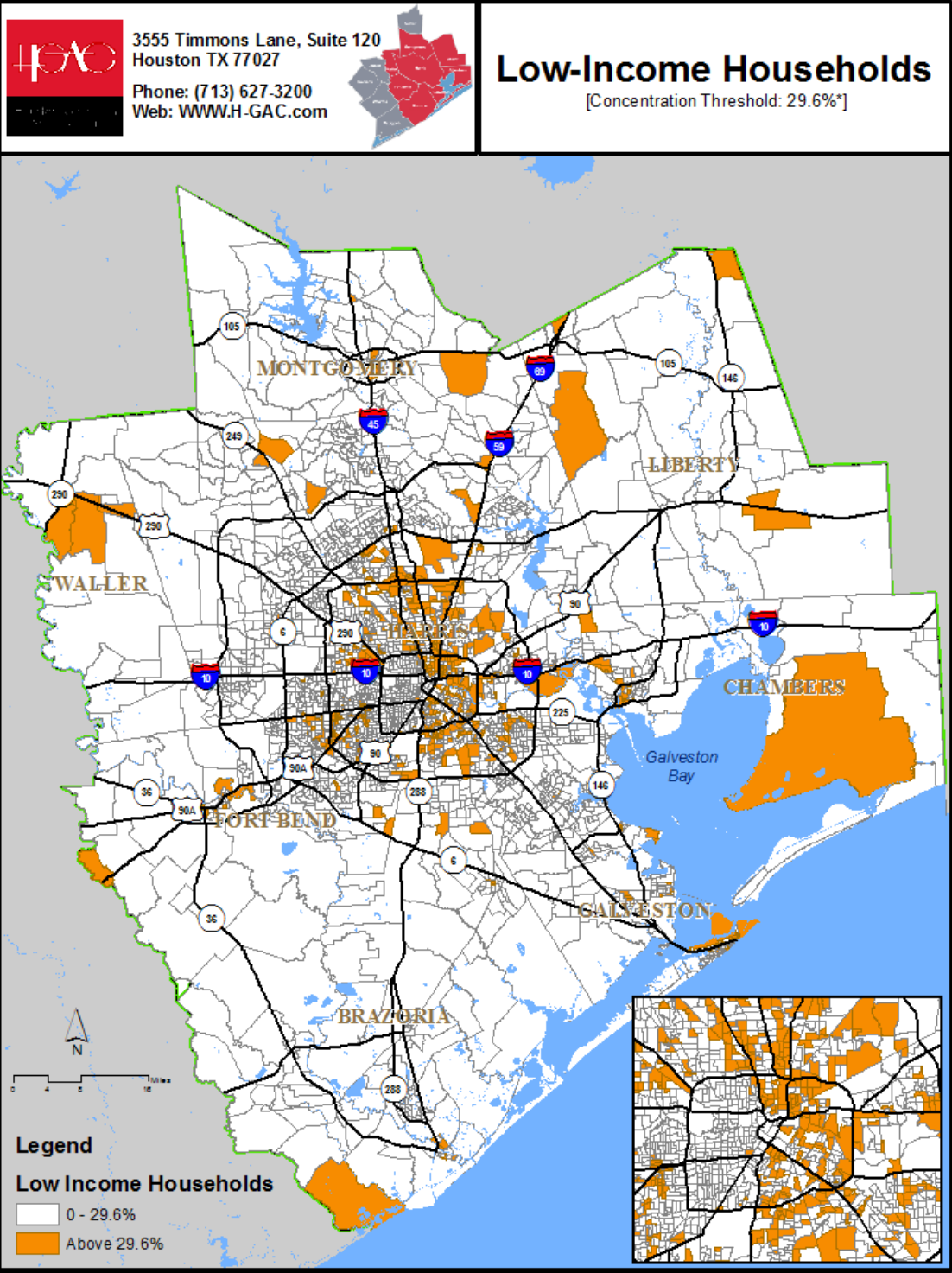
Map 3: High Concentration of Low-Income Households – By Census Block-Group

3555 Timmons Lane, Suite 120
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Senior Population
(65 Years and Over)
[Concentration Threshold: 18.53%]

Legend

Senior Population
- 0 - 18.53%
- Above 18.53%
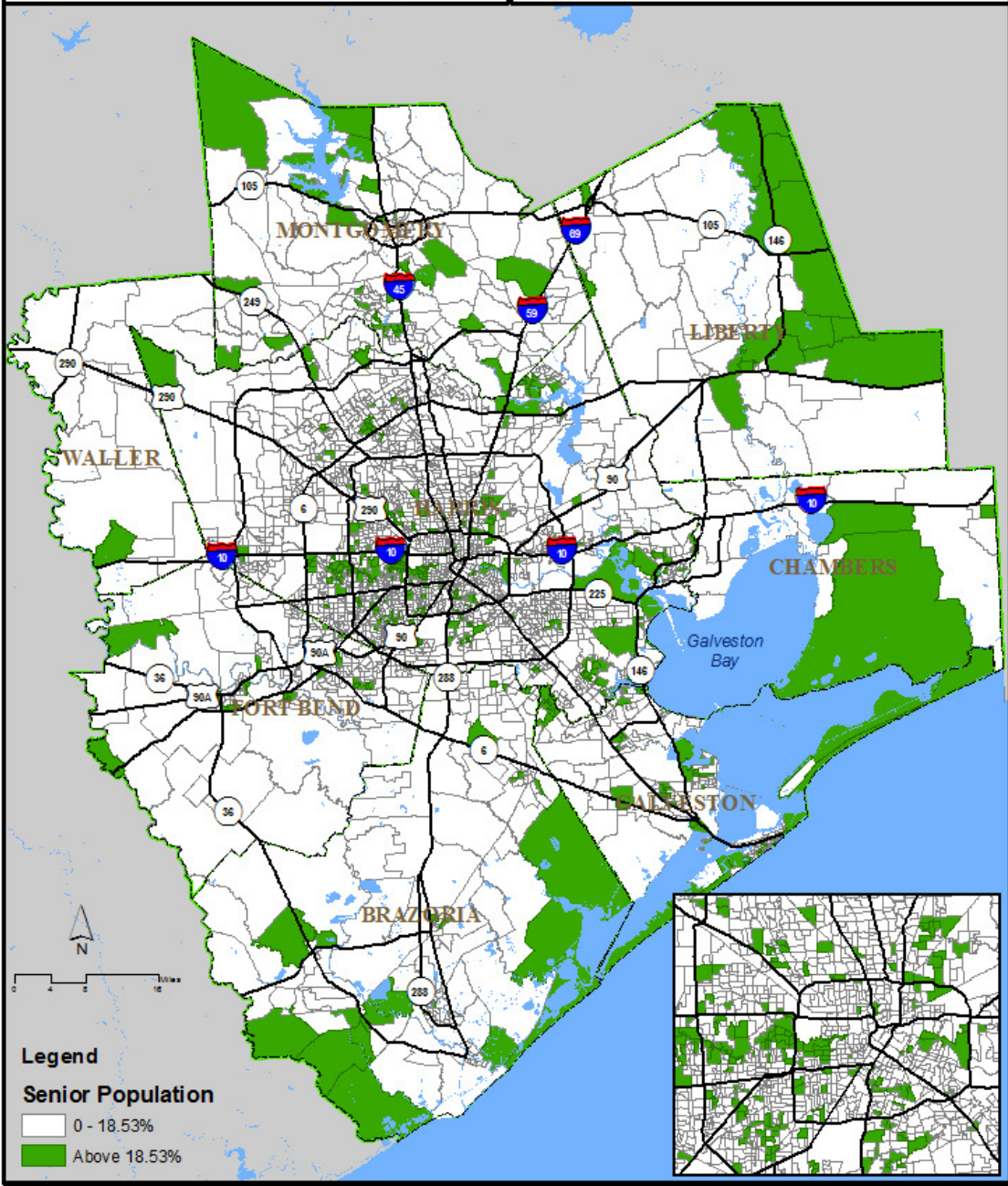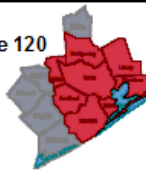
Map 4: High Concentration of Senior Population – By Census Block-Group
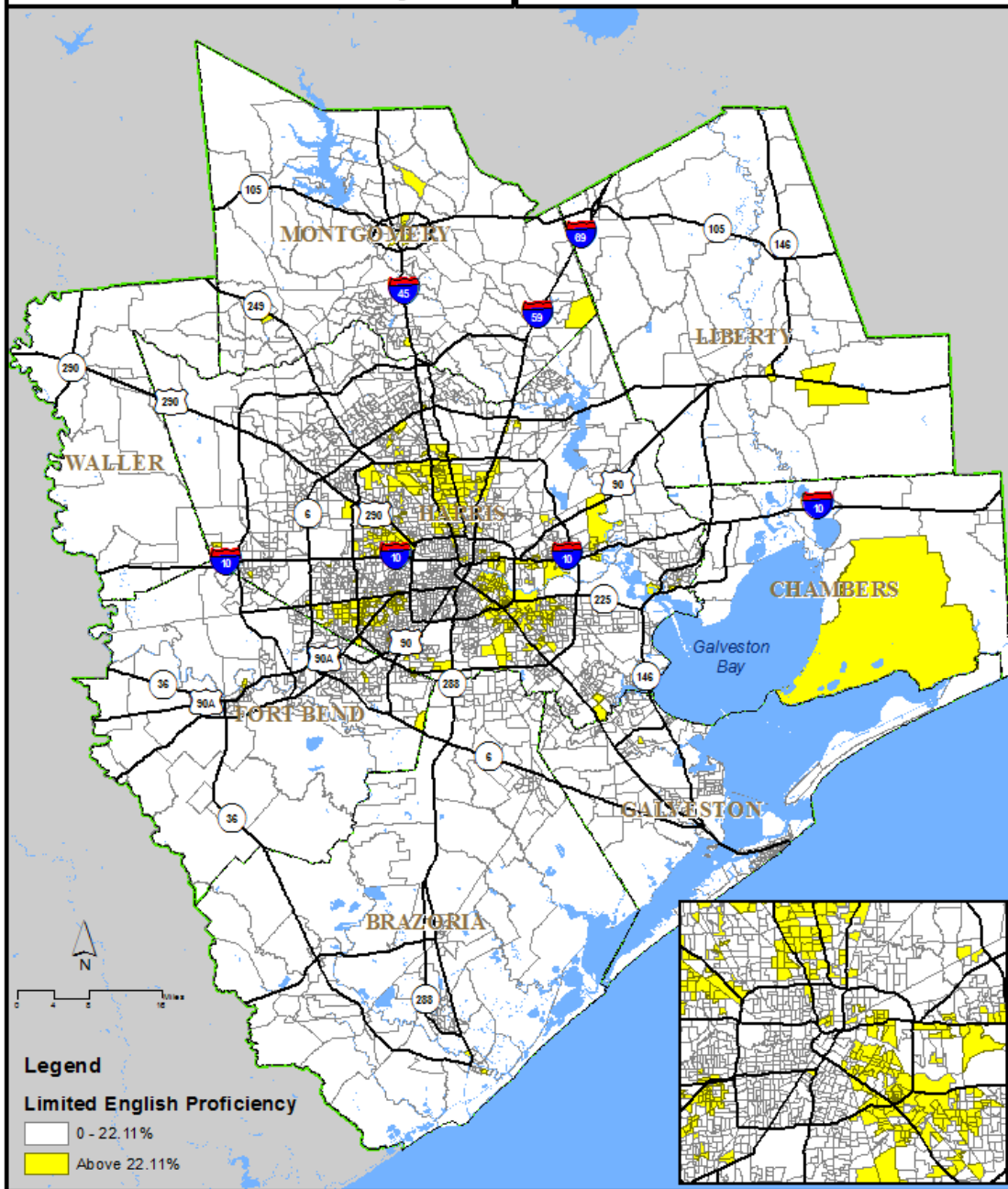
Map 5: High Concentration of LEP Population – By Census Block-Group
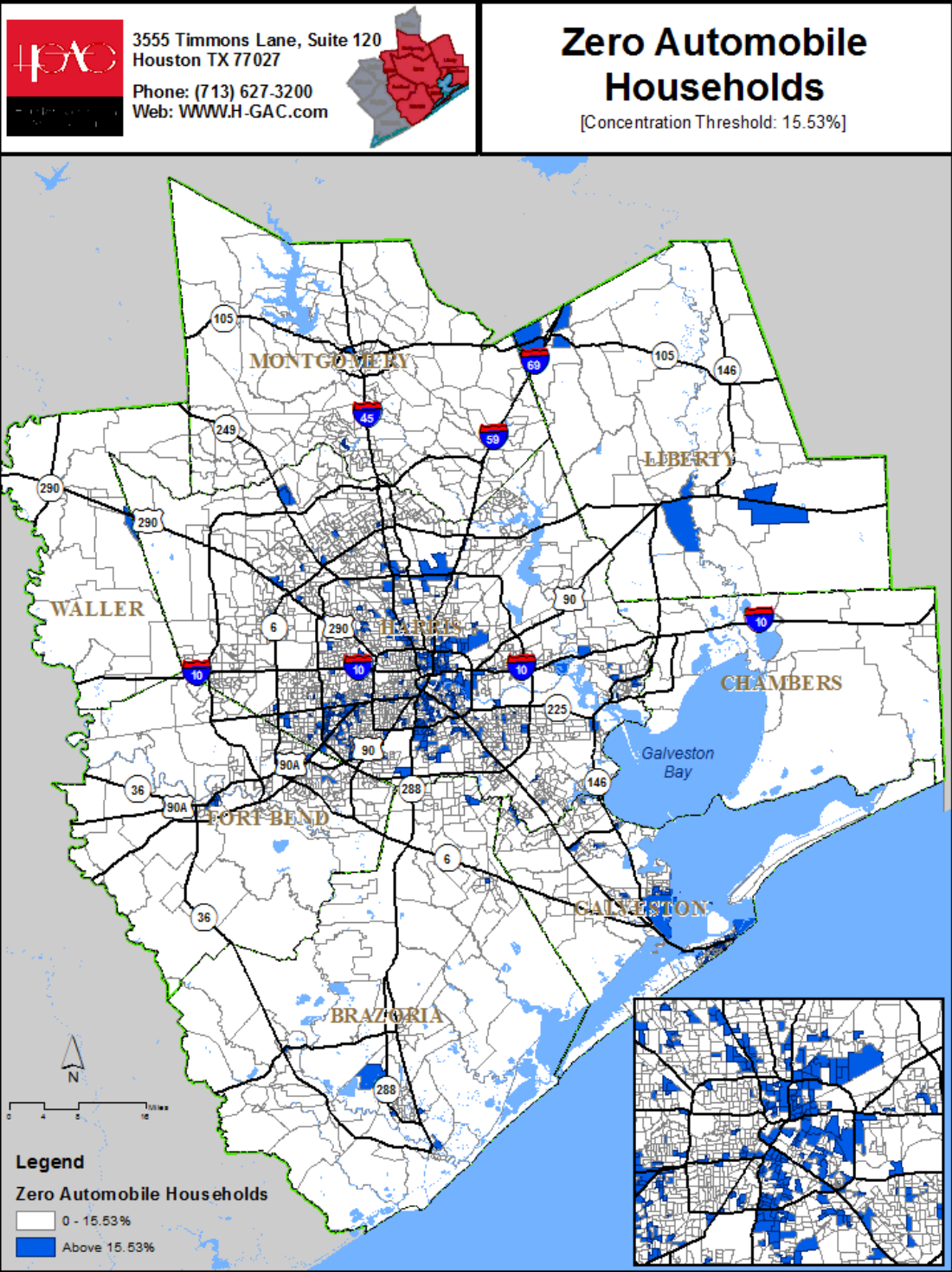
Map 6: High Concentration of Carless Households – By Census Block-Group
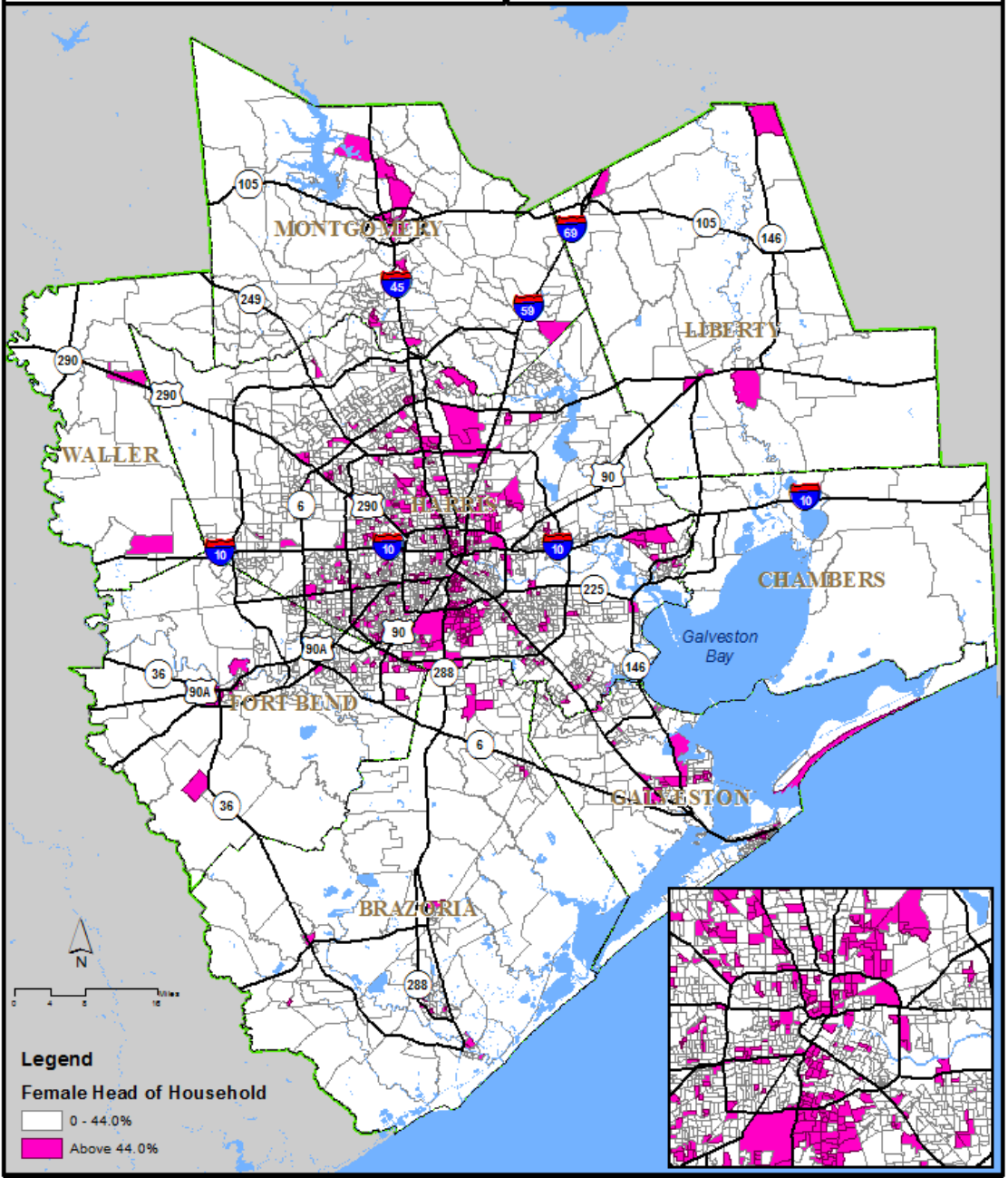
Map 7: High Concentration of Female Headed Households – By Census Block-Group
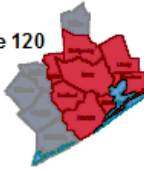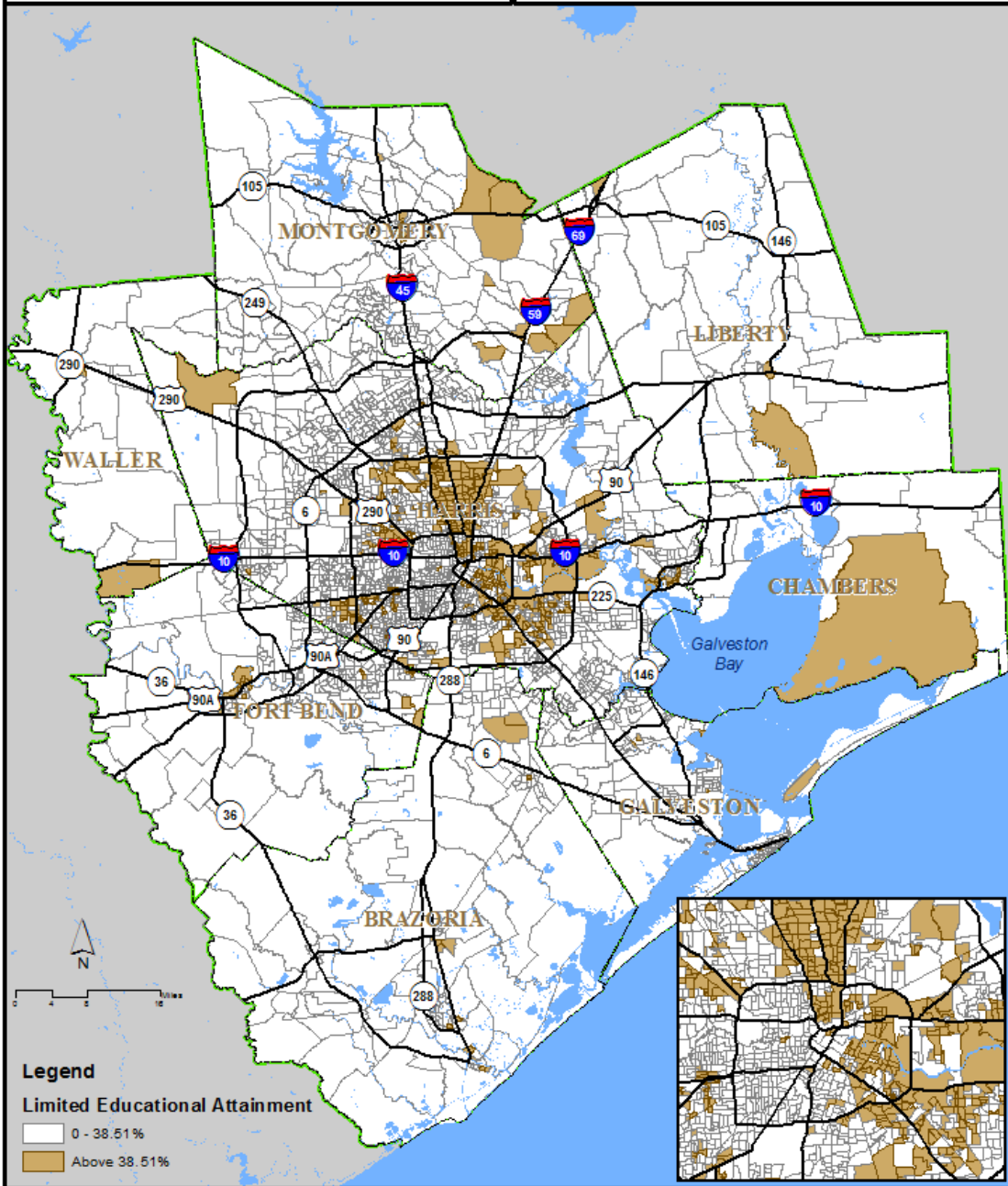
Map 8: High Concentration of LEA Population – By Census Block-Group

5.5   Supplementary Indicators of Disadvantage – Title VI Parameters

Title VI of the Civil Rights Act of 1964 prohibits discrimination on the grounds of race, color, national origin, age, sex, disability, or religion. Under Title VI, no one in the United States may be refused participation or denied the benefits from any public program or activity that receives federal financial assistance. Many local planning organizations consider the disabled community in their environment justice review. Disability in individuals is often coupled with unemployment, poverty, and a dependence on transit services for mobility. There are however several different nomenclatures for disability and variations in the way they are reported. This makes it unfeasible to compare disability statistics based on different surveys. Data on detailed disability variables from the American Community Survey (ACS) is currently only available at the census tract and larger levels of geography. H-GAC includes the disabled population as one of the target populations in its Regionally Coordinated Transportation Planning (RCTP) program. This metric is however not currently applied in the environmental justice analysis.

Map 9 shows the census block-groups in the MPO region where disability within the population is at or above the concentration threshold of 35.18%.[7] Up to 479 (16%) of the 3001 census block-groups in the MPO have a concentration of disabled residents. These census block-groups coincide with 313 (19.7%) of the block-groups identified as environmental justice sensitive, and over one-quarter (28.7%) of the EJ block-groups with high disadvantage. Like the map for the elderly population, concentrations of disabled persons are found in large numbers in the rural White-majority counties.

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[7] Calculated as the regional average plus one standard deviation added.

3555 Timmons Lane, Suite 120
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Phone: (713) 627-3200
Web: WWW.H-GAC.com
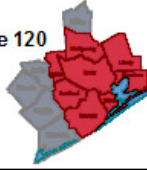
Disabled Population
[Concentration Threshold: 35.28%]

Legend
Disabled Population
- 0 - 35.28%
- Over 35.28%
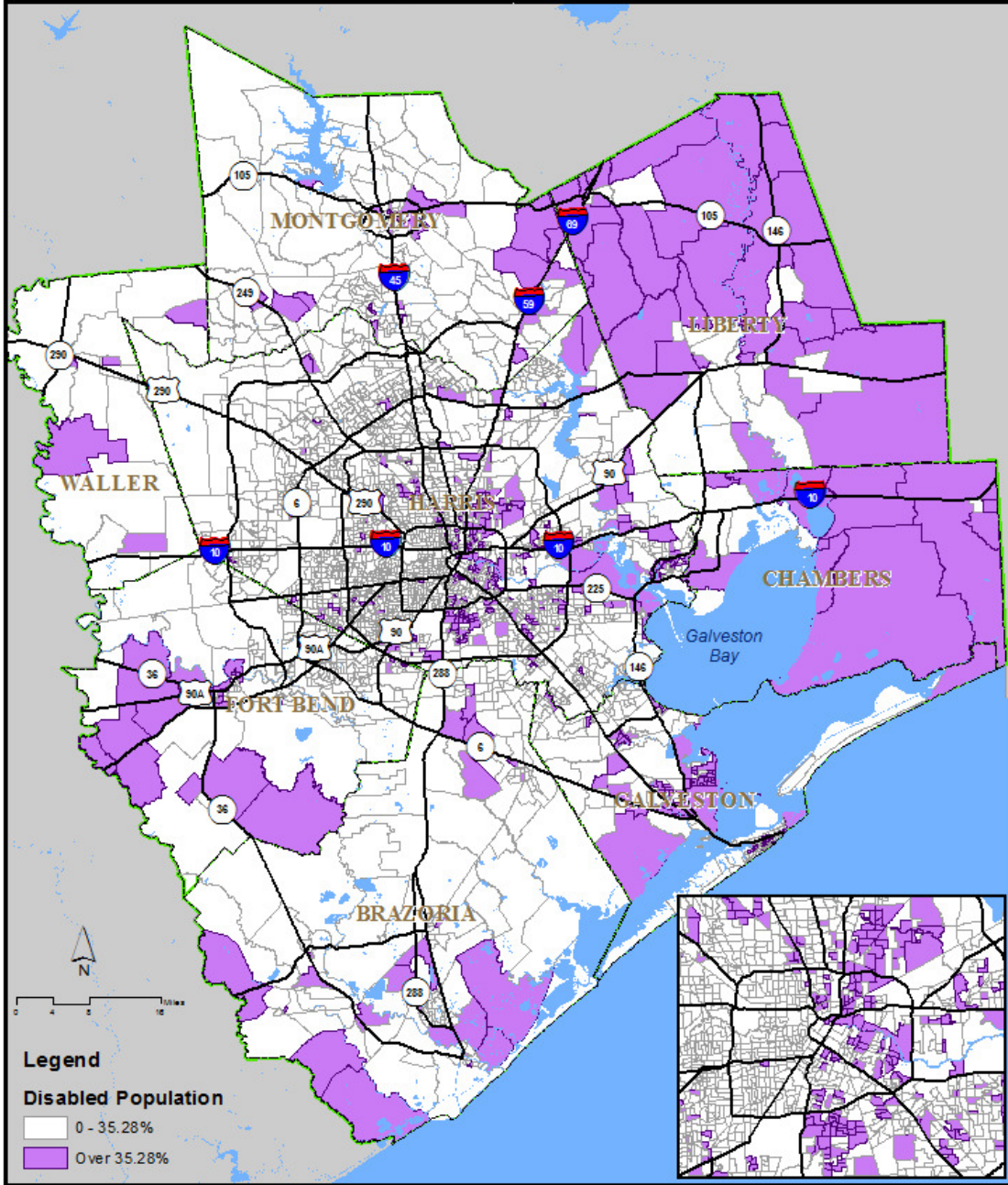
Map 9. High Concentration of Households with Disabled Persons – By Census Block-Group

5.6   Alternate Environmental Justice Determinations

The Federal Transit Authority (FTA) Circular 4703.1 issued on August 15, 2012 urges that environmental justice determinations should focus on all EJ potential effects notwithstanding the size of the population impacted, and advises that care be taken in the delineation of EJ boundaries to avoid overlooking an enclave of protected persons who may not reach the threshold value. The risk of overlooking a small group of environmental justice populations is probably most significant for an analysis performed at the project level. One size does not fit all in environmental justice analysis. A growing practice is the use of multiple threshold values, (including no threshold), to accommodate different project needs. H-GAC acknowledges this fact and as circumstances dictate will apply a no-threshold standard to identify small pockets of geographically dispersed and/or transient persons among the minority and low-income populations, who would be similarly affected by proposed FHWA or DOT programs.

5.7   Concentrations of Disadvantage

While minority and low-income status remain the primary markers of disadvantage for environmental justice considerations, the existence of multiple overlapping factors of disadvantage in a community may signal a greater degree of vulnerability for that community. A "concentration of disadvantage" exists in a census block-group where one or more of the secondary indicators of disadvantage listed above occur - *in addition* to minority and/or low-income status. The greater the number of socio-economic indicators of disadvantage attributed to a census block-group, the higher the concentration of disadvantage in that community.

While every environmental justice population is a community of concern, H-GAC recognizes those communities where the residents have a concentration of four or more indicators of economic, physical, or social hardship as communities of "high disadvantage" (Map 10). Arguably, a community with multiple factors of hardship will be less resilient in the face of adverse conditions that may potentially accompany planning and development activities. A greater level of environmental justice scrutiny and support may be needed to achieve equity for that population. Even though they are separate and individually significant environmental justice indicators, poverty and minority status coincide, the greater the concentration of disadvantage in a community. Of the 1589 census block-groups within the MPO that are identified as environmental justice sensitive zones, 366 or 23% of these zones are characterized as zones of high disadvantage.

Table 6 provides a statistical breakdown of the number of census block-groups with concentration of disadvantages, listed by minority and low-income status

Table 6: Concentrations of Disadvantage by Low-Income and Minority Status

Number of Indicators	Percent of All Block-Groups	Minority Block-Groups	Percent of EJ Block-Groups	Low-Income Block-Groups	Percent of EJ Block-Groups
0	47.1%	0	0.0%	0	0.0%
1	17.4%	513	32.3%	10	0.6%
2	11.7%	338	21.3%	46	2.9%
3	11.6%	342	21.5%	121	7.6%
4	7.8%	232	14.6%	205	12.9%
5	3.7%	111	7.0%	107	6.7%
6	0.7%	20	1.3%	20	1.3%
7	0.03%	1	0.1%	1	0.1%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

5.8 Applying the Pearson Correlation Coefficient

Correlation analysis is a statistical technique for investigating the relationship between two continuous quantitative variables, and indicates the probability of one condition occurring, given that the other condition is present. A Pearson's Correlation Coefficient (r) measures the strength and direction of the relationship that exists between these two sets of variables, and can range in a continuum between the values of -1 and +1. An "r" value of zero indicates that there is no relationship between the sets of variables. A negative "r" value indicates that an inverse relationship exists between the variables. This means the presence of one variable indicates that the other variable is unlikely to be present. An "r" value of 5 implies that only a moderate relationship exists, while an "r" value that tends toward the number +1 or -1 signifies a strong direct or a strong indirect relationship between the two variable sets respectively.

5.8.1 Pearson Correlation between Indicators of Disadvantage

A correlation matrix was drawn for all the indicators of disadvantage that H-GAC uses in its environmental justice analysis, to understand the strength of the relationships and the dynamics that exist between these different factors that define the underserved and disadvantaged communities (Table 7). The correlation matrix reveals several informative facts:

- With the population of the entire H-GAC MPO as the universe, there is a positive but only a moderate association between minority status and being low-income (r = O.5377). This suggests that a significant proportion of the demographic class of minorities are not in poverty and therefore the instinct to equate minority status with poverty is not universally true.
- A strong and direct relationship exists between minority status and being LEP (r = 0.7519). This statistical association is to be expected especially because of the large numbers of persons in the immigrant communities who do not speak English as their "home" language.
- There is a tendency that a female head of household would be a member of a racial or ethnic minority groups (r = 0.6369). This speaks to a difference in cultural expectations where it is socially acceptable to be a single mother within certain communities but disapproved in others.
- A very strong and direct relationship exists between individuals with LEP status and persons who have achieved only a limited level of education attainment (LEA) (r = 0.8333). This relationship

is intuitive because the inability to communicate effectively in the English language would also be a barrier to obtaining academic qualifications through the English-based educational system of the United States.

- A significant and direct association exists between low-income status and households without an automobile (r = 0.6320). This relationship is again intuitive because households with income deficits will probably not be able to afford personal automobile.
- There is no significant correlation between senior status and any of the other indicators of disadvantage (r value range = 0.0593 to 0.4340). An individual may be 65 or older yet not have any other limiting conditions. However, senior status concurrent with other socio-economic challenges is typically opportunity limiting. The lack of a significant positive correlation within the universe of the MPO population between senior status and other indicators of disadvantage led to the decision to apply this and other secondary factors of disadvantage only where they occurred concurrent with minority or low-income status – to prevent an expansive environmental justice delineation.

Table 7: Correlation Matrix of Indicators of Disadvantage for all EJ Zones

	Minority	Low-Income	Elderly	LEA	Zero Automobile	Female HH	LEP
Minority	-	0.5377	0.3702	0.6559	0.2496	0.6369	0.7519
Low-Income	0.5377	-	0.0687	0.5975	0.6320	0.5555	0.5720
Senior	0.3702	0.0687	-	0.1039	0.0593	0.4340	0.1322
LEA	0.6559	0.5975	0.1039	-	0.2846	0.2934	0.8333
Zero Automobile	0.2496	0.6320	0.0593	0.2846	-	0.4431	0.2526
Female HH	0.6369	0.5555	0.4340	0.2934	0.4431	-	0.3479
LEP	0.7519	0.5720	0.1322	0.8333	0.2526	0.3479	-

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

5.8.2 Correlation Matrix for EJ Zones with High Disadvantage

A similar correlation analysis was performed specifically for those environmental justice zones that demonstrate conditions of high disadvantage. The purpose was not only to understand the strength of the relationships and the dynamics that exist between these different factors that define the underserved and disadvantaged communities, as in the previous exercise, but also to demonstrate the unique internal cohesiveness that authenticates the argument that this segment of the population as particularly vulnerable (Table 8).

An important observation from this analysis is that most of the significant associations identified between the indicators of disadvantage for the general population remain true for the EJ zones of high disadvantage. In certain cases, the correlation values indicate an even stronger relationship than was observed for the general population. This result is to be expected for the population which purportedly

has the greatest concentration of socio-economic disadvantage in the region. The EJ correlation matrix reveals several informative facts:

- For the most disadvantaged members of the society there is a high and positive correlation between race\ethnicity and poverty (r = 0.7746). This value was much lower in the analysis for the general population of the MPO. The high "r" observed here accurately demonstrates that a direct relationship exists between these two variables within the universe of the most underprivileged.
- Minority status correlates high with LEP status (r = 0.7596) as well as LEA status (r = 0.7954). Both results indicate a stronger relationship between these variables for the most disadvantaged than was observed for the general population. While minority status may intuitively be associated with LEP status because of the immigrant population, LEA status is not limited by race or ethnicity. However, among the minority population with the greatest concentration of disadvantage, there is also a high occurrence of a limited educational achievement.
- The correlation between the households headed by a female and their minority status (r = 0.5803) remains moderately significant but is reduced from what was observed for the general population (r = 0.6369). On the other hand, within the population with the greatest disadvantage, a strong association exists between the female headed household and poverty (r = 0.7324), and between the female headed household and the households without an automobile (0.6638). Both observations show increased "r" values over the analysis for the general population.
- As in the analysis for the general population, there is no significant correlation between elder status and any of the other indicators of disadvantage (r value range = -0.0897 – 0.3836) even though low-income status (r = 0.2148) and zero automobile status (r = 0.3294) showed marked increases. The relationship between elderly status and LEP status within the population of the most disadvantaged flipped to a negative (though insignificant) correlation value (- 0.0897), indicating a tendency towards an inverse relationship between the two variables.

Table 8: Correlation Matrix of EJ Indicators for Highly Disadvantaged Zones

	Minority	Low-Income	Elderly	LEA	Zero Automobile	Female HH	LEP
Minority	-	0.7746	0.1655	0.7954	0.4087	0.5803	0.7596
Low-Income	0.7746	-	0.2148	0.5571	0.6883	0.7324	0.5086
Elderly	0.1655	0.2148	-	0.1115	0.3294	0.3836	-0.0897
LEA	0.7954	0.5571	0.1115	-	0.2125	0.2467	0.8655
Zero Automobile	0.4087	0.6883	0.3294	0.2125	-	0.6638	0.1026
Female HH	0.5803	0.7324	0.3836	0.2467	0.6638	-	0.1219
LEP	0.7596	0.5086	-0.0897	0.8655	0.1026	0.1219	-

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

5.9 Leading Local Environmental Justice Indicators

An examination of the most common clusters of socio-economic indicators of disadvantage for those EJ zones with a high concentration of disadvantage may help to better understand the disadvantaged neighborhoods and may inform actions to address the special needs present within these communities and to more accurately evaluate the nature and extent of the potential impact of federal actions.

Only one EJ census block-group has a high concentration with all 7 indicators of disadvantage (Table 9). The block-group is in southeast Houston, close to the Hobby Airport. The population within this census block-group is 82% Hispanic and 9% White. Seniors, 65 years and over, make up 19% of the population while persons of working age, 18 – 64 years, are 53% of the population. Unemployment within the census block-group is very high at 19% of the civilian labor force.

Twenty EJ census block-groups have a concentration of 6 indicators of disadvantage. The most common combination of indicators in this category which is shared by 16 (or 80%) of the 20 block-groups are **minority status, low-income, LEA, zero automobiles in the household, a female household head, and LEP status**. Missing from this list is elder status which, as noted earlier does not bear a strong correlation with any of the other indicators of disadvantage. The EJ zones with this combination of indicators are dispersed around the metropolitan region although most occur inside the Beltway. The population in the 16 block-groups is 66% Hispanic and 24% black. The population is also youthful. As high as 34% are under 18 years while 59% is between 18 – 64. Only 7% of the population is 65 years or older. However, 9% of the civilian labor force are unemployed.

For the EJ census block-groups with a concentration of 5 indicators of disadvantage, the most common combination of socio-economic indicators is **minority status, low-income, LEA, zero automobiles in the household, and LEP status**. A geographic distribution pattern starts to emerge revealing concentrations of disadvantaged neighborhoods with the same indicator cluster in southwest Houston, the east and southeast, and the near-northside. The population within these zones is 80% Hispanic and 10% Black, and is generally youthful with 35% under age 18, and 61% between 18 – 64. Only 5% of the population is 65 years or older. However, the unemployment rate in these zones is high at 10%.

The cluster of indicators of high disadvantage most common in zones with 4 indicators of disadvantage are **minority status, low-income, LEA, and LEP status**. As many as 95 EJ zones share this specific combination of factors. Geographically, they create noticeable clusters in southwest, the east and southeast, and the northside and north-west sectors of the City of Houston. The population within this these disadvantaged areas is 83% Hispanic and 8% White. Unemployment in these zones is high at 9%.

To summarize, the neighborhoods with the greatest concentration of disadvantage are Hispanic majority and generally employment challenged. The factors of disadvantage common to every one of them are minority status, low-income, limited education achievement, and a limited proficiency in the English language. Added to these four factors, zero automobile and female headed households make up the most common environmental justice exacerbating conditions for the highly disadvantaged areas in the planning region. Given the current population dynamics in the upper Gulf Coast region which is

characterized by the rapid growth of the Hispanic population particularly through in-migration, the number of the EJ zones with high disadvantage within the planning region can be expected to increase.

Table 9: Leading EJ Indicators in Zones with High Disadvantage

Conc. of Disadvantage	Most Common Clusters of Environmental Justice Indicators	Block-Groups with Conc.	Percentage of Group
7	Minority, Low-Income, Seniors, LEA, Zero Auto, Female HH, LEP	1	100%
6	Minority, Low-Income, LEA, Zero Auto, Female HH, LEP	16	80%
5	Minority, Low-Income, LEA, Zero Auto, LEP	59	53%
	Minority, Low-Income, LEA, Zero Auto, Female HH	17	15%
	Minority, Low-Income, LEA, Female HH, LEP	11	10%
4	Minority, Low-Income, LEA, LEP	95	41%
	Minority, Low-Income, Zero Auto, Female HH	56	24%
	Minority, LEA, Female HH, LEP	15	6.4%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Table 10 is derived from the H-GAC travel forecast model and indicates the current size and projected growth in the number of households in the planning region. The forecast estimates suggest a continued growth of all the indicators of disadvantage on which the environmental justice program is based.

Table 10: Households in Different Environmental Justice Categories (2017 and 2040)

	Number of Households 2017	Number of Households 2040	Percent Change
Non-EJ Population	1,112,584	1,880,000	69%
EJ Population	1,341,612	1,940,598	45%
EJ Population with High Disadvantage	1,171,750	1,662,655	42%
Minority	1,162,874	1,662,655	43%
Low-Income	364,406	477,965	31%
LEA	337,642	427,388	27%
LEP	315,613	416,201	32%
Zero Automobile	272,360	360,741	32%
Female Householder	326,408	443,662	36%
Seniors	92,818	120,328	30%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates
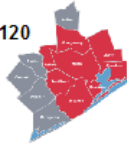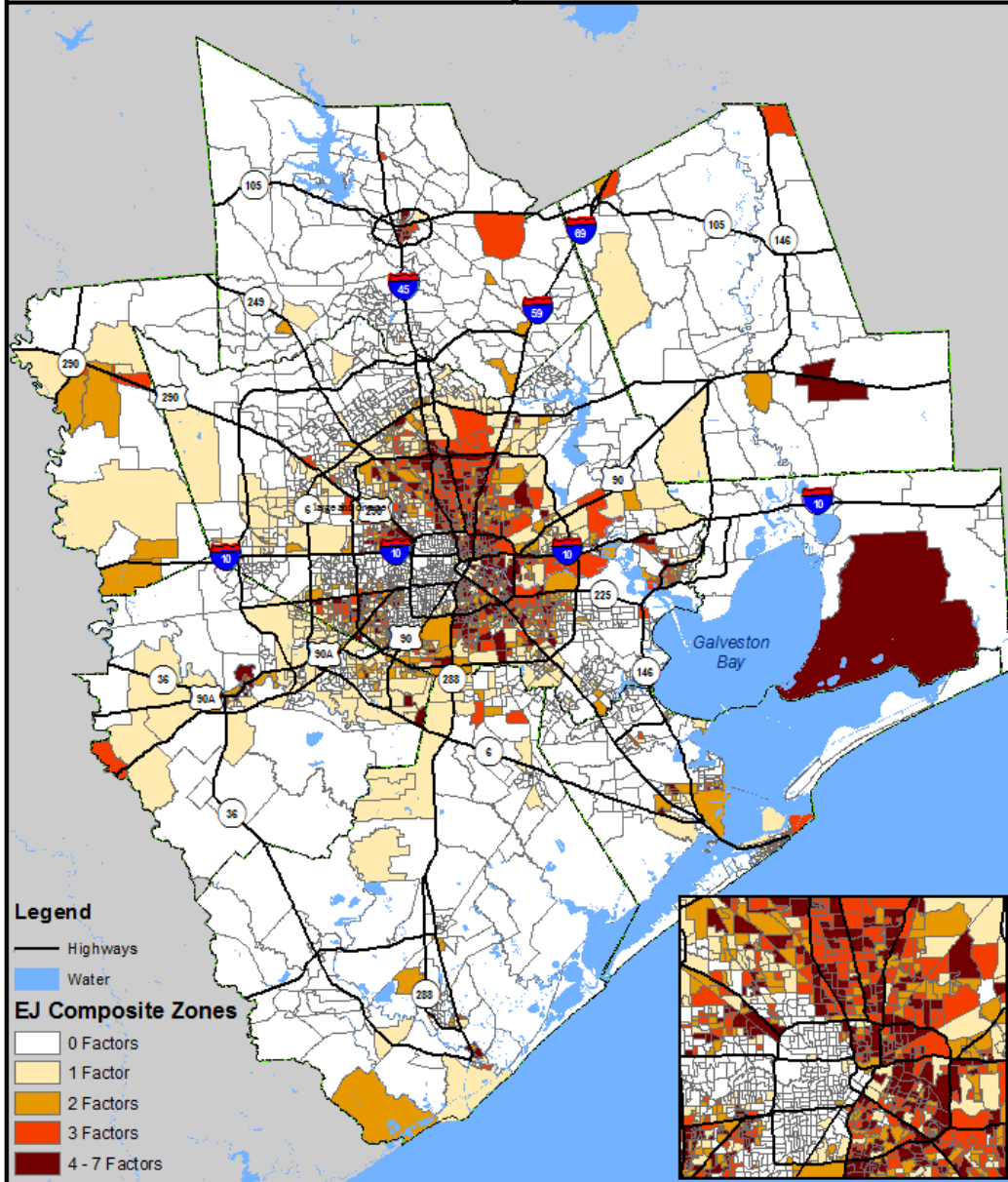
Map 10: Environmental Justice Zones with Concentrations of Disadvantage

6.0   DEMOGRAPHIC CHARACTERIZATION OF THE EJ POPULATION

A fair knowledge of the nature and characteristics of the protected population and their environment will help in understanding the immediate community needs, their vulnerability to adverse impacts from development actions, and the appropriate and effective approaches to avoid, minimize, or mitigate any potential adverse impacts which proposed transportation projects may have on their communities.

6.1   Racial and Ethnic Distribution

Maps of the distribution of racial/ethnic communities in the environmental justice areas are provided below. These maps are based on demographic statistics provided by the 2011 – 2015 U.S. ACS 5-Year Estimates and broadly show the location of concentrations of racial/ethnic minority communities within and around the Houston Metropolitan area. Many of these concentrated centers correspond with the traditionally recognized racial/ethnic communities and officially designated "super neighborhoods." The maps show the population density of the main minority populations groups, normalized by a logarithmic scale which allows for a direct comparison between the individual maps. An important finding from the race and ethnic concentration maps is that while the White majority population can be traced to distinct segregated communities, some of the minority dominant communities are blended in such a way that it is difficult to assign a specific characteristic to the composite ethnic\racial structure. This is especially so with the influx of the Hispanic immigrants into the region.

6.2   Black Communities

Neighborhoods with a high concentration of African American residents are located concentrically around the urban core of the Houston metropolitan region, reaching as far out as Highway 6 (Map 11). Distinct neighborhoods with a high concentration of black residents include the Greater Third Ward – Macgregor – South Park – Sunnyside zone to the south; the Westchase – Westwood – Sharpstown – Alief zone to the southwest; and the Independence Heights – Acres Home – Greater Fifth Ward – Kashmere Gardens – Denver Harbor – Settegast zone to the north.

6.3   Hispanic Communities

Like the black community, the Hispanic residents are spread all around the central core of the Houston metropolitan area, excluding the wedge to the west that includes Inner West Loop, the River Oaks-Greater Memorial-Katy corridor (Map 12). Distinct neighborhoods with a heavy concentration of Hispanic residents include Greater Eastwood-Lawndale-Wayside; Gulfton-Sharpstown-Alief; and Northside Village. Individuals of Hispanic origin make up the majority in many of the inner-city neighborhoods and reside in large numbers alongside other minority populations.

6.4   Asian Communities

The Asian community is more distinctly segregated than other racial groups and make their residence mainly in the west side of the Houston Metropolitan region - between the West Loop and SH 6 (Map 13). The Asian community has a significant presence in Southwest Houston, particularly in the

Alief-Sharpstown-Westchase super neighborhoods, a locale popularly known as "Chinatown." This Asian community includes a mix of individuals of Chinese, Vietnamese, and Korean national origin.
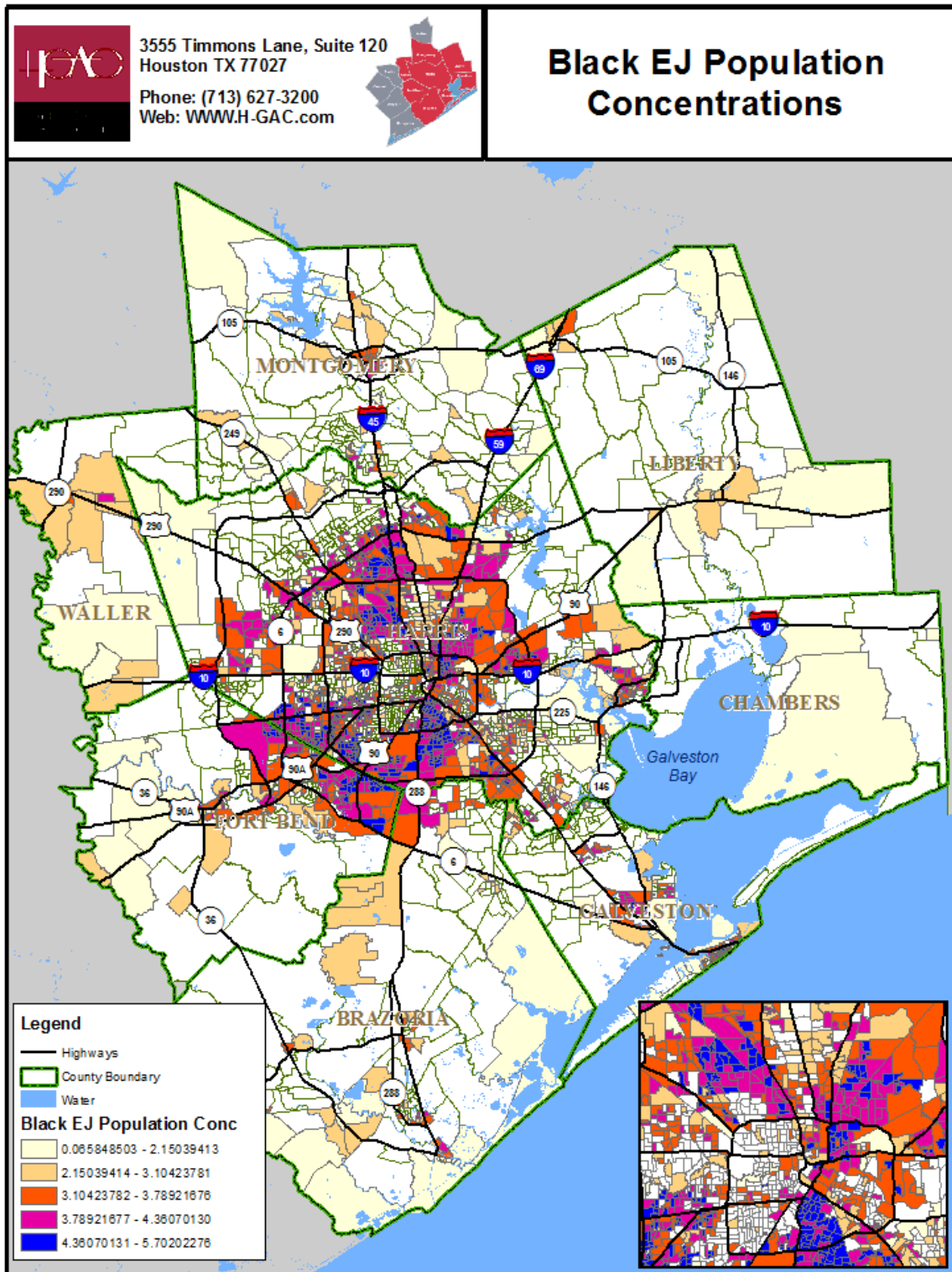
Map 11: Concentrations of Black Population – By Census Block-Group
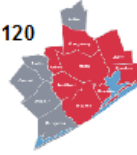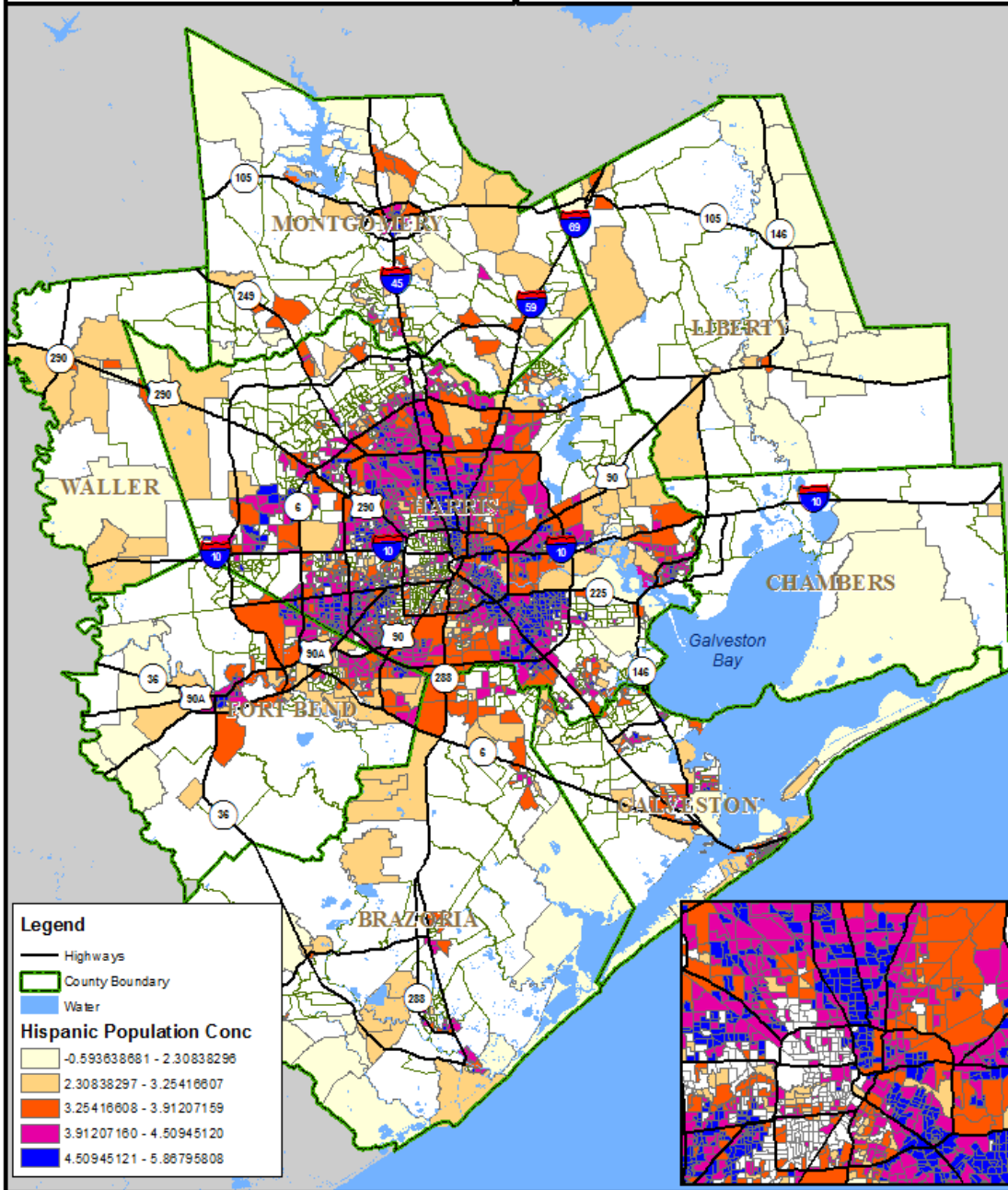
Map 12: Concentrations of Hispanic Population – By Census Block-Group
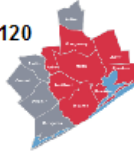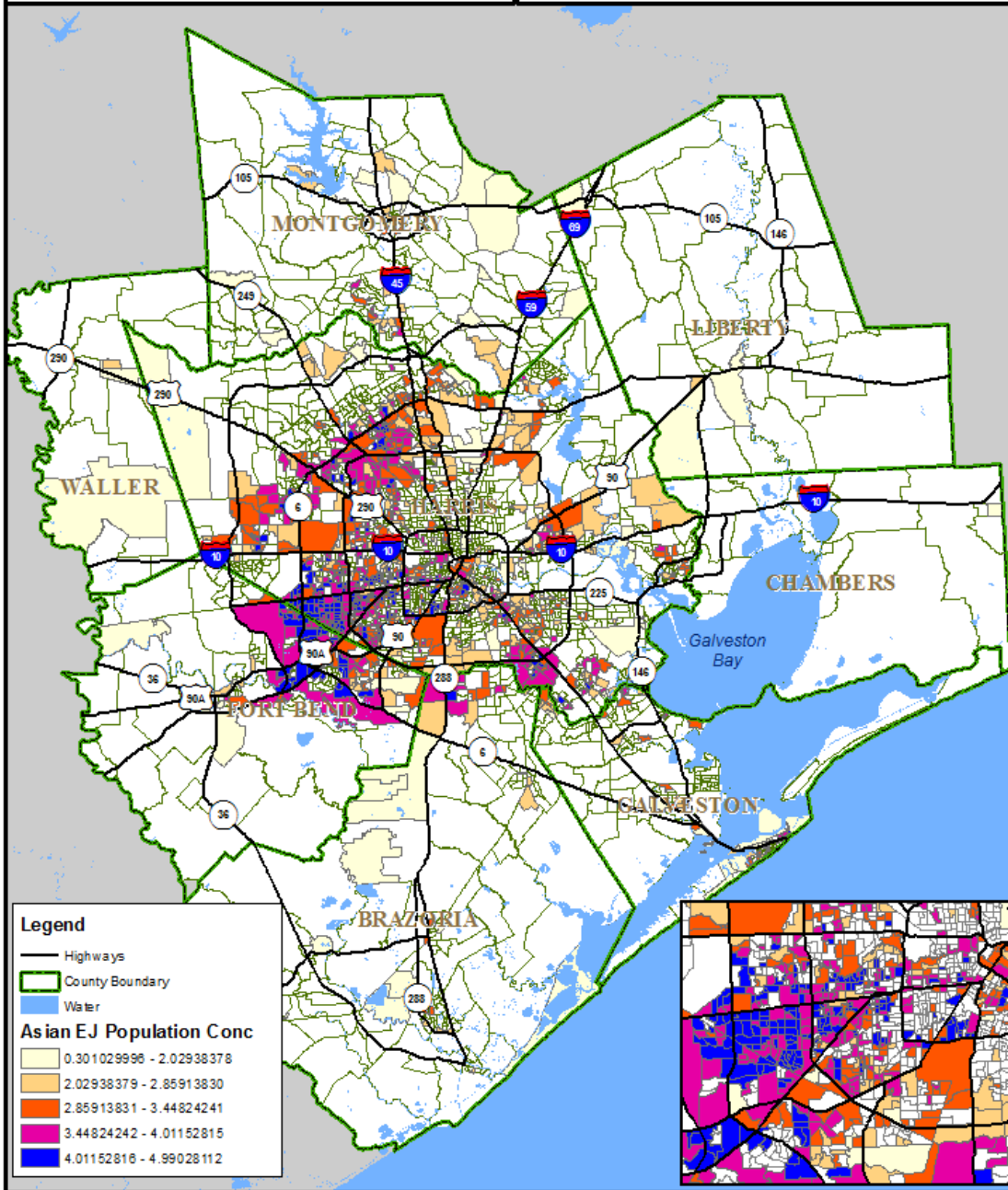
Map 13: Concentrations of Asian Population – By Census Block-Group
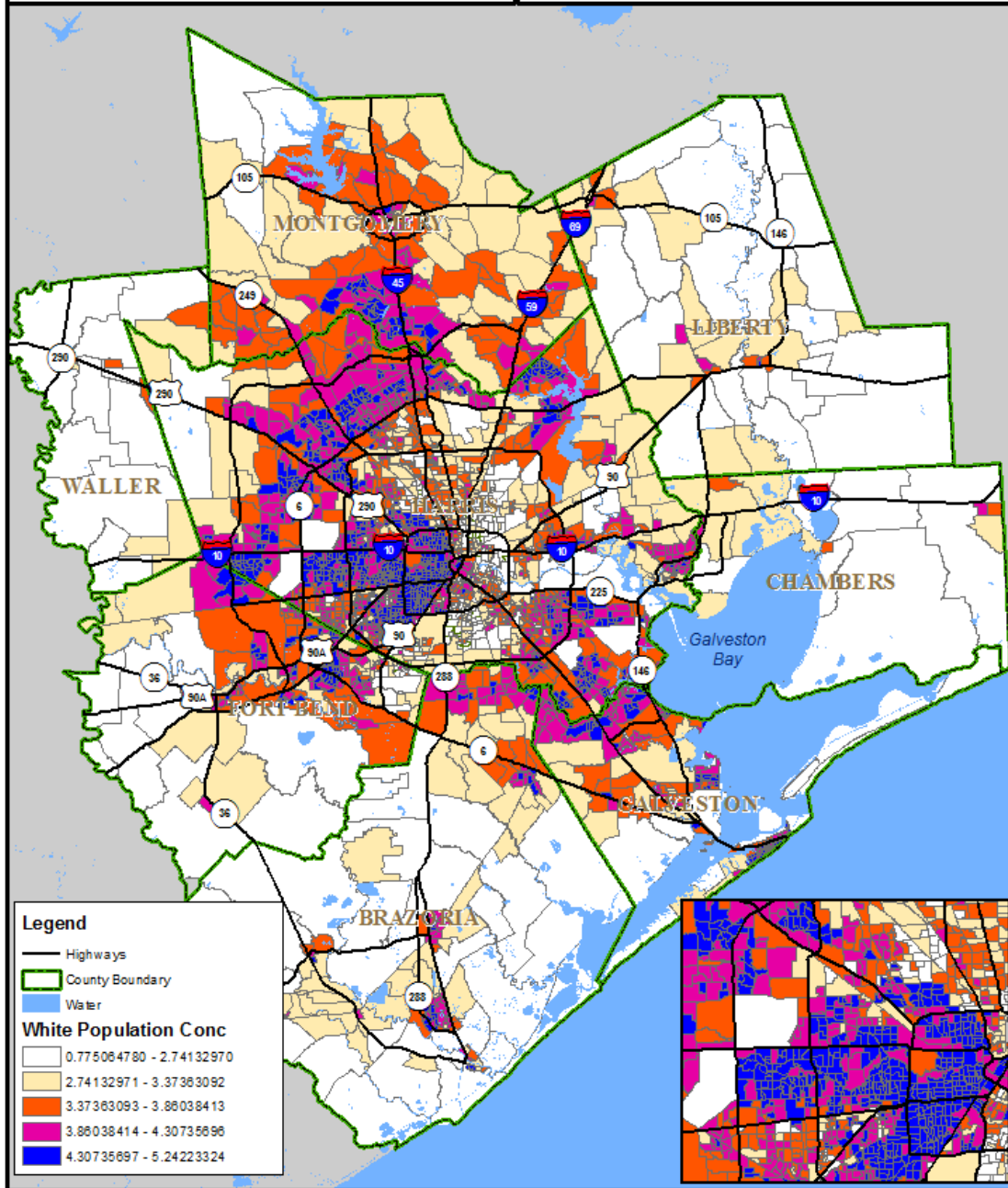
Map 14. Concentrations of White Population – By Census Block-Group

The data on the location of concentrations of minority populations indicate that there is a level of blending of the minority communities in certain parts of the region, especially within the Northside Super Neighborhood (which has a significant concentration of both Black and Hispanic residents), and the Alief Super Neighborhood (which has a high concentration of both Black and Asian residents). There is however comparatively little similar blending of large populations of minority residents in the many communities with a high concentration of the White population (Map 14).

6.5   White Poverty

A consideration of environmental justice tends to focus on the protected population within the racial and ethnic minority populace probably because they are the most numerous and the most visible. Executive Order 12898 defines the protected population for environmental justice oversight as the minority populations and low-income populations. Often overlooked is the category of White poverty.

The H-GAC environmental justice map of White poverty is a subset of the concentration of White residence, filtered by a poverty rate that is at or above the environmental justice threshold (Map 15). In other words, the map shows every block-group defined as environmental justice sensitive based on the low incomes of the residents and classified by the intensity of White presence. The resulting picture is a non-cohesive pattern with the highest concentrations scattered in little enclaves in the West and Southwest parts of the metropolitan region - outside the urban core. Slightly over 10% of the population in the planning region protected for environmental justice based on their poverty is White.

Geographically, pockets of poverty in the White community are embedded in neighborhoods within the City of Houston that are predominantly ethnic minority communities. There is also a substantial presence of White poverty on the island of Galveston, in Texas City, Pasadena, Conroe, and the Cities of Richmond and Rosenberg.
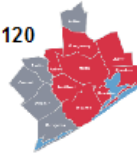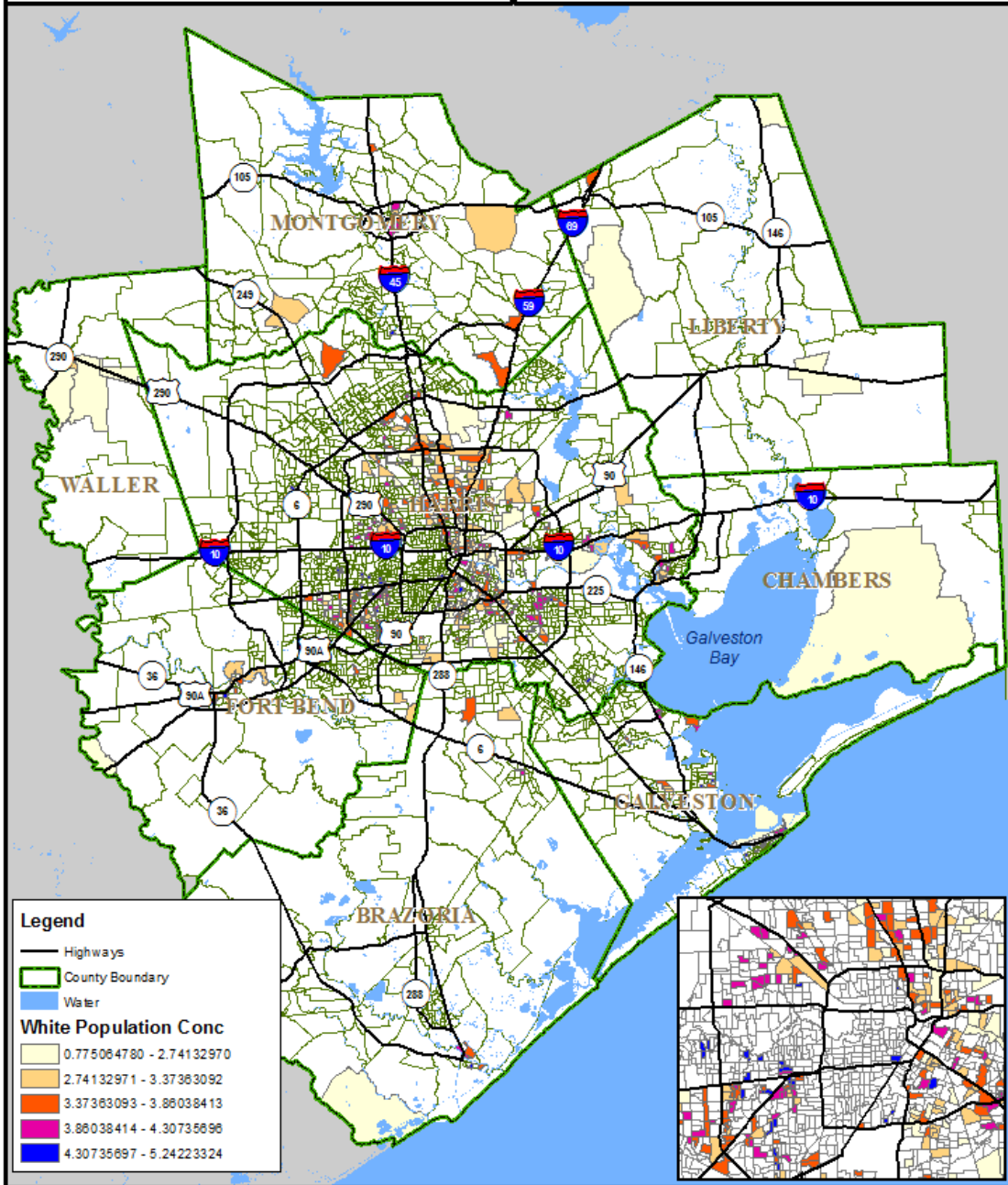
Map 15: Concentrations of White Population in Poverty– By Census Block-Group

7.0   SOCIO-ECONOMIC CHARACTERIZATION OF THE EJ POPULATION

7.1   Employment

Employment is one of the social indicators of the vitality of a community. Although low wage employment may not engender personal self-esteem in the individual worker or provide what may be considered a "living wage" without supplemental assistance, having a regular income may protect the individual from homelessness or destitution. A high rate of unemployment in an area will generally indicate a distressed community. This section looks at employment and related social metrics for the environmental justice communities.

In 2015, the eight-county MPO region was estimated to have about 3.1 million jobs. Table 11 is based on the Census Bureau 2011 – 2015 ACS 5-year estimates. It presents a picture of employment for the State of Texas and the eight-county MPO region, and examines any differences between these regions and the environmental justice sensitive areas, including those EJ zones that are classified as areas with "high disadvantage" because of the presence of four or more indicators of disadvantage. The universe is the population that is sixteen years and over.

Table 11 indicates that 67.1% of the population sixteen years and over who live in an environmental justice zone are within the active labor force. This is comparable to the proportion in the active labor force for the eight-county MPO region, reported at 67.3%, and higher than the numbers reported for the State of Texas (64.7%). The implication of these numbers, however, is that about one-third of the population (the population not within the labor force) is dependent on the working population for their livelihood. The numbers are different for the environmental justice zones described as highly disadvantaged. Only 63.8% of the working-age population is within the active labor force, and over 36% of the population in these areas is dependent on the active labor force for their livelihood. Furthermore, the unemployment rate for all the EJ areas (8.7%) is much higher than the unemployment numbers for the State of Texas (7.0%), and the eight-county MPO average (7.6%).

The unemployment figures given for the State of Texas and the MPO region are relatively high and reflect the somewhat depressed economic climate of the period. The contemporaneous estimates of unemployment reported for the EJ zones with high disadvantage was as high as 11.4%. The elevated unemployment rate reported for the EJ zones with high disadvantage is expected, and is consistent with the heightened level of socio-economic distress that is often found in the disadvantaged neighborhoods.

Table 11: Employment Profile of the Eight-County MPO Region

	Texas	H-GAC MPO	EJ Areas	EJ with High Disadvantage
Population 16 Years and Over	20,241,168	4,784,242	2,473,090	444,713
Total Labor Force *[% of Pop. 16+]*	13,101,788 *64.7%*	3,218,070 *67.3%*	1,659,883 *67.1%*	283,845 *63.8%*
Employed *[% of Labor Force]*	12,189,720 *93.0%*	2,990,323 *92.9%*	1,514,088 *91.2%*	251,373 *88.5%*
Un-Employed *[% of Labor Force]*	912,068 *7.0%*	227,747 *7.6%*	144,723 *8.7%*	32,472 *11.4%*
Not in Labor Force *[% of Pop. 16+]*	7,139,380 *35.3%*	1,566,172 *32.7%*	813,207 *32.9%*	160,868 *36.2%*

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

The 2015 employment map for the eight county MPO region shows that large concentrations of job opportunities occur at several regional centers (Figure 5). These centers include downtown Houston, the Texas Medical Center, Uptown/Galleria, Greater Greenspoint, The Sugarland and Woodlands Town Centers, Downtown Galveston and the UTMB complex. These centers offer over 5000 jobs per square mile. Concentrations of job opportunities also occur along the major highway corridors in the region: including IH-45 North, US 290, IH 10 West, and along FM 1960. Outside of these major employment areas, jobs availability is spread uniformly around the region within the Beltway, and particularly inside the IH 610 Loop.

Figure 5: Regional Employment Growth – 2010 to 2040
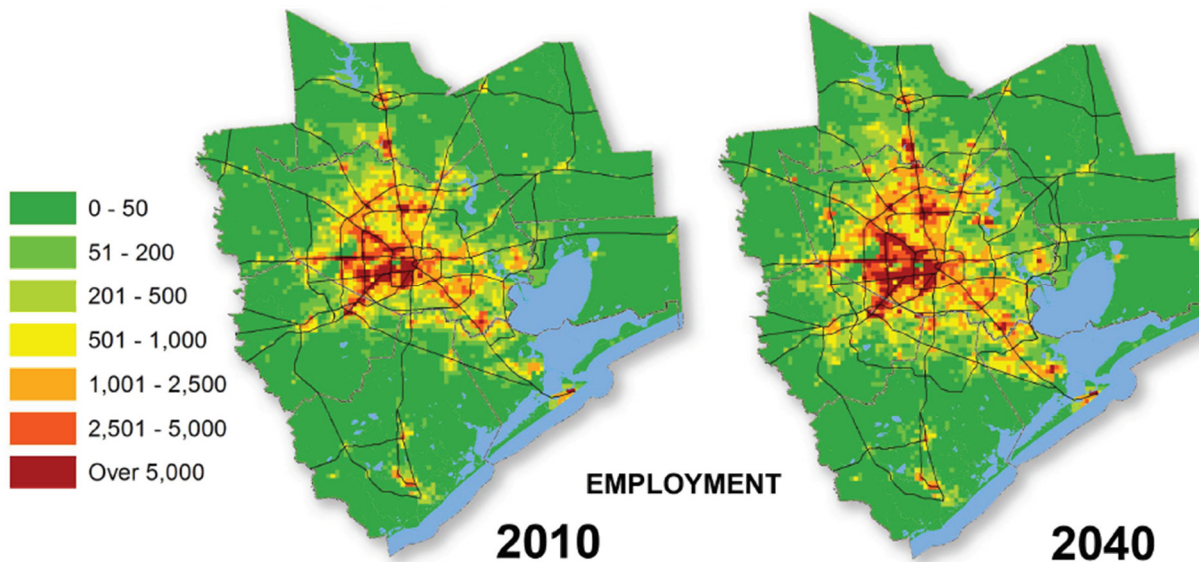
Source: Houston-Galveston Area Council Socio-Economic Forecast, 2016.

7.2 Where the Protected Population Work

Where the environmental justice population find their employment and their travel patterns may be deduced from an examination of their home-based work trips (HBW). Understanding the travel patterns of the underserved may also be useful to identifying opportunities to improve their mobility options and increase their access to jobs and lifeline services. Information regarding home-based work trips for the MPO region was obtained from H-GAC's interactive Web tools which report the Longitudinal Employer-Household Dynamics: Origin-Destination Employment Statistics (LODES) data provided by the U.S. Census Bureau. H-GAC divides the MPO region into 25 travel sectors that largely conform to boundaries created by major highways (Figure 6). The LODES application identifies all the origins and destinations for employment plus the number of jobs within each destination sector that are performed by workers that come from sectors designated as the trip origin. The travel sectors were overlaid on a map of the environmental justice sensitive areas within the MPO region, to gain insight into the travel habits of the EJ population.

This analysis looks at the nine travel-employment sectors that are within Beltway 8. The Beltway area contains 942 (59%) of the region's 1589 environmental justice census block-groups. The nine sectors also contain 297 (81%) of the EJ census block-groups identified as having high disadvantage. The environmental justice population either make up the entire population or are a majority in all nine travel sectors. The commute information for the sectors is therefore directly applicable to EJ analysis. The next section outlines the commute pattern of workers who live within the Beltway 8 region, followed by a characterization of each individual travel sector.

Figure 6: Workers from Travel\Employment Sectors
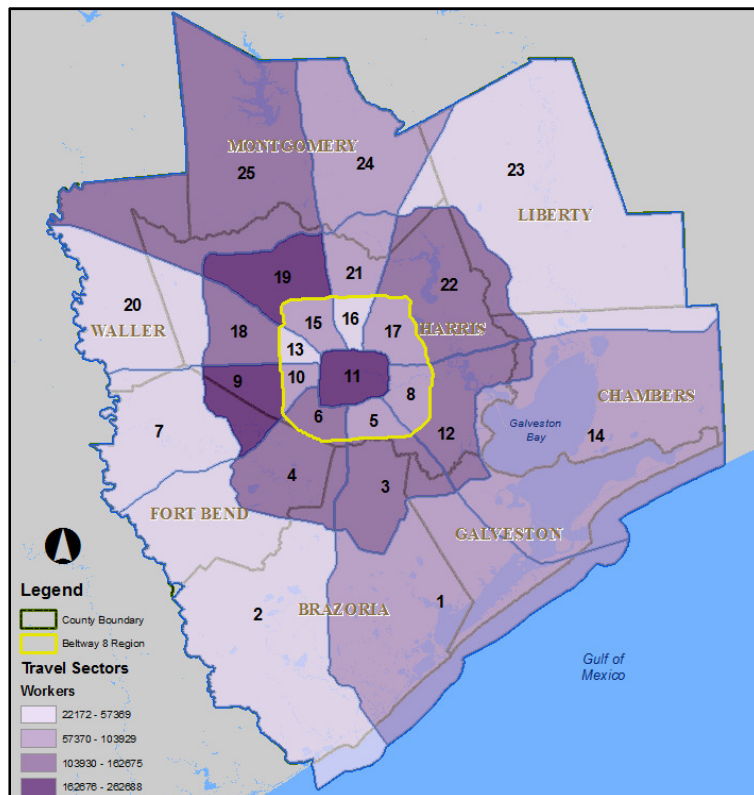
7.3 Origin-Destination Travel Patterns

7.3.1 Destinations

The largest single commute destination from all the travel sectors within Beltway 8 is Sector 11 (Table 12). This sector receives 27.6% of all the HBW trips in the beltway region and is presumably the zone that most workers from the environmental justice communities find their employment. Sector 11 embodies the Houston urban core and is defined as the area within the IH 610 Loop. This sector contains the largest agglomeration of jobs and major employers within the eight-county MPO region. It includes regional employment centers like the Houston downtown business district, Greenway Plaza, the Texas Medical Center, the University of Houston, and the Texas Southern University. Every travel sector in the region contributes trips to Sector 11, following the traditional radial commuting pattern from the suburbs to the central business district. Interestingly, the greatest volume of HBW trips to Sector 11 come from within Sector 11 itself. It should also be noted that Sector 11 is adjacent to every other travel sector within the beltway.

Table 12: HBW Trip Origins – Destinations within the Beltway 8 Region

Trip Origin	Trips to Sector 11	Trips Within Home Sector	Trips to Adjacent Sectors	Trips out of Region	Other
Sector 11	97,012 (44.6%)	(97,012) (44.6%)	39,504 (18.2%)	19,192 (8.8%)	61,774 (28.4%)
Sector 16	12,596 (22.0%)	6,783 (11.8%)	11,806 (20.6%)	5,546 9.7%)	20,638 (36.0%)
Sector 5	22,154 (31.7%)	5,427 (7.8%)	13,747 (19.6%)	5,726 (8.2%)	22,932 (32.8%)
Sector 8	17,786 (20.2%)	14,872 (16.9%)	23,736 (27.0%)	7,537 (8.6%)	23,966 (27.3%)
Sector 10	23,010 (25.8%)	19,831 (22.2%)	21,918 (24.6%)	9,437 (10.6%)	15,048 (16.9%)
Sector 6	37,983 (33.7%)	9,258 (8.2%)	13,925 (12.4%)	10,229 (9.1%)	41,341 (12.4%)
Sector 17	19,847 (27.1%)	4,501 (6.2%)	18,989 (26.0%)	6,380 (8.7%)	23,396 (32.0%)
Sector 15	24,403 (23.5%)	10,090 (9.7%)	32,208 (31.0%)	9,624 (9.3%)	27,606 (26.6%)
Sector 13	9,834 (20.0%)	6,577 (13.4%)	19,400 (39.5%)	5,034 (10.3%)	8,253 (39.5%)
TOTAL	**264,625** (27.6%)	**174,351** (18.2%)	**195,233** (20.4%)	**78,705** (8.2%)	**244,954** (25.6%)

Source: Houston-Galveston Area Council Socio-Economic Forecast, 2016

Sector 11, Sector 10 and "Out of Region" make up the top three individual destinations of all the HBW trips that originate inside the beltway. Sector 11 has been described above. Within Sector 10 is the Uptown-Galleria and Westchase business districts, and includes the Sharpstown and Memorial City malls. "Out of region" refers to non-designate places away from a reference location reported by the employer - but may be assumed to be outside the home sector.

Another notable inference from the travel pattern is the propensity for workers to find employment within their home sector or in the sectors adjacent to their residence. This might reflect a conscious decision by the workers to maximize accessibility to their jobs and\or manage the travel costs of time and money.

7.3.2. Travel Mode

Residents of the Beltway 8 region overwhelmingly choose the automobile for their daily transportation needs (Table 13). On average, over 75% of all the HBW trips that originate within the region are single-occupant automobile trips. Many of the households without automobiles rely on carpools. Sector 13 stands out as the sector with the greatest proportion of HBW carpool trips, which is coupled with relatively low single-occupant vehicle travel (72.3%). The reason for the high carpool rate is unclear but given the low single-occupant travel, carpooling here could be a necessary cost saving choice or a green lifestyle decision. Among all the nine travel sectors, workers from Sector 11 have the lowest carpool rate. This low carpool rate however does not translate to higher single-occupant vehicle travel. Noticeably, participation in alternate commute solutions is greater here than in other travel sectors.

Transit use is a function of the availability and quality of transit service, and the level of transit demand. Demand for transit is influenced by the convenience of access to a transit stop and the absence of viable alternatives. Several factors underlie the decision to provide transit service to an area, one of which is the presence of a "transit-supportive density." Transit supportive density could be measured in either the resident population, or the amount of employment available in an area. Sector 6 (6%), Sector 10 (5.1%), and Sector 11 (4.8%) have by a wide margin, the highest level of transit use in the Beltway region. These sectors are, respectively, the Houston southwest, near westside, and the urban core: areas which have a high resident population and employment density. Transit service is available in all the built-up area in these sectors (Figure 7). In contrast, Sector 8 with a use rate of 1.1% reports the lowest rate of transit use in the region. Transit service available here is limited to the western edge of the sector, and includes two park and ride routes that travel along the bordering freeway (Figure 8). The low transit use in Sector 8 is nevertheless compensated for by a high carpool rate.

Table 13: HBW Travel Mode for Trips Originating in Beltway 8 Region

	Drive in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
Sector 5	78.3%	10.4%	4.0%	1.5%	2.3%	3.4%
Sector 6	73.0%	12.8%	6.0%	2.1%	3.1%	2.9%
Sector 8	78.1%	15.3%	1.1%	1.8%	1.9%	1.8%
Sector 10	74.0%	12.7%	5.1%	2.7%	4.6%	0.9%
Sector 11	75.0%	9.7%	4.8%	4.6%	4.7%	1.3%
Sector 13	72.3%	17.1%	3.1%	3.5%	2.2%	1.8%
Sector 15	80.0%	11.3%	2.6%	1.7%	2.6%	1.8%
Sector 16	75.5%	11.3%	2.6%	1.7%	2.7%	6.2%
Sector 17	79.4%	12.5%	2.8%	1.4%	1.9%	2.0%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates

Figure 7: METRO Transit Service within Sector 6
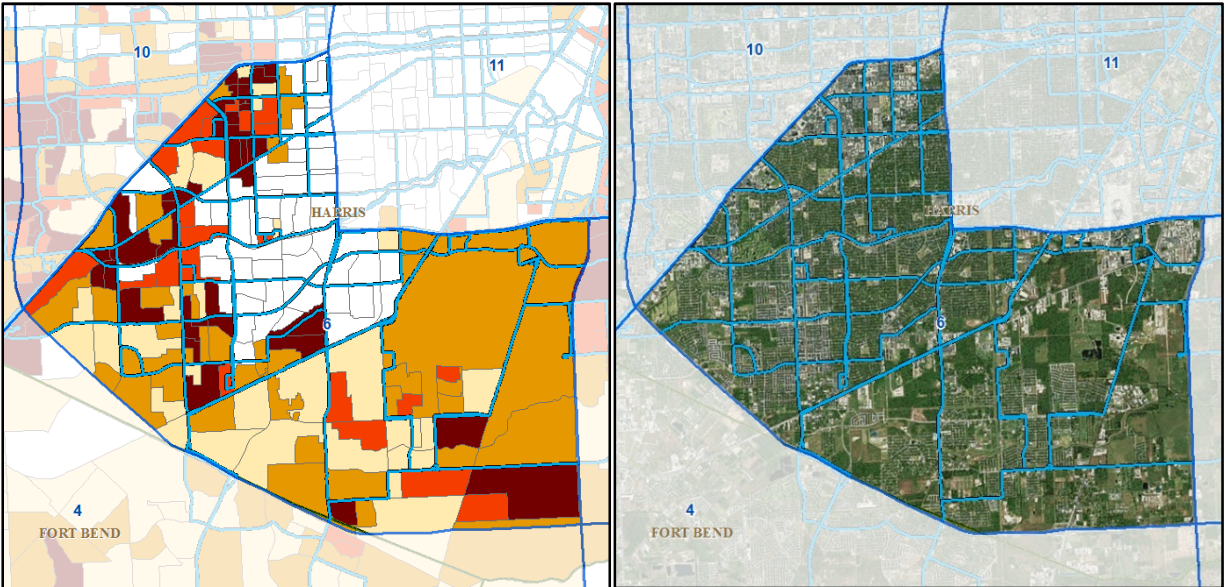
Figure 8: METRO Transit Service within Sector 8
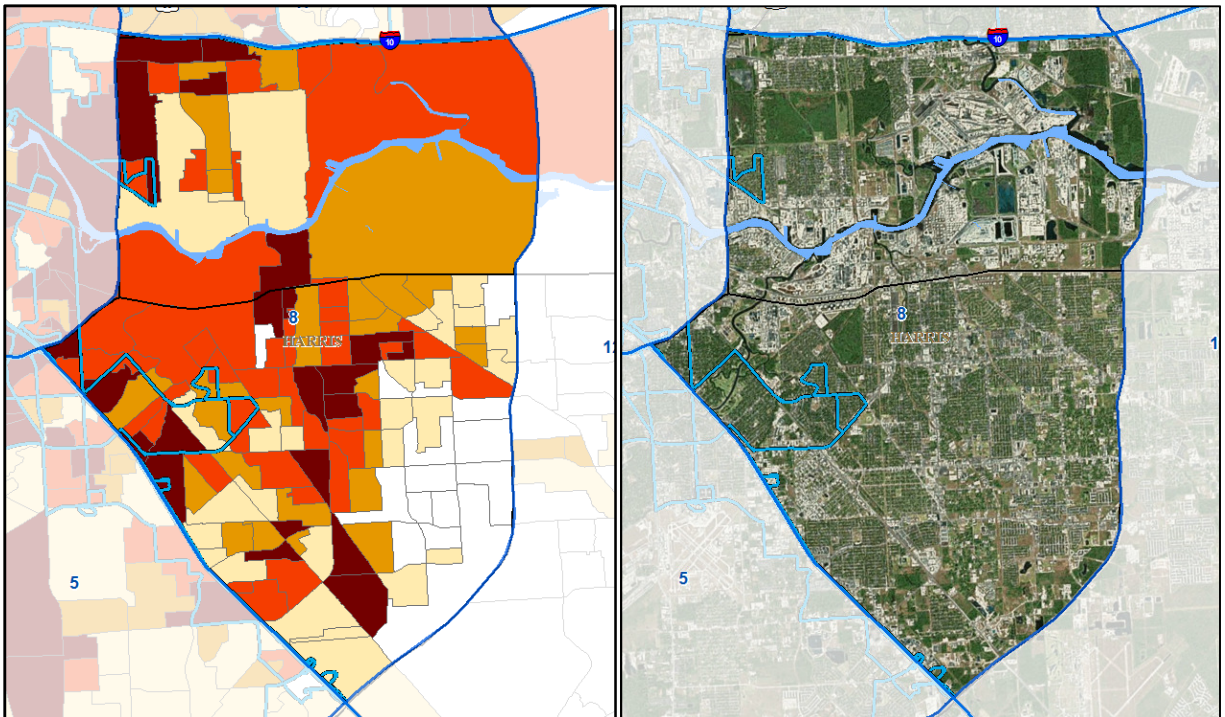
Alternate commute options are still very seldom used in the region. The travel sectors which show the greatest levels of pedestrian\bicycle travel or telework options are noticeably sectors in which there is a substantial non-environmental justice presence, such as Sector 10 and Sector 11. Furthermore, biking or walking options are only feasible where employment is within reasonable distance from the

residence, and where there is a relatively safe and convenient intervening pathway. Unlike many other cities in the nation, Houston is not the most "walkable" environment.

7.3.3. Travel Time

Anecdotal evidence suggests that travel time to work is on the rise within the Houston metropolitan region. Long trip lengths are traditionally associated with transit use. However, with increasing traffic congestion levels and commutes from more distant neighborhoods, lengthy travel times may be the new reality for all varieties of commuters. The large number of HBW trips from Travel Sector 5 that last over 60 minutes is probably related to transit use (Table 14). As established earlier, the majority of the HBW trips from this sector go to destinations within Sector 11. Most of the bus routes to Sector 5 are local service routes, some of which have stops or may require connecting transfers at intervening transit centers. These same factors may hold true for travel Sector 16, Sector 17, and Sector 8 which also have a high proportion of HBW trips that last over 60 minutes.

On the other end of the spectrum, Sector 11 has the largest proportion of HBW work trips that take under 15 minutes and the lowest rate for trips that last over 30 minutes. This is expected as most of the HBW trips that originate from this sector remain within the sector. It is germane to note the environmental justice neighborhoods within this sector have the benefit of METRO light rail service for trips to the downtown district and the Texas Medical Center.

Table 14: HBW Travel Time for Trips Originating in Beltway 8 Region

	Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
Sector 5	1.3%	15.0%	37.5%	36.3%	9.9%
Sector 6	1.4%	13.6%	39.1%	38.3%	7.5%
Sector 8	1.9%	20.5%	36.7%	32.6%	8.2%
Sector 10	1.8%	19.0%	44.2%	30.5%	4.6%
Sector 11	2.6%	25.8%	41.6%	25.2%	4.8%
Sector 13	1.4%	22.6%	38.4%	32.4%	5.3%
Sector 15	1.0%	13.3%	36.0%	42.2%	7.5%
Sector 16	1.7%	12.5%	31.1%	45.5%	9.3%
Sector 17	1.3%	15.1%	36.2%	39.3%	8.0%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates

A more detailed description of the racial profile, employment characteristics, and travel pattern of residents of each of the travel sectors within Beltway 8 is provided in the section that follows. Reference will be made to the Beltway 8 travel sectors later in this document as a surrogate for the core environmental justice zones.

7.4   TRAVEL-EMPLOYMENT SECTOR 5

Overview:

Sector 5 lies at the southern border of Harris County, bounded by Beltway 8 to the south, SH 288 to the west, IH 45 South on the east, and the IH 610 Loop to the north. Virtually every census block-group in the sector is considered environmental justice sensitive. Out of the 100 block-groups that are within the sector, 98 (98%) are classified as an environmental justice zone. Furthermore, 31 (32%) of the 98 EJ block-groups are considered areas of high disadvantage. The super neighborhoods within the sector include Sunnyside, South Park, South Acres/Crestmont, and the Minnetex super neighborhoods.
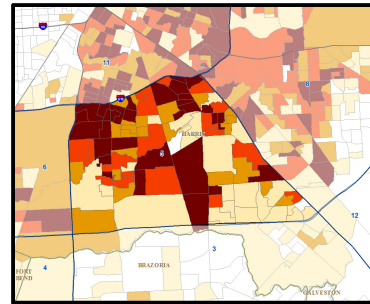
Population Profile:

Sector 5 has a population of about 179,930 residents that is 47% Hispanic and 41% Black. Over one third of the households live within or close to the poverty line.   More than one in every ten households do not have an automobile, however, 37.2% have one automobile, and as much as 50.3% of the households own two or more automobiles.

More than half of all the commuter trips that originate in Sector 5 take less than 30 minutes. Just about as many other commuting trips (45.5%) take between 30 to 60 minutes. Most of the commuters drive alone. However, a significant number of the commuter trips utilize alternate travel modes, including the 4.6% that ride bicycles or walk to work and the 4.7% that telework.

Median Household Income: $ 32,896.   **Average Household Size:** 3.06

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	34.4%	28.5%	26.3%	10.8%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
12.4%	37.2%	33.5%	12.0%	4.8%

Travel Time to Work

Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.3%	15.0%	37.5%	36.3%	9.9%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
78.3%	10.4%	4.0%	1.5%	2.3%	3.4%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, Sector 5 is home to as many as 65,586 workers (Figure 9). Most of these workers have their places of employment in the adjacent Sector 11, which includes the downtown region of Houston and the Texas Medical Center. As many as 22,154, or 31.7% of the home-based work (HBW) trips that originate in Sector 5 end in Sector 11. The next highest number of HBW trips that originate in Sector 5 end up outside the region (5,726 or 8.2%). The next largest grouping of workers find their employment within Sector 5. Other than the trips outside the region, most of the HBW trips are to Sectors adjacent to the trip origin.

Figure 9: Home-Based Work (HBW) Travel Pattern for Sector 5
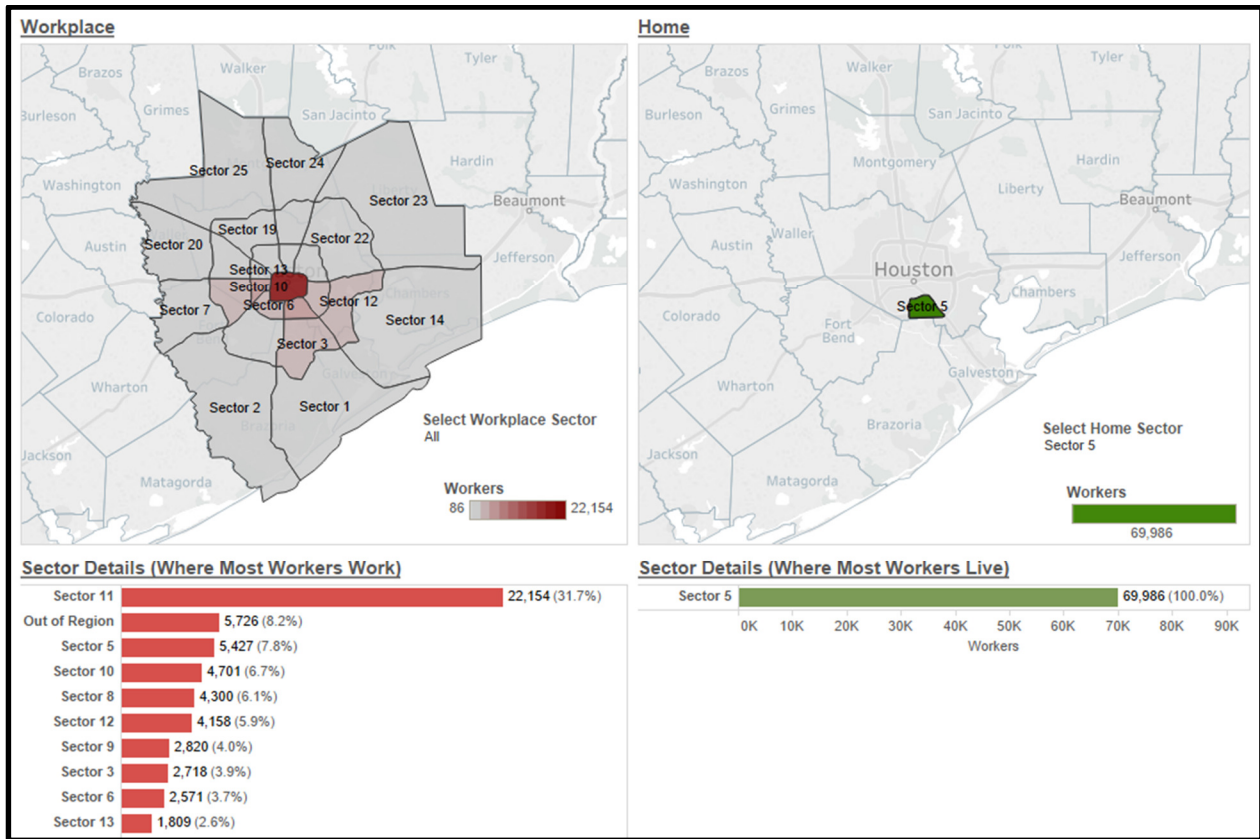
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014).

7.5. TRAVEL-EMPLOYMENT SECTOR 6

Overview:

Sector 6 is located in the Houston Southwest and bounded by US 59/IH 69 to the west, IH 610 to the north, SH 288 to the east, and Beltway 8 to the south. While the north-central part of the sector is for the most part a Non-EJ area, the block-groups that surround the central core of the sector consist almost entirely of environmental justice sensitive areas. Out of the 169 census block-groups within Sector 6, 126 or 74.5% were identified as environmental justice sensitive areas, and of the 126 EJ zones, 38 (30.1%) block-groups were classified as EJ areas with high disadvantage. The super neighborhoods within this travel sector include South Main, Willowbend, Meyerland, Gulfton, Braeburn, Greater Fondren, Westbury, Fondren Gardens, and Central Southwest.
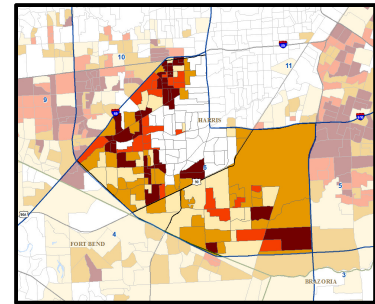
Population Profile:

The population of Sector 6 is about 285,700, of which 43.3% is Hispanic, 29.4% Black, and 19.4% White. Well over half the households in the sector (57.7%) have an income of less than $50,000. Over 30% of these households have incomes within or close to the poverty guidelines. For transportation, almost one-half of the households have one automobile, and over a third of the households have two vehicles.

Most commuter trips (54.1%) that originate in Sector 6 take less than 30 minutes, but a large number of commuter trips (38.3%) take between 30 to 60 minutes. Most commuters drive to work alone, however as many as 12.8% report carpooling, and as high as 6.0% commute by transit.

Median Household Income: $ 41,578   **Average Household Size:** 2.87

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	30.4%	27.3%	25.4%	16.9%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
11.0%	47.4%	37.9%	10.6%	4.1%

Travel Time to Work

Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.4%	13.6%	39.1%	38.3%	7.5%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
73.0%	12.8%	6.0%	2.1%	3.1%	2.9%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, about 112,736 workers live within Sector 6. Most of these workers find their employment in the adjacent Sector 11, which includes the downtown Houston area. As many as 37,983 or 33.7% of the home-based work (HBW) trips that originate in Sector 6 end in Sector 11 (Figure 10). The next highest number of HBW trips that originate in Sector 6 - (13,900 or 12.3% of HBW trips) - end up in the adjacent Sector 10. Up to 10,229 (9.1%) of the workers are employed outside the MPO region.

Figure 10: Home Based Work (HBW) Travel Pattern for Sector 6
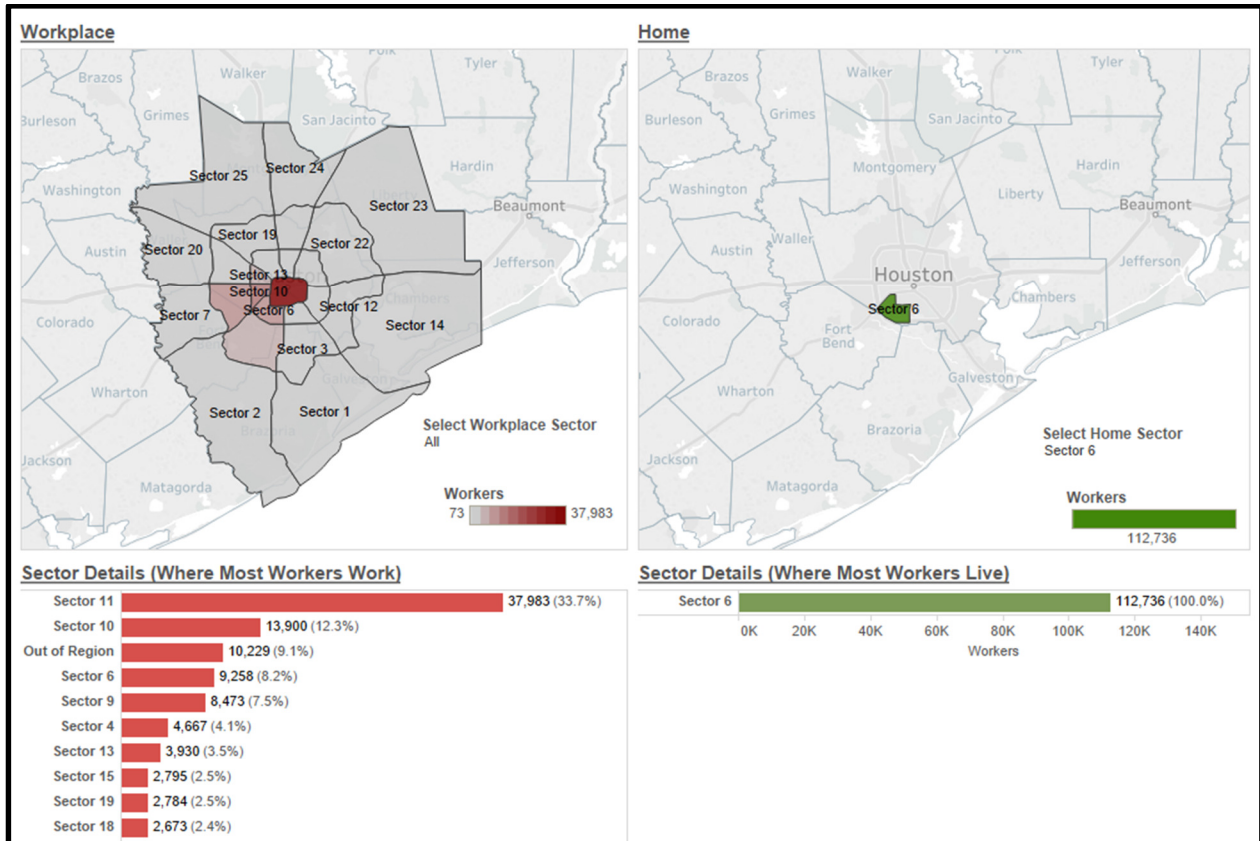
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014)

7.6 TRAVEL-EMPLOYMENT SECTOR 8

Overview:

Sector 8 lies to the east of IH 610. It is bounded to the north by IH 10 East, to the south by IH 45 South, and to the east by the Beltway 8. The sector is split by Buffalo Bayou/Houston Ship Channel which constitutes a major barrier to north-south travel within the sector. As high as 89% of the census block-groups within the sector are considered environmental justice sensitive. Out of the 119 EJ block-groups, 21 (17.6%) have been classified as EJ zones with high disadvantage. Landuse within Sector 8 is largely industrial. The area is home to petrochemical and manufacturing plants, warehouses, and port operations. The few residential neighborhoods are located at the edges of the region. Super neighborhoods within the sector include Northshore, Park Place, Meadowbrook, Edgebrook, and Southbelt/Ellington.

Population Profile:

The population of Sector 8 is about 209,860, of which 77.5% is Hispanic and 16.4% White. Up to 60% of the households in the sector have an income of less than $50,000. About 30% of all households have incomes within or close to defined poverty guidelines. Most households have one automobile, and almost as many households have two.

Travel by automobile is most important to commuters in this sector. Most commuter trips (59.1%) that originate in Sector 8 take less than 30 minutes, and most commuters drive alone (78.1%). However, as many as 15.3% of the commuters reported carpooling to work.

Median Household Income: $ 40,368   **Average Household Size:** 3.35

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	29.9%	30.1%	28.8%	11.2%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
7.7%	36.5%	35.9%	13.8%	6.0%

Travel Time to Work

Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.9%	20.5%	36.7%	32.6%	8.2%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
78.1%	15.3%	1.1%	1.8%	1.9%	1.8%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, Sector 8 is home to as many as 87,897 workers (Figure 11). Most of these workers travel to work in the adjacent Sector 11, which includes the downtown Houston area. As many as 17,786 or 20.2% of the home-based work (HBW) trips that originate in Sector 8 end in Sector 11 (Table 12). The next highest number of HBW trips that originate in Sector 8 (14,872 or 16.9%) end up inside the same sector. The next largest grouping of workers find their employment in adjacent Sector 12.

Figure 11: Home Based Work (HBW) Travel Pattern for Sector 8
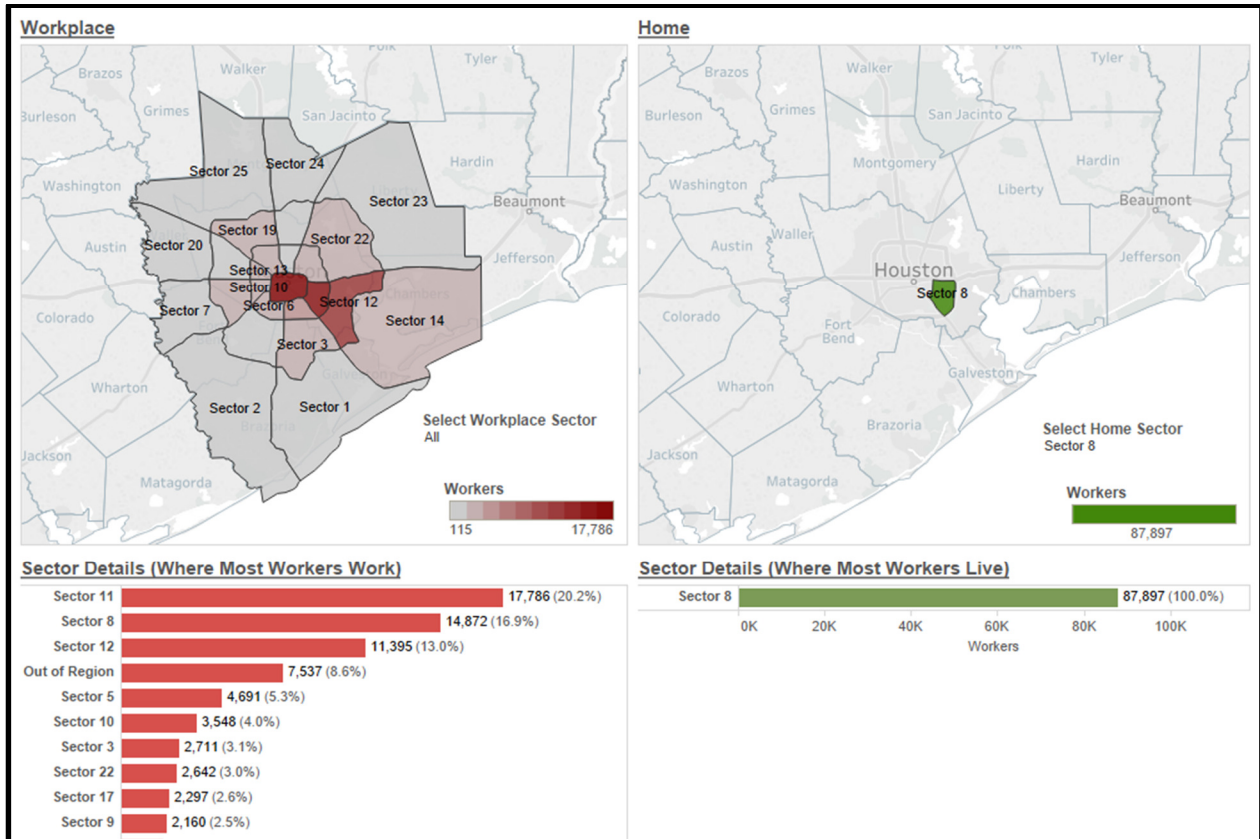
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014).

7.7   TRAVEL-EMPLOYMENT SECTOR 10

Overview:

Sector 10 is bounded by Beltway 8 to the west, IH 610 to the east, US 59/IH 69 to the south, and IH 10 West to the north. The northern half of the sector is mostly a Non-EJ area. Conversely, the region south of Westheimer almost entirely consists of environmental justice sensitive areas. Of the 138 census block-groups that are within the sector, 71 (51.4%) are identified as environmental justice sensitive. Of the 71, up to 24 (33.8%) block-groups were classified as EJ areas of high disadvantage. The super neighborhoods within this travel sector include Memorial, Briar Forest, Westchase, Greater Uptown, Sharpstown, and Westwood super neighborhoods.
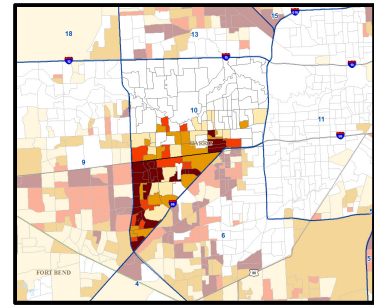
Population Profile:

The population of Sector 10 is about 225,020, which includes 36.9% Hispanic, 36.7% White, and approximately 12% each of Black and Asian residents. While just over one-fourth of the households are within the defined poverty guidelines, almost the same number earn over $100,000. One in every ten households do not have an automobile. However, 50.1% of the households have one vehicle, and over 30% have two.

Almost 21% of the trips to work that originate in Sector 10 take less than 15 minutes. An additional 44.2% commute trips take between 15 to 30 minutes. Most commuters drive to work alone, but almost 13% of the commute trips are in carpools. Compared with other travel sectors, a significant proportion of residents of Sector 10 (5.1%) chose transit as their commute mode (5.1%).

Median Household Income: $ 48,438   **Average Household Size:** 2.40

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	26.4%	23.7%	23.3%	26.1%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
10.4%	50.1%	31.1%	4.8%	2.7%

Travel Time to Work

| Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.8%	19.0%	44.2%	30.5%	4.6%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
74.0%	12.7%	5.1%	2.7%	4.6%	0.9%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, about 89,244 workers live within Sector 10 (Figure 12). Most of these workers find their employment in the adjacent Sector 11, which includes the downtown Houston area. As many as 23,010 or 25.8% of the home-based work (HBW) trips that originate in Sector 10 end in Sector 11. The next highest number of HBW trips that originate in Sector 10 (19,831 or 22.2% of HBW trips) end up inside the same sector. The next largest grouping of workers find their employment outside the region (9,437 or 10.6%).

Figure 12: Home Based Work (HBW) Travel Pattern for Sector 10
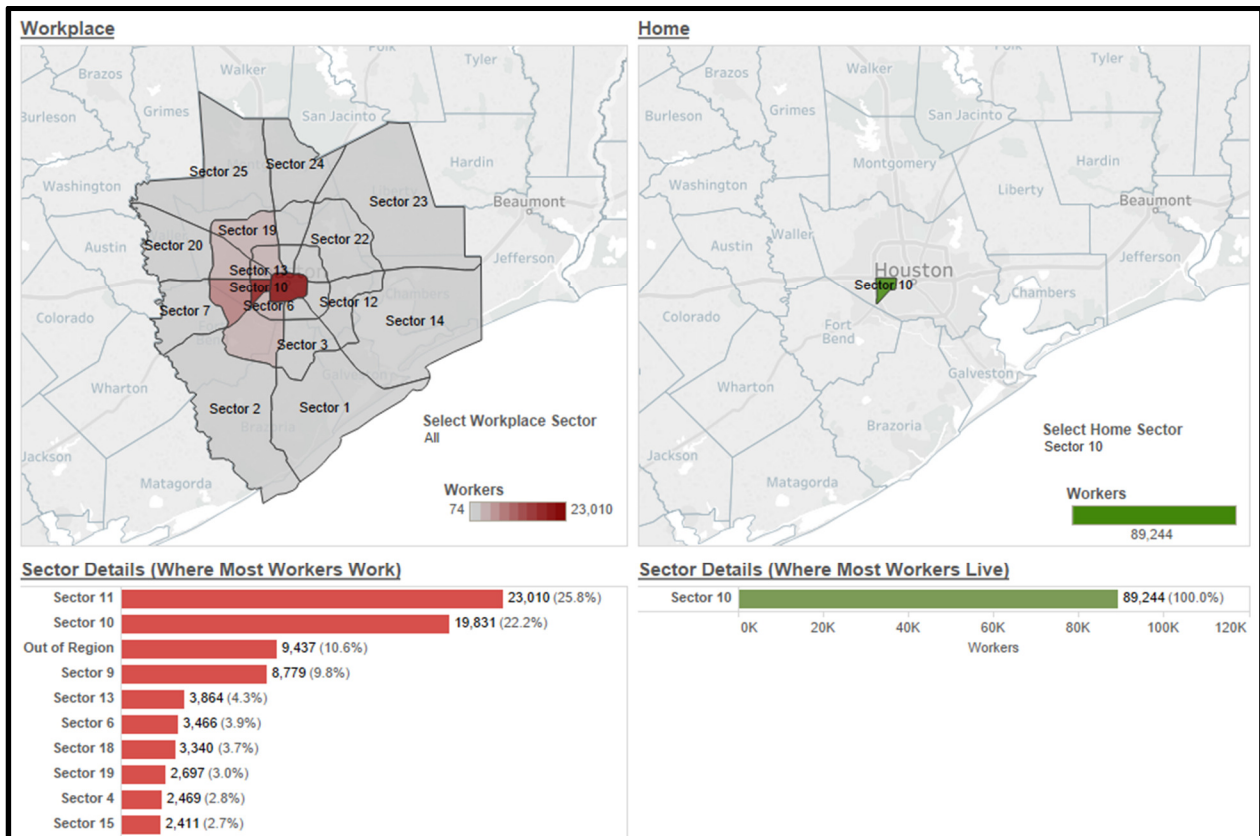
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014)

7.8 TRAVEL-EMPLOYMENT SECTOR 11

Overview:

Sector 11 covers the entire area within the IH 610 Loop (which includes downtown Houston). The whole eastern half of the sector is an environmental justice sensitive region. To the west are affluent areas with a majority White population. Of the 329 census block-groups within this travel sector, 172 (52%) are environmental justice sensitive. As many as 72 (42%) of the EJ block-groups are considered highly disadvantaged. The super neighborhoods within the sector include Greater Heights, Afton Oaks, Midtown, River Oaks, Montrose, University Place, Greenway/Upper Kirby, Northside Village, Kashmere Gardens, Gulfgate, Fifth Ward, Macgregor, Clinton Park, South Acres, Denver Harbor, Harrisburg, Lawndale, Eastwood, and Greater OST.
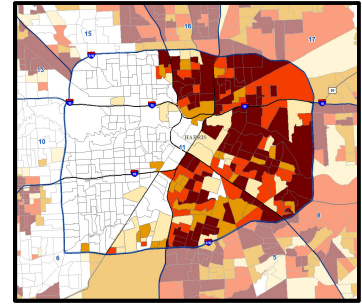
Population Profile:

The population in Sector 11 is about 477,700, of which 37.2% is White, 37.2% Hispanic, and 17.6% is Black. While about one fourth of the households are within the defined poverty guidelines, almost a third earn over $100,000. Most households have one automobile, and over one third have two. However, one in every ten households do not have an automobile. The carless households include households that cannot afford a vehicle as well as those that decide not to have a car as a lifestyle choice.

Most commuter trips that originate in Sector 11 take less than 30 minutes, and most of the commuters drive alone. However, a significant number of the commuter trips utilize alternate work access modes, including the 4.6% that ride bicycles or walk to work, and 4.7% that telework.

Median Household Income: $ 48,221.   **Average Household Size:** 2.44

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	24.7%	19.6%	23.8%	31.8%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
10.1%	44.6%	34.7%	7.9%	2.7%

Travel Time to Work

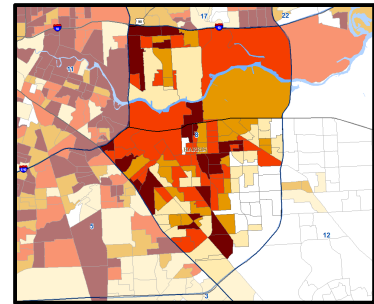| Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
2.6%	25.8%	41.6%	25.2%	4.8%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
75.0%	9.7%	4.8%	4.6%	4.7%	1.3%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

Over 217,000 workers live within Sector 11 (Figure 13). This figure includes workers from both the EJ and the Non-EJ communities. Most of these workers also work within the Sector. Over 97,000 or 44.6% of the home-based work (HBW) trips that originate in Sector 11 also end within Sector 11. Other than the trips outside the region, most of the HBW trips are to adjacent employment sectors to the west of Sector 11.

Figure 13: Home Based Work (HBW) Travel Pattern for Sector 11
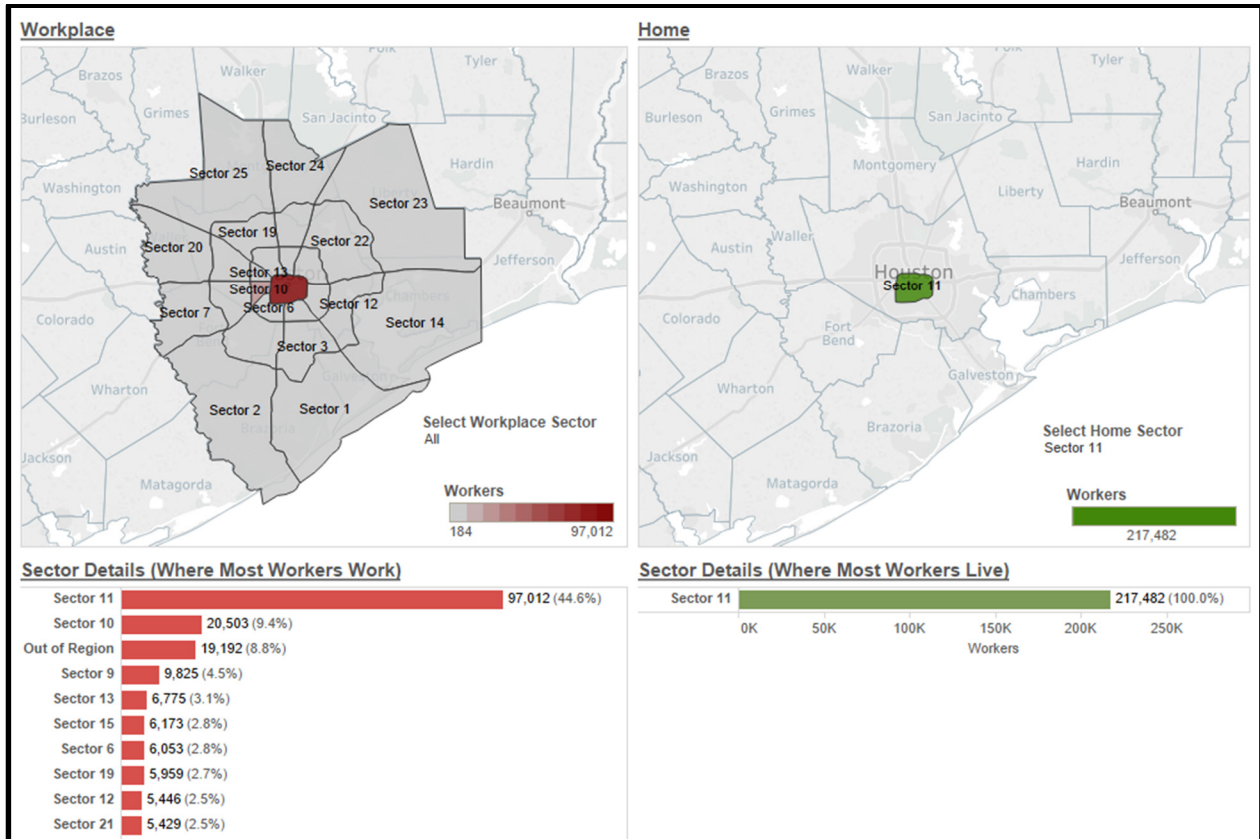
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014).

7.9   TRAVEL-EMPLOYMENT SECTOR 13

Overview:

Sector 13 is located in the northwest quadrant of the City of Houston. It is bounded to the west by Beltway 8, to the south by IH 10 West, to the east by IH 610, and to the north by US 290. There are 75 census block-groups within the sector, 51 (68%) of which are considered environmental justice sensitive. Of these 51 EJ block-groups, 16 (23.5%) were identified as EJ areas with high disadvantage. The block-groups to the south and along the west half of the sector form a contiguous non-EJ area that contains the wealthy localities of the Villages - Memorial belt. Super neighborhoods within this sector include Spring Branch, Langwood, Fairbanks, Westbranch, and Carverdale.
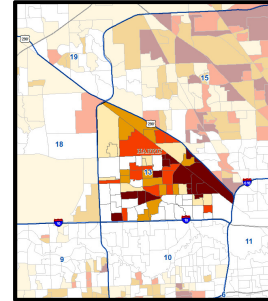
Population Profile:

The population of Sector 13 is about 131,800 of which 61.3% is Hispanic, and 27.0% White. Over 29% of the households in the sector have incomes that would define them as households in poverty. Only 7.3% households report not having an automobile while more than 90% of the households have one or more vehicles.

Just about half of the commute trips taken by workers in Section 13 are completed within 30 minutes, however, over 40% of the commute trips last between 30 and 60 minutes. Similar to commuters from other travel sectors studied, most commuters from Sector 13 drive to work alone (72.3%). The number of commuters that carpool is relatively high (17.1%).   Other alternate commute modes, including transit, are however not as commonly used by the residents in the daily commute.

Median Household Income: $ 40,878   **Average Household Size:** 3.01

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	29.3%	27.1%	25.1%	18.4%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
7.3%	40.4%	36.5%	11.9%	4.0%

Travel Time to Work

Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.4%	22.6%	38.4%	32.4%	5.3%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
72.3%	17.1%	3.1%	3.5%	2.2%	1.8%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, Sector 13 is home to as many as 49,098 workers (Figure 14). Most of these workers have their employment in the adjacent Sector 11, which includes the downtown Houston area. As many as 9,834 or 20.0% of the home-based work (HBW) trips that originate in Sector 13 end in Sector 11. The next highest number of HBW trips that originate in Sector 13 (6,754 or 13.8%) end in Sector 10 which is adjacent to the sector of trip origin. The next largest group of workers find their employment in within Sector 13, the HBW trip origin.

Figure 14: Home Based Work (HBW) Travel Pattern for Sector 13
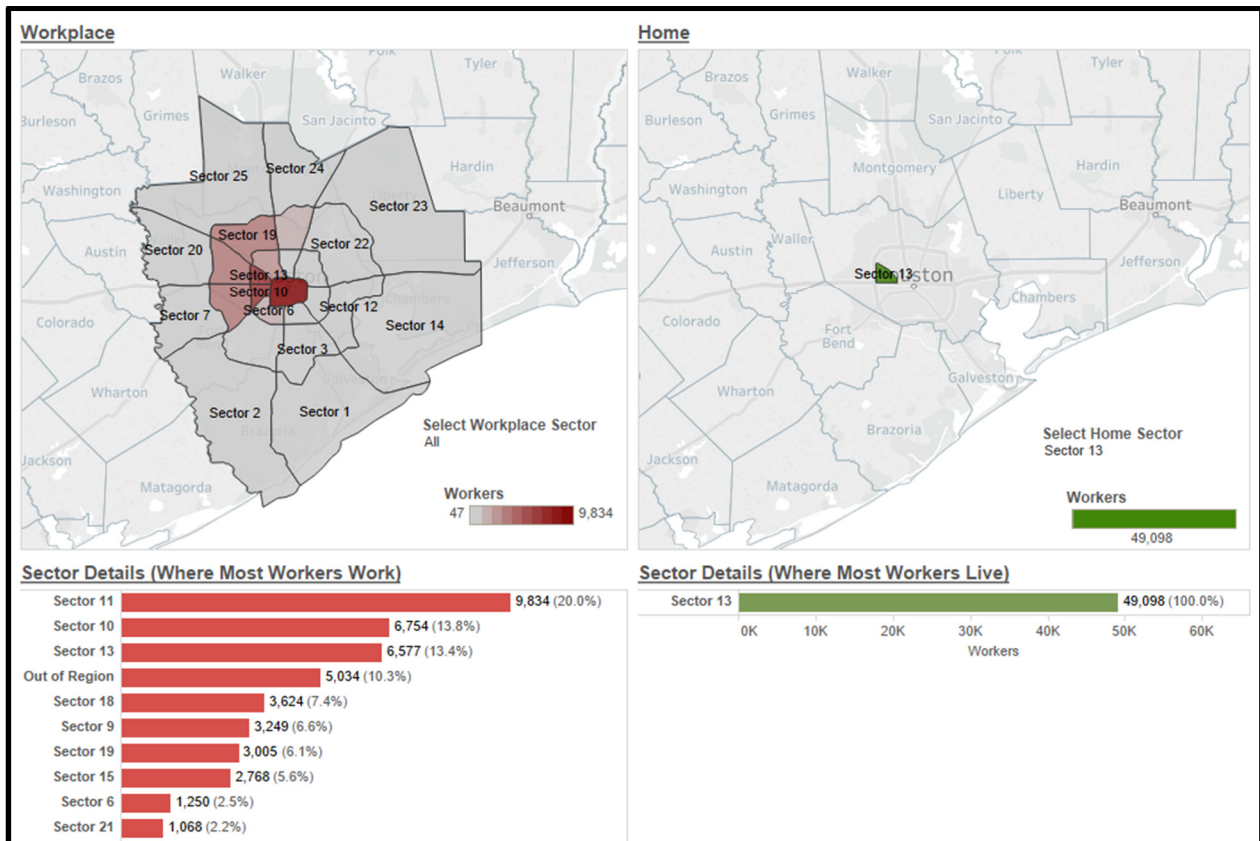
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014)

7.10 TRAVEL-EMPLOYMENT SECTOR 15

Overview:

Sector 15 lies in the northwest quadrant of the City of Houston. It is bounded to the north by Beltway 8, to the south by IH 610, to the east by IH 45 North, and to the west by US 290. There are 131 census block-groups within the sector, 106 or 80.9% of which are considered environmental justice sensitive. Out of the 106 EJ block-groups in the sector, 24 (22.6%) have been identified as EJ areas with high disadvantage. The super neighborhoods within this travel sector include Fairbanks, Greater Inwood, Acres Home, Hidden Valley, Langwood, and Garden Oaks.
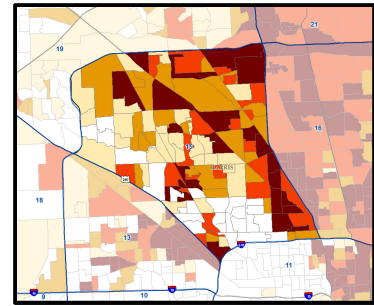
Population Profile:

The population of Sector 15 is about 249,975, which includes 51.3% Hispanic, 26.0% Black, and 17.0% White residents. Almost 28% of the households in the sector have incomes that would define them as households in poverty. Only 8.0% report not having an automobile while over 70% of the households have one or more automobiles.

Just about half of the commute trips taken by workers in Section 15 are completed within 30 minutes, however, over 40% of the commute trips last between 30 and 60 minutes. Most commuters from Sector 15 drive to work alone (80.0%). As many as 11.3% report completing their commute trips in carpools. Other alternate commute modes, including transit, are however not as commonly used in the daily commute.

Median Household Income: $ 41,624   **Average Household Size:** 3.04

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	27.8%	29.2%	27.7%	15.3%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
8.0%	38.5%	36.2%	12.6%	4.8%

Travel Time to Work

| Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.0%	13.3%	36.0%	42.2%	7.5%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
80.0%	11.3%	2.6%	1.7%	2.6%	1.8%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, Sector 15 is home to as many as 103,929 workers (Figure 15). Most of these workers have their employment in the adjacent Sector 11, which includes the downtown Houston area. As many as 24,403 or 23.5% of the home-based work (HBW) trips that originate in Sector 15 end in Sector 11. The next highest number of HBW trips that originate in Sector 15 (10,297 or 9.9%) end in Sector 19 which is adjacent to the sector of trip origin. The next largest grouping of workers find their employment in within Sector 15, the HBW trip origin.

Figure 15: Home Based Work (HBW) Travel Pattern for Sector 15
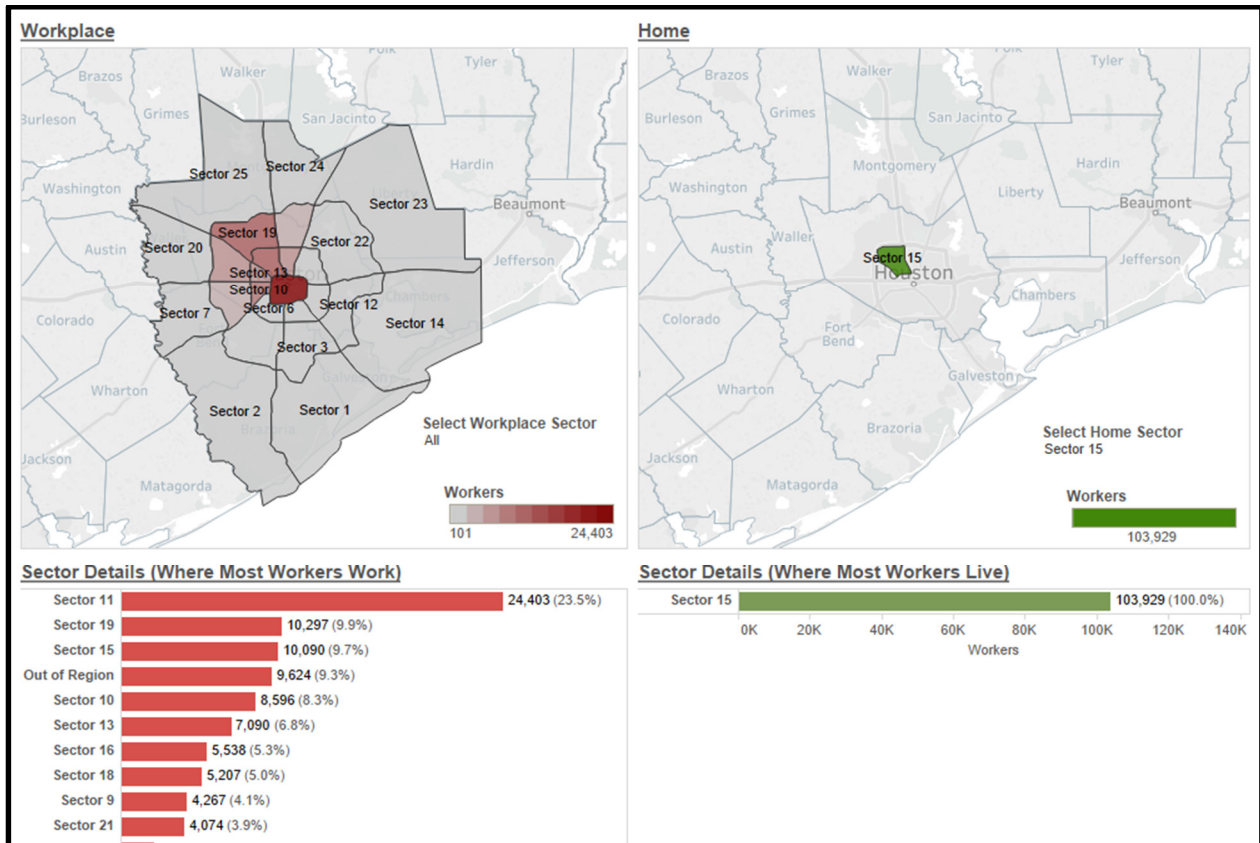
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014)

7.11 TRAVEL-EMPLOYMENT SECTOR 16

Overview:

Sector 16 lies between IH 45 North and US 59/IH 69 North, extending from the IH 610 Loop northwards to Beltway 8. All the 92 census block-groups that make up this travel sector are classified as environmental justice sensitive areas. Of these 92 EJ block-groups, as many as 34 (37%) are considered highly disadvantaged. The super neighborhoods within the travel sector include Northline, Eastex-Jenson, and Greater Greenspoint.
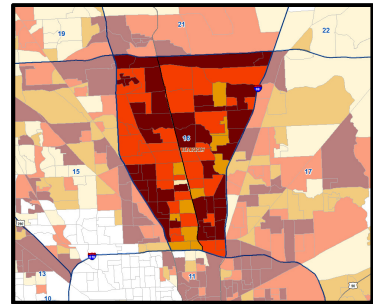
Population Profile:

Sector 16 has a population of about 170,950 residents of which 83.2% is Hispanic and 9.2% Black. Almost 70% of the households have an income of $50,000 or less, and over half of these households have incomes that would define them as households in poverty. Over one in every ten households do not have an automobile, however, 34.8% have one automobile and up to 54.3% have two or more automobiles.

Just over 45% of the commuter trips that originate in Sector 16 take less than 30 minutes. For many workers (45.5%), however, the commute trip takes as long as 30 to 60 minutes. Most of the commuters drive to work alone but a significant number of the commuter trips utilize alternate travel modes, including the 4.6% that ride bicycles or walk to work, and the 4.7% that telework.

Median Household Income: $ 34,460.   **Average Household Size:** 3.73

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	39.3%	30.2%	24.7%	5.8%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
10.9%	34.8%	32.5%	14.7%	7.1%

Travel Time to Work

| Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.7%	12.5%	31.1%	45.5%	9.3%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
75.5%	11.3%	2.6%	1.7%	2.7%	6.2%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, about 57,369 workers live within Sector 16 (Figure 16). Most of these workers travel to work in the adjacent Sector 11, which includes the downtown Houston area. As much as 12,508, or 22%, of the home-based work (HBW) trips that originate in Sector 16 end in Sector 11 (Table 12). The next highest number of HBW trips that originate in Sector 16 also end within Sector 16. Other than the trips outside the region, most of the HBW trips are to Sectors adjacent to the trip origin,

Figure 16: Home Based Work (HBW) Travel Pattern for Sector 16
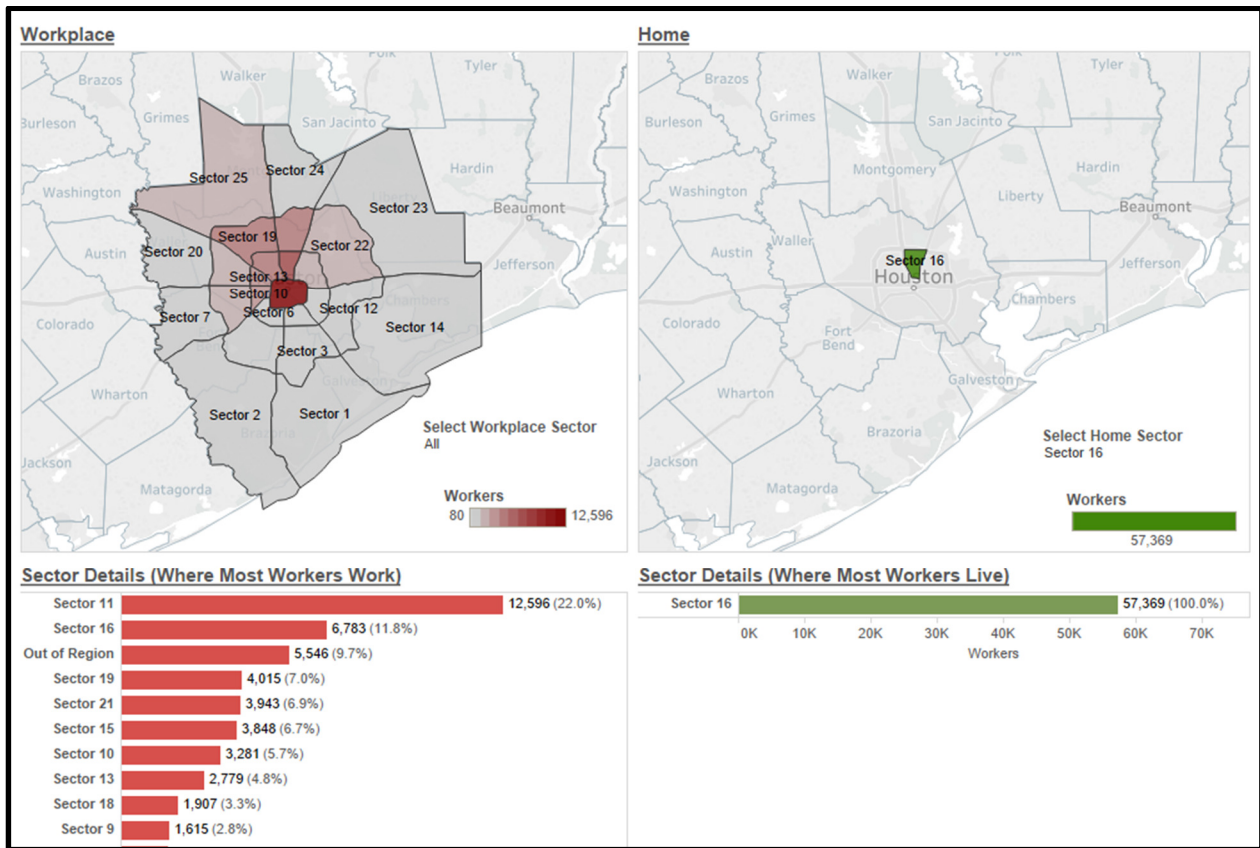
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014).

7.12 TRAVEL-EMPLOYMENT SECTOR 17

Overview:

Sector 17 is located in the northeast quadrant of the City of Houston and is bounded by US 59/IH 69 North to the west, IH 610 and IH 10 East to the south, and Beltway 8 to the north and east. As many as 96 (94.1%) of the 102 census block-groups within the sector were identified as environmental justice sensitive zones. Of these 96 EJ block-groups, 22 (23%) are considered EJ areas with high disadvantage. The super neighborhoods within this travel sector include Northshore, El Dorado, Hunterwood, Settegast, East Houston, Trinity, and East Little York.
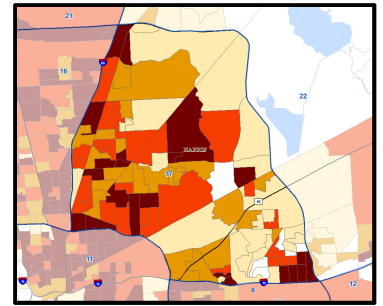
Population Profile:

The population of Sector 17 is 51.3% Hispanic and 36.0% Black. Just over 29% of the households in the sector have incomes that would define them as households in poverty. Over two-thirds of the households in the sector have at least one automobile. Only 8.1% report not having an automobile.

Most of the commute trips taken by workers in Section 17 are completed within 30 minutes. Nearly 40% of the commute trips last between 30 and 60 minutes. Like the commuters from other travel sectors studied, most commuters from Sector 17 drive to work alone (79.4%). As many as 12.7% report completing their commute trips in carpools. Alternate commute modes, including transit, are however not as commonly used in the daily commute.

Median Household Income: $ 36,794   **Average Household Size:** 3.16

Household Income Range

	Below $25,000	$25,000 to $50,000	$50,000 to $100,000	Above $100,000
% of Households	29.2%	30.7%	28.1%	11.9%

Number of Automobiles in Household

Zero Automobiles	One Automobile	Two Automobiles	Three Automobiles	Four or More Automobiles
8.1%	36.1%	35.4%	14.8%	5.6%

Travel Time to Work

Travel to Work Below 5 minutes	Travel to Work 5 – 15 Minutes	Travel to Work 15 – 30 Minutes	Travel to Work 30 – 60 Minutes	Travel to Work Over 60 Minutes
1.3%	15.1%	36.2%	39.3%	8.0%

Mode of Travel to Work

Drove in Car Alone	Carpool	Transit	Ped-Bike	Telework	Other
79.4%	12.5%	2.8%	1.4%	1.9%	2.0%

Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Travel Patterns:

According to the LODES data, about 73,113 workers live within Sector 17 (Figure 17). Most of these workers find their employment in the neighboring Sector 11, which includes the Houston downtown business district, Medical Center, and the Greenway Plaza. As many as 19,847 or 27.1% of the home-based work (HBW) trips that originate in Sector 17 end in Sector 11. The next highest number of HBW trips that originate in Sector 17 - (6,380 or 8.7% of HBW trips) -end up outside the region. The third largest travel course has 4,888 (6.7%) of the workers from Sector 17 move outwards to employment within Sector 22.

Figure 17: Home Based Work (HBW) Travel Pattern for Sector 17
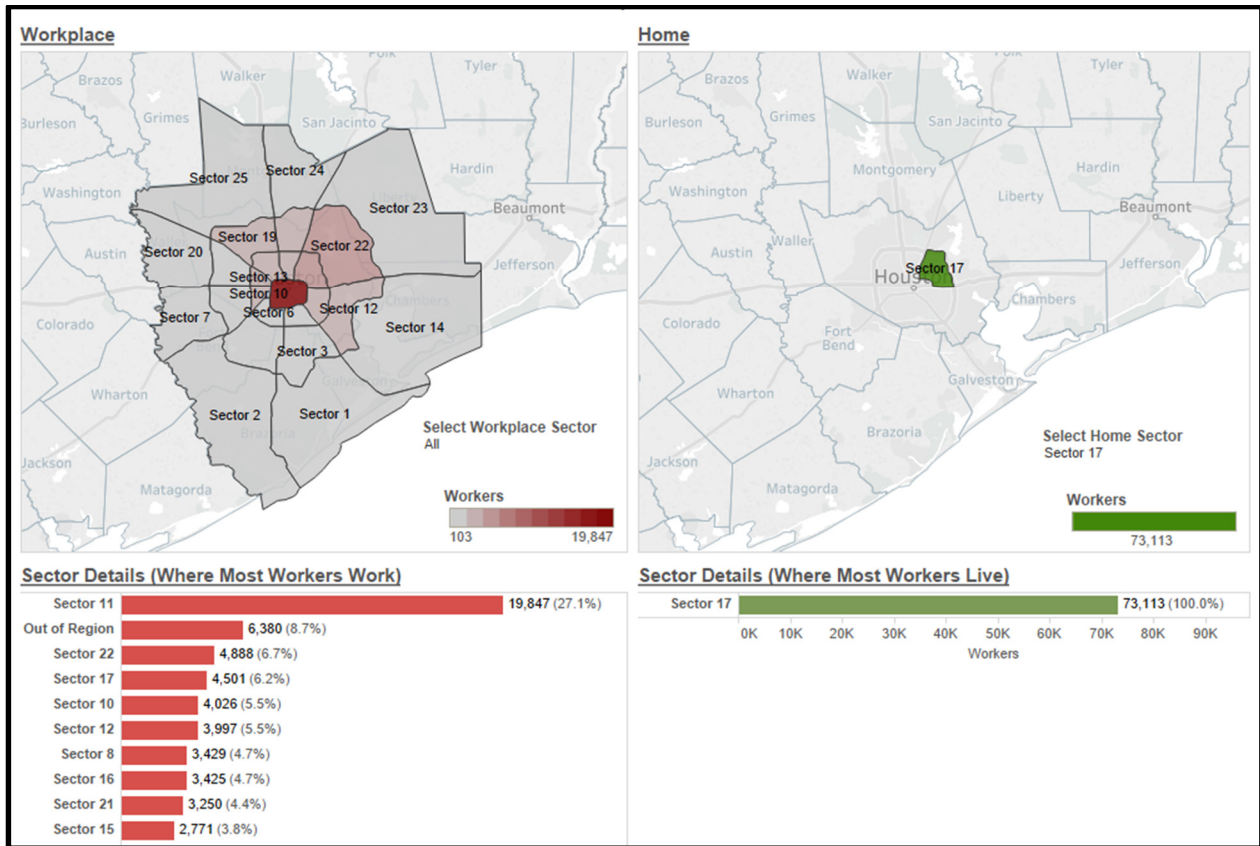
Source: H-GAC LEHD Origin-Destination Employment Statistics (2014)

8.0   IDENTIFYING DISPARATE BENEFITS AND DISPROPORTIONATE COSTS

Environmental Justice addresses two classes of concerns - the disparate distribution of benefits, (where one population receives beneficial investments and the other population does not receive similar investments), and the disproportionate imposition of high and adverse impacts from policies or actions. "High and adverse impacts" denote harm that is experienced by the protected class in an appreciably more severe or greater magnitude than what is experienced by the non-protected population. These environmental justice concerns stem from a US Constitution-based expectation that all populations would enjoy an equitable share in the investment of federal funds. Specific measures must be evaluated to determine whether a community enjoys an equitable level of investment benefits or will carry a disproportionate burden from their adverse effects.

8.1   Assessing the Environmental Justice Impact of New Toll Road Projects

The Houston-Galveston region is a national leader in the use of road pricing as a strategy to raise transportation financing and improve mobility. In 2013, the Harris County Toll Road Authority (HCTRA) ranked in the top ten nationally in terms of toll revenue.[8] There are currently 13 priced facilities in operation within the H-GAC planning region. These facilities are projected to be expanded from the 2017 level of about 1,000 lane miles to approximately 1,700 lane miles by 2040. The tolling of roads raises equity concerns because of the potential to disproportionately impact members of racial minority communities and individuals with low-incomes, collectively referred to as the environmental justice population.

Toll road projects are regionally significant controlled access roadways and do not conform to a spatial analysis at the neighborhood level (Map 16). An evaluation of distributional equity by a direct spatial review would be misinforming. The quantitative measures of "Mobility" and "Accessibility" are industry standards used to describe the transportation benefits of regionally significant roadway enhancements, and lend themselves to a region-wide assessment. Mobility measures the ability to travel from one location to the other - expressed in travel time. A mobility analysis compares the travel time that would be experienced by persons who reside in environmental justice zones with travel time for residents of the non-environmental justice zones. Accessibility on the other hand assesses the level of connectivity within the transportation network, and expresses how well the transportation network enables the traveler access to specific desired destinations and "opportunities." Mobility and accessibility have a direct impact on the quality of life of the community. It is assumed that the introduction of a new toll road facilities would result in savings in travel time, enhance accessibility, and reduce congestion on the regional roadways. These assumptions must however be tested, to verify that the benefits of the toll road construction accrue equitably to the entire population.

8.1.1   Travel Demand Analysis – Methodology and Assumptions

To conduct a mobility/accessibility analysis to determine the effects of priced facilities on environmental justice populations, a traffic demand model analysis was applied to the following transportation networks:

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[8] IBTTA, 2013.

- The 2017 network – containing all the network facilities that exist in the year 2017.
- The 2040 RTP Build network – containing all programmed RTP facilities, including the proposed priced facilities scheduled to be built by 2040.
- The 2040 RTP No-Build network – containing all programmed RTP facilities except the priced facilities scheduled to be built after 2017.

The traffic demand model simulates trips between TAZs, applying a "mode choice" analysis. The mode choice analysis implies that certain assumptions are made about the travel behavior of individuals and about the choice of transportation mode they make for each proposed trip. The system-wide mobility analysis models trips from home to work (HBW) and trips from home to non-work destinations (HBNW), producing estimates of the time it would take to travel between each origin and destination zone. Two travel time estimates are computed: (1) average trip length using tolled links, referred to as the "toll path" travel time, and (2) average trip length using the network without toll links, referred to as the "free path" travel time. Where travel time can be saved by using a toll path rather than a free path, the toll link is considered a "candidate" for the trip length analysis. If the toll path does not offer a shorter travel time than the free path, the toll path is a non-candidate path for the trip length analysis. The impact of the new toll facilities on mobility is determined by comparing average travel time for trips on the toll paths versus the free path - for both the build and the no-build alternatives.

8.1.2   Mobility Analysis – Home-Based Work Trips

Table 15 presents the number of home to work trips for the year 2040 and the predicted average trip lengths for both the free and tolled path options under the Build and the No-Build alternatives. The trip lengths are based upon the morning peak congested travel period. Some pertinent observations may be made from the data:

Of the total 4,241,724 HBW trips forecasted, 2,625,543 (61.9%) were produced by EJ zones while 1,616,181 (38.1%) were produced by non-EJ zones. However, of the trips that originated from an EJ zone, only 23.3% were identified as candidate trips (trips for which travel time could be saved by using the new toll facilities). In comparison, 33.8% of the trips that originated from a non-EJ zone were identified as candidate trips. Again, there were almost twice as many non-candidate trips originating from the EJ zones (2,013,900) as those originating from the non-EJ Zones (1,069,997). The EJ zones have a smaller proportion of candidate trips than would be expected based on their share in the population and the total number of trips they generate. This under-representation of the EJ candidate trips is likely to be a factor of the geographic location of the toll road network relative to the non-protected population.

For both the 2040 build and the no-build networks, the average trip length of the candidate trips is greater than those of the non-candidate trips. This couples with the fact that the average trip length for trips originating from the non-EJ zones is significantly larger than those that come from the EJ zones. Several conclusions may be drawn from these observations. Toll roads are designed to support rapid movement to and from the suburbs, consequently fewer inner-city trips will have optimal routes that could benefit from time saving via a tolled pathway. This buttresses the argument that the toll roads in the region appear to be geographically situated to meet the travel needs for the sub-urban destinations more than the travel needs of protected population, who generally tend to be situated closer to the inner city.

Other inferences may however be made from a comparison of average travel time savings between the trips from the EJ zones and the non-EJ zones. Overall, the addition of toll facilities in the 2040 build network would result in reductions in average travel time for both the EJ zones and the non-EJ zones (Table 15). For the 611,343 candidate trips originating from an EJ zone, choosing the toll path on the build network would save an average of almost one minute over toll path trips on the no-build network, and as much as 3.6 minutes over trips along the free path. Similarly, for the 546,184 candidate trips that originate from a non-EJ zone, trips using the toll path in the build network would save an average of 2.3 minutes over toll path trips on the no-build network, and as much 4.9 minutes when compared with trips along the free path. The difference in average travel time savings for trips originating in the EJ zones and the non-EJ zones probably reflects the urban nature and consequently shorter trips for the protected population as opposed to the suburban trip origins and longer average distances travelled by the non-protected population.

Table 15: 2040 HBW Person Trips – AM Peak Average Trip Lengths in Minutes

Production Zones	Segmentation of 2040 HBW Person Trips by potential time savings	Number of 2040 HBW Person Trips		2040 Build Network		2040 No-Build Network	
				ATL using a Toll Path (Minutes)	ATL using a Free path (Minutes)	ATL using a Toll Path (Minutes)	ATL using a Free Path (Minutes)
EJ Zones	Trips that can save 0+ minutes using a new toll facility	611,643	14.4%	33.3	36.9	34.2	37.3
	Trips that <u>cannot</u> save 0+ minutes using a new toll facility	2,013,900	47.5%	19.7	20.7	19.8	20.8
Non-EJ Zones	Trips that can save 0+ minutes using a new toll facility	546,184	12.9%	44.5	49.4	46.8	51.0
	Trips that <u>cannot</u> save 0+ minutes using a new toll facility	1,069,997	25.2%	24.4	25.4	24.7	25.9

AM Peak Average Trip Length (ATL) in minutes for Free Path and Tolled Path options under the Build and the No-Build networks
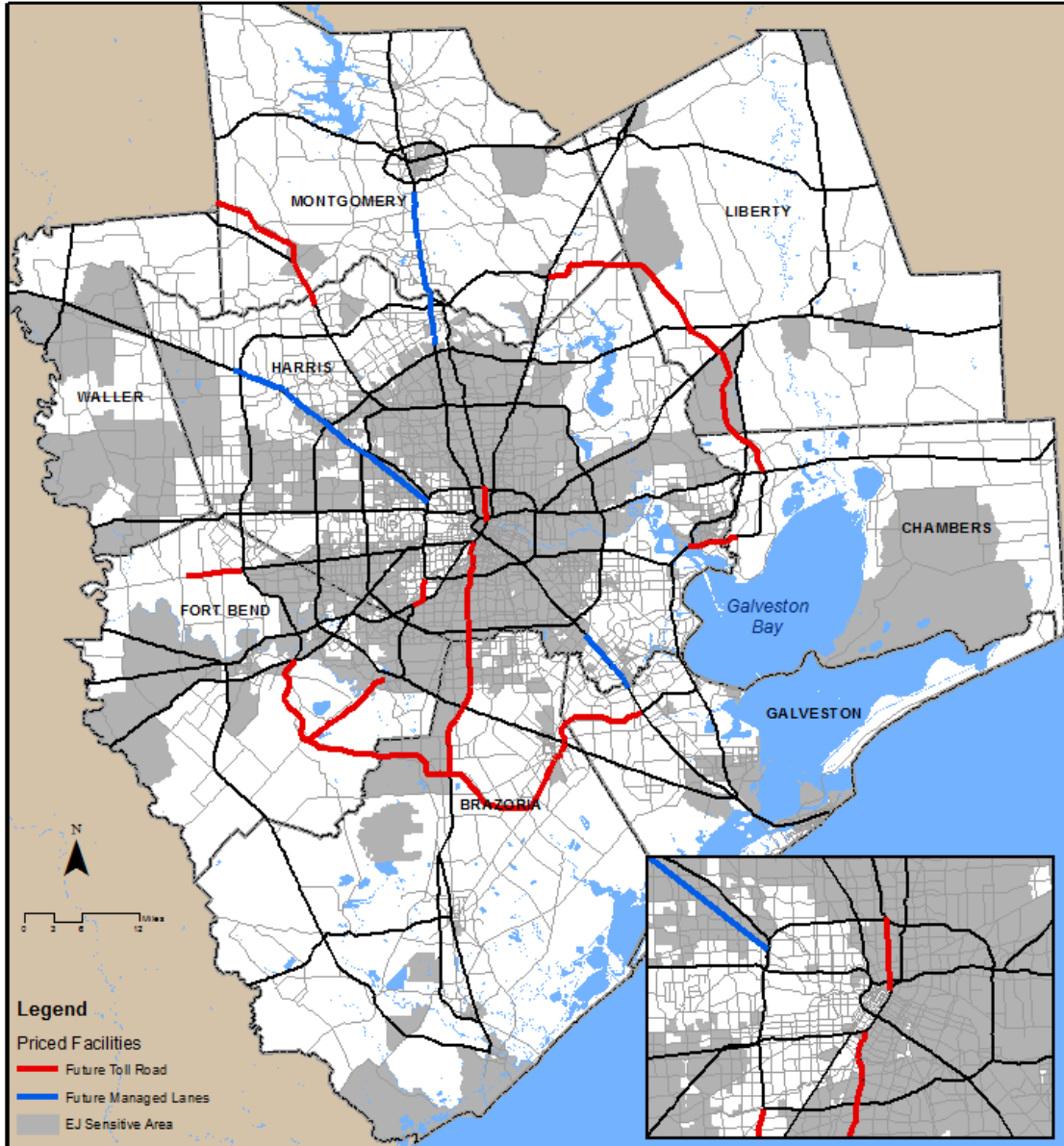
Map 16: Proposed Priced Facilities in the H-GAC 2040 RTP Update

8.1.3. Accessibility Analysis

"Accessibility" measures the number of activity centers or "opportunities" that may be reached by residents of a TAZ within a defined travel distance, travel time, or travel cost, and is an indicator of the quality of life for a community. The chosen metric for accessibility analysis is travel time. The analysis predicts the number of jobs that would be accessible to defined communities within 30 minutes when travelling by automobile, and within 60 minutes by transit. To analyze the effects of priced facilities on environmental justice populations, the traffic demand analysis was applied to three transportation networks:

- The 2017 network – containing all the network facilities that exist in the year 2017.
- The 2040 RTP Build network – containing all programmed RTP facilities, including the proposed priced facilities scheduled to be built by 2040.
- The 2040 RTP No-Build network – containing all programmed RTP facilities except the priced facilities scheduled to be built after 2017.

Table 16 shows the results of the region-wide analysis of accessibility to jobs, assessed for (1) the non-EJ neighborhoods, (2) the EJ neighborhoods, and (3) the EJ neighborhoods with high disadvantage. The analysis includes a focus on most vulnerable environmental justice communities, defined as communities which have the greatest concentration of indicators of hardship, to determine if they are disparately impacted compared with other communities.

Results of the analysis show that the 2040 build alternative would provide the protected population with 4.4% more jobs accessible within 30 minutes by automobile, and 17.3% more jobs accessible within 60 minutes by transit than was the case under 2017 conditions. Furthermore, the model predicts that under the 2040 build alternative, the EJ communities with high disadvantage would have as much as 17.3% more jobs accessible within 30 minutes by automobile, and 26.9% more jobs accessible within 60 minutes by transit than was the case with the 2017 network. Positive job access opportunities will also be available to the EJ communities under the no-build alternative for the transit users. This includes a 3.6% increase in the number of jobs accessible within 30 minutes by automobile and 16.8% within 60 minutes compared to the 2017 network for the EJ population. The EJ communities with high disadvantage can expect even higher job access numbers (16.5% within 30 minutes by automobile and 26.8% within 60 minutes by transit) than the EJ community at large.

Table 16: Accessibility to Jobs by Automobile and Transit Modes

	Number of Jobs Accessible within 30 Minutes by Automobile			Number of Jobs Accessible within 60 Minutes by Transit		
	2017	2040 Build Network	2040 No-Build Network	2017	2040 Build Network	2040 No-Build Network
Non-EJ Zones	937,833	844,709	839,970	2,031,672	1,965,868	1,937,073
Percent change from 2017 Network	-	-9.9%	-10.4%	-	-3.2%	-4.7%
EJ Zones	1,557,675	1,626,627	1,614,313	2,561,247	3,005,174	2,991,916
Percent change from 2017 Network	-	4.4%	3.6%	-	17.3%	16.8%
EJ Zones with High Disadvantage	2,059,634	2,415,254	2,399,440	2,753,607	3,494,401	3,491,334
Percent change from 2017 Network	-	17.3%	16.5%	-	26.9%	26.8%

Source: H-GAC Travel Demand Model, 2017.

The predicted job accessibility numbers for the EJ community contrasts with the non-EJ communities which under the 2040 build alternative are projected to *lose* up to 9.9% of the jobs accessible within 30 minutes by automobile and *lose* 3.2% jobs accessible within 60 minutes by transit when measured against the 2017 network. Again, under the 2040 no-build alternative, the non-protected population is expected to lose access to even more job opportunities (10.4% by automobile and 4.7% by transit use), if the proposed toll facilities are not built. The diminished access to job opportunities for the non-EJ population may relate in part to the location pattern of future employment in the urban core areas coupled with the sub-urban extension of residences for the non-EJ population.

In summation, for both automobile and transit travel options, the protected population will have access to more jobs than the non-protected population. The difference in job access numbers is more pronounced for the transit mode, which is probably tied to three factors: (1) the convergence of most transit service in the urban core, (2) the location of most job opportunities in the central city, and (3) the tendency for the EJ communities, (especially those with high disadvantage), to be situated nearer the inner city. These observations have important implications for the choices of mitigation strategies for EJ communities impacted by development proposals. Relocating the community further away from the urban core would more than likely impact their access to jobs, and their overall quality of life.

8.1.4. Transportation System Performance

Another set of metrics that can provide a comparative assessment of the potential impact of priced facilities on the environmental justice population in the region is the performance of the transportation network. A transportation equity enquiry looks at whether environmental justice communities will have similar benefits in travel conditions and congestion relief as the non-environmental justice communities in the region. The following analyses utilize the 2017 Network, the 2040 build network, and the 2040 no-build network, and models morning peak conditions for automobile users and for transit trips.

Table 17 compares the average vehicle trip time, trip length, and trip speed for the entire metropolitan planning region, the non-environmental justice areas, the EJ communities, and the EJ communities with high disadvantage. The analysis includes a focus on the most vulnerable environmental justice communities, defined as communities which have the greatest concentration of socio-economic indicators that imply hardship, to determine if they are disparately impacted when compared with other communities in the region.

Table 17: Trip Characteristics of Roadway Users During Morning Peak Period (6 am – 9 am)

	All TAZ Zones	Non-EJ Zones	EJ Zones	EJ Zones with High Disadvantage
Average Vehicle Trip Time (Minutes)				
2017 Network	20.2	22.2	18.6	15.7
2040 Build Network	24.8	28.6	21.1	17.2
2040 No-Build Network	24.9	28.6	21.1	17.2
Average Vehicle Trip Length (Miles)				
2017 Network	14.6	16.6	13.0	11.1
2040 Build Network	15.7	18.2	13.2	10.8
2040 No-Build Network	15.6	18.1	13.1	10.8
Average Vehicle Trip Speed (Miles/Hour)				
2017 Network	43.5	44.8	42.1	42.2
2040 Build Network	38.0	38.2	37.6	37.8
2040 No-Build Network	37.6	37.7	37.4	37.6

Source: H-GAC Travel Demand Model, 2017.

Average vehicle trip time and trip speed is expected to degrade across the planning region due to the increase in the regional population, and the associated growth in the number of cars on the roadway. However, for all the travel networks, average vehicle trip time and vehicle speed performance for the EJ communities exceed the regional average and the non-EJ communities. The better road network performance and shorter trip lengths for the EJ communities may derive from their being situated closer to the urban core than the bulk of the non-EJ community.

Table 18 details the system performance for transit users, showing the total transit trips, average travel time, trip length, and trip speed in the morning peak period. In all the three travel networks, most transit trips are associated with the EJ community, which receive 65.7% of the total trips in the 2017 network. The proportion of total regional transit trips serving the EJ community will rise to 67.3% in the 2040 build network. Comparing the 2017 network and the build network, EJ zones with high disadvantage are expected to have the greatest percentage of increased service of all the communities studied.

As with automobile traffic, average transit trip time and trip speed is expected to degrade across the planning region due to the increase in the regional population, and the associated growth in the number of vehicles on the roadway. For all the travel networks, average transit trip time and transit speed performance for the EJ communities exceed the regional average and the non-EJ communities. The larger proportion of transit trips, better system performance, and shorter transit trip lengths for the EJ

communities may derive from their being situated closer to the urban core than the non-EJ community, and may reflect planned expansion and focus on transit planning efforts to meeting the need of the transit dependent population, who mostly come from among the minority and the low-income population.

Table 18: Trip Characteristics of Transit Users During Morning Peak Period (6 am – 9 am)

	All TAZ Zones	Non-EJ Zones	EJ Zones	EJ Zones with High Disadvantage
Average Vehicle Trip Time (Minutes)				
2017 Network	16.3	17.8	15.4	12.3
2040 Build Network	18.9	22.5	17.2	13.6
2040 No-Build Network	19.1	22.7	17.3	13.6
Average Vehicle Trip Length (Miles)				
2017 Network	11.4	13.2	10.5	8.2
2040 Build Network	12.3	15.0	10.9	8.4
2040 No-Build Network	12.3	15.0	10.9	8.3
Average Vehicle Trip Speed (Miles/Hour)				
2017 Network	42.2	44.4	40.9	40.2
2040 Build Network	38.9	40.0	38.2	37.0
2040 No-Build Network	38.9	39.6	37.9	36.8
Number of Transit Trips				
2017 Network	164,354	56,402	107,952	21,565
2040 Build Network	234,997	76,918	158,080	33,854
2040 No-Build Network	237,792	78,429	159,363	33,985

Source: H-GAC Travel Demand Model, 2017.

8.2. Major Transportation Investments - Ten-Year Plan (2017 – 2026)

One approach to looking at equity in transportation planning decision-making is to examine the investments programmed for the region to see whether the environmental justice communities receive a similar level of investments as the non-protected population. The distribution of transportation investments reflect the policy and planning decisions that have been made by the project sponsors.

Table 19 describes the locational distribution of the top projects by dollar amount that have been programmed in the H-GAC Ten-Year Transportation Plan (FY 2017 – 2026). A non-exclusive spatial analysis examines which projects pass through or run adjacent to the traffic analysis zones identified as EJ sensitive, and the non-target. Approximately 62% of the mapped projects pass through or run adjacent to an environmental justice zone (Map 17). The scheduled cost of these projects amount to approximately 83% of the total budget for all the mapped projects. The proportion of these major projects that fall within or run adjacent to an environmental justice zone with high disadvantage drops to 23%, which corresponds to only 49% of the total project cost. On the other hand, as much as 89% of the mapped transportation projects fall within or intersect a non-environmental justice zone, representing approximately 86% of the total project costs.

The number of the programmed roadway projects that pass through or physically touch the protected and the non-protected communities in this non-exclusive geographic analysis differ broadly, but the dollar value of the projects that pass through each community is comparable. However, the EJ zones with high disadvantage will receive a disproportionate share of major project investment benefits in terms of major projects, when compared with the non-environmental justice areas.

Table 19: Major Investments in the H-GAC 10-Year Plan (FY 2017-2026)

	EJ Target Areas	EJ Target Areas of High Disadvantage	Non EJ Target Areas
Number of Projects (Percent of Projects)	77 out of 124 (62%)	28 out of 124 (23%)	110 out of 124 (89%)
Cost of Projects (Percent of Budget)	17,299,192,141 (83%)	10,206,081,459 (49%)	18,110,893,331 (86%)

Source: H-GAC Ten-Year Plan (FY 2017 – 2026)

Transportation projects of regional significance will generally contribute to enhancing mobility and accessibility well beyond their immediate vicinity (Table 20). These benefits could accrue to the protected population even though the project does not physically pass through their boundary. A travel-demand analysis would therefore yield a mobility/accessibility based picture of the potential benefits of the investments for the protected and non-protected communities. Again, a cursory look at the geographical relationship fails to inform on the allocation of the externalities related to a project. This fact is evident especially for the North Houston Highway Improvement Project (NHHIP) which is anticipated to cause significant and disparate adverse impacts to the environmental justice community, including those with high disadvantage. This will be discussed in some more detail later in this study.

Table 20: Major Projects in H-GAC 10-Year Plan (FY 2017-2026)

Corridor/ Initiative	Description of Major Investment	Budget Totals
NHHIP	Reconstruct main lanes, frontage lanes, and interchanges between IH 45, IH 10, & IH 59 and between IH 69/SH 288. Construct additional managed lanes, including bridges, interchanges	$8,107,658,286
GPW (SH 99)	Construct segments H, I-1, & I-2, 4-lane tollway with interchanges & non-continuous 2-lane frontage roads	$3,328,609,037
IH 45 S	Widen main lanes & frontage Rd from NASA 1 to FM 518	$1,468,370,000
BW8	Widen from 4 to 8 lanes from IH 45 to IH 10, including Houston Ship Channel Bridge	$1,185,671,228
SOUTHWEST CORRIDOR	Railroad underpass replacement on US 90A/SH 36; realign & widen SP 529; construct 4-lane toll road & Brazos bridge	$1,124,170,141
US 290	Construct commuter transit rail along Hempstead Row (high capacity transit – 6 stations)	$1,080,807,300
IH 10 W	Construct 4 toll lanes on FM 1093 & widen to 4 lanes from James lane to FM 359; additional corridor improvements to frontage road	$1,067,895,698
SH 249	Construct 6-lane tollway with grade separations; widen from Chasewood to Gregson to 8 lanes; reverse ramp at Spring Cypress road; construct 4-lane tollway with grade separations at Stagecoach, Woodlands Parkway	$1,058,801,019
SH 146	Widen existing roadway and construct grade separations at major intersections from Fairmont Parkway to FM 1764, construct railroad overpass.	$ 692,964,745
SH 36	Widen existing roadway to a four-lane divided roadway in Brazoria and Fort Bend Counties	$ 675,818,261
IH 610	Construct IH 610/IH 69 Interchange with HOV access to Uptown Transit Center, reconstruct main lanes and frontage road, and construct overpass at Cambridge.	$ 476,447,811
SH 288	Construct toll lanes in Brazoria County; reconstruct intersection at FM 518; construct grade separation	$ 384,349,606
IH 45 (N of IH 10)	Construct 4-lane toll road to complete Hardy Toll Rd; & reconstruct interchange between IH 45, IH 10, & IH 69	$ 381,910,134
US 59 N	Reconstruct and widen US 59 N from Cleveland Bypass to Montgomery C/L; from San Jacinto C/L to Cleveland Bypass; from Kingwood Dr. to Harris C/L; from Fostoria Rd to Liberty C/L	$ 249,155,982
IH 10 E	Widen existing freeway from 4 to 6 lanes from SH 73 to Jefferson C/L; Construct eastbound entrance ramp	$ 44,179,677

Source: H-GAC Ten-Year Plan (FY 2017 – 2026)
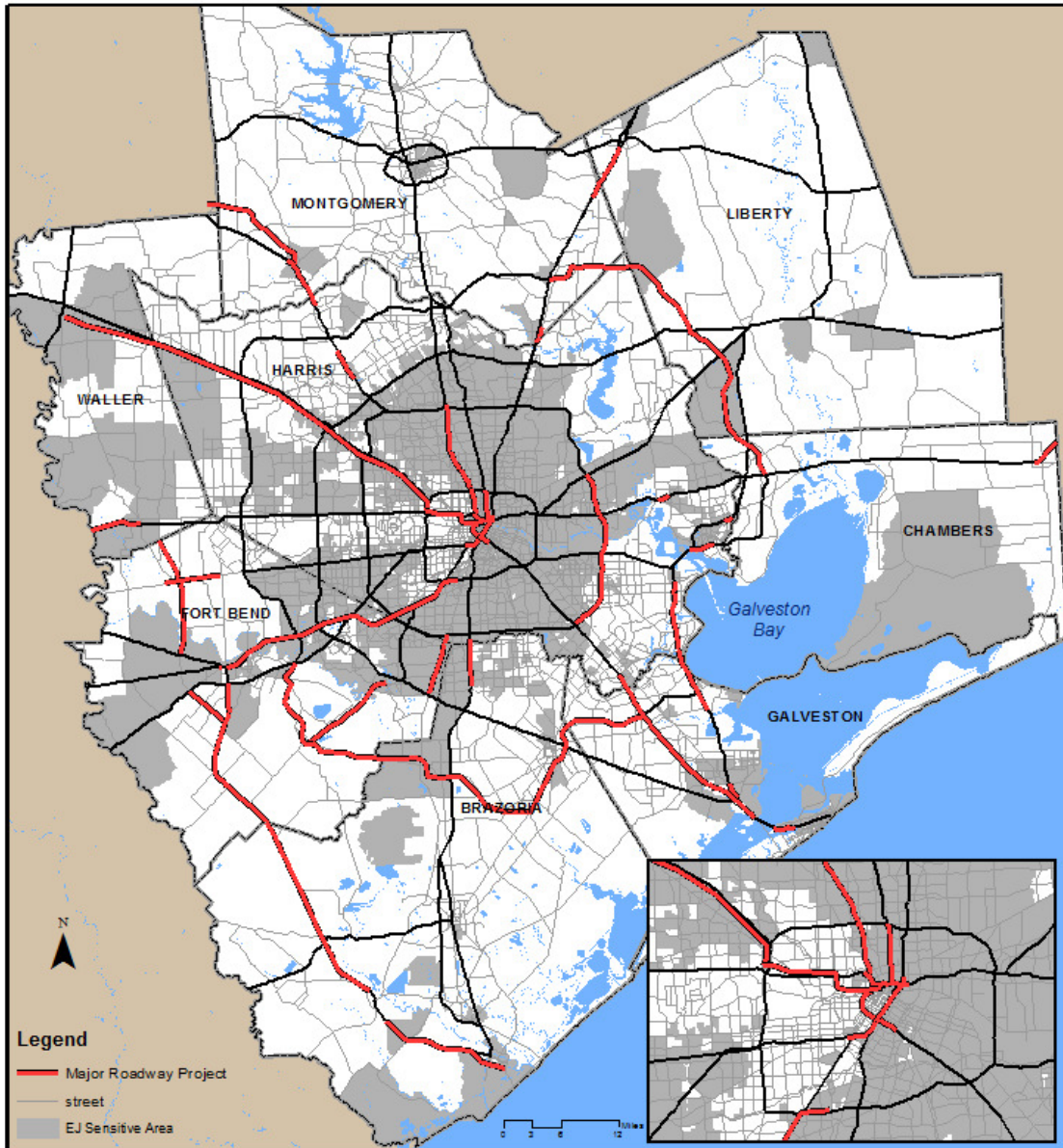
Map 17: Major Transportation Investments in H-GAC Ten-Year Plan (2017 – 2026)

8.2.1. Travel Model Analysis

A travel model analysis was conducted to evaluate the impact of the major transportation projects on the performance of the regional transportation network, specifically assessing whether the protected population would be disproportionately served. The "2040 Build (Conformity) Network" includes the major transportation projects listed in Table 20 while the "2040 No-Build Network" represents the scenario in which these major investment projects were not built. Tables 21 through 24 describe the impact of these network scenarios on transportation performance on the protected and the non-protected communities. The travel model results suggest that both the protected and the non-protected populations will obtain transportation benefits from the construction of the major projects.

Accessibility to Jobs

If the major projects are constructed, the environmental justice population especially those neighborhoods with high disadvantage would have access to more jobs when travelling either by automobile and by transit (Table 21). Compared head to head, the environmental justice population would also have accessibility to almost double the number of jobs that will be accessible to the non-environmental justice population when travelling by both automobile and transit modes.

Average Vehicle Trip Speed

Congestion will improve with the construction of the major transportation projects. The environmental justice zones will enjoy an increase in traffic speed of up to one-half mile-per-hour on average when travelling by automobile (Table 22). This increase in trip speed will however be less than the regional average as well as the speed improvements experienced by the non-target population. The travel model also indicates that the environmental justice community will experience a reduction in average speed when travelling by transit. This reduction in average transit speed will be less than the regional average as well as the transit speed reductions experienced by the non-target population.

Average Vehicle Trip Time

The average trip time by automobile for the non-target population will decrease by over one-half minute with the construction of the major transportation projects (Table 23). This is better than the anticipated improvements in average trip time for the environmental justice population (-0.2 mins) or the environmental justice population with high disadvantage (-0.1 mins). On the other hand, average trip time for transit users from the non-protected population is projected to increase by up to 6.8 minutes, but by only 1.7 minutes in the environmentally sensitive zones and 1.2 minutes for the EJ population with high disadvantage.

Average Vehicle Trip Length

The average vehicle trip length is a measure of the convenience of travel within the local transportation network. The shorter the average trip length, the less convenient is the travel experience. Average trip length for the environmental justice is projected to be slightly greater if the major transportation investment projects are built (Table 24) suggesting that the projects would benefit the protected population. The average trip length benefit for the environmental justice population will be much lower than the regional average and the average for the non-target population.

Level of Service

Network-wide, the construction of the major transportation projects is projected to improve the morning peak level of service for all classifications of roadways in the region (Table 25). The travel model analysis consistently indicates a greater percentage of travel at levels of service "A-B-C" with the building of the projects. In addition, the travel model projects a reduction in the percentage of occasions these roadways would operate at a level of service "F." These improvements to the travel network would also benefit the roadway users from the environmental justice population.

Table 21: Major Projects - Accessibility to Jobs by Automobile and Transit Modes

	Number of Jobs Accessible within 30 Minutes by Automobile		Number of Jobs Accessible within 60 Minutes by Transit	
	2040 Build Network	2040 No-Build Network	2040 Build Network	2040 No-Build Network
Non-EJ Zones	793,196	772,991	1,798,243	1,750,445
EJ Zones	1,496,144	1,452,572	2,874,770	2,852,608
EJ High Disadvantage	2,264,518	2,207,636	3,432,997	3,420,487

Source: H-GAC Travel Demand Model, 2017.

Table 22: Major Projects - Average Vehicle Trip Speed for Automobile and Transit Modes

	Average Vehicle Trip Speed by Automobile (mph)		Average Vehicle Trip Speed by Transit (mph)	
	2040 Build Network	2040 No-Build Network	2040 Build Network	2040 No-Build Network
All TAZs	36.2	35.4	35.7	36.8
Non-EJ Zones	36.6	35.5	36.3	38.3
EJ Zones	35.8	35.3	35.3	36.1
EJ High Disadvantage	35.5	34.9	35.1	34.9

Source: H-GAC Travel Demand Model, 2017.

Table 23: Major Projects - Average Vehicle Trip Time During AM Peak (6 am – 9 am)

	Average Vehicle Trip Time by Automobile (minutes)		Average Vehicle Trip Time by Transit (minutes)	
	2040 Build Network	2040 No-Build Network	2040 Build Network	2040 No-Build Network
All TAZs	25.6	25.9	35.7	36.8
Non-EJ Zones	29.2	29.8	28.0	21.2
EJ Zones	22.0	22.2	19.8	18.1
EJ High Disadvantage	17.2	17.3	16.4	15.2

Source: H-GAC Travel Demand Model, 2017.

Table 24: Major Projects - Average Vehicle Trip Length During AM Peak (6 am – 9am)

	Average Vehicle Trip Length by Automobile (miles)		Average Vehicle Trip Length by Transit (miles)	
	2040 Build Network	2040 No-Build Network	2040 Build Network	2040 No-Build Network
All TAZs	15.5	15.3	13.2	11.6
Non-EJ Zones	17.8	17.6	16.9	13.5
EJ Zones	13.2	13.0	11.6	10.9
EJ High Disadvantage	10.1	10.1	9.6	8.8

Source: H-GAC Travel Demand Model, 2017.

Table 25: Major Projects - Level of Service During Morning Peak Period (6 am – 9 am)

Roadway Classification	2040 Conformity		2040 No-build	
	LOS	% By Class	LOS	% By Class
Freeway	A-B-C	74.8%	A-B-C	73.0%
	D-E	9.3%	D-E	9.0%
	F	15.9%	F	18.0%
Toll Roads	A-B-C	84.0%	A-B-C	79.9%
	D-E	7.2%	D-E	10.9%
	F	8.8%	F	9.2%
Principal Arterials	A-B-C	84.1%	A-B-C	82.1%
	D-E	8.5%	D-E	8.6%
	F	7.4%	F	9.3%
Other Arterials	A-B-C	86.1%	A-B-C	84.3%
	D-E	7.2%	D-E	7.8%
	F	6.7%	F	7.9%
Collectors	A-B-C	92.3%	A-B-C	91.0%
	D-E	3.2%	D-E	3.3%
	F	4.5%	F	5.7%
Frontage Road	A-B-C	85.0%	A-B-C	83.0%
	D-E	6.2%	D-E	7.1%
	F	8.8%	F	9.9%
HOV	A-B-C	64.5%	A-B-C	51.7%
	D-E	8.9%	D-E	21.7%
	F	26.6%	F	26.6%
HOT	A-B-C	72.1%	A-B-C	63.3%
	D-E	7.3%	D-E	10.6%
	F	20.6%	F	26.1%

Source: H-GAC Travel Demand Model, 2017.

8.7. Local Thoroughfare Projects - Ten-Year Plan (2017 – 2026)

A complement to examining the regionally significant projects in a spatial equity analysis is the evaluation of the local thoroughfare investments (Map 18). Local transportation projects reflect the investment choices that have been made by the different local government and state entities within the planning region in furtherance of the mobility plans for their jurisdictions. The pattern of local transportation projects is appropriate evidence of distributional equity because the transportation benefits of local projects are felt within their immediate environment while any related externalities would typically apply to the same geographical extent as the benefits. Environmental justice review is required for all actions that have a federal nexus. This includes all programs or activities of federal aid recipients, subrecipients, and contactors, irrespective of the funding sources for the programs or activities under immediate consideration. This rule puts local transportation projects within the purview of Title VI and environmental justice compliance. Knowledge of the environmental justice implications of local thoroughfare projects is important to the MPO because of their role in coordinating the Regional Transportation Plan and their responsibility and commitment to promote the welfare and meet the transportation needs of all their residents, including the environmental justice population.

The conclusions from the spatial review of local projects parallel the observations of the major road investment analysis. Approximately 66% of the mapped local projects pass through or run adjacent to an environmental justice zone (Table 26). The cost value of these projects amount to approximately 50% of the total budget for all the mapped projects. The proportion of the local projects that fall within or run adjacent to an environmental justice zone with high disadvantage drops to 14%, which corresponds to only 9% of the total budget for the projects. In contrast, as much as 78% of the mapped local transportation projects fall within or run adjacent to a non-environmental justice zone. These projects represent approximately 88% of the cost value of all the local projects.

Several conclusions may be drawn from this information. The number of local projects that pass through or are adjacent to the protected communities and the overall cost of these projects differ significantly from those projects proposed for the non-protected communities. Again, comparatively less investment is programmed for the environmental justice areas with high disadvantage. It may be reasonably concluded that the environmental justice population will receive a disproportionate share of investment benefits in terms of their proximity to local road improvement projects, when compared with the non-environmental justice population.

Table 26: Local Thoroughfare Improvement Projects in H-GAC 10-Year Plan (FY 2017-2026)

	EJ Target Areas	EJ Target Areas of High Disadvantage	Non EJ Target Areas
Number of Projects (Percent of Projects)	98 out of 149 (66%)	21 out of 149 (14%)	116 out of 149 (78%)
Cost of Projects (Percent of Budget)	1,883,026,217 (50%)	331,286,749 (9%)	3,272,353,545 (88%)

Source: H-GAC Ten-Year Plan (FY 2017 – 2026)
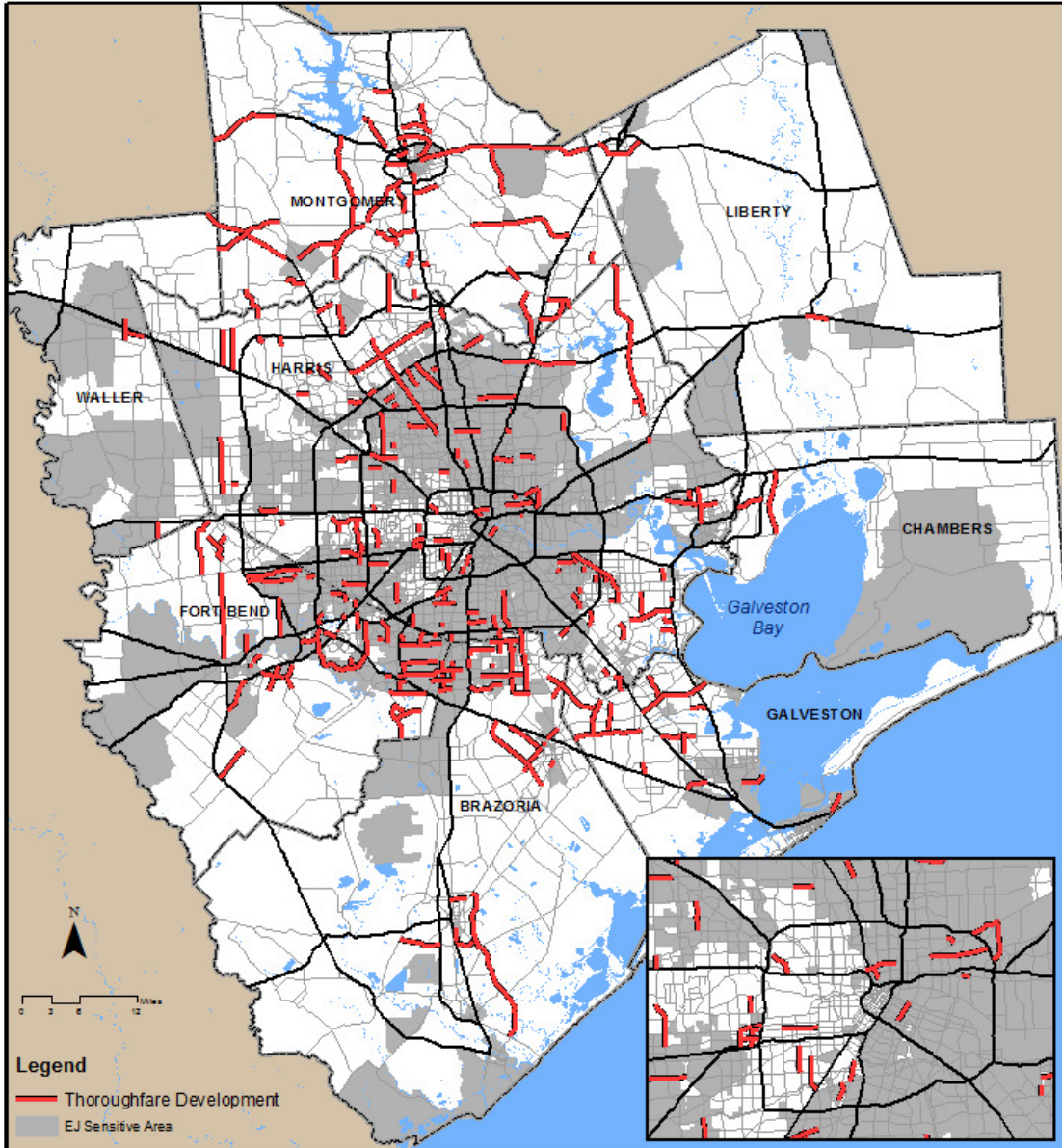
Map 18: Local Thoroughfare Investments in H-GAC Ten-Year Plan (2017 – 2026)

8.8. The North Houston Highway Improvement Project

The North Houston Highway Improvement Project (NHHIP) is a proposal by the Texas Department of Transport (TxDOT) to modify a section of Interstate Highway 45 (the North Freeway) from Beltway 8 to the downtown loop (Map 19). The project is expected to create additional roadway capacity, manage congestion, enhance safety, and improve the mobility and operational efficiency to this highway.[9] Proposed roadway improvements will add managed express (MaX) lanes, remove the curved/elevated portions of Interstate Highway 45 around downtown, and re-align the highway parallel to US Highway 59/Interstate Highway 69. The project will involve a massive reconstruction of the existing main lanes and frontage road network and the reworking of access to the western half of the downtown region from the re-aligned freeways. Other associated roadway improvements include the addition of full-width shoulders as well as pedestrian/bicycle lanes along frontage roads. The NHHIP project is currently in the Draft Environmental Impact Statement (DEIS) review process and any references in this study to anticipated environmental justice impacts are taken directly from the DEIS.

The NHHIP project area is almost entirely built up and has little available developable vacant land. This project area corresponds to Travel Sectors 11 and 16, described earlier in this study, and crosses several super neighborhoods known for their concentration of environmental justice sensitive populations. Several alternatives are being evaluated for each of the three segments that comprise the NHHIP project. All the alternatives will require the acquisition of new right-of-way. The controversial feature common to each alternative is their potential to severely impact the environmental justice community, even though the direct benefits that will accrue to these communities from the project will be limited. Potential impacts to community resources identified in the DEIS include the displacement of residences and businesses, the loss of community facilities, isolation of neighborhoods, changes in mobility and access, and the increased noise and visual impacts.[10]

The NHHIP Draft EIS asserts that all the reasonable project alternatives would result in "disproportionately high and adverse effects on minority and/or low-income populations because the adverse impacts would be predominantly borne by minority and low-income populations."[11] Notable impacts from the preferred alternative include residential displacements to up to 1,067 multi-family housing units, (which include Clayton Homes and Kelly Village - subsidized public housing for low-income families owned by the Houston Housing Authority), and the removal of about 168 single-family homes. Displacement would also affect Hispanic houses of worship, church run schools, soup kitchens that serve the homeless, and Asian owned businesses and restaurants. Other property owned by the environmental justice protected class will be impacted temporarily by increased traffic, noise, air emissions, and other construction related effects. TxDOT is committed to using best management practices to limit the environmental impacts of the construction activities, and to protect the vulnerable population from its unsafe conditions.

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[9] North Houston Highway Improvement Project: Draft Environmental Impact Statement, Texas Department of Transportation. April 2017.

[10] Ibid.

[11] Ibid.

The Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) provides protections and requires assistance for persons affected by Federally funded projects. TxDOT is coordinating with the Houston Housing Authority to consider housing alternatives for the public housing residents that may be displaced by this project. There is a present shortage of public housing owned by the City of Houston Housing Authority, which may influence plans to relocate displaced public housing tenants to comparable housing. There is however an opportunity to learn from practices from other jurisdictions across the nation which have successfully served the needs of both the State and the impacted communities, engendering goodwill in the underserved communities and laying a groundwork for beneficial partnerships for the future.
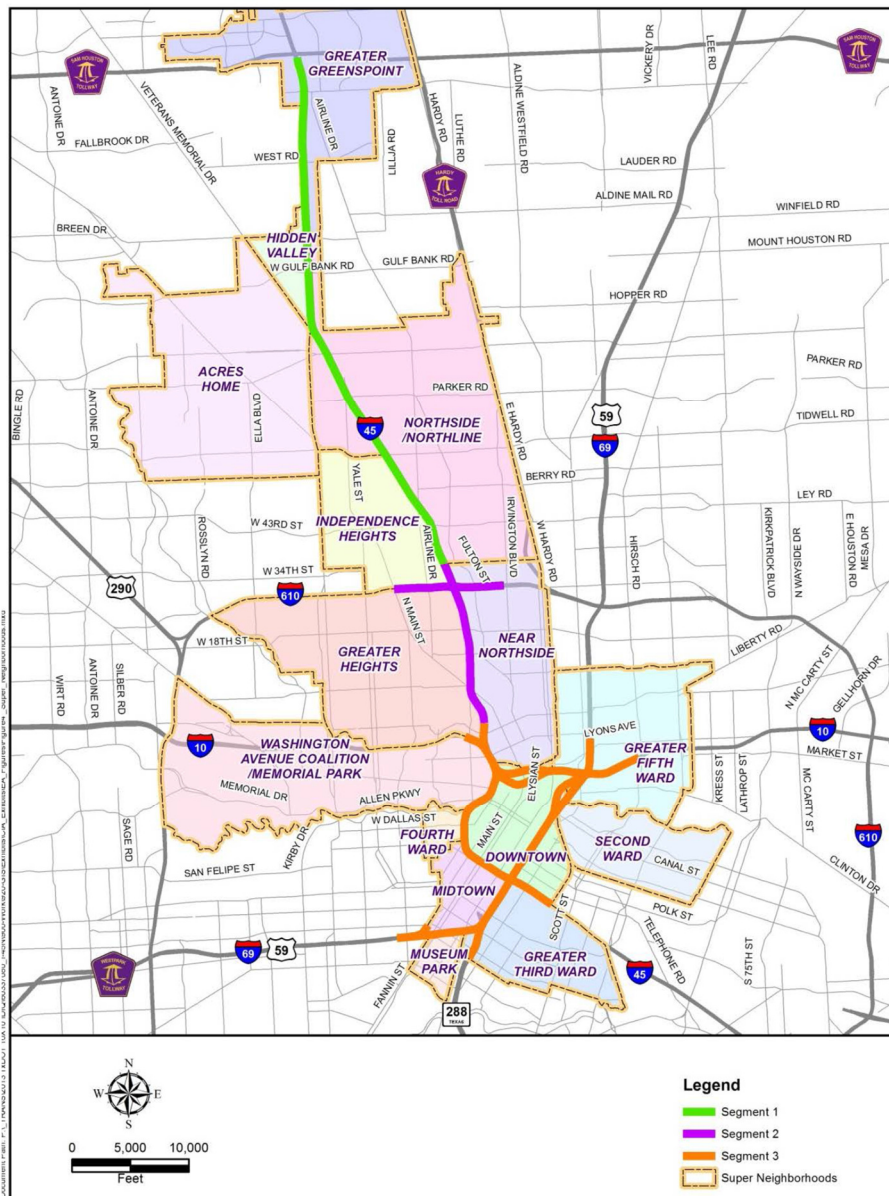
Map 19: Segments of the North Houston Highway Improvement Project

9.0. EQUITY IN ACCESSIBILITY TO PUBLIC AMENITIES

The following analyses look at access to public amenities for residents in the environmental justice communities compared to the access available to members of the non-target population. It offers a regional equity assessment of how well the state and local transportation partners provide for access to opportunities and to different community facilities and vital services.

9.1. Accessibility to Pedestrian-Bicyclist Infrastructure

The H-GAC region has over 1,300 miles of pedestrian/bicycle infrastructure (Map 20). Access to safe and convenient pedestrian and bicycle facilities could encourage residents to use these non-motorized transportation modes for their commuting, personal, and recreational needs. Conversely, walking and biking is dissuaded and conflicts with other roadway users are exacerbated where these facilities are lacking. Pedestrians and bicyclist who are forced to share the roadway with cars and trucks are exposed to greater risk of accidents and physical injury.

The H-GAC Pedestrian-Bicyclist (Ped-Bike) program promotes efforts and initiatives aimed at making the region more "walkable and bikeable." This section looks at the existing pedestrian-bicyclist infrastructure in the eight-county MPO region to determine the level of facilities available to the environmental justice communities. The review compares the length of bicycle lanes and walking trails that are within or adjacent to the environmental justice areas with the facilities that service the non-target areas. The assessment does not trace the connectivity of each individual facility to the entire Ped-Bike network.

Table 27 summarizes the main features of the bikeway infrastructure available to the target and the non-target communities. The environmental justice communities have direct access to approximately 469 miles of bikeway facilities which includes about 85 miles of bike lane facilities - almost half the system of bike lanes in the region. Nevertheless, the total length of the bikeway infrastructure within the non-target community is almost twice the length of the infrastructure located in the environmental justice sensitive region. Other than the bike lane system, the development of every other bikeway facility appears to be focused outside the environmental justice region.

Table 27: Bikeway Infrastructure in the H-GAC Eight-County Region

Ped-Bike Facility	Regional Total	In Non EJ Area	% of Network	In EJ Area	% of Network	EJ with High Disadvantage	% of Network
Bike Lane	174 Miles	89 Miles	51%	85 Miles	49%	24 Miles	14%
Shared Use Path	811 Miles	544 Miles	67%	267 Miles	33%	22 Miles	3%
Signed Shared Roadway	281 Miles	185 Miles	66%	97 Miles	34%	24 Miles	9%
Signed Shoulder Bike Route	103 Miles	83 Miles	80%	20 Miles	20%	1 Mile	1%
Total	1,370 Miles	901 Miles	66%	469 Miles	34%	70 Miles	5%

Source: H-GAC Regional Bikeway Plan 2014
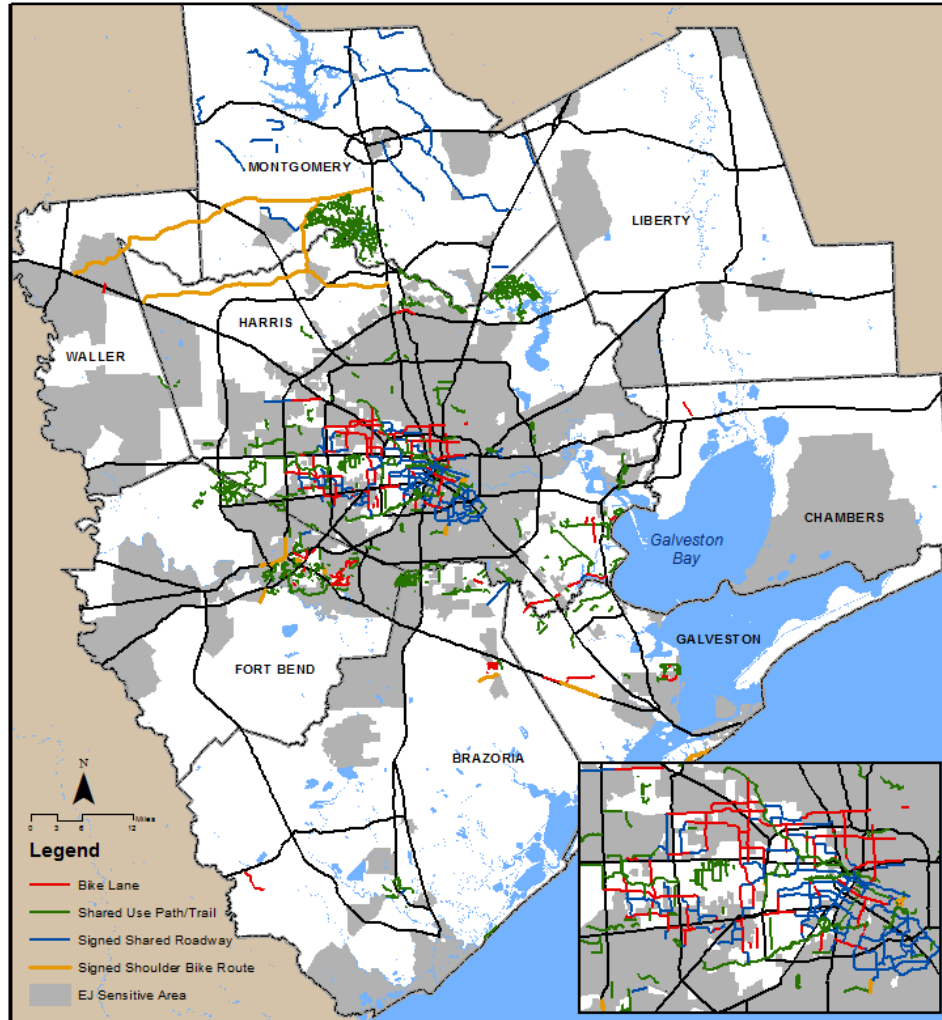
Map 20: Distribution of Pedestrian-Bicyclist Facilities in the Eight-County TMA Region

Environmental justice areas identified as having high disadvantage derive even less benefit from the bikeway infrastructure as only 5% of the total bikeway network run through or is adjacent to these communities. Some of the trail facilities follow the natural creek\bayou drainage network which is determinative of their regional distribution.

9.2. Accessibility to County Libraries

There are about 110 county library facilities within the H-GAC planning region. As many as 44 (40%) of these library facilities are located within an environmental justice area. Up to 12 (11%) of the libraries are within an environmental justice zone identified as having high disadvantage. In comparison, though more dispersed, 66 of the county library facilities (60%) are located within the non-target areas.

Many of the county libraries are clustered near the City of Houston urban core because of the high concentration of population and the intense demand for library facilities available there. Map 21 shows a travel shed around these county libraries. The travel shed is different from a buffer analysis because it is modeled on the local street network and attempts to provide a realistic approximation of movement within the neighborhoods. This analysis excludes highways but assumes a local street network with adequate sidewalks and other infrastructure for safe walking and bicycle travel.
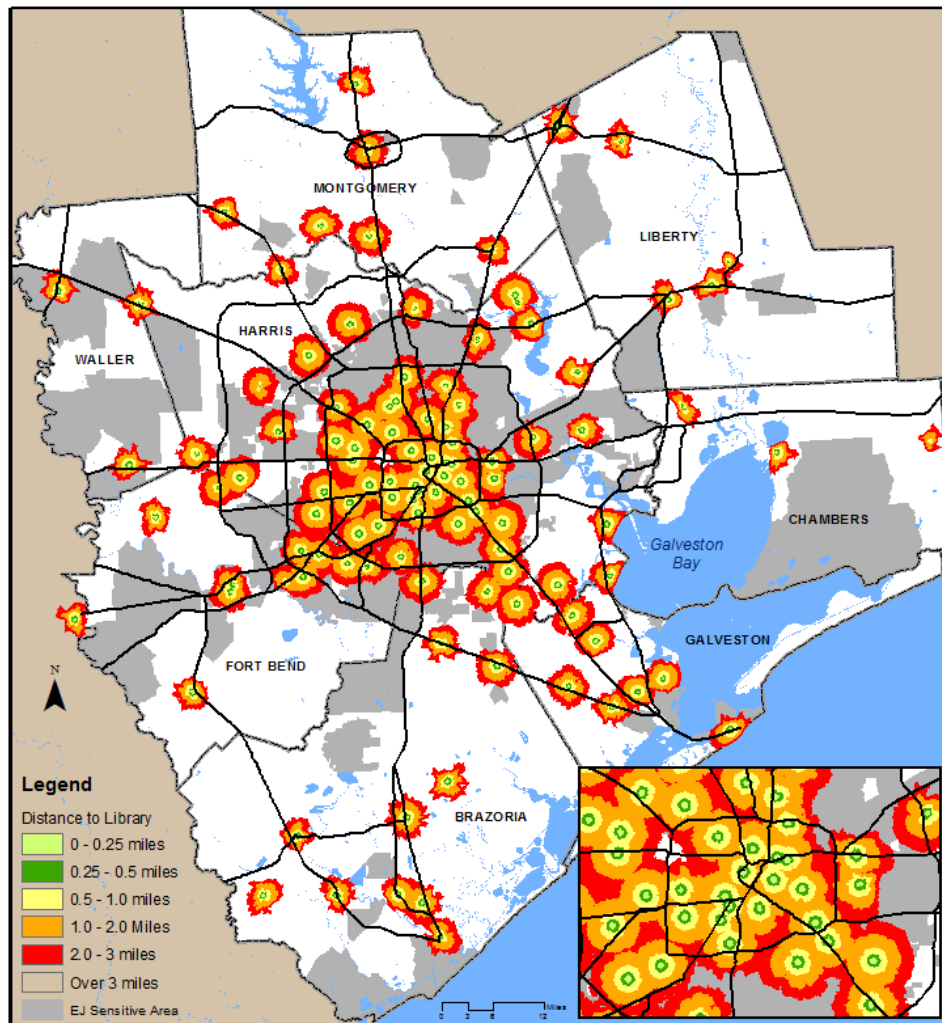
Map 21: Travel-Shed for County Library Facilities in the Eight-County TMA Region

Accessibility by Biking and Walking

A three-mile travel shed posits the furthest distance from which a middle school student can be expected to travel by bicycle to a local library facility, while a one-mile limit represents the distance that will typically be covered by a 15-minute walk. The County Library travel shed is graduated in quarter-mile and half-mile increments, suggesting boundaries from which walking and biking to the library could be a viable option for the library patron. Because of their relative locations, the library facilities in this study appear to be more accessible to the environmental justice population when biking or walking than to the non-target population.

Up to 70% of the environmental justice block-groups that are inside the limits of beltway 8 are within the 3-mile travel shed limit for a bicycle trip to a library facility. There are however accessibility gaps to the south (travel sector 5), east (travel sector 17), and northwest (travel sector 15) of the beltway region. Even greater gaps in accessibility unfold when considering the one-mile walking trip to a library, which is defined by the yellow band on the travel shed map.

Accessibility by Automobile and Transit

Both the environmental justice communities and the non-target population have good access to a library facility by automobile (Table 28). Significant differences arise when comparing accessibility by transit. Only 39% of the households in the environmental justice communities in the planning region have access to a library within 60 minutes of travel. This number increases to 78.7% of the households, when considering only households from the environmental justice areas described as having high disadvantage. These accessibility figures contrast with the non-target population in which only 18.1% of the households have access to a library facility within 60 minutes of travel by transit.

Table 28: Accessibility to County Library Facilities by Automobile and Transit Modes

	Total Households	Households within 15 mins by Automobile		Households within 60 mins by Transit	
		2017 Network	Percentage	2017 Network	Percentage
Non-EJ Zones	1,112,584	1,068,900	96.1%	210,869	18.1%
All EJ Zones	1,341,612	1,322,912	98.6%	529,683	39.5%
EJ High Disadvantage	136,123	135,902	99.8%	107,106	78.7%
Minority	1,162,874	1,150,071	98.9%	481,467	41.4%
Low-Income	364,406	361,344	99.2%	235,897	64.7%
LEA	337,642	334,948	99.2%	207,693	61.5%
LEP	315,613	315,392	99.9%	195,354	61.9%
Zero Auto HH	272,360	272,360	100.0%	197,395	72.5%
Female HH	326,408	325,689	99.8%	187,475	57.4%
Seniors	92,818	92,274	99.4%	45,477	49.0%

Source: H-GAC Travel Demand Model, 2017.

The explanation for the high rate of accessibility by transit service for the environmental justice communities with high disadvantage is that these communities are geographical clustered near the central

city - a location with a high concentration of the library facilities and an area that is intensely served by public transit. The low rate of accessibility to a library facility by transit for households from the non-target population is because much of this population is spread out in the suburban and rural locales, beyond the service areas of major transit and where library facilities are fewer are more dispersed.

The travel demand modeling analysis also measured accessibility to County Library facilities for persons described by each of the seven categories of socio-economic disadvantage that define environmental justice status (Table 28). Accessibility to the library facilities by personal automobile is comparatively high for all the environmental justice subgroups but dissimilarities appear in the measurements of accessibility by transit. Over 70% of the households with no automobiles can reach a library facility within 60 minutes travelling by transit. The percentages fall to close to 60% for the households defined as low-income, LEA, LEP, or headed by a female. The lowest levels of accessibility to a public library facility by transit within the environmental justice population occurs for the minority and the elderly, which are probably the most geographically dispersed groups within the environmental justice population. A possible explanation for the high accessibility rate by transit for the zero automobile households is that they compensate for the disadvantage of not possessing personal automobiles by locating within reasonable reach of public transit service.

9.3. Accessibility to Full-Service Hospital Facilities

The Upper Gulf Coast region is home to over a hundred full-service hospitals - four of which are Level 1 Comprehensive Trauma Centers. Healthcare services are an important component of the regional economy and an essential resource for every community. The Texas Medical Center in central Houston is the largest medical complex in the world and is reputed to record up to ten million practitioner-patient encounters annually.[12] Accessibility to quality medical care is an important measure of social welfare and a huge environmental justice concern. This section examines how well the regional transportation system enables access to these lifeline Hospital resources, particularly by the protected population (Map 22).
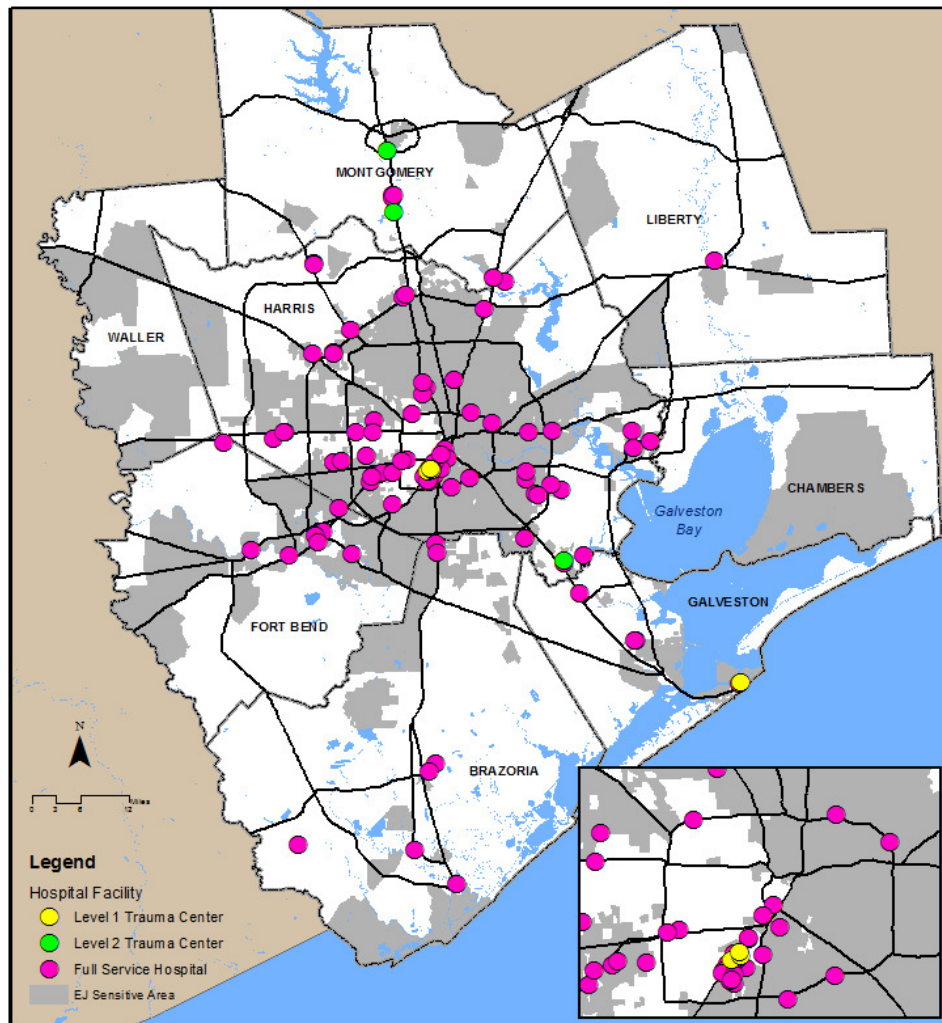
Map 22: Full Service Hospital Facilities in the Eight-County TMA Region

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The assessments from the H-GAC travel demand model indicate that the environmental justice population is not disproportionately disposed with regards to accessibility to a full-service hospital facility. Up to 81% of households from the non-target population are within 15 minutes of a full-service hospital, travelling by automobile. This can be contrasted with 95% of households from the environmental justice communities, and as high as 99% of households from the environmental justice areas classified as high disadvantage (Table 29).

The difference in accessibility is more striking when considering travel by public transit. Only 25% of households from the non-target population are within 60 minutes of a full-service hospital facility travelling by transit. In comparison, 51% of households from the environmental justice population and 53% of the environmental justice households that are highly disadvantaged are accessible to a full-service hospital within 60 minutes - travelling by public transit.

Table 29: Accessibility to Full-Service Hospital Facilities by Automobile and Transit Modes

	Total Households	Households within 15 mins by Automobile		Households within 60 mins by Transit	
		2017 Network	Percentage	2017 Network	Percentage
Non-EJ Zones	1,112,584	902,961	81.2%	277,972	25.0%
All EJ Zones	1,341,612	1,279,298	95.4%	686,826	51.2%
EJ High Disadvantage	136,123	135,109	99.3%	111,554	82.0%
Minority	1,162,874	1,115,456	95.9%	622,243	53.5%
Low-Income	364,406	356,388	97.8%	266,462	73.1%
LEA	337,642	331,044	98.0%	230,371	68.2%
LEP	315,613	315,157	99.9%	233,601	74.0%
Zero Auto HH	272,360	269,480	98.9%	211,198	77.5%
Female HH	326,408	323,335	99.1%	236,635	72.5%
Seniors	92,818	91,179	98.2%	59,523	64.1%

Source: H-GAC Travel Demand Model, 2017.

The travel demand model analysis also measured accessibility to full-service hospitals for residents classified by the seven categories of socio-economic disadvantage that define environmental justice status. Accessibility by automobile is high and comparable for all the different subgroups but slight differences appear comparing trips by public transit. Households that do not have a car have the highest percentage rates of accessibility to a hospital facility by transit, closely followed by LEP households, low-income households, and households headed by a female. The lowest percentages occur for the minority subgroup and the elderly, which are probably the most dispersed groups within the environmental justice population. A possible explanation for the high rates of accessibility by the zero automobile households is that they compensate for the disadvantage of not possessing an automobile by residing within reasonable access to public transit service.

9.4. Accessibility to High-Level Trauma Centers

High-level trauma centers are regional hospitals that can provide comprehensive and definitive care to the most critical injuries or health conditions and represent the highest quality of medical care available in the nation. These high-level trauma centers are referral resources in every medical specialty for all other hospitals in the region. While patients can be transported by helicopter ambulance services, having reasonable accessibility to these potentially life-saving facilities by automobile and transit is desirable. This section examines accessibility to the seven high-level trauma centers[13] in the H-GAC planning region to determine if the environmental justice communities are disproportionately served.
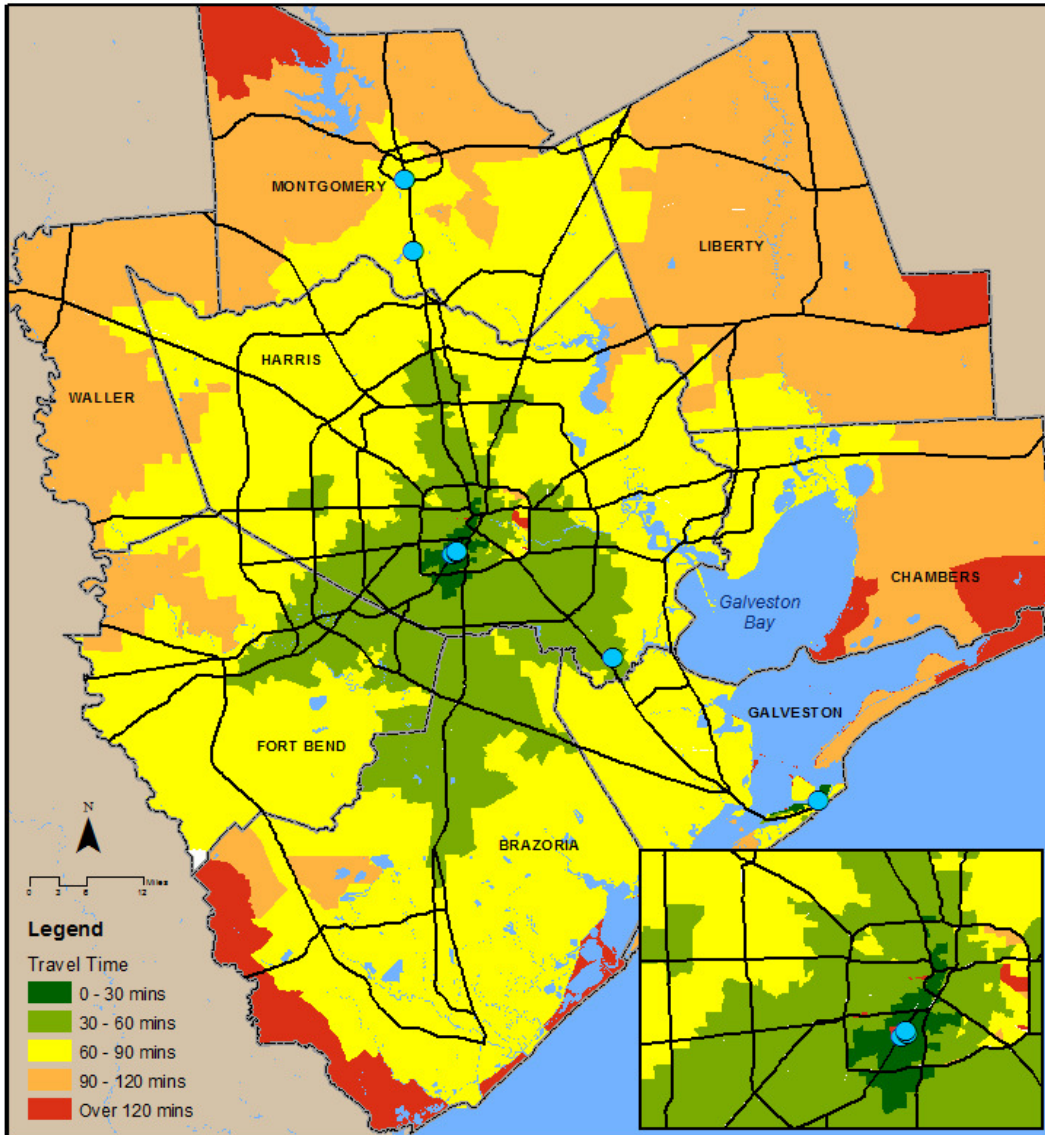
Map 23: Travel Time to the High-Level Trauma Centers in the Eight-County TMA Region

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[13] Only Level 1 and Level 2 trauma centers are considered.

Because of the exclusive nature of high-level trauma centers and their detached locations in the north, central, and southeast sections of the planning region, the measurements of accessibility to these facilities for both the environmental justice and the non-target population is low (Table 30). The H-GAC travel demand model analysis suggests that the non-target population may have greater accessibility to the high-level trauma centers than the protected population. About 31% of the households from the non-protected areas can reach a high-level trauma center within 15 minutes of travel by automobile. This compares with only 19.8% of households in the environmental justice areas.

On the other hand, up to 38% of households from environmental justice areas characterized as areas with high disadvantage can reach a high-level trauma center within 15 minutes of driving (Map 23). This is probably because these neighborhoods are clustered near the city center and are therefore close to the high-level trauma facilities in Texas Medical Center. A higher percentage of this population is within 60 minutes by transit of a high-level trauma center than the non-target population.

Table 30: Accessibility to High-Level Trauma Centers

	Total Households	Households within 15 mins by Automobile		Households within 60 mins by Transit	
		2017 Network	Percentage	2017 Network	Percentage
Non-EJ Zones	1,112,584	346,463	31.1%	272,908	15.5%
All EJ Zones	1,341,612	265,893	19.8%	338,038	25.2%
EJ High Disadvantage	136,123	52,017	38.2%	77,148	56.7%
Minority	1,162,874	215,169	18.5%	304,374	26.2%
Low-Income	364,406	111,851	30.7%	162,785	44.7%
LEA	337,642	78,845	23.4%	127,731	37.8%
LEP	315,613	73,593	23.3%	125,172	39.7%
Zero Auto HH	272,360	115,689	42.5%	159,700	58.6%
Female HH	326,408	100,093	30.7%	125,308	38.4%
Seniors	92,818	19,358	20.9%	21,182	22.8%

Source: H-GAC Travel Demand Model, 2017.

The travel model analysis also measured accessibility to high-level trauma centers for the seven categories of socio-economic disadvantage that define environmental justice status. Accessibility to the high-level trauma centers by automobile and transit is highest for those households that do not have a car and lowest for the elderly and the minority subgroups. The low percentages for the minority and the elderly subgroups are probably because these are the most dispersed subgroups within the environmental justice population. Overall, the accessibility figures suggest that there are no adverse effects imposed on the protected population and they do not suffer disproportionate treatment with respect to their accessibility to the trauma centers.

9.5. Accessibility to Institutions of Higher Education

Accessibility to institutions of higher education is essential to enable the residents of the region achieve their education goals and gain access to better employment opportunities. It is also a pointed measure of transportation equity. There are over 60 universities, junior colleges, and technical institutions within the planning region (Map 24), nearly half of which are in an environmental justice sensitive area (Table 31). These include campuses of major universities and junior college systems. Accessibility to an institution of higher education is measured by the H-GAC travel demand model. For this analysis, the travel demand model assumes that every institution is an equally desired destination for education from the universe of households.

Table 31: Distribution of Institutions of Higher Education in the Gulf Coast Region

	Colleges/Prof Schools	Junior Colleges	Technical Schools	Total
EJ Areas	6	16	8	30
Non-EJ Areas	14	16	3	33
EJ - High Disadvantage	1	3	2	6

Source: H-GAC GIS, 2017.

Table 32 shows that on average, the protected population have better access to institutions of higher education in the planning region than the non-protected population. Almost 84% of the households from the environmental justice areas can reach an institution of higher education within 15 minutes of travel by automobile (Map 25). The number of households accessible within 15 minutes are even greater for the environmental justice areas with high disadvantage (99.7%). These statistics contrast with the regionally dispersed non-target population from which only 71.6% of the households can reach an institution of higher education within 15 minutes of travel by automobile.

Table 32. Accessibility to Institutions of Higher Education

	Total Households	Households within 15 mins by Automobile		Households within 60 mins by Transit	
		2017 Network	Percentage	2017 Network	Percentage
Non-EJ Zones	1,112,584	796,684	71.6%	289,487	26.0%
All EJ Zones	1,341,612	1,125,736	83.9%	653,259	48.7%
EJ High Disadvantage	136,123	135,667	99.7%	116,084	85.3%
Minority	1,162,874	986,533	84.8%	589,955	50.7%
Low-Income	364,406	342,925	94.1%	265,458	72.8%
LEA	337,642	317,488	94.0%	223,023	66.1%
LEP	315,613	306,964	97.3%	229,606	72.7%
Zero Auto HH	272,360	261,793	96.1%	216,651	79.5%
Female HH	326,408	307,875	94.3%	222,630	68.2%
Seniors	92,818	88,898	95.8%	58,668	63.2%

Source: H-GAC Travel Demand Model, 2017.

Accessibility to educational institutions by automobile is high for all the seven socio-economic subgroups that make up the environmental justice population. Households that do not have a car have the highest rates of accessibility to the academic institutions by public transit, followed by the low-income and LEP households. As in previous observations, the environmental justice subgroups with the lowest rates of accessibility by transit are the elderly and the minority population, which are also the most geographically dispersed subgroups within the environmental justice population. A possible explanation for the high rates of accessibility by the zero auto households is that they compensate for this disadvantage by locating within reasonable access to public transit service. Based on the accessibility statistics it may be concluded that there are no adverse effects imposed on the protected population and no associated disproportionate treatment with regards to their accessibility to institutions of higher learning.
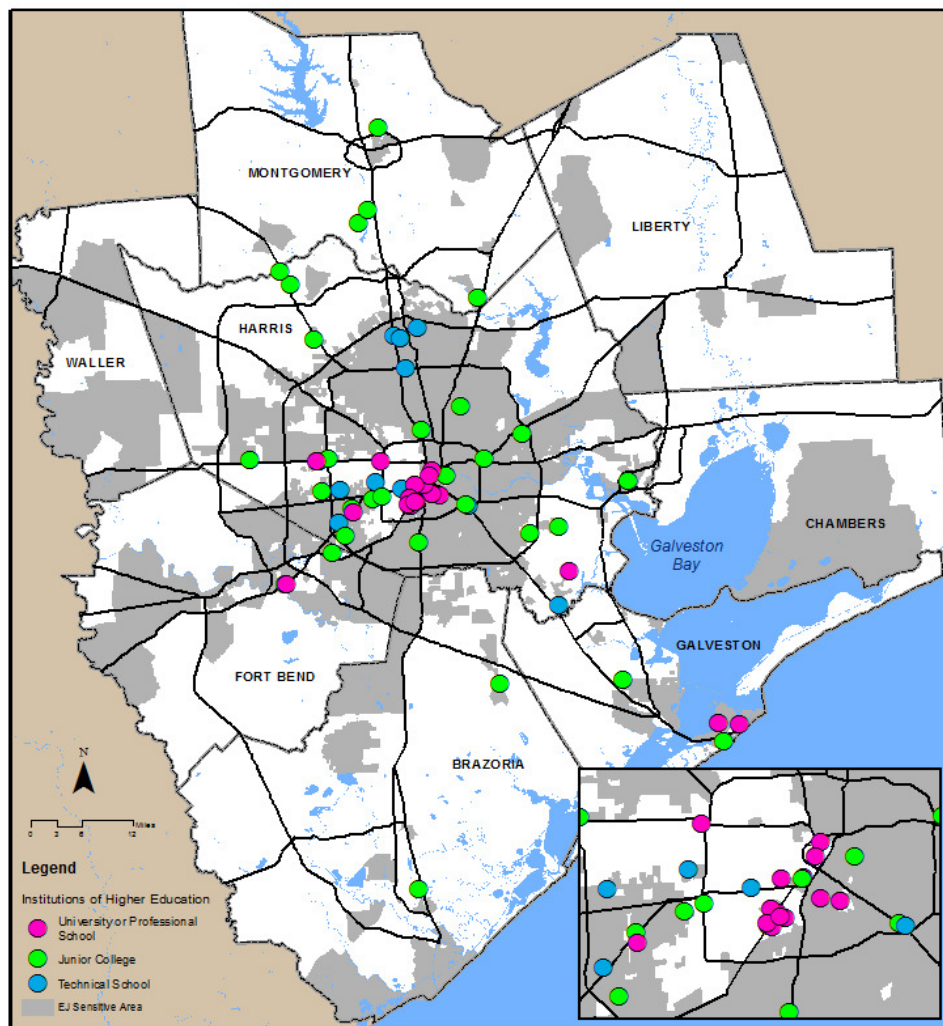
Map 24: Institutions of Higher Learning in the Eight-County TMA Region
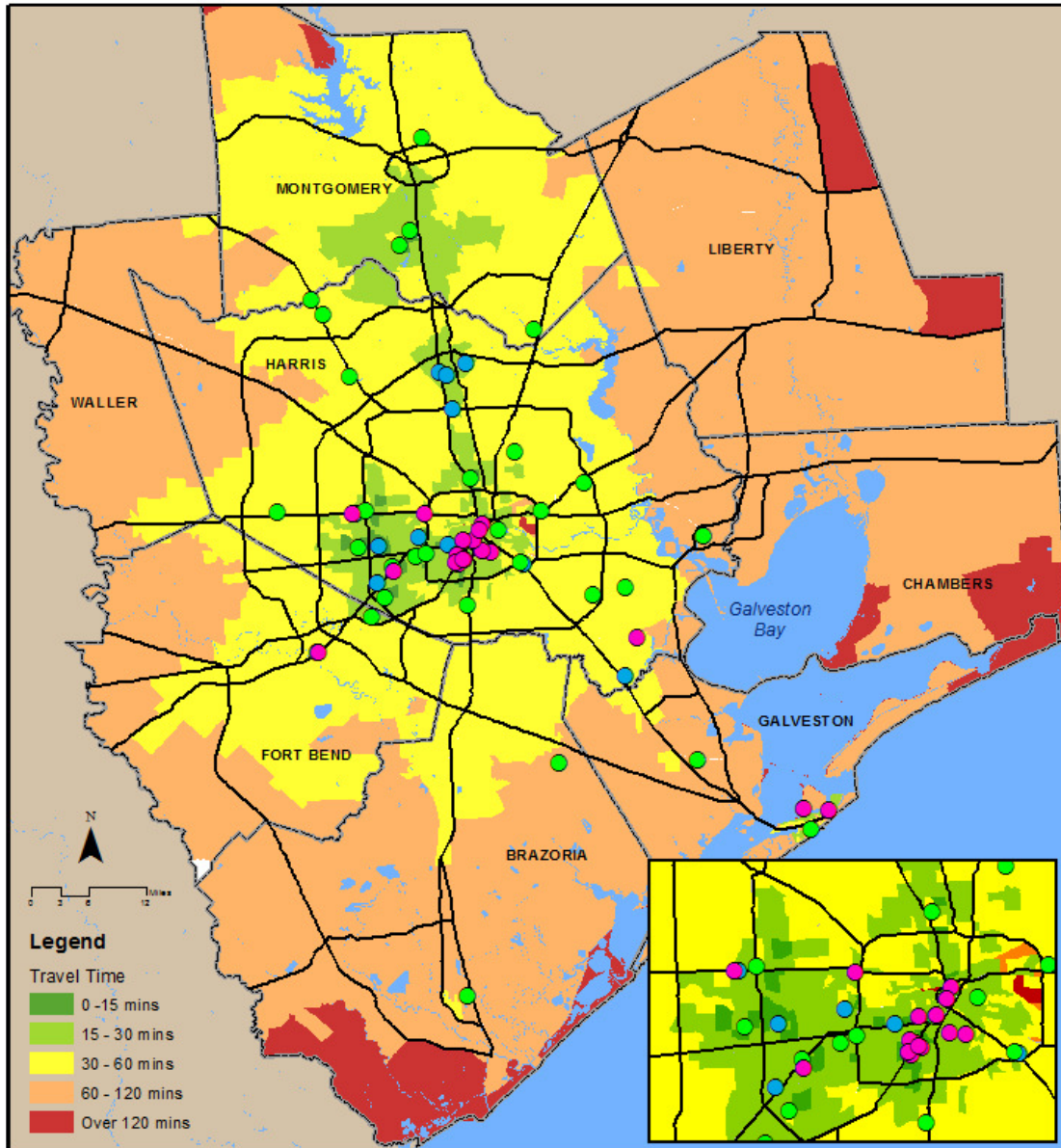
Map 25: Travel Time to Institutions of Higher Learning in the Eight-County TMA Region

9.6. Accessibility to Fixed Route Transit Service

An examination of the available fixed route transit service provides another context for assessing regional equity - whether the minority and low-income populations equitably benefit from the geographic distribution of available transit service. The largest transit service provider in the Houston metropolitan region is the Metropolitan Transit Authority of Harris County (METRO). This analysis looks at the level of service available to the environmental justice neighborhoods as well as accessibility to a METRO bus stop compared with the non-target areas.
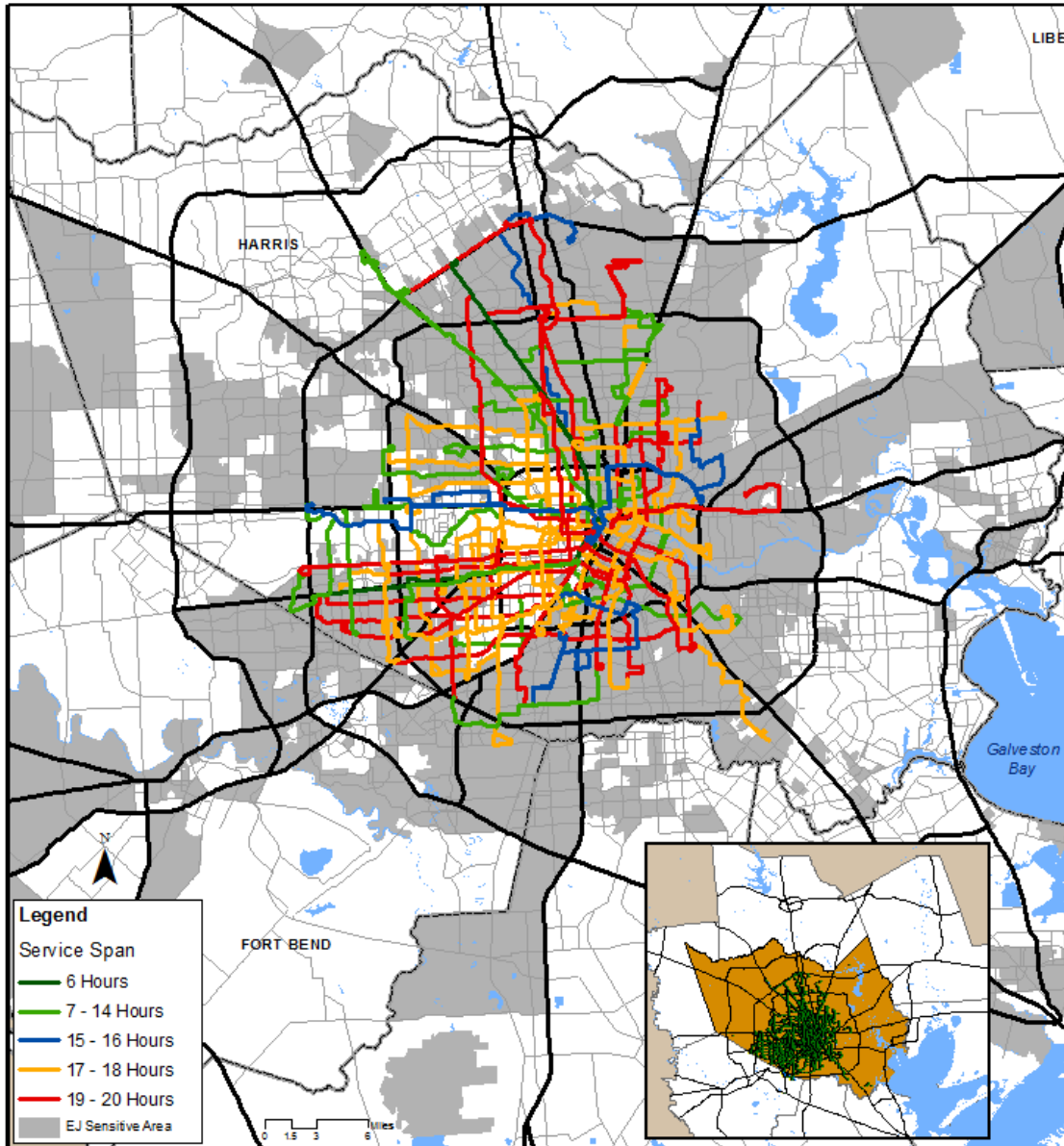
Map 26: METRO Local and Express Bus Routes - Approximate Hours of Route Operation

For logistical reasons, METRO's local and express bus service is limited to the heavily populated areas of the Houston metropolitan area. Map 26 shows that more of these bus routes run through the environmental justice areas than the non-target areas. The route-mile difference for service through these two communities is almost 2:1. With regards to the span of daily service, the environmental justice sensitive areas also receive more daily hours of transit service than the non-target areas. However, the worst peak-hour bus headway conditions apply to environmental justice communities to the north of the city within Travel Sectors 15, 16, and 17 (Map 27).

Accessibility to Bus Stops

Bus stops are the point of access to transit service and are a good indicator of user accessibility. There are approximately 8,978 bus stops within the METRO service area. These bus stops are situated predominantly within environmental justice areas (Table 33). H-GAC's travel demand model examined accessibility to these bus stops for households from both the environmental justice communities and the non-target areas. The quantitative analysis suggests that the environmental justice population will have greater access to available transit service than the non-protected population (Table 34). A significant observation is that over 70% of households from the environmental justice areas identified as highly disadvantaged are within convenient walking distance from a bus stop. This compares with only 22% for the non-target areas.

Table 33: Distribution of METRO Bus Stops in the Houston Metropolitan Region

	Number of Bus Stops	Percent of Bus Stops
EJ Areas	6,223	69%
Non-EJ Areas	2,755	31%
EJ – High Disadvantage*	2,235	25%
Total	8,978	100%

Source: Metropolitan Transit Authority of Harris County, 2017. * Subset of the Environmental Justice Areas

Table 34: Accessibility to METRO Bus Stops from Households in the Eight County MPO

	Households within One-Quarter Mile 2017			Households within One-Quarter Mile 2040		
	Total Households	2017 Network	Percentage	Total Households	2017 Network	Percentage
Non-EJ Zones	1,112,584	244,988	22.0%	1,888,000	311,872	16.6%
All EJ Zones	1,341,612	536,073	40.0%	1,940,598	704,392	36.3%
EJ High Disadvantage	136,123	98,127	72.1%	172,823	124,456	72.0%
Minority	1,162,874	480,047	41.3%	1,652,860	638,838	38.7%
Low-Income	364,406	232,341	63.8%	477,965	290,890	60.9%
LEA	337,642	197,312	58.4%	427,388	241,056	56.4%
LEP	315,613	192,436	61.0%	416,201	246,401	59.2%
Zero Auto HH	272,360	186,481	68.5%	360,741	246,292	68.3%
Female HH	326,408	188,592	57.8%	443,662	242,300	54.6%
Seniors	92,818	44,831	48.3%	120,328	54,161	45.0%

Source: H-GAC Travel Demand Model, 2017.
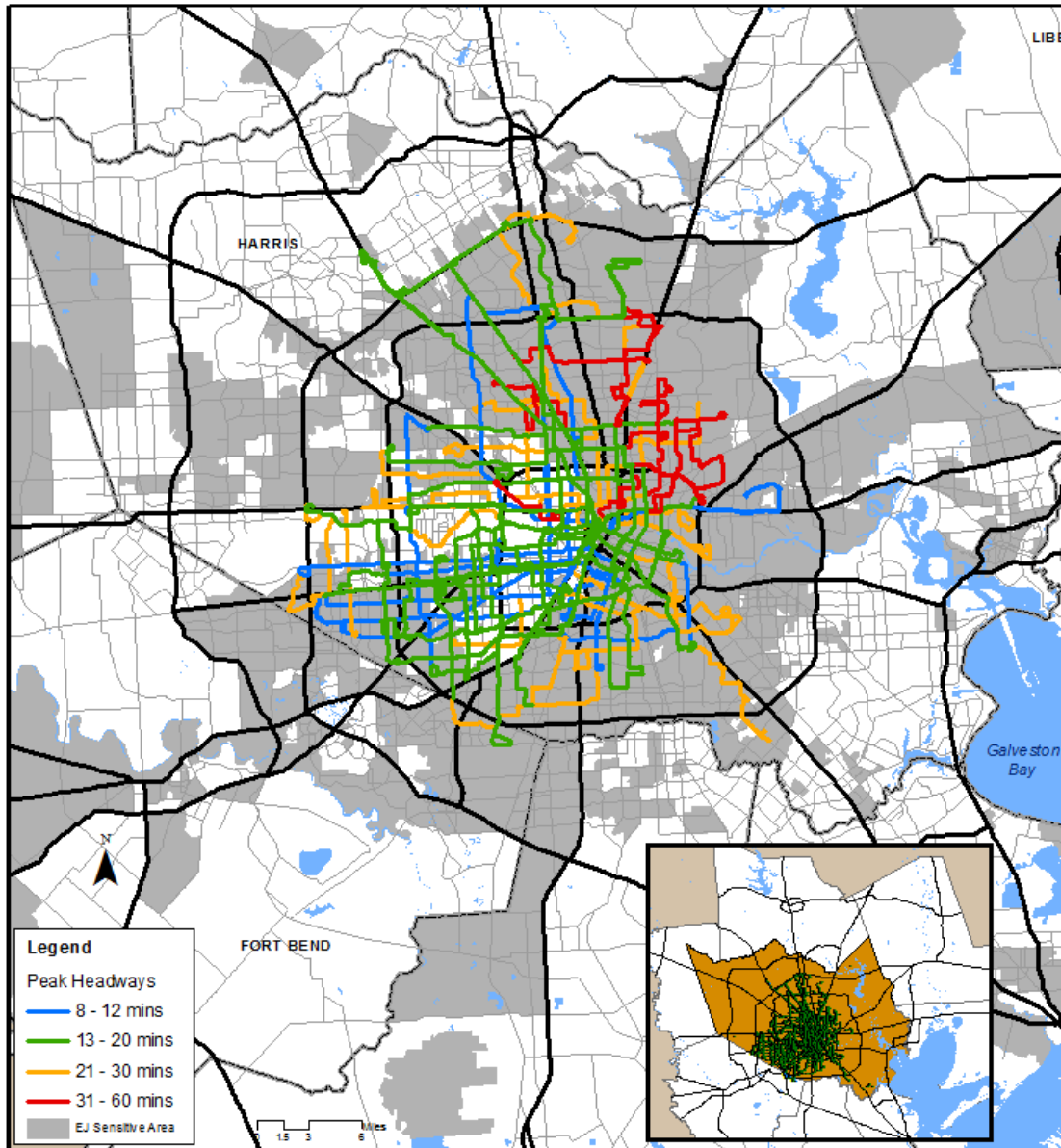
Map 27: METRO Bus Routes - Peak Headway Conditions

The travel model analysis also measured accessibility to bus stops broken down by the seven categories of socio-economic disadvantage that define environmental justice status. Accessibility to a bus stop was highest for those households without a car and the low-income households, and was lowest for the seniors and the minority group. The low percentages for the minority and the senior subgroups are probably because they are the most geographically dispersed groups within the environmental justice population.

Overall, the analyses suggest that there are no adverse effects imposed on the protected population and no disproportionate treatment related to their accessibility to public transit service.

10.0   TRANSPORTATON SAFETY

Improving safety on the roadways is one of the goals of H-GAC's Regional Transportation Plan and an important consideration in undertaking any new or redesigned roadway project. The Houston region has historically had the worst safety record in the State of Texas and is today regarded as one of the most unsafe metropolitan areas in the nation. This section examines roadway accidents in the planning region to determine whether a disproportionately high number of crashes occur in areas heavily populated by the traditionally underserved. Understanding the patterns could help the identification of causal factors for the crash events and guide the choice of appropriate remedial measures to improve safety and enhance transportation performance, whether by education, engineering, enforcement, or emergency response. The accident information comes from the Crash Records Information System (CRIS) compiled and geocoded by TxDOT from all the crash events reported by law enforcement officers across Texas. High severity crashes are those crashes in which a vehicle occupant, pedestrian, or bicyclist suffered an incapacitating injury or was killed.

10.1   Transportation Safety and the Environmental Justice Community

Transportation safety is a grave concern for environmental justice neighborhoods. More than one million motor vehicle crashes occurred within the eight-county MPO region between 2007 and 2016. Environmental justice areas are overrepresented in these crashes (Table 35). Over 60% of the crashes occurred in an environmental justice sensitive area even though the environmental justice community make up only 53% of the region's population. One-fifth of the crashes that occurred within the environmental justice zones occurred in the areas identified as having high disadvantage. In comparison, 39% of all the motor vehicle crashes in the region occurred in a non-target area. A similar picture exists for crashes with high severity in which the environmental justice sensitive areas are also overrepresented.

Table 35: Motor Vehicle Crashes in the Eight-County MPO Region (2007 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
Percent of Total Population	53%	47%	19%	100%
Number of Crashes	657,538	425,812	129,717	1,083,350
% of Crash Total	61%	39%	20%	100%
Crashes per 1000 Population	205	150	212	-
Vehicle Miles Travelled (VMT)	100,879,192	69,193,733	8,775,120	170,072,925
Crashes Per 100 Million Vehicle Miles Travelled (VMT)	179	169	405	-
High Severity Crashes	13,519	10,972	2,542	24,491
% of High Severity Crash Total	55%	45%	19%	100%
High Severity Crashes per 100,000 Population	422	387	416	-

Source: Geocoded TxDOT Crash Records Information System (CRIS).   * Crash numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals.   ** Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Accident incident rates are indicators of safety which permit an objective comparison between different localities. Estimates of vehicle crashes per 1,000 and per 100,000 population, as well as crashes per 100 million vehicle miles travelled (VMT) for the H-GAC planning region suggest that the environmental justice areas are significantly more unsafe in terms of vehicle accidents than are the non-environmental justice areas (Table 35). It is also worth noting that the environmental justice zones identified as the highly disadvantaged communities experience even higher crash rates than is recorded for the population of environmental justice taken as a whole.
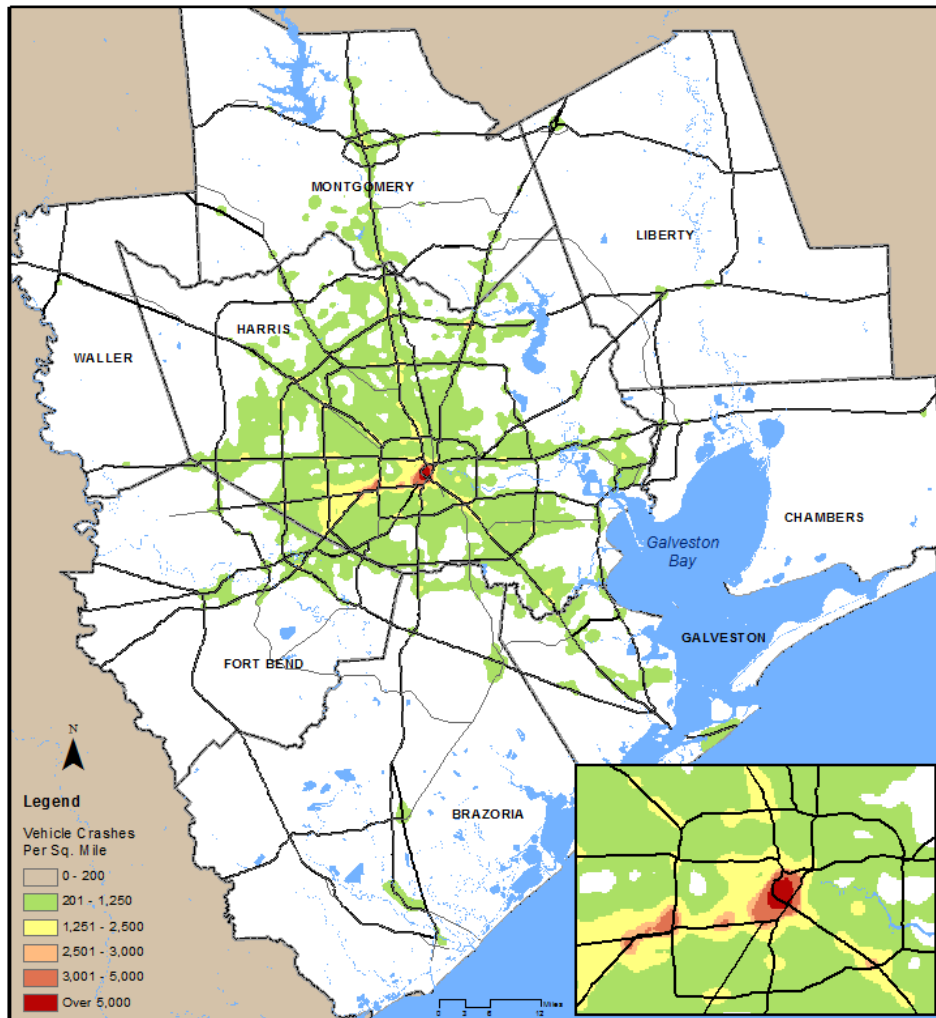
Map 28: Motor Vehicle Crash Density in the Eight-County Region (2007 – 2016)

10.2. Vehicle Accident Hotspots in the Eight-County Region

A hotspot analysis reveals locations in a transportation network with the highest concentration of vehicular crash events. These hotspots are traffic conflict points where remedial actions may be required to improve safety. Based on CRIS records, the most hazardous locations in the planning region are the Houston Downtown and the Midtown districts. These areas with high traffic volumes experienced over 5,000 accidents per square mile, averaged over the ten-year period from 2007 – 2016 (Map 28). Other extremely high crash locations include the US 59/IH 69 Southwest Freeway stretch from Spur 527 to the intersection with Hillcroft, the IH 45 South intersection with I 610, and the intersection between US 59 North and FM 1960.

Several environmental justice sensitive areas show relatively high crash incidents above a background value of 1000 vehicle crashes per square mile. The Houston Southwest is notable (Map 29). This area corresponds to Travel Sector 10, (described earlier in this document), and encompasses the Gulfton, Mid West, Westwood, Sharpstown, Westchase and Alief super neighborhoods. These areas consist of a large concentration of ethnic minority residential and
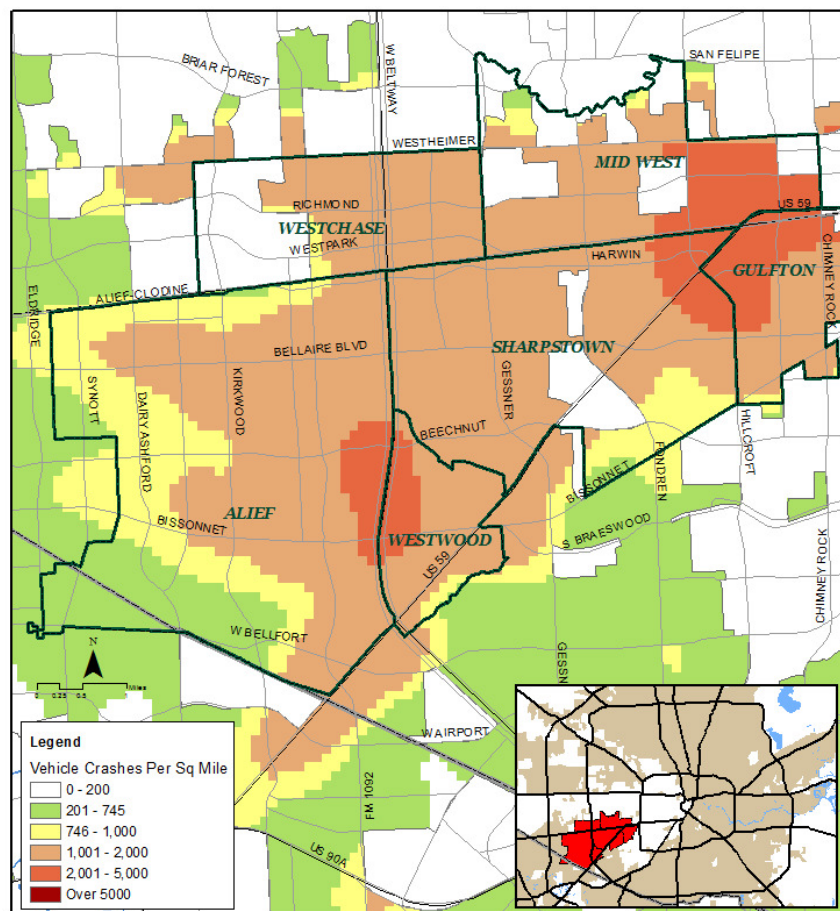
Map 29: Motor Vehicle Crash Density in the Southwest Houston (2007 – 2016)

business communities where the high accident rates are not just limited to the highways, but also occur on the local streets.

10.3. Crash Trends

Motor vehicle crashes in the planning region are on the increase after a period of gradual decline (Figure 18). Trendlines suggest that vehicle crashes are increasing at a faster rate within the environmental justice areas than in the non-target areas. The trend is confirmed by the 5-year rolling average for the high severity crashes that occurred in an environmental justice area (Figure 19).

Figure 18: Vehicle Crashes in the Eight-County TMA Region (2007 – 2016)
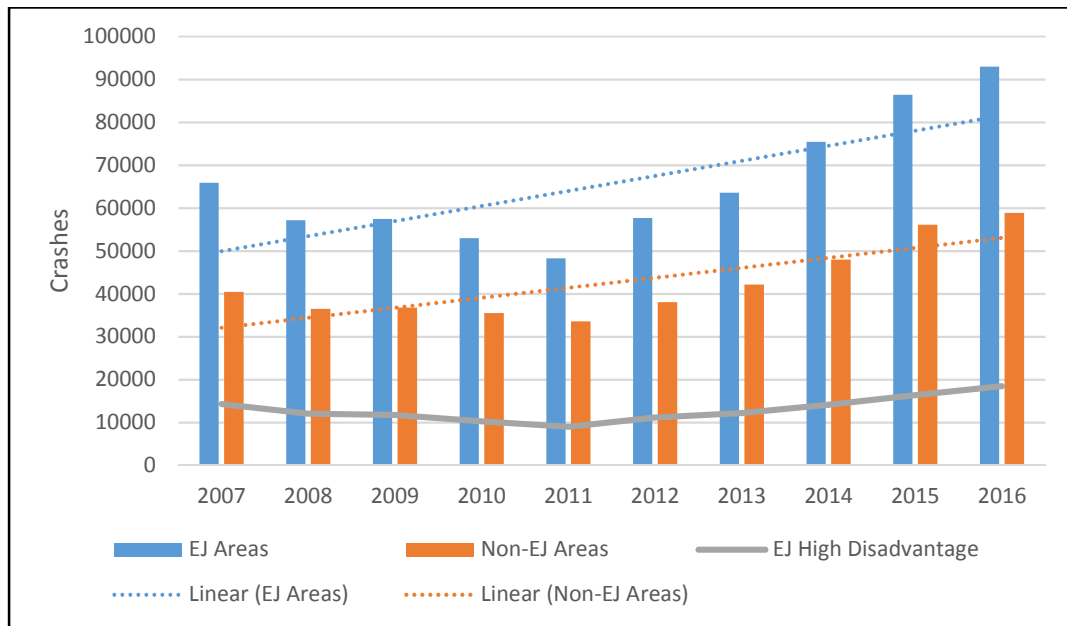
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Figure 19: 5-Year Rolling Averages of High Severity Vehicle Crashes in EJ Zones (2007 – 2016)
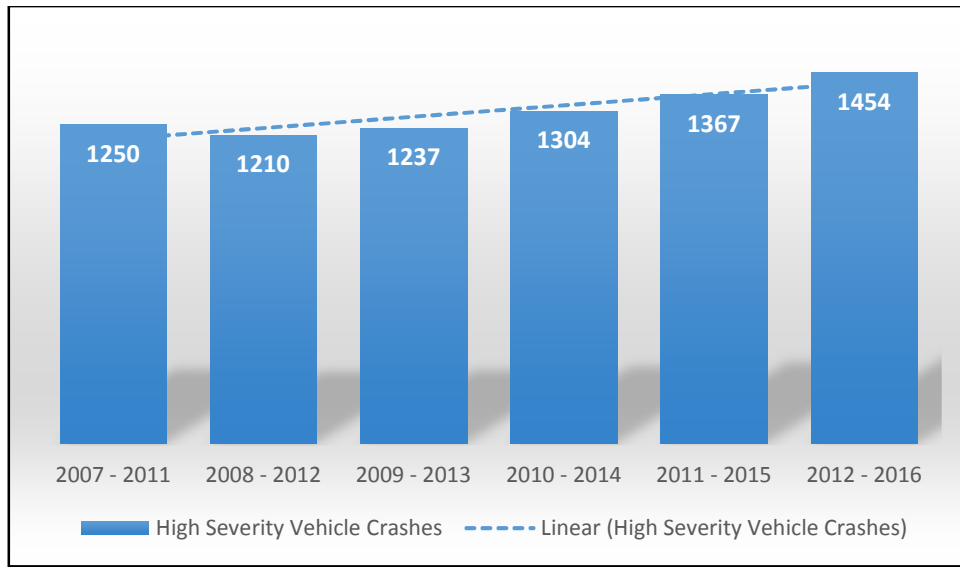
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Figure 20: Fatalities Resulting from Motor Vehicle Crashes by Road Class (2007 – 2016)
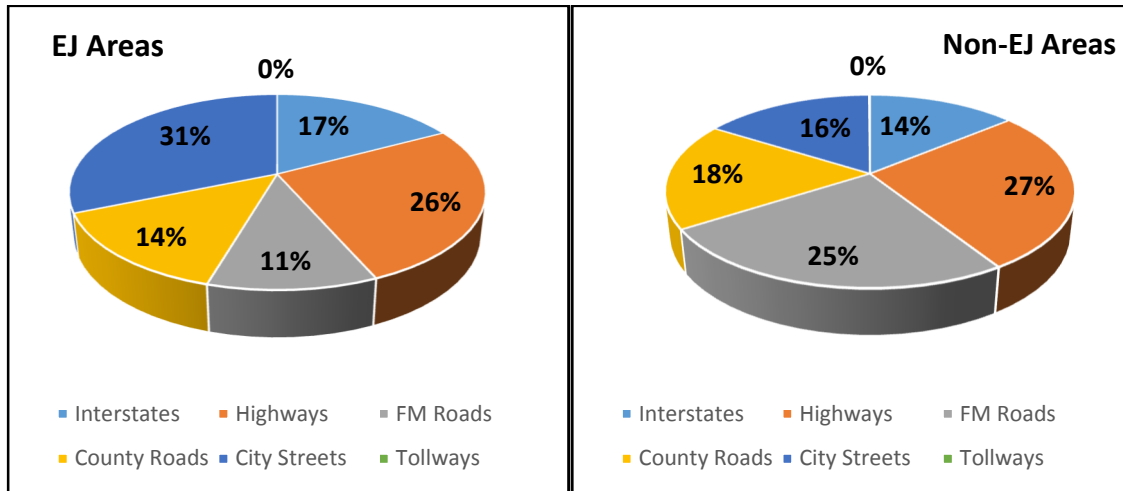
Source: Geocoded TxDOT Crash Records Information System (CRIS).

10.4. Vehicle Crash Causal Factors – Distracted Driving

Distracted driving is the act of operating a vehicle while one's attention is diverted to other activities. Forms of distraction include attending to children, talking on the phone or to passengers, texting, adjusting the vehicle stereo or navigation system, eating, grooming, and even rubbernecking. Texting while driving is the most common cause of distracted driving accidents.

Between 2007 and 2016, approximately 96,546 or close to 12% of the vehicular crashes that occurred in the MPO region were attributed to distracted driving (Table 36). These crashes resulted in 365 fatalities and over 2,400 serious injuries. Figure 21 shows the magnitude of distracted driving crashes in the region and reveals two trends. First, the number of distracted driving crashes is on the rise again after a period of steady decline. Second, environmental justice areas experience much higher distracted driving crash incidents than the non-environmental justice areas. Although the number of crash victims who sustained serious injuries was higher in environmental justice sensitive areas, fatalities that resulted from the distracted driving crashes in the non-target areas exceeded those that occurred in environmental justice areas.

Figure 21: Distracted Driving Crashes (2007 – 2016)
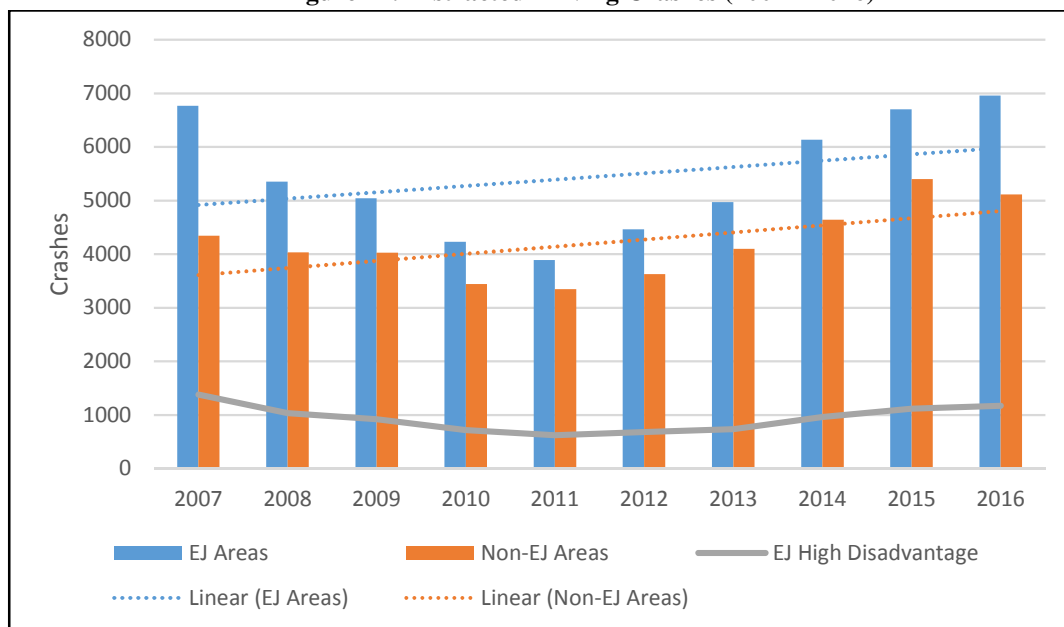
Source: Geocoded TxDOT Crash Records Information System (CRIS).

In both the environmental justice sensitive and the non-environmental justice areas, most distracted driving accidents resulting in incapacitating injuries or fatalities occur on city streets and on the highways (Figure 22). The non-environmental justice zones include large sections of rural and unincorporated county. Traffic volume in these areas are high on the county roads and the Farm-to-Market roads. So is the number of high severity crashes.

Distracted driving accidents are preventable because they stem from unsafe but governable behavior. The escalating trend of distracted driving crashes in environmental justice areas calls for increased education efforts targeted at these communities as well as enhanced enforcement action that reinforce the message that the unsafe behaviors will not be condoned.

Broken down by race/ethnicity, residents from the minority communities make up the bulk of the individuals involved in the recorded distracted driving crash events. White residents made up 35% of the individuals involved in distracted driving crashes, Hispanic residents made up 28%, and the African American residents 20%.

Table 36: Distracted Driving Crashes in the Eight -County MPO Region (2007 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Distracted Driving Crashes	54,489	42,057	9,346	96,546
Percent of Total	56%	44%	17%	100%
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
Crashes Per 1000 Population	17	15	15	-
Number of Crashes of High Severity	1,486	1,318	225	2,804
Percent of Total	53%	47%	15%	100%
High Severity Crashes Per 100,000 Population	46	46	37	-
Fatalities	163	202	31	365
Percent of Total Population	45%	55%	19%	100%

Source: Geocoded TxDOT Crash Records Information System (CRIS). * Crash numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals. ** Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Figure 22: High Severity Distracted Driving Crashes by Road Class (2007 – 2016)
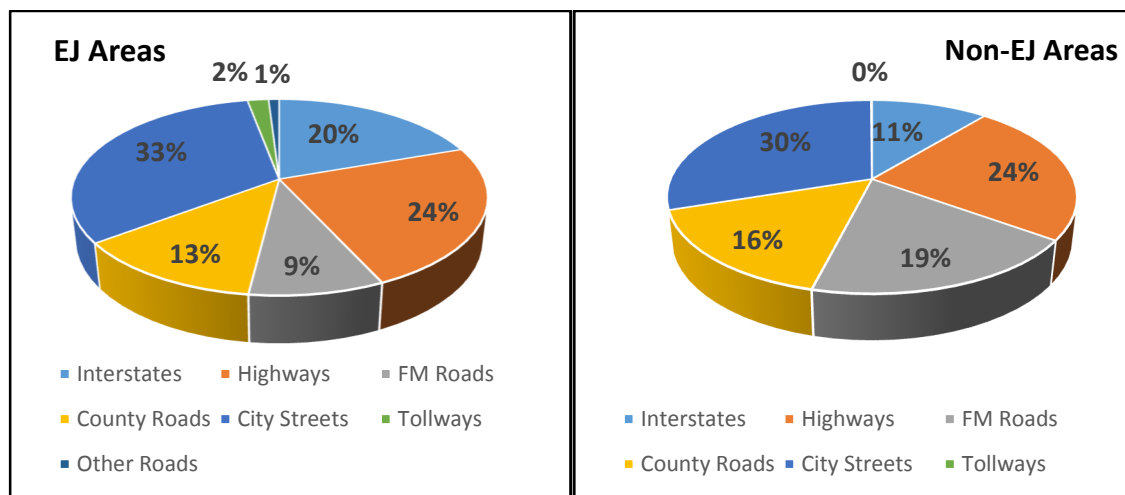
Source: Geocoded TxDOT Crash Records Information System (CRIS).

10.5. Vehicle Crash Causal Factors – DWI Driving

Until recently, DWI associated vehicle crashes within the planning region were higher in the non-target areas than in the environmental justice sensitive areas (Figure 23). While the number of DWI related crashes in the non-target areas have remained relatively uniform over the past ten years, DWI crashes in the environmental justice sensitive areas have been on the rise and now exceed the numbers in the non-target zones. The reason for the increase in drunken driving incidents within the environmental justice sensitive zones is unknown but the consequences are undesirable. The number of fatalities stemming from DWI related crashes that occurred in the protected zones increased by 73% between 2007 and 2016 (Figure 24).

Figure 23: DWI Related Crashes in the Eight-County TMA Region (2007 – 2016)
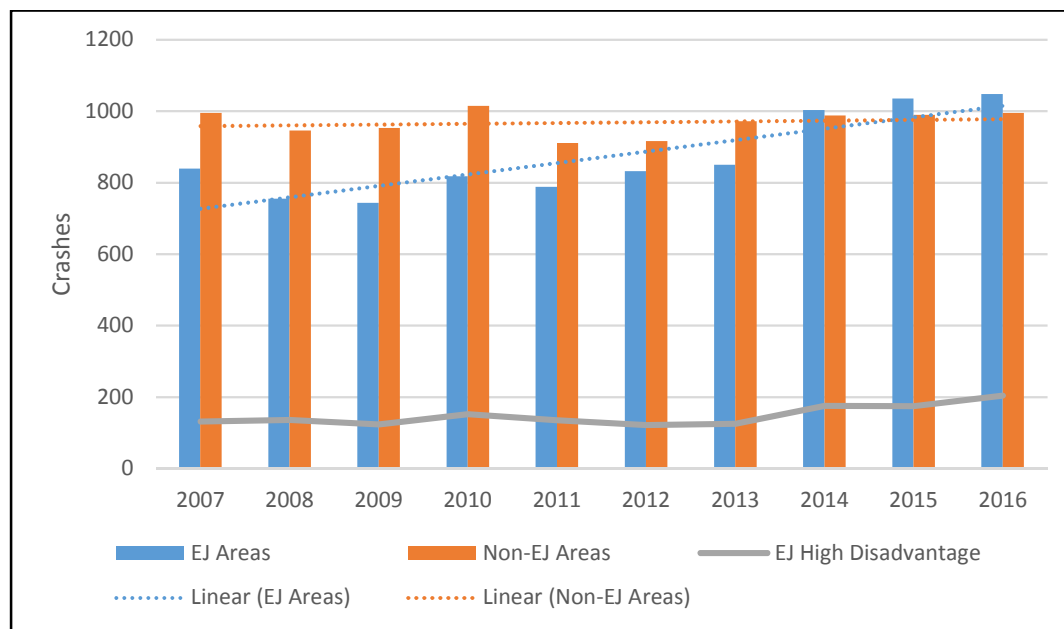
Source: Geocoded TxDOT Crash Records Information System (CRIS).

An examination of the CRIS DWI crash statistics suggests that the environmental justice community are disproportionately impacted by this problem. Averages for the ten-year period from 2007 to 2016 show that most of the geocoded DWI crash incidents occurred in the non-target areas (Table 37). The non-target areas also had the greatest number of high severity crashes and displayed a higher incident rate for all the DWI crash measures considered. The important difference is that the DWI related fatalities is higher for the environmental justice areas than in the non-target areas (Figure 24). This statistic holds true when only incidents on local streets are considered. Overall, DWI related crash fatalities in the environmental justice areas account for 56% of all the geocoded DWI crash fatalities that occurred in the planning region between 2007 and 2016.

The minority population is over-represented in this category of crashes. Broken down by race/ethnicity, Hispanic residents were involved in 43% of the recorded DWI crashes, African American residents were involved in 14% of the crash events, while White residents were involved in 35% of the crashes.

Table 37: DWI Crashes in the Eight-County MPO Region (2007 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
DWI Crashes	8,711	9,681	1,481	18,392
% of DWI Crash Total	47%	53%	17%	100%
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
DWI Crashes Per 1000 Pop	2.8	3.4	2.4	-
High Severity DWI Crashes	1,198	1,228	213	2,426
% of High Severity DWI Crash Total	49%	51%	18%	100%
High Severity DWI Crashes Per 100,000 Pop.	37.4	43.3	34.8	-
DWI Crash Fatalities	440	349	77	789
% of DWI Crash Fatalities	56%	44%	18%	100%

Source: Geocoded TxDOT Crash Records Information System (CRIS).   * Crash numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals.   ** Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Figure 24: DWI Related Fatalities in the Eight-County TMA Region (2007 – 2016)
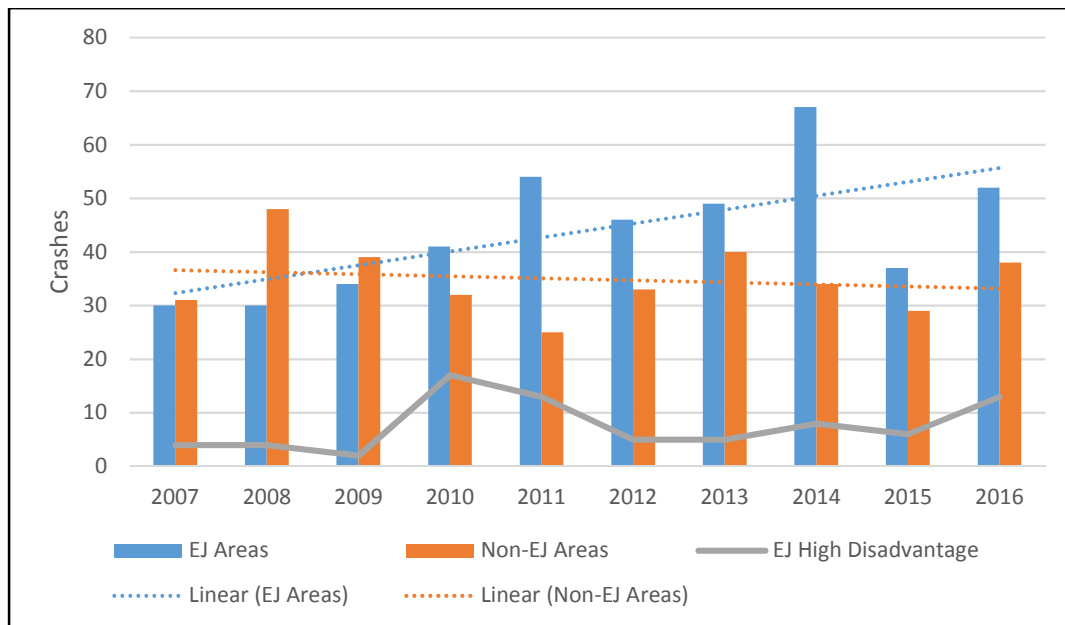
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Most of the DWI fatalities in environmental justice sensitive zones occurred on county roads (Figure 25). In the non-target areas, most DWI crash fatalities occurred on farm-to-market roads, and on the county roads.

Figure 25: DWI Crash Fatalities – By Road Class (2007 – 2016)
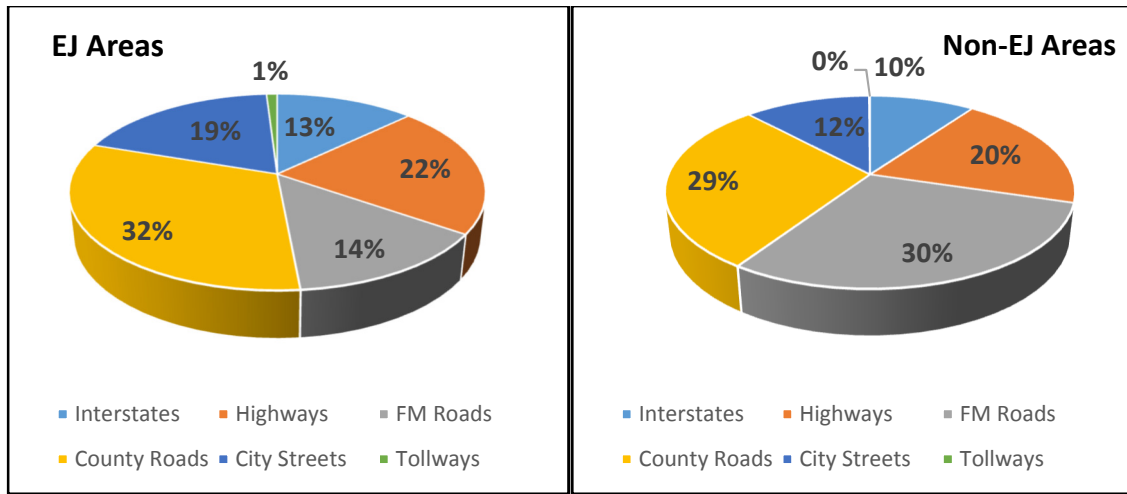
Source: Geocoded TxDOT Crash Records Information System (CRIS).

10.6 Crash Events – Bicycle Crashes

Biking can be a dangerous transportation alternative or recreational pastime in the underserved neighborhoods because of narrow roads and the lack of sidewalks, roadway shoulders, or dedicated bike lanes. Bicycle accident statistics are difficult to track since not every significant incident is recorded by law enforcement. However, based on mapped CRIS records for the planning region, the bicycle crashes that occurred within an environmental justice sensitive area between 2007 and 2016 exceeds the bicycle crash incidents that occurred within the non-target areas (Figure 26). Although the number of bicycle crash incidents have fluctuated over time, the statistical trend suggests a gradual increase in bike accidents both regionally and within the environmental justice community (Figure 27).

Figure 26: Bicycle Crashes in the Eight-County Region (2007 – 2016)
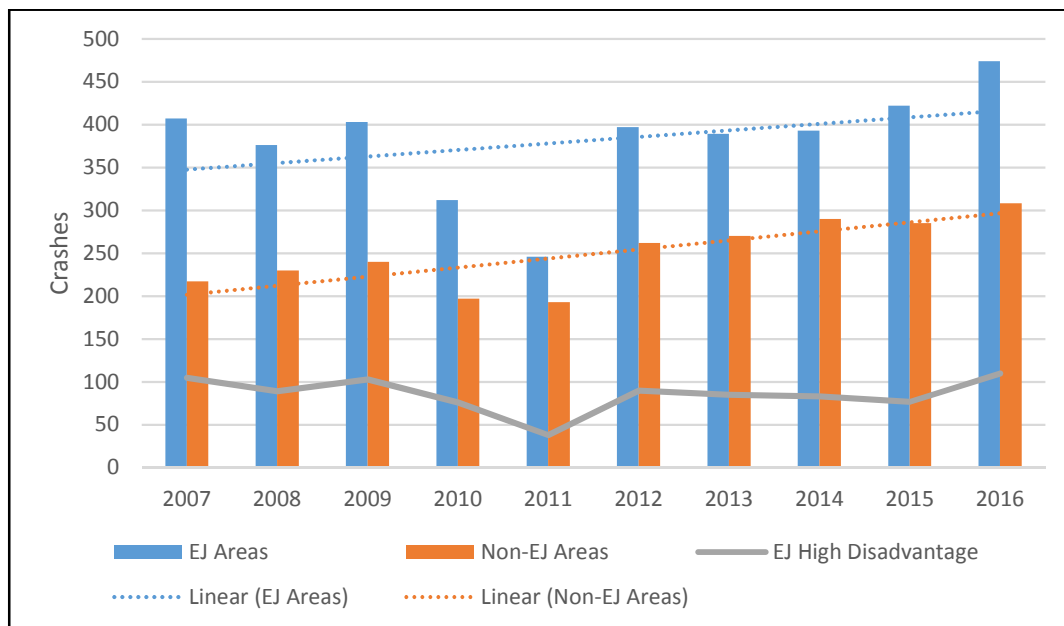
Source: Geocoded TxDOT Crash Records Information System (CRIS).

A review of the bicycle crash statistics suggest that the environmental justice community is disproportionately affected by these events. Over 60% of the geocoded crash incidents that occurred between 2007 and 2016 fell within an environmental justice sensitive area (Table 38). These areas experienced most of the high-severity crashes and registered the largest number of bike crash fatalities. The environmental justice areas also have a higher crash incident rate than the non-target areas for all the crash measures considered. An important finding is that bicycle crash incident rates are highest for those environmental justice areas described as having the population with the highest levels of socio-economic disadvantage.

Table 38: Bicycle Crashes in the Eight-County MPO Region (2007 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Bicycle Crashes	3,818	2,492	856	6,311
% of Bicycle Crashes	61%	39%	22%	100%
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
Bike Crashes Per 1000 Pop	1.2	0.9	1.4	-
High Severity Bicycle Crashes	477	342	91	819
% of High Severity Bicycle Crash Total	58%	42%	19%	100%
High Severity Bicycle Crashes Per 100,000 Pop.	14.9	12.1	19.9	-
Bicycle Crash Fatalities	76	62	18	138
% of Bicycle Crash Fatalities	55%	45%	24%	100%

Source: Geocoded TxDOT Crash Records Information System (CRIS).   * All numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals.   ** Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Figure 27: 5-Year Rolling Averages for High-Severity Bicycle Crashes in EJ Areas (2007 – 2016)
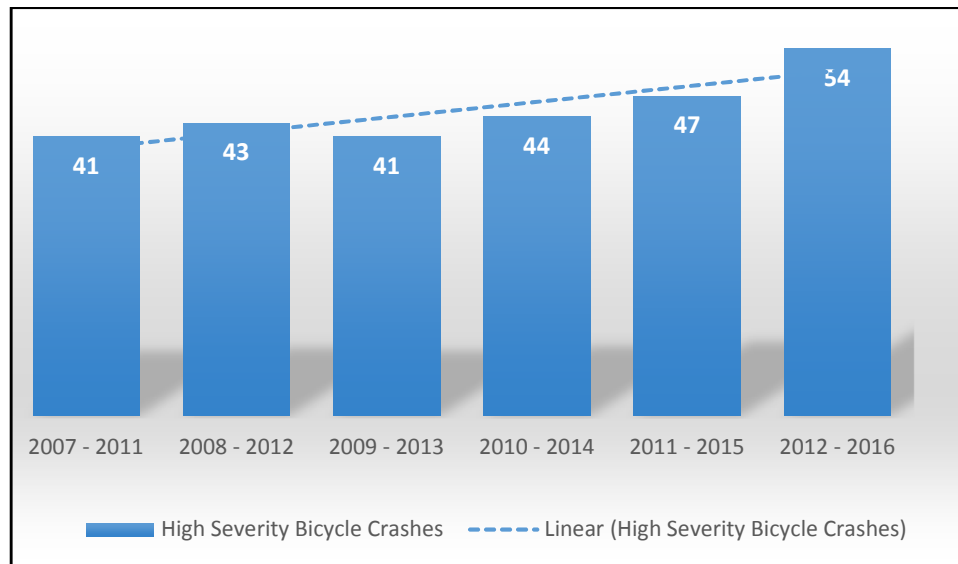
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Figure 28: Bicycle Crash Fatalities in the Eight-County Region (2007 – 2016) - by Road Class
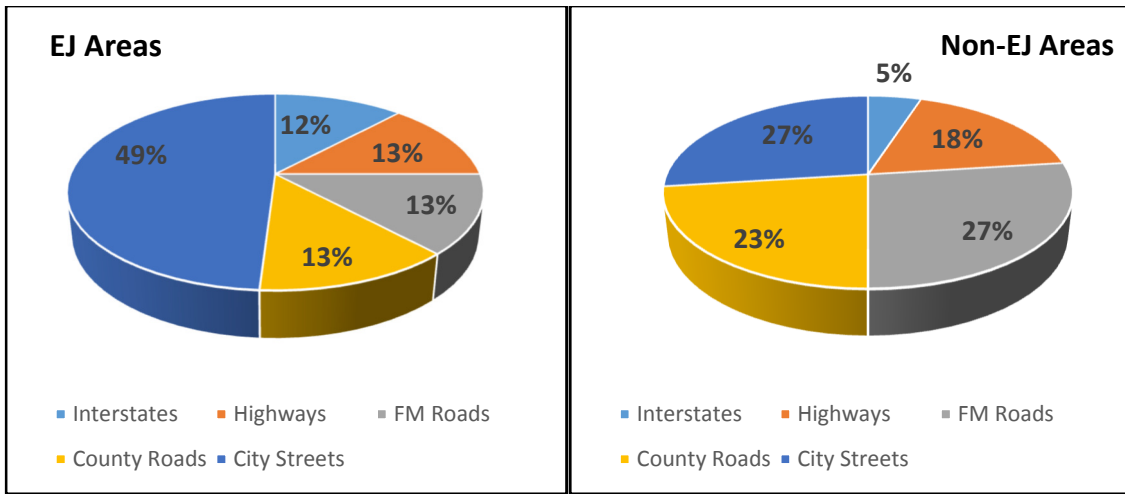
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Bicycle crashes will typically occur somewhat close to the home of the victim because of physical limits to the "ride-shed." This fact makes it desirable to know more of the details of these crash events and their possible linkage to environmental or behavioral factors. Figure 28 shows that by a wide margin, most fatalities from bicycle crash events in the environmental justice neighborhoods occurred on a city street. This probably reflects the lack of sidewalks or safe bicycle pathways in the underserved areas.

10.6.1. Bicycle Accident Hotspots

A hot spot analysis reveals locations with the highest concentration of bicycle crash events in the planning region. Based on the geocoded crash data, the most hazardous locations for biking are centered on the Houston Downtown, Midtown, Fourth Ward, and Montrose Districts (Map 30). These highly trafficked areas averaged more than 30 bike accidents per square mile over the ten-year period from 2007 – 2016. Other extremely high bicycle crash locations include a concentric zone around the Houston downtown region that encompasses parts of the Museum, Eastwood, Third Ward, Heights, Greenway/Upper Kirby, Medical Center, and University Place Super Neighborhoods.

Within the environmental justice neighborhoods, a particularly hazardous location for biking is the Gulfton-Westheimer-Harwin triangle where multiple crashes, including some fatalities, were registered along the area's thoroughfares (Map 31). Most of these crashes occurred on weekdays during the afternoon peak period, and over one-third occurred between 6 and 8 p.m. (Figure 29).
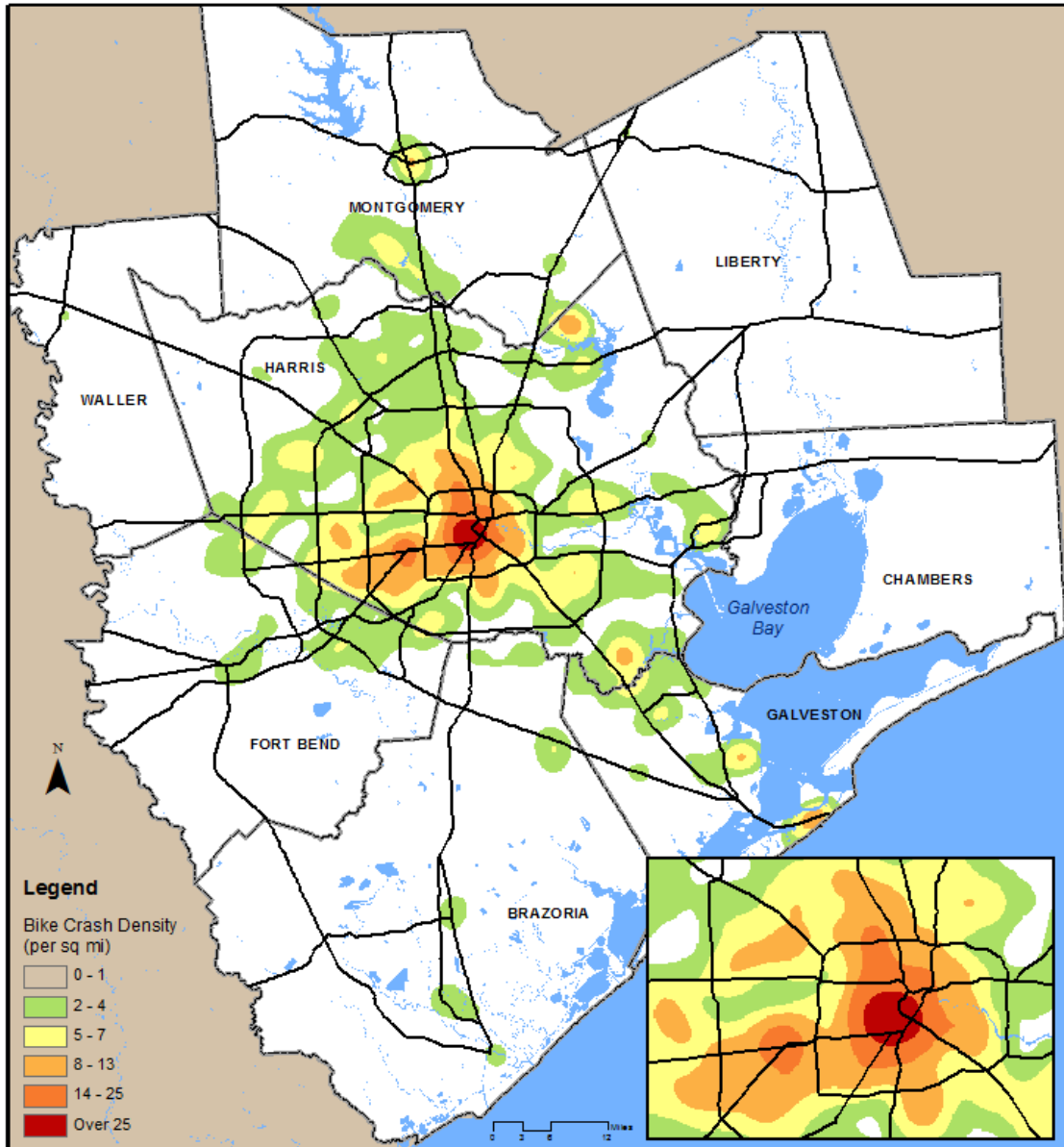
Map 30: Bicycle Crash Densities in the Eight-County TMA Region (2007 – 2016)

Figure 29: Bicycle Crashes in the Gulfton-Westheimer-Harwin Area (2007 – 2016) by Time of Day
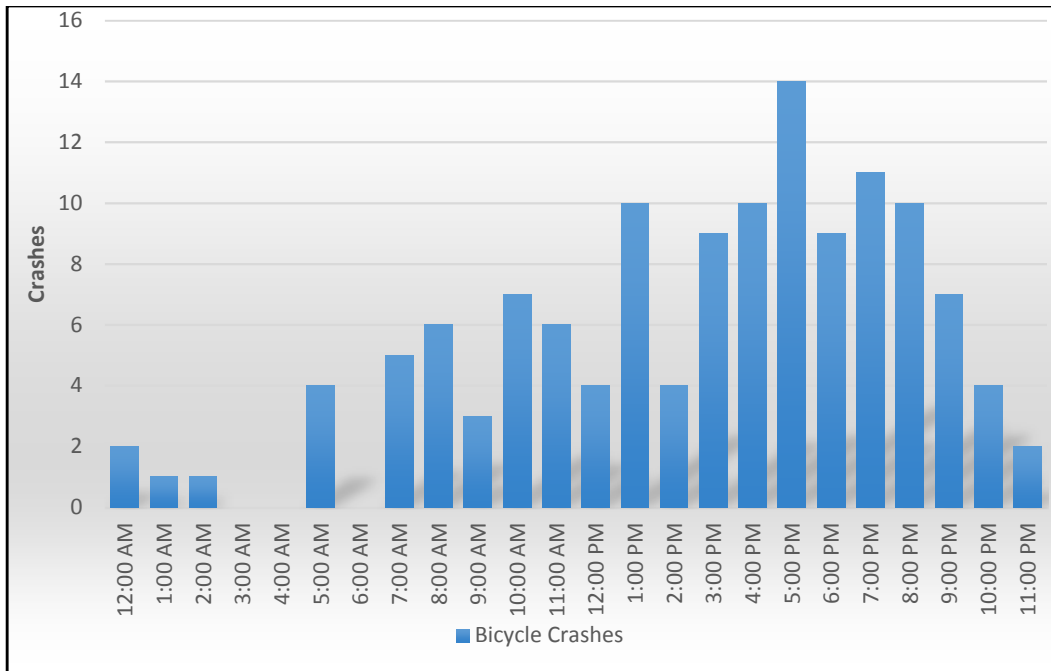
Source: Geocoded TxDOT Crash Records Information System (CRIS).
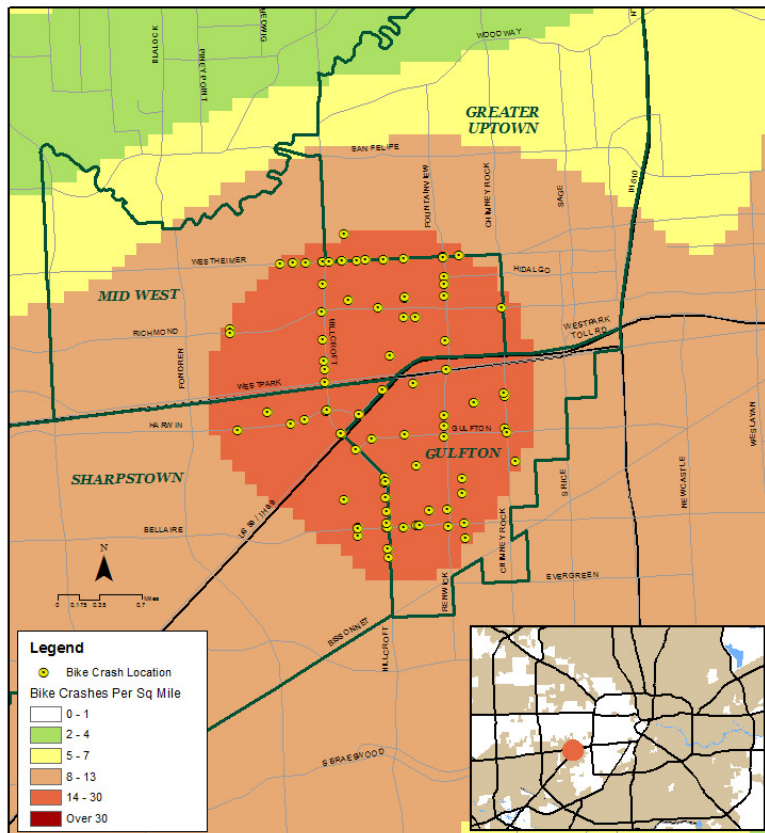
Map 31: Gulfton-Westheimer-Harwin Bike Crash Hotspot Zone

10.7   Crash Events – Pedestrian Crashes

Virtually every trip that is taken involves some measure of pedestrian travel somewhere between the trip origin and the final destination. Pedestrian crashes are more likely to involve physical injury compared with other roadway crashes because of the vulnerability of the unprotected human body. According to the Center for Disease Control (CDC), a pedestrian is 1.5 times more likely to be killed in an automobile crash than a vehicle occupant per outing. [14] Apart from being inconvenient, walking within many poor neighborhoods can be quite dangerous because of the lack of sidewalks, roadway shoulders, and crosswalks that adequately protect the pedestrian from the motorized traffic.

The geocoded CRIS pedestrian crash records suggest that the environmental justice community is disproportionately represented in pedestrian crash events (Figure 30). The number of the pedestrian crashes that occurred within the environmental justice communities in the planning region between 2007 and 2016 is more than double the pedestrian crash incidents that occurred within the non-target areas (Table 39). Trendlines suggest that the disparity in the number of pedestrian crash incidents between the two communities might continue to grow.

Figure 30: Pedestrian Crash Incidents in the Eight-County TMA Region (2007 – 2016)
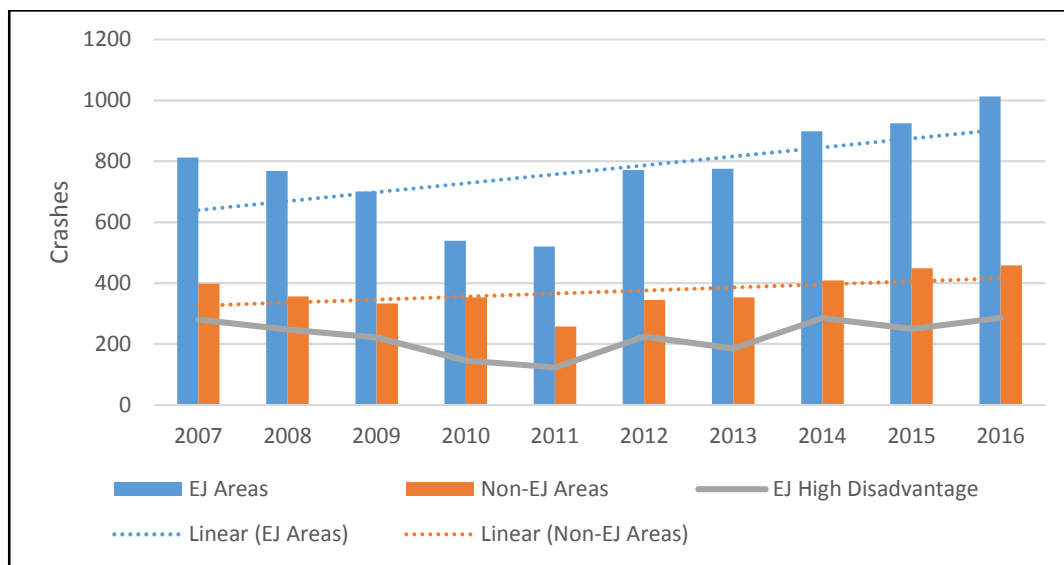
Source: Geocoded TxDOT Crash Records Information System (CRIS).

10.7.1. Pedestrian Crash Rates

The crash rate metrics derived in this analysis suggest that the environmental justice neighborhoods have a higher risk of pedestrian crashes than the non-protected neighborhoods. This is a particularly significant issue for those environmental justice areas identified as having the highest degrees of socio-economic disadvantage. The geocoded pedestrian crash records for the planning region show that between 2007 and 2016 there were 31 high-severity crashes per 100,000 population in the non-

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[14] Center for Disease Control and Prevention. Injury Prevention and Control: Motor Vehicle Safety. January 2, 2018; www.cdc.gov/motorvehiclesafety/Pedestrian_Safety/factsheet.html

environmental justice areas. In comparison, the crash rate in the environmental justice areas was 70 high-severity pedestrian crashes per 100,000 population but as high as 85 high-severity pedestrian crashes per 100,000 population in the environmental justice areas with the highest disadvantage. Also significant is the fact that about 70% of all the pedestrian crash fatalities from 2007 to 2016 occurred in the protected regions.

Table 39: Pedestrian Crash Incidents in the Eight-County MPO Region (2007 – 2016)

|	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Pedestrian Crashes	7,720	3,608	2,249	11,328
% of Pedestrian Crashes	68%	32%	29%	100%
Population of Area**	3,200,431	2,834,536	611,548	6,034,967
Ped Crashes Per 1000 Pop	2.4	1.3	3.7	-
High Severity Pedestrian Crashes	1,981	868	520	2,849
% of High Severity Pedestrian Crash Total	70%	30%	26%	100%
High Severity Pedestrian Crashes Per 100,000 Pop	70	31	85	-
Pedestrian Crash Fatalities	706	312	172	1,018
% of Pedestrian Crash Fatalities	69%	31%	24%	100%

Source: Geocoded TxDOT Crash Records Information System (CRIS).   * Crash numbers here are a subset of EJ Zone totals. Percentages reflect a share of EJ Zone totals.   ** Source: US Census Bureau, 2011-2015 American Community Survey Estimates 5-Year Estimates.

Accidents with fatalities often occur while the pedestrian is trying to cross a roadway. The Kinder Institute for Urban Research found that intersections controlled by traffic lights were more than nine times as likely to have a fatal car crash incident involving pedestrians or bicyclists than chance occurrences.[15] The study also found that uncontrolled intersections on long stretches of un-signalized roadways or in close proximity to a bus or rail stop also contributed to a high accident risk.[16] Figure 31 gives a breakdown of the roadways on which fatal pedestrian crashes occurred in the planning region.

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[15] Rice Kinder Institute for Urban Research. Dangerous Crossings: The Relationship Between Intersections and Crashes in Houston. Rice University, June 2017.

[16] Ibid.

Figure 31: Pedestrian Crash Fatalities by Road Class (2007 – 2016)
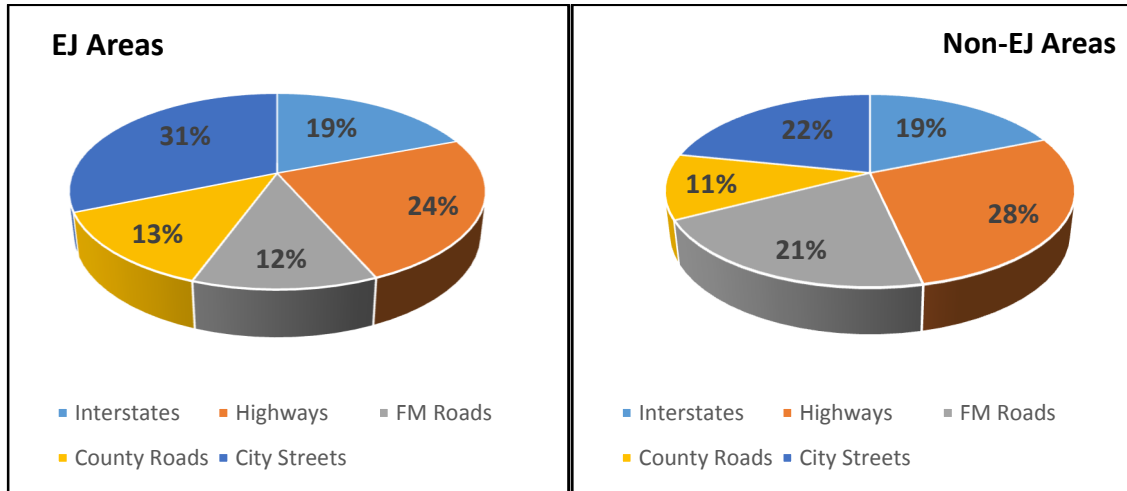
Source: Geocoded TxDOT Crash Records Information System (CRIS).

Within the environmental justice neighborhoods, more fatal incidents occurred on local streets than on highways. This may be caused by inadequate sidewalk infrastructure, the failure to yield the right of way, and speed. Most pedestrian accidents occurred in the afternoon peak period, tapering into the night hours. About half of these crashes occurred between 3 and 9 p.m. (Figure 32).

Figure 32: Pedestrian Crashes in the Environmental Justice Areas (2007 – 2016) - by Time of Day
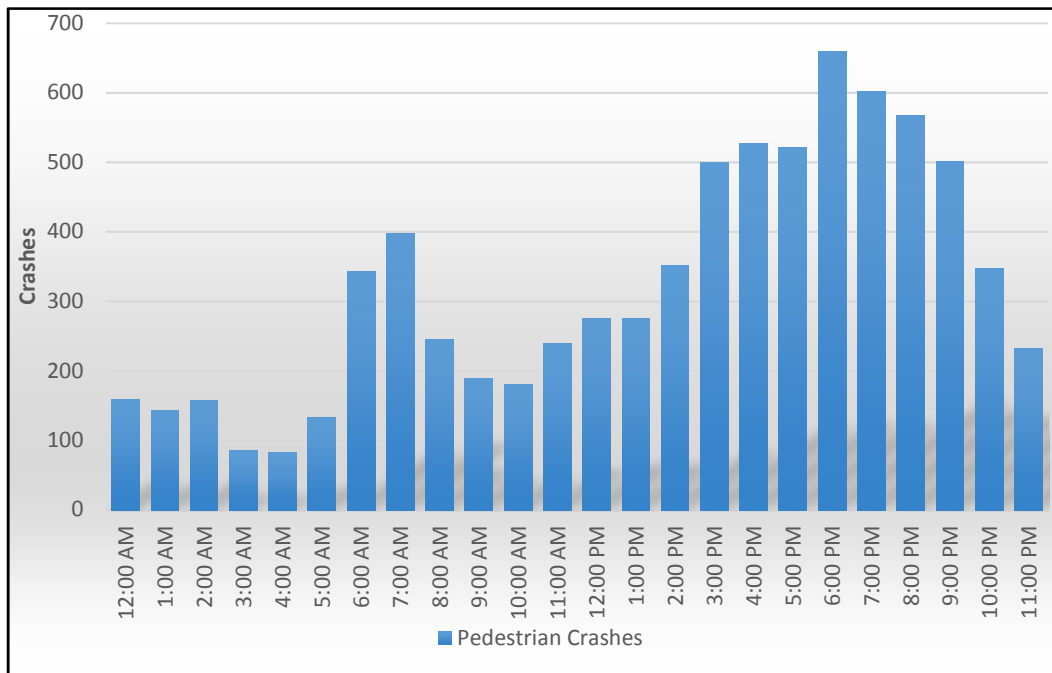
Source: Geocoded TxDOT Crash Records Information System (CRIS).

10.7.2. Pedestrian Accident Hotspots

Based on the geocoded CRIS crash data, the most hazardous location for pedestrians in the planning region is centered on the Houston Downtown and Midtown districts (Map 32). The potential for roadway conflict is exacerbated by the fact that both pedestrian and vehicular traffic are extremely high in these areas.
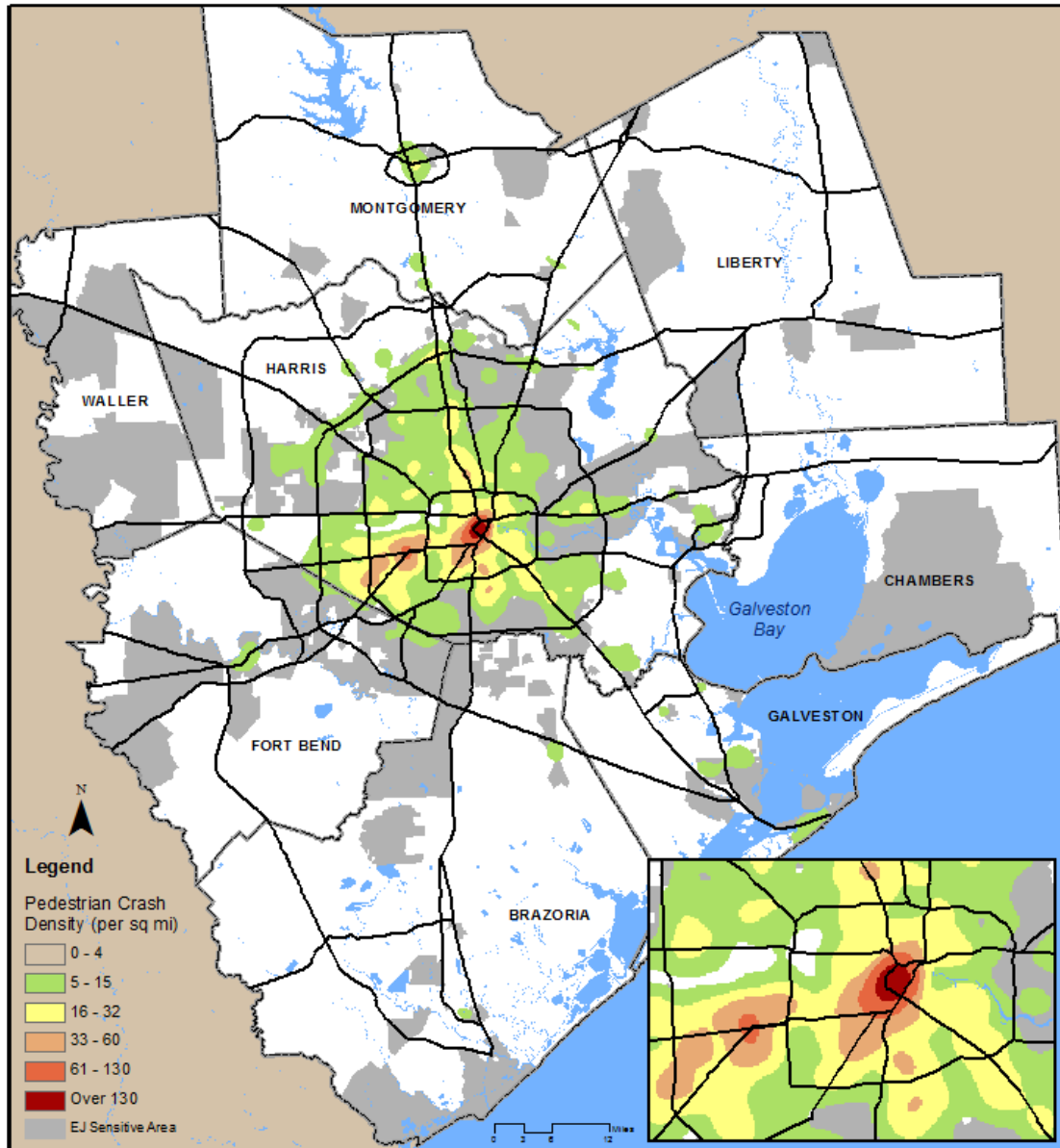
Map 32: Pedestrian Crash Density in the Eight-County TMA Region (2007 – 2016)

Within the environmental justice neighborhoods, the Houston Southwest region is a particularly hazardous area for pedestrians. This area corresponds to Travel Sector 10 (described earlier in this document) and encompasses the Gulfton, Mid West, Westwood, Sharpstown, Westchase and Alief

super neighborhoods. The high accident rates here are not limited to highways and occur also on the local streets.

Broken down by race, pedestrian crash victims are predominantly individuals from ethnic minority populations. African American residents were involved in 34% of the crashes, Hispanic residents in 32% of the crashes, and White residents in 27% of the pedestrian crashes.

10.8.   Highway – Railroad At-Grade Crossing Crashes

Railroads are an important link in the intermodal system for the transportation of bulk material and manufactured goods to and from the deep-water ports in the Gulf Coast Region. Because of the vast difference in their mass, accidents between freight trains and automobiles can easily result in severe injury and have fatal outcomes. This section looks at 191 dangerous railroad crossings in the MPO region and examines their impact to the environmental justice community. The railroad crossing crash information comes from the Crash Records Information System (CRIS) and covers the years 2012 through 2016. For this review, a crossing is considered "dangerous" if at least one accident occurred at that location between 2012 – 2016. Multiple crashes are defined as 3 or more crashes occurring at one crossing location.

As many as 191 at-grade railroad crossings in the region had at least one accident between 2012 and 2016 (Map 33). Close to two-thirds of these crash events occurred in an environmental justice sensitive area (Table 40). While most of the 191 railroad crash sites experienced just one crash event, a few sites had multiple incidents within the 5-year window. More than 70% of the sites that experienced 3 or more crash events were in an environmental justice sensitive area. The highest number of crashes that occurred at any railroad crossing on record was 5 crashes, and 6 out of the 7 sites that experienced up to 5 crash events were in an environmental justice sensitive zone. These different statistics suggest that a disproportionate share of railroad crashes impact the environmental justice population.

Table 40: At-Grade Railroad Crashes in the Eight-County MPO Region (2012 – 2016)

	EJ Zones	Non-EJ Zones	EJ Zones with High Disadvantage*	Total
Dangerous RR Crossings	121	70	37	191
Percent of Dangerous Crossings	63%	37%	19%	100%
Number of Crash Events	174	92	55	266
Percent of Crash Events	65%	35%	21%	100%
Sites with Multiple Crashes	13	5	4	18
Percent of Multiple Crash Sites	72%	28%	22%	100%

Source: TxDOT Crash Records Information System (CRIS). * Crash numbers are a subset of totals of the EJ Zone.

Map 33: At Grade Railroad Crash Frequency (2012 – 2016)
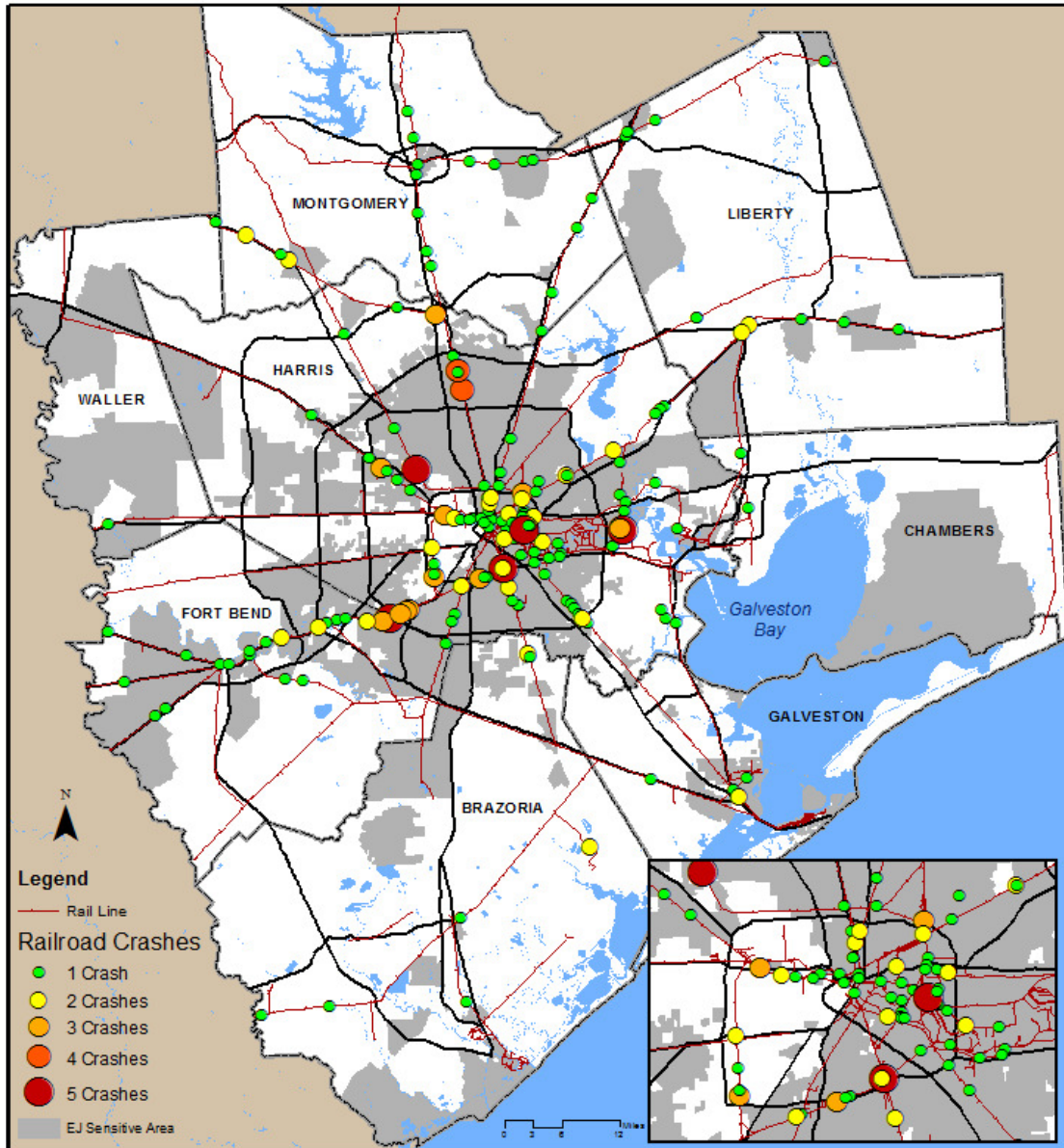
11.0   PUBLIC INVOLVEMENT

"Public involvement" is an integral part of the planning process and considered the panacea for achieving the non-discrimination mandates of Title VI and EO 12898. This term of art encompasses activities purposed for public participation as well as efforts toward public outreach. Public involvement is appropriately construed as a process that must be woven into the planning decision-making stream.[17] As part of their planning procedures, MPO's must proactively reach out to the disadvantaged and traditionally underserved populations, to assess their transportation needs and to provide them a meaningful opportunity to contribute their comments about proposed transportation plans and pertinent planning issues. Federal law requires MPO's to document their public participation process in a Public Participation Plan (PPP).[18] Federal law also requires MPO's to conduct periodic reviews that evaluate the effectiveness of the public participation process, to ensure that the process provides "full and open" access to all parties.[19] Best practice standards suggest that a Public Participation Plan should include:

- Strategies for involving minority populations, low-income populations, and other protected groups in transportation decision making;
- Strategies to reduce participation barriers for minority and low-income populations;
- Outreach to organizations representing minority and low-income populations;
- Mechanisms to ensure documentation and consideration of issues raised by minority and low-income populations;
- Periodic review of the effectiveness of environmental justice strategies and tracking of mitigation measures.

The requirement for the continuous involvement of the public during the planning process is calculated to bring the range of community needs and interests to the table prior to and during the decision-making period. Members of the disadvantaged and traditionally underserved communities have typically been underrepresented in the planning and decision-making process and consequently suffer from a general lack of awareness of transportation programs and mobility options. H-GAC developed its Public Participation Plan in 2007, subsequently updating it in 2012, and most recently, in 2017.

11.1   The RTP 2040 Plan Update Public Engagement

The public engagement process in developing the 2040 Regional Transportation Plan has been described as "highly proactive." The outreach program consisted of three rounds of public meetings and open house events which targeted elected and appointed officials; business, chamber of commerce and transportation organizations, and lastly, organizations representing the traditionally underserved population. Public meetings included slide presentations describing the RTP process and introducing

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[17] Aimen, D. & Morris, A. (2012). Practical Approaches for Involving Traditionally Underserved Populations in Transportation Decision-Making. National Cooperative Highway Research Program (NCHRP) Report No. 710

[18] 23 CFR 450.316 – Interested parties, participation, and consultation.

[19] Ibid.

proposed projects and a question/answer or comment period. Meeting participants were also provided information on how to reach the RTP 2040 Update website and how to access an online survey.

Public outreach meetings were held in the conference rooms at the H-GAC offices and at strategic locations across the planning region. Some of these meetings were designated specifically to reach the environmental justice communities and were held at locations expected to be accessible to this target community. Event notification included e-blast messaging, postings on online news sites, press releases, and phone calls to key community leaders and agency representatives. Flyers were placed at public gathering places like grocery store notices boards, while invitations were sent by US Mail to targeted individuals and groups.

11.2   Improving Public Participation by the Minority and Low-Income Population

One of the great challenges for a public involvement program is securing the participation of the underserved community. A low turnout by the working-class minority and low-income citizens at public meetings and open house events is a common experience. The question is how to engage those persons with no previous knowledge or interest in a project and little leisure time to spare. Transportation and environmental studies may be of little concern to this class of residents unless they will be directly and adversely impacted. Added to these constraints to participation by the public is apathy that arises from the belief that their opinions and concerns would not be given serious consideration by planning officials. Environmental justice nevertheless requires that the traditionally underserved and underrepresented population be empowered to bring their needs and concerns into the theatre of policy-making deliberations. Because some of the best practice outreach strategies that address the low turnout problem may involve an extra level of effort and expense, some planning organizations may not have the means or the resolve to explore them.

Public involvement is an activity where one size will not fit for all the desirable outcomes. Traditional outreach practices would more often than not result in less than optimum participation by the public - particularly the underserved. Best practices identify communication through existing community links as the most effective ways to reach the low-income and minority communities at the grassroots. It is important to identify agencies, organizations, and individuals that represent the traditionally underserved population on a regional basis or at the community level. Fostering relationships with these community-based organizations and local experts will enable the planning team to understand the values, perspectives and needs of the community. At a high level, this can be accomplished by engaging focus groups made up of elected officials, representatives of neighborhood associations, community leaders, and social advocates. These community "links" could additionally identify other important individuals to contact or may themselves become community liaisons or trusted intermediaries who can introduce the planning team to the community, help to distribute project information and notices, and encourage public feedback and participation. A word-of-mouth invitation from someone the community knows and trusts will usually be more effective in encouraging local participation than random notices, especially when the community is suspicious and possibly resentful of "outsiders."

The truth of the matter is that a large percentage of the working-class population will never attend a public meeting nor seriously consider responding to an invitation flyer. Nevertheless, not every citizen stakeholder encounter must occur within an organized public meeting setting. Ultimately, seeking out

and obtaining the diverse views of individual members of the low-income and minority population at the local level may require door to door visits in the target neighborhoods or going out to meet members of the target population at their community gatherings and other settings they frequent as a matter of course. Potential public engagement opportunities include the meetings of faith-based institutions, community centers, neighborhood meetings, community fairs, local grocery stores, transit centers, and the local schools. Knowing when community events are scheduled and determining how they could fit within the project development schedule would require adequate research and community groundwork.

11.3   Implementing an Effective LEP Engagement Program

The eight-county H-GAC TMA is home to a diverse population of more than 6 million residents. A significant proportion of these resident speak languages other than English as their "home" language. According to the United States Census Bureau 2011 – 2015 ACS 5-Year demographic estimates, almost one million of these residents have a primary language of communication that is not English (Table 41). They are members of several immigrant communities that include persons of Chinese, Korean, Vietnamese, Arabic, Filipino, Hispanic, European, and African descent. Executive Order 13166, "Improving Access to Services for Persons with Limited English Proficiency" directs federal agencies to ensure that linguistic isolation is not a barrier to meaningful access to any activities or services that are supported with federal funding.

H-GAC implements a language assistance program that includes interpretation and translation services, to protect the rights of persons with limited English proficiency (LEP) and to aid their participation in agency programs and services. The Hispanic population is the largest immigrant group in the planning region and Spanish is the primary language of over 80% of the area LEP population. Most of the Hispanic population come originally from Mexico. However, Mexico is not the national origin of every native Spanish speaker. While the regional linguistic variations within the spoken Spanish language will not warrant individualized LEP services, it is advised for the outreach planner to be cognizant of the national differences within the Hispanic population.

Table 41: LEP Population in the Eight-County MPO Region

County	Total Pop 5 Yrs. and Over	LEP Population	% LEP of Total Population	LEP Spanish Language	LEP Asian Languages	LEP Indo-European Languages	LEP "Other" Languages
Brazoria	307,400	24,417	7.9%	19,141	4,087	723	466
Chambers	34,716	3,343	9.6%	2,922	169	203	49
Fort Bend	612,667	79,947	13.0%	38,165	26,351	11,715	3,716
Galveston	287,973	18,339	6.4%	14,660	2,379	1,147	213
Harris	4,013,836	819,879	20.4%	681,373	88,594	34,384	15,528
Liberty	72,186	4,698	6.5%	4,462	160	76	0
Montgomery	467,817	38,123	8.1%	34,566	2,191	1,066	300
Waller	42,816	4,497	10.5%	4,387	23	83	4
MPA Total	5,839,411	993,243	17.0%	799,676	123,954	49,397	20,276

Source: U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimate

11.4   Improving Participation by the LEP Population

Efforts to engage the LEP population in the transportation planning process must be flexible and purposeful in reaching out to these communities. A common concern within the immigrant population is distrust of government authority which can stem from various historical reasons. Because of this reticence, the LEP population will typically avoid the public expressions that can potentially call attention to their presence.

Best practices suggest approaching the non-English speaking communities through established community organizations or trusted ambassadors who can alleviate any concern about governmental intrusions in their lives. Effective outreach can be achieved by using the services of community outreach consultants who are known to the LEP community or who can quickly build trust, bridge the communication gap, and generate an interest in the planning outcomes that may impact their communities. Through the prior contact with the LEP community it can be determined if interpretation services will be needed at public meetings.

In keeping with the letter and spirit of EO 13166, a policy to translate information notices and major planning documents into the main languages understood by the LEP population should be applied as a matter of course. However, to avoid this becoming a perfunctory and inconsequential exercise, periodic dialogue should be maintained with members of the LEP community beyond the active outreach period. Invariably, continuity in community contact would build and strengthen collaborative partnerships and facilitate public involvement efforts.

12.0. SUMMARY OF THE ENVIRONMENTAL JUSTICE ENVIRONMENT

This study has examined the landscape of environmental justice in the upper Texas Gulf Coast region to identify and characterize the environmental justice population and to evaluate several metrics that convey whether these communities are equitably served or disparately impacted by the transportation investment choices and related planning activities. The key measures evaluated include the distribution of transportation investments, accessibility to public amenities and vital services, the state of transportation safety, and public involvement. Some of the key findings from the assessment are summarized below.

12.1   Who are the Environmental Justice Community?

- Environmental justice status is defined by seven socio-economic factors of disadvantage: minority status, low-income, low educational achievement, limited English proficiency, female household headship, zero automobile ownership, and senior status (65 years and over).
- The environmental justice population make up about 53% of the population of the H-GAC MPO and are concentrated in distinct neighborhoods within and surrounding the Houston city center.
- Hispanic residents are the predominant minority group and constitute the largest pool of non-English speakers.
- About 23% of the environmental justice census block-groups are considered highly disadvantaged zones because of a concentration of multiple factors of disadvantage.
- For zones with multiple concentrations of disadvantage factors, the most occurring combination of factors are minority status, low-income, low educational attainment, and limited English proficiency.
- Within the most disadvantaged environmental justice tracts, there is a high likelihood that being a racial minority or living in a household headed by a female, you would be in poverty.

12.2   Social and Economic Characterization of EJ Population

- The low-income and members of zero automobile households typically live close to the central city, near transit stops, and reasonably accessible to jobs and public amenities.
- Most workers drive to work alone, use carpools or depend on transit.
- Many find employment within the IH 610 Loop region, which includes the Downtown, TMC, and Greenway Plaza business districts.
- High unemployment exists especially in the most highly disadvantaged environmental justice neighborhoods.

12.3   Pattern of Transportation Investments in the Region

A non-exclusive spatial review of the proposed local thoroughfare and major transportation improvements reveals a disparate level of investments in the environmental justice sensitive areas compared with the non-target areas.

- Up to 78% of the mapped local projects from the H-GAC ten-year plan (2017 – 2026), amounting to about 88% of the allocated funding, were programmed in the non-environmental justice target

areas. In comparison, 66% of the projects fell within or ran adjacent to an environmental justice sensitive area. The cost of the projects serving the environmental justice neighborhoods amounted to about 50% of the allocated funding.

- The spatial distribution of the major transportation investments, including tolled facilities is similar to that of the local projects, and will disparately benefit the non-target areas.
- Despite locational disparities, quantitative analysis suggest that the environmental justice population would enjoy greater accessibility to jobs than the non-target population by the construction of the regionally significant projects.
- Although the environmental justice population will experience improvements in travel time and travel speed, improvements in these areas will be proportionately less than the improvements experienced by the non-target population.

12.4   Accessibility to Public Infrastructure and Vital Services

Pedestrian-Bicyclist Infrastructure:
    A spatial analysis shows a disproportionate level of trail development in the environmental justice community compared with the non-target areas.

- About one-third of the pedestrian-bicyclist infrastructure in the region is within or adjacent to an environmental justice region while the other two-third lie within the non-target area.
- Only 5% of this regional network of pedestrian-bicyclist infrastructure are within environmental justice areas described as having high disadvantage.

    However, travel demand model analysis suggest that the environmental justice population have comparable or better accessibility to library facilities, full-service hospitals, high-level trauma centers, institutions of higher learning, and transit service than the non-target population.

Library Facilities:
- 40% of all the county libraries in the region are in an environmental justice zone.
- Virtually all the environmental justice areas in the IH 610 urban core region is within biking reach of a library.
- Environmental justice areas have greater accessibility to a library by transit than the non-target area. Accessibility by transit is greatest for areas with the highest socio-economic disadvantage.

Hospitals, Trauma Centers:
- 95% of households in environmental justice areas are within 15 minutes of a full-service hospital travelling by auto, compared to 81% for the non-target areas.
- 51% of households in environmental justice areas are within 60 minutes of a full-service hospital by transit, compared to only 25% from the non-target area.
- Non-target areas have better access to high level trauma centers by automobile, but households in protected areas have better accessibility by transit.

Higher Education Facilities:
- More households from environmental justice areas (84%) are within 15 minutes of an institution of higher education than from the non-target areas (72%).

- 49% of environmental justice households are within 60 minutes by transit, compared with 26% from the non-target areas.

Transit Service:
METRO transit service is geared to serve the transit dependent population within the heavily populated areas of the Houston metropolitan area.
- Transit route-miles within the environmental justice areas are approximately double the route-miles that run through the non-target areas.
- Transit routes with the best peak period headways serve central and southwest Houston which benefit both target and non-target populations.
- The worst transit peak period headways impact the environmental justice communities to the Houston north and northeast.

The Highly Disadvantaged Environmental Justice Population:
The EJ population with the highest concentration of socio-economic disadvantages are uniquely concentrated within and around the central city. This attribute contributes to circumstances and impacts that are distinct from the larger environmental justice population and the non-target areas.

- Highest accessibility to library facilities, hospitals and trauma centers, and educational institutions.
- Greater accessibility to bus stops and transit routes.
- The least access to pedestrian-bicyclist infrastructure.
- The smallest level of transportation infrastructure investments.

12.5   Transportation Safety

Transportation safety is a major concern in the Gulf Coast planning region and the environmental justice areas are over-represented in all measured crash categories.

Vehicle Crashes:
- Over 60% of all the vehicle crashes that occurred in the eight-county region between 2007 and 2016.
- These areas also experienced most of the high severity crashes and presented the highest crash rates per capita.
- Crash statistics indicate that crash incidents are on the rise within the planning region, but they are rising at a faster rate within the environmental justice areas than in the non-target areas. This is particularly true for the DWI related accidents.

Bicycle and Pedestrian Crashes:
- The target areas accounted for 61% of all the bicycle crashes, up to 58% of the bicycle crashes with high severity, and 55% of the crash fatalities that occurred between 2007 and 2016.
- Hotspots for pedestrian and bicycle crash incidents coincide with the hotspots for vehicle accidents. For the environmental justice areas, these hotspots occur mostly in the Houston Southwest, in areas surrounding the Gulfton - Alief super neighborhoods

Crashes at Railroad Crossings:
- Close to two-thirds of mapped crashes at railroad crossings occurred in an environmental justice zone.
- Over 70% of the crossing sites with multiple crash events are in an environmental justice area.

13.0   ACHIEVING ENVIRONMENTAL JUSTICE

13.1   Roadmap for Integrating Environmental Justice in the Planning Process

The foregoing assessments identify challenges to effecting environmental justice for the protected populations of the H-GAC MPO region. To be the focal issue it is intended to be, environmental justice principles must permeate the entire transportation planning process - under sustained leadership support. In addition, environmental justice must be embraced as an issue of regional interest for it to be an applied effectively. Achieving this level of support will require programmatic and structural changes. The following strategies are offered as possible approaches to elevating and applying the federal environmental justice and non-discrimination directives more purposefully in the transportation programs and activities of the MPO and its planning partners.

1.   Increase Environmental Justice Awareness

(a) Designate the month of February as "Title VI/Environmental Justice Awareness Month."[20]

A month devoted to activities that publicize federal non-discrimination mandates and connects the decision makers, planners, and community stakeholders would help to build awareness and serve to keep discussions of equity in the forefront of planning practice. Among the potential benefits of a commemorative month is the opportunity to build bonds with representatives and members of the protected population and to lay foundations for greater cooperation that could help the future outreach activities of the MPO and the development of transportation plan updates. An informed public would enrich the planning process.

In addition to strengthening external ties, activities of the commemorative month could build internal cohesion by accenting the work performed by the different departments of the H-GAC Council of Governments who serve the needs of the target population in areas relating to housing, safety, transportation, employment, and services to the aging population.

(b) Institute environmental justice training for MPO project managers, planners, and outreach staff.

Fundamental to building a strong environmental justice program is having key staff that understand and appreciate the purpose and directives of environmental justice and other non-discrimination mandates and know how they translate to their day to day activities. The loss of institutional knowledge of environmental justice practice will typically occur through staff reassignments and personnel turnover. An education program should be required for project managers, planners, and community outreach staff to keep them abreast with strategies and resources for responding to environmental justice demands throughout the transportation planning process.

   i.   Produce training manuals and videos for key staff or prescribe web-based training classes such as the online seminars provided by the National Highway Institute (NHI).

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[20] Executive Order 12898 instituting Environmental Justice was signed in the month of February. This is also the month selected to celebrate historical minority figures.

ii. Review Title VI program activities identifying best practices from Federal and State agencies and from national and regional peer institutions.

2. Enhance Sensitivity to Title VI/Environmental Justice in Transportation Investment Decisions

(a) Encourage the flow of development funds towards the underserved communities.

Enhancing sensitivity to how well local transportation investments choices benefit the underserved communities in comparison to other parts of the region may help to improve equity in the distribution of investments. This may possibly be achieved by policy modifications that increase the funding going to improve these areas.

i. Make benefits to an environmental justice area one of the scoring criteria considered in the selection of transportation projects submitted for Federal funding.
ii. Create a "set-aside" category of funding for projects that address specific needs within an environmental justice area.

3. Support Local Efforts to Improve Transportation Service in the Underserved Areas

(a) Provide technical assistance and encourage coordination between the regional partners.

Increasing technical assistance and coordination between the MPO, TXDOT, local governments and other transportation partners will advance information exchange and help to generate consistency in environmental justice data analysis and identify common areas of need.

i. Develop analytical tools and methodologies to standardize the evaluation of disproportionate impacts of development activities and investment choices on the target population.
ii. Create a regional working group to provide input and guidance from the regional perspective, including information about existing conditions, specific regional needs, and provide feedback on how proposed programs and investments would impact the environmental justice groups they represent, and how projects would address their needs.

4. Improve Safety in Environmental Justice Areas

(a) Address the high and worsening crash rates in environmental justice sensitive areas.

Over the ten years from 2007 - 2016, the number of crash events and the proportion of crash events with high severity outcomes has increased nationally and within the planning region. This trend is replicated in the environmental justice sensitive areas, which are overrepresented in crashes of all types and severity levels. The large number of Hispanic and African American residents involved in crash events indicate that safety is a major problem in the minority community. The high and disproportionate number of crashes and elevated crash rates in the underserved areas warrants special attention by the Regional Safety Council and special consideration for the prioritization of safety interventions. If the environmental justice areas are overlooked in the regional safety improvement efforts, the crash numbers in these areas will continue to reflect badly for the whole

region. Congestion in the region may also be exacerbated by the continued high occurrence of accidents. Suggestions of best approaches include:

    i. Analyze crash data related to environmental justice areas to identify problem areas and patterns, including issues that may relate to language or cultural differences.
    ii. Develop strategies, including targeted education, to address the safety issues in environmental justice sensitive areas as part of the Regional Safety Plan.
    iii. Give scoring merit to transportation projects that improve safety in an underserved neighborhood in the consideration of projects for funding.

5. Improve Methodologies to Evaluate the Impact of Transportation on Target Populations

(a) Quantitative assessments predicting mobility and accessibility improvements are the measures of resort used to evaluate the future impact of roadway projects. Executive Order 12898 instituting environmental justice prescribes a commitment to research, data collection, and an enhanced analysis that extends the envelope in understanding on how transportation projects may impact the protected population.

    i. Introduce fresh analyses that study the impact of transportation projects on less considered subjects like public health, household economics, and community cohesion.
    ii. Collect data on collateral factors like air quality, particulate matter, noise, socio-economic impacts on household expenditure, housing and travel mode choice, value of time decisions, or other informative data that permit more robust analyses which describe the ancillary effects of transportation on the population.

6. Improve Public Involvement by the Underserved Population

(a) Overcome the general apathy towards government and the disinclination to participate in public meeting events inherent in the communities of the low-income and minority citizens while facilitating their meaningful involvement in the planning process.

Conventional outreach efforts through social media, radio, television, flyers, billboards, roadway signs, and target mailing to advertise a public meeting will often not result in a significant turnout by the underserved citizenry nor facilitate their meaningful participation in the decision-making process. Alternate and non-traditional methods may be necessary to stimulate their interest and encourage them to voice their opinions to further the planning process. The key is to reach out to the public rather than expecting them to come to you.[21] This outreach approach will ultimately guarantee greater and more effective participation by the target population, at a reduced cost in both time and money. The following strategies, applied in conjunction with conventional outreach methods, have been found to improve participation by the underserved community:

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[21] Community Impact Analysis: A Quick Reference for Transportation (FHWA, 1996).

Event Notices:

i. Engage key stakeholders, elected officials, community leaders, leaders of faith-based organizations, and local residents to help notify the public of project related events.
ii. Make meeting announcements or distribute information at community events such as neighborhood meetings, religious services, and sporting events.
iii. Place project flyers at local businesses and social gathering places like grocery stores and barber's shops where they may become issues of conversation and ultimately, information is transferred by word of mouth.
iv. Distribute information through the schools, utility bills, ethnic media like local newspapers, community radio stations, and public service announcements.
v. Tailor meeting notices to culturally competent messaging, phrasing issues in a way that encourages participation.

Public Meeting Logistics:

i. Select locations that are accessible by transit and ADA compliant, including non-governmental sites like community centers, churches, recreation centers, and hotel meeting spaces that are reasonably accessible to the target community.
ii. Set meeting hours that are convenient for full time workers.
iii. Offer snacks to meeting participants where feasible, and consider child care facilities.
iv. Develop and maintain a public involvement community contacts database of individuals, businesses and organizations representing the traditionally underserved population that will be a focus for continuous public outreach engagement during and beyond the project cycle.

Engaging the Underserved Public

i. Apply the dictum that planning must reach out to the public rather than expecting the public to come to it. Seek planning opinions from the target community through direct encounters in non-traditional settings outside of the formal public meeting.
ii. Engage the services of a liaison who can help to establish trust between the community and the planning team and use individuals who live within the community to assist with outreach efforts, including door to door outreach, block meetings, and neighborhood meetings.
iii. Develop appropriate questionnaires and surveys that elicit answers pertinent to the plan or project in consideration.
iv. Develop printed material that describe the project in languages that can be easily understood by the target public.
v. Establish working groups that include members of the target community through whom dialogue about specific project/community related issues may be exchanged, and to educate members

LEP Involvement:

The LEP population face the barriers of language isolation and cultural differences in addition to time constraints and emotional distance. Some members of this population may never have

experienced the public involvement process and will not understand or appreciate the desire for their opinions. It is important to understand who the LEP population are, and to discover how best to secure their trust and cooperation.

   i. Conduct a community analysis to identify who the LEP are and know the features of the community.
   ii. Look for a trusted intermediary like a bilingual community liaison or a consultant with community links who can serve as a bridge to the insular community.
   iii. Develop informational material in the home language of the LEP community and provide interpreter services as necessary.

13.2   Next Steps

- Improve regional collaboration by Initiating dialogue between TxDOT Civil Rights Division, H-GAC, Metropolitan Transit Authority of Harris County (METRO), the City of Houston, Harris County, and other local government stakeholders to:

   o identify organizational policies and practices towards equity in transportation programs;
   o examine opportunities, share experiences, coordinate efforts, and promote best practices for addressing non-discrimination and achieving environmental justice in the regional transportation planning.
   o Reiterate ongoing commitment to promoting equity in programs, policies, and activities that may affect human health and the environment or influence economic and social conditions.

- Engage key stakeholders, local elected officials, community leaders, leaders of faith-based organizations, and involved residents to.
   o identify and articulate community concerns, needs, and desires related to transportation in the underserved communities, and how best to address them.
   o create a channel of communication that enhances public participation and facilitates public outreach.
   o Encourage community education.
- Develop new solutions, investigate new models, tools, and metrics that improve the measurement of transportation's impacts on the population and expand ways to identify disproportionate harm to the protected communities.
- Implement recommendations and document lessons learned.

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Title VI Civil Rights Act of 1964, 42 USC 2000d et seq., CFR Part I.

APPENDIX A

ENVIRONMENTAL JUSTICE AND NON-DISCRIMINATION LEGISLATION AND POLICY GUIDELINES

1964
Title VI of the Civil Rights Act prohibits recipients of Federal financial assistance from discriminating based on race, color, or national origin.

1968
23 U.S.C. 140-Nondiscrimination (amended in 1991) refers to State employment assurances. Refers to race, color, creed, national origin, or sex.

1969
NEPA requires Federal agencies to analyze the environmental impacts of their actions. Agencies must account for impacts on populations and consult the public throughout their analyses.

1970
The **Federal Highway Act of 1970** requires that adverse economic, social, and environmental impacts of federally supported highway projects be fully considered during project development and that final project decisions are made in the best overall public interest.

1970
The **Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970** requires fair and equitable treatment of people displaced as a direct result of programs or projects undertaken by a Federal agency or with Federal financial assistance.

1970
Title 49 CFR 21.9(b), "Nondiscrimination in federally assisted programs of the Department of Transportation (DOT)," was enacted to effectuate the provisions of Title VI of the Civil Rights Act of 1964 to the end that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the DOT.

1973
Section 504 of the **Rehabilitation Act of 1973** prohibits discrimination on the basis of disability in programs conducted by Federal agencies, in programs receiving Federal financial assistance, in Federal employment, and in the employment practices of Federal contractors.

1975
The **Age Discrimination Act of 1975** prohibits discrimination on the basis of age in programs receiving Federal financial assistance

1987
The **Civil Rights Restoration Act of 1987** clarifies the intent and reach of Title VI and specifically prohibits discrimination based on race, color, gender, national origin, age, or disability throughout an entire agency if any part of the agency receives Federal financial assistance, whether or not the particular project under review has federal funding.

1990
The **Americans with Disabilities Act of 1990 (ADA)** extended many of the protections and remedies of the Civil Rights Act to persons with disabilities, and broadened the Rehabilitation Act's provisions to entities that do not receive Federal funds.

1991
The **Intermodal Surface Transportation Efficiency Act (ISTEA)** made major changes to transportation planning and policy. It created flexible funding, enhanced the role of metropolitan planning organizations (MPOs), and strengthened the requirements for transportation planning and programming.

1992
The **Office of Environmental Equity** was established in the U.S. Environmental Protection Agency (EPA). The Office was later renamed the Office of Environmental Justice. This office was supported by a work group on environmental equity, which produced a report on examining environmental inequalities. Along with this office, EPA implemented a new organizational infrastructure to integrate environmental justice into their policies, programs, and activities.

1993
The **National Environmental Justice Advisory Council** was created. This Council represents the first time that representatives of community, academia, industry, environmental, and indigenous, as well as State, local, and tribal government groups, were gathered to discuss and suggest solutions to environmental justice problems.

1994
Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

1997
The Council on Environmental Quality (CEQ) issues Environmental Justice Guidance Under the National Environmental Policy Act to assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed.

1997
DOT Order 5610.2 - The DOT Order on Environmental Justice to Address Environmental Justice in Minority Populations and Low-Income Populations establishes as DOT policy the full consideration of environmental justice principles throughout the transportation planning and decision-making processes, and provides guidance to the operating administrations regarding implementation of these principles.

1998
DOT Order 6640.23 - The FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations further specifies how highway projects should incorporate environmental justice in complying with EO 12898. It is intended to prevent and address disproportionately high and adverse effects on minority and low-income populations.

1999
The FHWA and the Federal Transit Administration (FTA) issue a memorandum, **"Implementing Title VI Requirements in Metropolitan and Statewide Planning,"** which provides clarification for field offices on how to ensure that environmental justice is considered during current and future planning certification reviews.

1999
The EPA issues their **"Final Guidance for Consideration of Environmental Justice in Clean Air Act 309 Reviews."** This document provides guidance on reviewing and commenting on other Federal

agencies NEPA documents to help ensure that environmental effects on minority communities and low-income communities have been fully analyzed. It is meant to be used internally by EPA reviewers.

2001
Executive Order 13166 signed by President Clinton requires Federal agencies to develop systems by which people with a limited ability to communicate in English can access the services of those agencies. Title VI Legal Manual, U.S. Department of Justice, Civil Rights Division, issues a manual intended to provide guidance on Title VI to Federal agencies and other interested entities.

2004
Executive Order 13330 - Human Service Transportation Coordination, signed by President G.W. Bush advocates an improved level of community based transportation services be provided to transportation-disadvantaged persons, identified as persons with disabilities, persons with low incomes, and the elderly.

2005
The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU*)* places additional emphasis on environmental stewardship, the consideration of environmental issues as part of Metropolitan and Statewide Transportation Planning, and increases the importance of public participation in the planning process.

2010
Senior Advisor on Environmental Justice appointed at the EPA by Obama administration at the EPA and reinvigorating the Environmental Justice Interagency Working Group (EJ IWG) – established by E.O. 12898– showing the Federal Government's commitment to environmental justice.

2011
On August 4, 2011, the Secretary of Transportation, along with heads of other Federal agencies, signed a **Memorandum of Understanding on Environmental Justice and Executive Order 12898 (EJ MOU)** confirming the continued importance of identifying and addressing environmental justice considerations in agency programs, policies, and activities as required by EO 12898. As part of the EJ MOU, each Federal agency agrees to review and update their existing environmental justice strategy as appropriate, and to publicize the updated strategy.

2011
"Guidance on Environmental Justice and NEPA" issued by FHWA. This resource is meant to advise practitioners on the process to address environmental justice during the NEPA review, including documentation requirements. It supplements the FHWA Technical Advisory 6640.8A, which provides guidance for documenting the potential social, economic, and environmental impacts considered in the selection and implementation of highway projects.

2012
FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (6640.23A*)* establishes policies and procedures for the FHWA to use in complying with EO 12898. This directive updates FHWA Order 6640.23, "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," dated December 2, 1998. It is intended to prevent and address disproportionately high and adverse effects on minority and low-income populations.

2012
The **Final USDOT Environmental Justice Order (DOT Order 5610.2(a))** updates the DOT's original Environmental Justice Order (1997). The Order continues to be a key component of the DOT's strategy

to promote the principles of environmental justice in all DOT programs, policies, and activities. It describes how the objectives of environmental justice will be integrated into planning and programming, rulemaking, and policy formulation. The Order sets forth steps to prevent disproportionately high and adverse effects on minority or low-income populations through Title VI analyses and environmental justice analyses conducted as part of Federal transportation planning and NEPA provisions. It also describes the specific measures to be taken to address instances of disproportionately high and adverse effects and sets forth relevant definitions.

2012

The **FTA guidance (Circular 4701.1B)** provides recipients of Federal Transit Administration (FTA) financial assistance with guidance and instructions necessary to carry out DOT Title VI regulations, and to integrate into their programs and activities considerations expressed in the Department's Policy Guidance Concerning Recipients' Responsibilities to Limited English Proficient Persons.

2012

The **FTA guidance (Circular 4703.1)** provides recommendations to State Departments of Transportation, Metropolitan Planning Organizations, public transportation providers, and other recipients of FTA funds on how to fully engage EJ populations in the public transportation decision-making process; how to determine whether EJ populations would be subjected to disproportionately high and adverse human health or environmental effects as a result of a transportation plan, project, or activity; and how to avoid, minimize, or mitigate these effects.

2013
President Obama releases the **Presidents' Climate Action Plan** which provides that through the use of annual Federal agency "Environmental Justice Reports," the administration would continue to identify innovative ways to help the nations' most vulnerable communities to prepare for and recover from the impacts of climate change.

2016
The **USDOT Environmental Justice Strategy** updates its previous policy statements and strategies for achieving environmental justice and reiterates DOT's ongoing commitment to promoting equity in its programs, policies, and activities that may affect human health and the environment or influence economic and social conditions in a way that may affect the protected population.

APPENDIX B

CALCULATING CONCENTRATION THRESHOLDS FOR ENVIRONMENTAL JUSTICE INDICATORS

Calculating Concentration Thresholds for Environmental Justice Indicators

The concentration threshold represents the value at which an environmental justice indicator for a populated zone is high enough to warrant identifying the zone as environmental justice sensitive for that socio-economic indicator. A zone is considered to have a high concentration when the zonal average for the socio-economic indicator exceeds the average for the entire region plus one standard deviation. [22]

To calculate the concentration threshold for an environmental justice indicator, the average value of the indicator in question is summed for each zone and divided by the total number of zones in the region. The zonal average value for each indicator is obtained by dividing the size of the population in the zone characterized by the indicator by the relevant universe. The equations to determine average percentages in a zone for each indicator are as follows:

1. **Minority Population** % of Minority Population =

$$\frac{(Total\ Population) - (White, Not\ Hispanic\ Population)}{(Total\ Population)}$$

2. **Low Income Households**

   % of Low-Income Households = $\frac{(Households\ with\ Income\ below\ Poverty\ Level)}{(Total\ Households)}$

3. **Senior Population**

   % Population Age 65 and over = $\frac{(Population\ 65\ years\ and\ over)}{(Total\ Population)}$

4. **Limited Educational Attainment (Age 25 or older without high school diploma)**

   % of Limited Educational Attainment = $\frac{(Population\ Age\ 25\ or\ older\ without\ HS\ diploma)}{(Total\ Population\ Age\ 25\ or\ older)}$

5. **Zero Automobile Ownership**

   % of Households with Zero Automobiles = $\frac{(Households\ with\ no\ Automobiles)}{(Total\ Households)}$

6. **Female Head of Households**

   % of Female Headed Households = $\frac{(Households\ with\ Female\ Household\ Head)}{(Total\ Households)}$

7. **Limited English Language Proficiency**

   % Limited English Proficiency =

   $$\frac{(Population\ that\ Speak\ English,"Not\ Well") + (Population\ that\ Speak\ English\ "Not\ at\ All")}{(Total\ Population\ Age\ 5\ or\ Older)}$$

8. **Disabled Population**

   % of Disabled Population = $\frac{(Number\ of\ Disabled\ Persons)}{(Total\ Population)}$

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[22] Because of the high regional average, the standard deviation value was not added to determine the Minority Population threshold.