A Framework to Determine Purpose and Need for Increased Travel Options in the Megaregion for Vulnerable Non-urban Communities

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16. Abstract Texas' largest cities, Houston, San Antonio, Dallas and Austin form a triangle in the state's interior. Although cities are known for poverty pockets, many low income residents are not concentrated in central cities. Travel for this population is predominantly by private vehicle and is more expensive than for urban residents with access to public transportation. Transportation project decision making requires a presentation of need showing deficiencies in the existing transportation network. The challenge is in quantifying the rural travel needs in order to be competitive for limited transportation funds when measured against solving congestion and safety problems in cities. This work presents a framework enabling non-urban areas to more easily define need for transit funding.		
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Executive Summary

Per the concept of megaregions, linkages between key cities is key to optimizing outcomes for area residents and businesses. The Texas Triangle is formed by Dallas and Houston (connected by IH 45) Dallas and San Antonio/Austin (connected by IH 35) and Houston and San Antonio (connected by IH 10). A US Highway 290 corridor connects Houston, the state's largest city and Austin, the state capital. Seven counties make up this corridor anchored by Austin's Travis County and Houston's Harris County with 5 counties in between. More than 20% of the state's population lives in that corridor. The interstice counties are comprised of rural areas and small towns and travel is predominantly by private vehicle. Proximity to Austin and Houston could offer meaningful improvements in accessing goods and services to rural and small town residents.

As growth in the megaregion continues, the need for multiple travel options from rural areas and small town will increase. Good transportation is essential to rural areas as a link to jobs, to facilitate the movement of goods, to access health care and educational opportunities, and to provide links to food and necessary social services. Traditional transportation planning processes are led by metropolitan planning organizations (MPOs) who produce a coordinated plan for their region's transportation future. The need reflects the gap between the existing condition and the improvements essential for improved functioning of the transportation system.

Better documentation of need in the context of metropolitan planning organization decision making can assist MPOs in better addressing travel needs or rural and small town residences. This study showed 34 of 72 block groups in the US 290 corridor with a higher level of vulnerability than the general populace through mean values of poverty, ethnicity, and ability to speak English. This work proposes a multi-step rubric to ascertain vulnerability and link with accessibility variables to indicate public transit need.

Chapter 1. Introduction

Transportation project decision making requires a presentation of need that shows gaps in the existing transportation network or service sector that need addressing. Typically, congestion mitigation and improving safety are understandably high priorities. These two variables often focus on priorities in urban areas where daily travel problems are acute and obvious. Still, there is widespread consensus among transportation professionals about the need to meet travel needs of people in rural and exurban communities. Many low income residents are not concentrated in central cities. Moreover, as technology improves travel in urban areas, in part through Transportation Network Companies (TNCs such as Uber and Lyft), rural residents have little to no access to these service types. The challenge is in documenting and quantifying the rural and exurban travel needs in order for their deficiencies to be competitive for limited transportation funds when up against solving congestion and safety problems in the urban areas. This work builds on existing and often used typologies to form the foundation of a framework that will enable non-urban areas to define the purpose and need for funding projects and services and be better positioned to compete for transportation funding.

1.1 The Texas Megaregion

In many cases, rural communities may identify with their nearest large city. For Texas, 2016 data show the largest cities are Houston (2.3 million), San Antonio (1.5 million), Dallas (1.3 million) and Austin (1 million)[1]. The location of these cities forms a triangle in the state's interior. These locales form a megaregion linked by the state's economic, energy and environmental sectors and is referred to as the Texas Triangle (Figure 1)[2]. Per the concept of megaregions, connections across the cities is key to optimizing outcomes for the areas' residents and businesses. Dallas and Houston are connected by IH 45, Dallas and San Antonio/Austin by IH 35, and Houston and San Antonio by IH 10. A US Highway 290 corridor connects Houston, the state's largest city and Austin, the state capital. Seven counties make up this corridor anchored by Austin's Travis County and Houston's Harris County with 5 counties in between. More than 20% of the state's population

[1]United States Census Bureau (2017).
https://www.census.gov/quickfacts/facts/fact/table/austincitytexas/PST045217
[2] Per Table 1.

lives in that corridor. The interstice counties are comprised of rural areas and small towns. Internal and external travel is predominantly by private vehicle. Travel options beyond personal vehicles are limited to non-existent. Proximity to Austin and Houston could offer meaningful improvements in accessing goods and services to rural and small town residents. As the megaregion continues to develop, the need for multiple travel options for rural and small town residents will increase.

Good transportation is essential to rural areas as a link to jobs, to facilitate the movement of goods, to access health care and educational opportunities, and to provide links to food and necessary social services. Transportation supports businesses and is a critical contributor to a community's quality of life. Inadequate transportation and total reliance on a personal vehicle for travel leaves many rural residents lacking in needed levels of connectivity[3] Better documentation of need in the context of metropolitan planning organization decision making can assist rural communities in advocating for improved travel options.

1.2 Multijurisdictional Planning

Traditional transportation planning processes are led by metropolitan planning organizations (MPOs) who are responsible for coordinating with transportation agencies and management organizations, partner jurisdictions and the public to produce a coordinated plan reflecting their region's transportation future. The MPOs are bound by legislation to focus within their designated boundaries. The Texas Department of Transportation (TxDOT) assembles the plans for all the state's public transit providers in order to present a combined view of statewide service, but none of the entities conducts planning across agency boundaries to determine potential gaps across jurisdictions. One argument for megaregions is that the boundary restrictions compromise efficiency and optimum operation. The requirement to provide service and plan only within an agency's boundary is particularly acute for public transit and does not enable the most vulnerable to have their trip needs examined or quantified if travel needs move beyond their local agency's parameters. The most recent report completed for TxDOT regional transit coordination planning

[3] Trip. 2015. Rural Connections: Challenges and Opportunities in America's Heartland, Washington, DC.

noted five consistent needs: 1) Expand and increase transportation services, 2) Increase coordination and collaboration, 3) Increase and improve connectivity and access, 4) Increase ridership through targeted outreach, marketing, and engagement, and 5) Determine additional funding sources. The report notes, "In rural areas, people from all over the region have a desire to access major employers that are potentially located miles from where they live"[4] With continued changes in community demographics, public transportation will be even more integral in ensuring people have access to jobs and other daily needs. Meanwhile transportation agencies must address planning only within their jurisdictional boundaries. The magnitude of the challenge to meet transportation needs of people in non-urban communities is described in USDOT's Beyond Traffic 2045 (BT); the document refers to the difficulties of coordinating transportation across boundaries as follows:

> **Suburban and rural concentrations**. Low income residents are not concentrated in central cities. Beyond lower income communities of cities and suburbs, megaregions will result in areas typically termed rural incorporated into consideration of travel needs. Rural residents face challenges accessing transportation services for medical, work, and basic life sustaining activities. Despite being in the midst of a boom in technology, rural residents find themselves on the fringe as their access to these technologies is limited. For example, TNCs like Uber or Lyft operate in urban areas but have not made great strides to operate in rural areas [5]

For the US 290 corridor, five MPOs cover the geographic corridor and would be appropriate to investigate rural and small town corridor need, but do not have the authoritative charge to do so.

1.3 Determining Need

US DOT requires all projects to begin with a statement of purpose and need. The point is to clearly show why a particular transportation concept is proposed, supported by descriptions of what will be accomplished, if successful. The need reflects the gap between the existing condition and the

[4] Miller, Kristie. TxDOT Project 409256-106, Technical Memorandum, Statewide Perspectives from the 2017-2021 Regionally Coordinated Transportation Plans Review of 2017-2021 Public Transit-Human Services Transportation Plans (https://static.tti.tamu.edu/tti.tamu.edu/documents/TTI-2017-11.pdf), pg. 20.
[5] US Department of Transportation. Beyond Traffic: 2045. http://www.dot.gov/sites/dot.gov/files/docs/Draft_Beyond_Traffic_Framework.pdf (retrieved October 4, 2017. p.22.

improvements essential for improved functioning of the transportation system. In the book, *A Guide to Assessing Needs: Tools for Collecting Information, Making Decisions, and Achieving Development Results*[6], the author provides specific guidance to professionals and stakeholder groups working through this first step in the planning or implementation process**.**

There is an important connection between transportation and community residents' health and overall well-being. *Community in Action: Pathway to Health Equity* reports that inadequate or lack of public transportation is a barrier to accessing health care and other vital services.[7] Transportation costs are a barrier to mobility for households in poverty, which are often minority. The report notes that long commute times and high transportation costs are significant barriers to employment and financial stability particularly in rural and other underserved communities.

Work by Prialakou, Gkrita and Fricka[8] indicates that the US lags in studies about how to address vulnerable and rural residents. They note these residents are disadvantaged due to lack of transit, fewer economic, recreational and other opportunities. These researchers conduct an extensive literature review and conclude that most research focuses on demographic characteristics, whereas their work, research, and recommendations, termed 'moves', are calculated based on distances and travel times to walk or drive a car. They conduct a robust review of 23 international studies with research describing three basic strategies for measuring transport disadvantaged – accessibility, mobility and outcome based. Prialakou, Gkita and Fricka point out advantages and shortcomings of each approach. Of the research they review, none of the approaches are structured to fold into a decision making process to improve transportation for vulnerable communities.

[6] Watkins, Ryan. (2012) A Guide to Assessing Needs: Essential Tools for Collecting Information, Making Decisions, and Achieving Development Results. World Bank Training Series.
[7] Weinstein, James A. Amy Geller, Yamrot Negussie, and Alina Baciu -- Editors (2017). Communities in Action: Pathways to Health Equity. Committee on Community-Based Solutions to Promote Health Equity in the United States National Academies of Sciences.
[8] Prialakou, Dimitra, Konstantina Gkrita and Jon Fricka (2016). Accessibility, Mobility and Realized Travel Behavior: Assessing of Transport Disadvantaged. Journal of Transport Geography 51, pp 252-269.

Methods to incorporate equity measure into system network decision making were offered by Behbehani[9] and others. Their work included historical theories of determining social need and incorporates benefit measurements, target group strategies and varying methods of considering social equity.

Changing demographics will require new approaches to increasing available travel options for rural and small communities. Nonmetropolitan areas have higher proportions of older and lower-income citizens who could directly benefit from increasing the availability of viable transportation options. These groups, including persons with disabilities, often remain isolated in their homes with few options for getting around. Rural areas and small towns are particularly vulnerable to increasing economic insecurity.[10]

A further challenge to residents of vulnerable communities will be the incorporation of innovation and new methods. For instance, Transportation Network Connectors (TNCs) like Uber and Lyft have already materially altered the travel options for many Americans. While less expensive than taxis, the higher than public transportation costs limit how frequently lower income residents utilize these services. Plus, increasing use of apps and electronic shopping are causing a collapse of traditional brick and mortar stores. Even supermarkets advertise services that deliver groceries to the home. However, these amenities are largely or totally unavailable for non-urban communities leaving even greater gaps in their access to goods and services. Further, with each new year, advances are likely for automated vehicles. It is important for attention to be paid to vulnerable populations in non-urban areas as these advances occur to assure people in these communities are not left even more behind if their current communities are not in the electronic commerce environment. Quite the opposite, though, if properly anticipated. The advances discussed have the potential to allow more accessibility, better connectivity and improved quality of service for vulnerable communities. However, without attention, these communities will potentially be left behind and left out of the innovation wave.

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[9] Behbahani, H., Transportation Research Part A (2018), A Design Problem Considering Social Equity Criteria Conceptual Framework To Formulate Transportation Network. https://doi.org/10.1016/j.tra.2018.04.005

[10] Shoup, Lilly and Becca Homa (March 2010). Principals for Improving Transportation in Rural and Small Town Communities. White Paper. Transportation for America.

Chapter 2. Study and Corridor Description

2.1 Research Objective

The objective of this research is to formulate a rubric styled framework for planners to craft purpose and need statements that will support development of transportation projects for vulnerable populations in the non-urban portions of a megaregion. The framework will be designed to assist decision making by providing an assessment tool to identify the location of vulnerable populations and determine the travel needs that can be met in the megaregion -- outside traditional jurisdictional boundaries.

2.2 Methodology

The first step in the rubric analytic tool development is based on results of literature review, viewing other assessments for other purposes and adapting for the application to transportation decision making. Data were compiled from generally publicly available sources. Key variables were assembled including ethnicity, poverty level, whether of senior aged, auto availability, single female head of household and primary language spoken in the home. The team gathered statistics based on state of Texas means. In Texas, the poverty rate mean was 15.9 percent; this mean formed the foundation for viewing the variables. The spreadsheets displayed the census block groups exceeding the mean as the basis for assessment. Specifically, data were collected for the US 290 corridor with the boundary described as five (5) miles from the centerline of US 290 (Figure 1). US Census data and other line sources served as the principal sources of data. The study team mapped the data using ARC GIS and prepared the structure of the rubric analytical tool using two potential formats. A workshop of MPO planners, public transportation providers and the study team allowed a review of findings and solicited input for the final report.

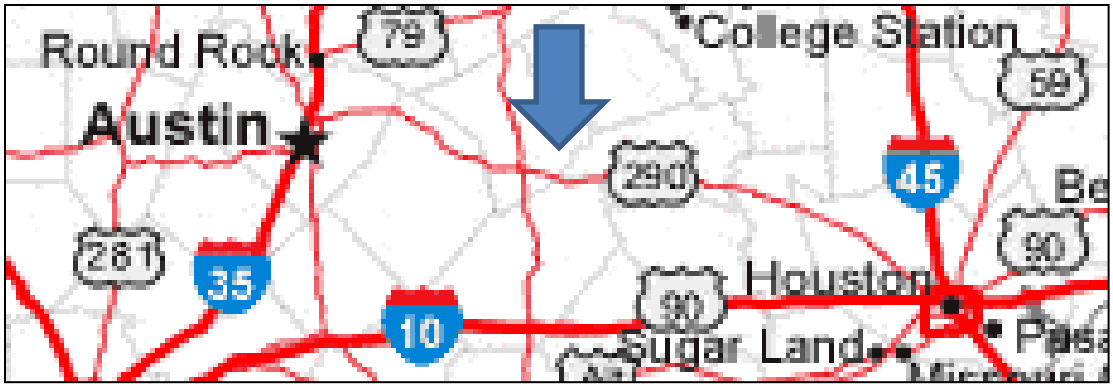


Figure 1. US 290 corridor connecting Houston and Austin.

2.3 Description of US 290 Corridor Counties

Six counties are contiguous to the US 290 corridor between Houston/Harris County and Austin/Travis County. Some of the counties are very large geographically, resulting in residents potentially being closer to other routes if traveling to Austin or Houston. A 5-mile boundary was set on both sides of the centerline as a cordon identifying potential corridor travelers. The counties in the interstice are Austin, Bastrop, Lee, Waller, Washington and Fayette.

Anchor counties for the corridor on the southern end are Harris County, including Houston with more than 4.5 million people and a poverty rate of 16.6% and on the northwestern end, Austin with Travis County, 1.2 million people and a 12.3% poverty rate. Note that Harris County exceeds the state's mean poverty rate, while Travis County rate is lower than the state's mean.

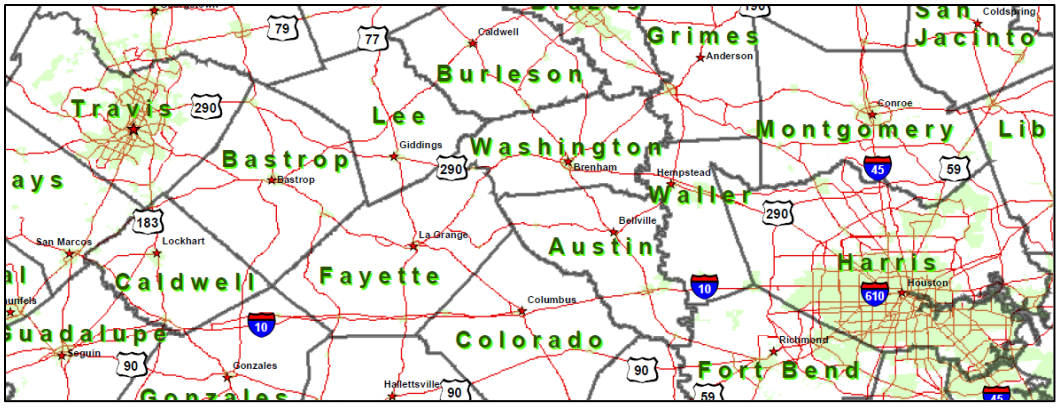


Figure 2. Counties contiguous to US 290

Of the counties in the interstice, Bastrop is the largest with slightly more than 78,000 people and the smallest is Lee with almost 17,000 people. Countywide, the percent of residents in poverty in

each county is less than Texas' mean, excepting Waller at 19%. Because poverty is generally concentrated, the 5-mile buffer along US 290 captures the block groups in those counties with a higher poverty rate than the Texas mean (Table 1).

Table 1. US 290 Corridor County Population, Employment and Poverty Rate

County	Population	Employment	Poverty Rate
Interstices			
Austin	29,107	13,410	14.5
Bastrop	78,286	32,589	13.6
Fayette	24,909	11,484	10.8
Lee	16,754	7,645	14.8
Waller	47,049	20,418	19
Washington	34,544	14,677	14.4
Anchors			
Harris	4,590,000	2,200,000	16.6
Travis	1,200,000	672,575	12.3
Texas	28,304,596	13,286,314	15.9

Source: https://datausa.io/profile/geo/**(county name)**-county-tx/

2.4 Existing Travel Options

The dominant travel method for residents in the US 290 corridor is personal vehicle. The vehicle ownership rate is high as public transportation options are few to nonexistent in most of the study corridor. The exception is for counties near Austin serviced by Capital Area Rural Transportation System (CARTS) with buses circulating in Bastrop, Lee and Fayette Counties. CARTS provides six (6) service categories including Interurban linking outlying communities with Austin. A connector distributor distributes riders once arriving in the Austin area (Figure 3).

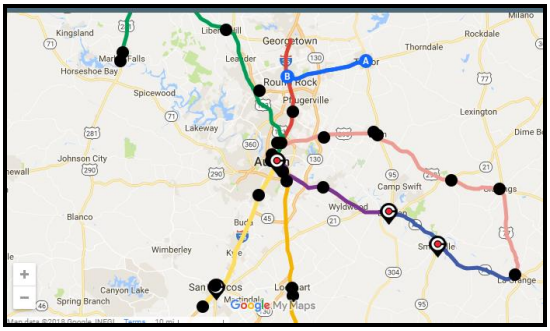


Figure 3. CARTS Interurban Bus Routes

Chapter 3. Identification of Vulnerability

3.1 Vulnerability Variables

A basic tenet of living in the US is fair and equitable access to goods, services and public projects leading to a balanced approach to accessing quality of life necessities. Demographic variables are typically used in identifying potentially marginalized communities or people at risk of being left behind. Focus is generally on variables reflecting income, age, ethnicity, English proficiency and gender for the head of household. Historically, vulnerability variable lists included auto ownership, but many investigators lately have found auto ownership to be less important than originally thought because in many communities, such as in the interstice counties, a car is required despite income levels. This work included the category at the initiation of the study. For this studies purposes, those variables were identified with the definition reflected in Table 2.

Table 2. Socio Economic Variables Pointing to Vulnerability

Variable	Definition
Female Head of Household	Households with more than one person, no male head of household is present
Non-English Speaking	Primary language spoken is not English
Minority Population	African Americans, American Indians, Asians, Native Hawaiians, and Hispanics or Latinos
Poverty Population	Federal threshold based on income and household size; slightly over $24,000 for family of four (2016)
Senior Population	Persons 65 years and older
Zero Automobile Ownership	Households with zero automobiles available

3.2 Vulnerable Block Groups in the US 290 Corridor

The data was dissected into US Census block groups for the interstice counties and totaled 76 block groups. The specific data (taken from the US Census 2015) analyzed total population, Non English speaking population, minority population, poverty population, the senior population and the zero automobile population**.** Per the methodology, the analysis process began with identification of block groups within 5 miles of the US 290 centerline that have a mean poverty

level greater than the Texas 15.9 percent mean. Of the 76 block groups in the 6 counties, thirty-four block groups (slightly fewer than 20%) met that threshold (Figure 3).

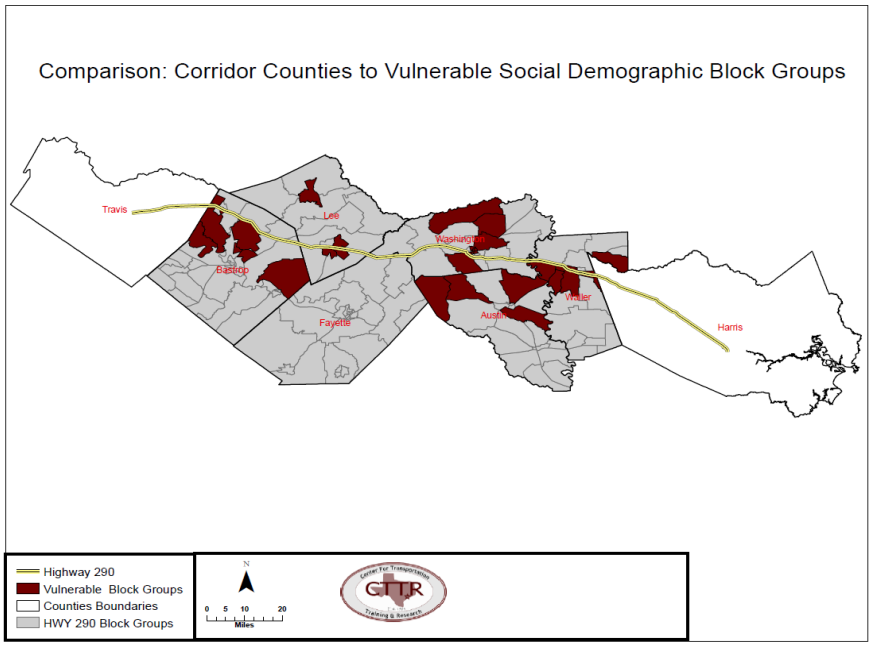


Figure 3. Block Groups with Poverty Rates in Excess of 16%

The team assembled the remaining vulnerability variables per those block groups. Figure 4 shows the mean of each variable for the 34 block groups compared to the 6 county mean. The percentage of Female Head of Household and those with Zero Auto Ownership are nearly equal for the block groups and the county means. The rationale for high auto ownership is because transit is unavailable in 3 of the counties, the auto is a necessity. For remaining variables, the 34 block groups exceed the mean values except for the percentage of seniors. The implication is that many senior residents are not as financially challenged as those in the identified block groups. Most notable are the bar heights for percentage poverty and percentage minority in the 34 block groups. The mean percentage of residents in poverty is slightly more than 10 percent for all counties, but approaching 30% for the 34 block groups mean.

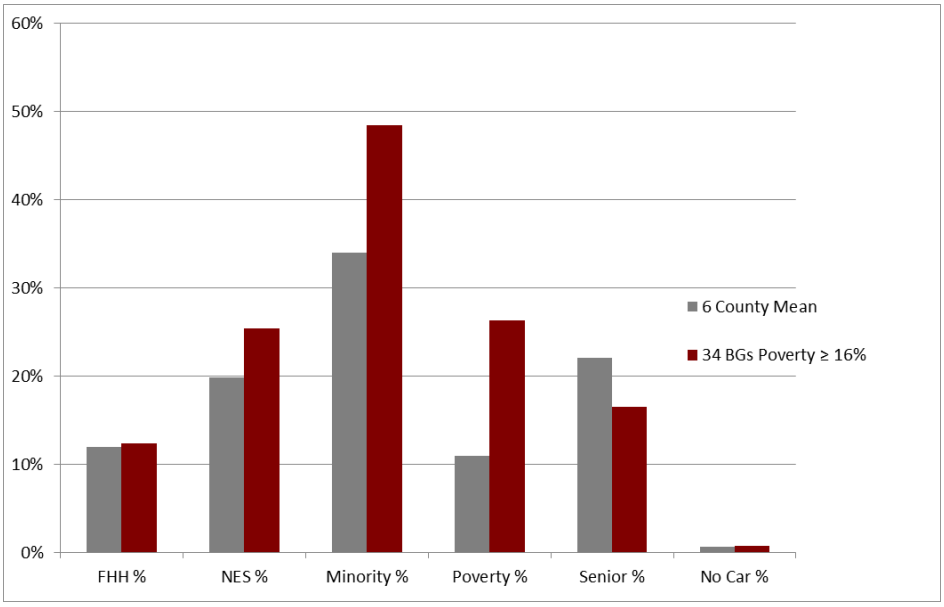


Figure 4. 6 County Means Compared to 34 Block Group Means

Table 3 reflects the single highest values viewed in the block groups. Bastrop shows the highest values on each variable with more than 25% of residents in poverty, 67% minority, 13% elderly and 8% with no auto available for the trip. Bastrop is on the northern end of the corridor and closest to Austin. There are two block groups each in Waller and Austin Counties with poverty rates about 20% and minority percentages above 50. The auto availability rates in these block-groups vary from 2% to 7%. Female headed households (FHH) ranges from 2 to 20%; Non-English from 2 to 64%. Because the greatest variability is seen in Non-English speaking, minority and poverty, Table 3 shows the comparisons by each county. There are no block groups in Fayette County with a mean poverty percentage greater than the state mean and the highest percentage block group in Fayette County is less than 10 percent. In cases that reflect more in the percent vulnerable group than the county mean, there still may be a wide range of percentages. For instance in Austin County, there is a block group with only 2 percent of the residents in poverty, while the remainder of the block groups all exceed the Texas mean.

Table 3. County Percent Means Compared to Means of the Vulnerability Block Groups (VBG)

County	% Mean Non-English	% Mean VBG Non-English	% Mean Minority	% Mean VBG Minority	% Mean Poverty	% Mean VBG Poverty
Austin	17	19	26	29	21	19
Bastrop	47	57	69	77	29	24
Lee	20	26	37	48	15	22
Waller	24	32	54	66	18	31
Washington	11	20	32	47	15	26

The research shows 34 block groups in the US 290 corridor that show a higher level of vulnerability than the general populace through mean values of poverty, ethnicity, and ability to speak English. There was no substantial variation in the mean values for female head of household or level of auto ownership. The mean value for senior residents was higher in the general population, showing vulnerable residents in this corridor trend toward the under 65 age category.

3.3 Personal Vehicle Transportation Costs as Percent of Income

As noted the population in the vulnerable block groups still had a high rate of auto ownership. One perspective is that viewing the 15 block groups with the highest poverty percentages (all above 25%), the highest percentage block group with zero autos was 2.83 percent. Six of the block groups showed no one without a vehicle (Appendix C).

Chapter 4. Case Studies: Most Vulnerable Block Groups

Nationally, households spend 13 percent of income on transportation. In order to better examine and understand the impact of the vulnerabilities affecting the 290 corridor, the block groups with the highest percentage of poverty were identified in Bastrop and Washington Counties – Bastrop Block Group 4, census tract 9502 with a percentage poverty population of 43.67% and Washington Block Group 1 Census Tract 1705 with a poverty population of 42.24% (See Appendix B). Residents in those block groups spend a noticeably higher percentage of income than other those in other communities (Table 4).

Table 4. Percentage of Income Spent on Personal Vehicle Transportation

Unit	Annual Household Income	Percent Spent on Transportation
Bastrop County Block Group 4	$ 29,730	19
Washington County Block Group 1	40,250	14
Texas	54,727	11
US	$ 57,617	13

4.1 Bastrop County, Texas

The most vulnerable block groups is in Bastrop County. Bastrop is about 890 square miles and is on both sides of the 290 corridor. This county's roots date back to 1832; the community's economy was originally based on farming and timber. During World War II, roughly 5,000 people lived there. The community throughout history has had many challenges including fires, flooding, and later sewage pollution, but still they persevered.[11] Today, Bastrop County boasts of a population of approximately 80,527, with a median household income of $53,382 and a median house value of $121,500.[12] The industry sectors are education services, accommodation and food services,

[11] Bastrop, Texas Network. (1996). Retrieved February 15, 2019, from http://www.bastroptexas.net/history/bastrop.htm

[12] J. (2016, October 19). Economic Overview: Bastrop County, Texas. Retrieved February 15, 2019, from https://www.co.bastrop.tx.us/upload/page/0104/docs/EconomicOverviewBastropCountyTexas.pdf

agriculture, forestry, fishing and hunting, mining, quarrying, oil and gas extraction and utilities. Employment recorded by Jobs EQ in 2016 numbered 20,048. The highest employing industries are retail and education, followed by accommodation and food services; construction and healthcare also provide significant contributions to the employment statistics.

The area examined in this case study will be block group, Census Tract 9502, GEOID 480219502004 (Figure 5).

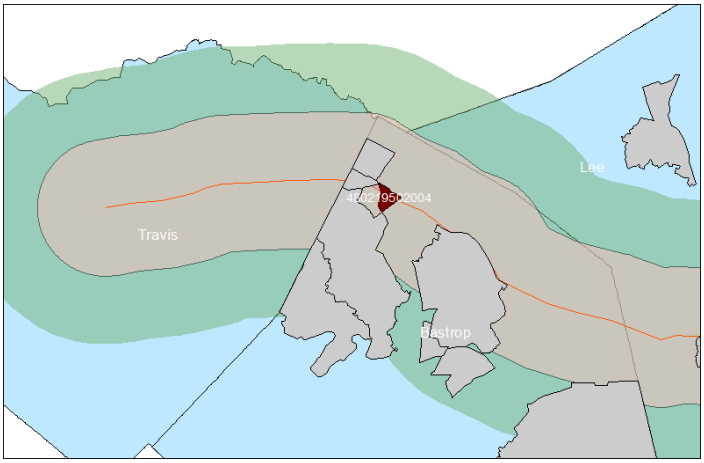


Figure 5. Bastrop County Case Study Block Group (shown in darkest hue near center)

According to the US Census data, the 2014 population was 1,352 and then in 2015 the population in this block group dropped to 1,205. Of the 1161 head of household population, 119 are female which accounts for 10 percent. During that year, the demographics reflect that 61 percent of the population is non-English speaking, with a total of 85 percent belonging to minority populations. The overall poverty in the area is 44 percent and 27 percent are seniors. Females represent 63 percent of the population.

This block group houses an elementary school (Booker T. Washington) which has a population of 622 students and employs a total of 42 teachers. The majority (75 percent) are Hispanic. More than 80 percent are economically disadvantaged, and 48 percent have limited English proficiency.[13] Within this block group, there are five churches, one early childhood learning center, three restaurants, one kennel, one body shop, one gas station and a party supply store.

[13] Murphy, R., & Daniel, A. (2015, December 08). Booker T Washington Elementary School. Retrieved February 15, 2019, from https://schools.texastribune.org/districts/elgin-isd/booker-t-washington-elementary-school/

The nearest grocery store is located 1.4 miles by automobile miles from the closest boundary and 1.7 miles from a central location (Booker T. Washington Elementary School). There is no scheduled public transportation system with predetermined routes and times and would require 33 minutes to traverse to the store by foot. CARTS is a Regional Transportation for the non-urbanized areas which is demand responsive and caters to the County of Bastrop which serves the area. This block area is included in the listed service area. The headquarters for CARTS is located on the other side of Bastrop County proximate to the closest hospital (Family Health Center of Bastrop) approximately 18 miles from the center of the outlined study area.

According to the United States Census Bureau, the block group showed a decrease in population for the 5-year period 2008 to 2012 to 985 which resulted in a reduction in the number of its white population by 42 percent as well as its black population by 17 percent. Records show that "other" population spiked to 60 percent. Compared to the rest of Bastrop County, the white population showed a marginal decrease of 0.7 percent and blacks an increase of 9 percent. Similarly, the Bastrop County "other" ethic group of other increased by more than 150 percent.

This study area of Bastrop shows that a total of 239 residents hold a high school diploma, while 31 residents earned a college degree, bachelors being the highest attainment. This number shows a 54 percent decrease in college educated persons from 2008 to 2012, while Bastrop County showed a 24 percent increase in college degrees over the study period.

Recent 2017 census data also reflect a shift in the block group from family households to nonfamily households. Family households decreased by 30 percent while non-family households (persons living alone) increased by 10 percent which is double the national average. Median household income was at $29,264 (down 43 percent) from 2014, while for the rest of Bastrop county median household income went up 12 percent to $59,185. There are 617 (38 percent) in the 16 years and older labor force leaving more than half of that category not in the labor force. The block has 436 homes of which 86 are vacant; only 29 percent are owner occupied with the rest renters. Of the owner-occupied homes, 36 percent are white owned and 17 percent black owned. The Texas and

national averages for white home ownership are 66 percent and 69 percent respectively and black Texas; national ownership averages are 41 percent.

4.2 Washington County, Texas

Another of the most vulnerable block groups in the US 290 corridor is in Washington County. Named after the first president of the United States, the county contains about 611 square miles and is rich in mineral resources of oil, natural gas, lignite, brick clay salt and sulfur. Historical evidence shows that this area was first inhabited by Indians, but the area was settled by Europeans in 1821. In 1850 the population was about 1500, but by the 1860 had increased to 15,000. From its European beginnings, by the 1960s, the white to black ratio was 2 to 1. Later in the 1970s, the population rose to approximately 22,000.[14]

Washington County's current population is roughly 34,667 with a white majority of 77.9%. Employment statistics show that 14,897 are employed.[15].The economy is comprised of agriculture, forestry, fishing, hunting, manufacturing and construction. The largest industries are manufacturing, healthcare and education, although the highest paying industries are mining, quarrying, oil and gas extraction.

The most vulnerable block group in the County is Block 1 Census Tract 1705 GEOID 484771705001 (Figure 6).

[14] Hailey, J. L., & Lefter, J. (2010, June 15). Texas State Historical Association: WASHINGTON COUNTY. Retrieved February 15, 2019, from https://tshaonline.org/handbook/online/articles/hcw04

[15] Pensacola News Journal. (2018, December 06). 2017 American Community Survey 5-Year Estimates. Retrieved March 03, 2019, from https://data.pnj.com/american-community-survey/washington-county-texas/population/total-population/yty/05000US48477/

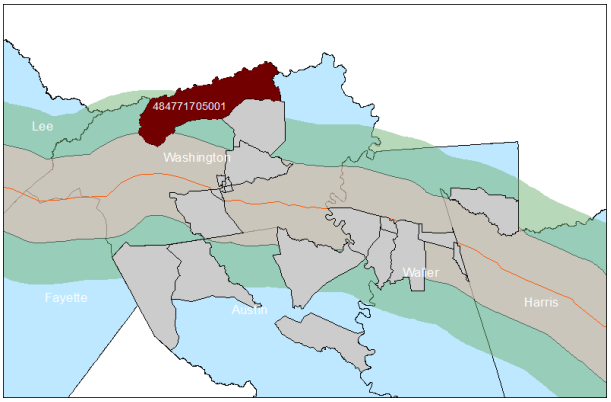


Figure 6. Washington County Case Study Block Group (shown in darkest hue)

In 2015, the population for this block was 1,546 with 9 percent being female head of household and non-English speaking population of 13 percent. More than half of the population is minority (53 percent) and more than 40 percent in poverty.

The American Community Data Survey completed by the US Census Bureau in 2017 showed a 28 percent decrease in the block group total population from 2008 to 2012 ACS 5 year summary[16]. Approximately 65 percent attained a high school or and 32 percent have a college degree. Of that total 18 percent hold a bachelor degree and 5 percent have a doctoral degree.

Regarding households, 70 percent are classified as family. There are 568 houses contained within this study area and 164 are vacant; eighty-five percent (404) of the homes are owner occupied with the remaining 15 percent renter occupied. The ownership distribution of the 343 houses are 229 white owned and 96 black owned. The data show that compared to the 2008-2012 data white ownership has decreased and black ownership has increased. The median house value is $101,000 which shows a 13.1% increase compared to 2008-2012 ACS 5 Year Summary.

The16 years and over population is 892 of which 61 percent are in the work force and 14 percent are listed as unemployed which is three (3) times the national and Texas levels. The unemployment rate is nearly four (4) times Washington county level. Almost 40 percent of the 16 and over population are not counted in the labor force.

[16] United States Census Bureau (2017). https://www.census.gov/quickfacts/fact/table/austincitytexas/PST045217

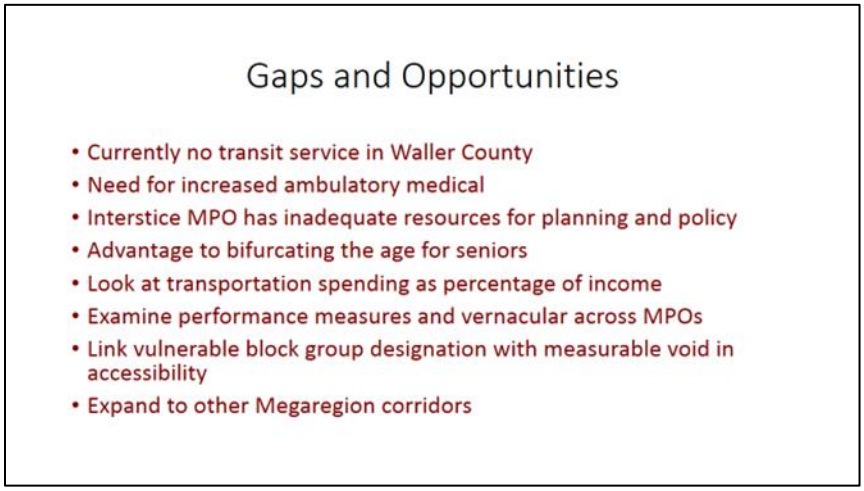
The median household income is $46,435, which is significantly less than the Washington County level of $55,793. Also the black median household income in the county is 50% less than white households. Indian and Asians household income is 1.5 times that of the white households in the County.

The nearest grocery store is Independence Food Center in Brenham which is 15.6 miles away; the nearest hospital is Baylor Scott and White which is 12 miles away. No transportation service was found in this area and census data shows that two (2) percent of this block group has no automobile.

Chapter 5. Opportunities and Rubric Template

The review of literature showed many methods of identifying vulnerability and inclusion of social equity into decision making. Incorporating transportation and equity variables from literature is sometimes quite complex and not necessarily designed with a view to the metropolitan transportation planning decision making process or to linking with megaregions. Many address transportation generally, but fewer transit, in specific. Attendees at a workshop of stakeholders conducted as part of this research confirmed the research approach and direction and added depth to the investigation. Included in the suggestions were to consider transportation costs as a percentage of income, bifurcating the senior category and asking for additional attention to ambulatory medical needs. The team included that first suggestion in the preceding case study section. Table 5 summarizes identified gaps and opportunities.

Table 5. Gaps and Opportunities



This research applied standard vulnerability variables in the US 290 corridor that showed 34 block groups classified as vulnerable based on exceeding the state of Texas mean poverty percentage of 15.9. The more detailed investigation of the case study block groups showed residents spend a greater percentage of income devoted to moving around in the auto-dominated environment. The guidelines for incorporating this information to form a rubric for transit decision making follow.

Decision making to better include the vulnerability variables is in two parts. The first is the vulnerability sequence presented in Chapter 3. The second is inclusion in a metropolitan planning organization process that ranks projects for funding opportunities. This could be a planning or analysis process or a Transportation Improvement Plan (TIP). Note that any project included in a TIP must also be in the area's Regional Transportation Plan (RTP).

5.1 Examine Block Groups for Vulnerability

Three steps are included in the vulnerability determination and include collecting the raw socio-demographic data and calculating the values.

Step 1. Assess for vulnerability. Per the approach in this research, the mean of the state serves as the basis for identifying block groups for additional consideration. Those that exceed the mean are included for further assessment.

Step 2. Analyze by Socioeconomic Variables. For block groups that exceeded the poverty mean assessment from Step 1, tabulate means for the remaining socioeconomic variables to be considered for vulnerability per the list below. Compare the block group mean to their county mean. Those that exceed the mean for the county, move to Step 3.

- Female Head of Household
- Auto Availability
- Ethnicity
- English Proficiency
- Percent Transportation Costs as Percentage of Income
- Senior Population, in two categories

  (Our workshop recommendations include bifurcating seniors to reflect greater propensity to mobility for people in their 50s, 60s and perhaps early 70s. The time parameters of this work did not allow adequate time to determine the appropriate break point, but that should be done in future research).

Step 3. Identify Variables for Index. Block groups with the mean exceeding the county mean for each variable are indexed to reflect the value for statistical assessment. For instance, for the block groups in the interstices of the US 290 corridor, it was learned that the means for female head of household and auto ownership were comparable. The means for senior population was higher in

the counties than in the 34 block groups. In this US 290 corridor scenario, those three variables would not be included in the next assessment, leaving the ethnicity, income, and non-English variables for further assessment.

Step 4. Index Remaining Variables

For each variable that enters step 4, index the block group value to the state value of 1. Aggregate the values for the Composite Index Value and rank the block groups. Table 6 shows an example.

Table 6. Example of Vulnerability Index

	Percent Minority	State Mean	Index Value	Percent non-English	State Mean	Index Value	% Trans $ of Income	State Mean	Index Value	Com-posite Index Value
Block Group 1	64	21	3.0	38.0	35.0	1.1	19.0	10.0	1.9	2.0
Block Group 2	48	21	2.3	18.0	35.0	0.5	14.0	10.0	1.4	1.4
Block Group 3	30	21	1.4	10.0	35.0	0.3	16.0	10.0	1.6	1.1

5.2 Include Composite Index Value in Decision Making Process

The composite vulnerability value is designed to include as a variable in decision making in a planning process. The value must be applied to a specific project for evaluation such as an intercity bus route, transit center or park and ride that would facilitate travel by enabling residents of several non-urban communities to gather for transport. Processes for two of the metropolitan planning organizations (MPOs) covering the US 290 corridor have criteria that include improving multimodal service, enhancing levels of service, economic competitiveness, ridership and state of good repair. One of the MPOs includes 5 of 100 points for environmental justice communities. Benefit cost assessments follow for both MPOs. This work recommends the Composite Vulnerability Index be added and receive greater points in the process. The suggestion clearly requires discussion with the MPOs about the benefits of reviewing consideration of rural non-urban needs. A next step in this work will be a second workshop as indicated desirable from the year one workshop outcomes described in Appendix A.

Chapter 6. Summary of Findings

There are a number of communities at risk of inadequate public transportation per their vulnerability. Current transit decisions often reflect need as a response to congestion, to improve air quality and through other variables that do not fare well for rural community residents. In order for non-urban areas to better position themselves for limited transportation funding, a first step is to quantify the extent of their transportation need. This work suggests doing so with a Composite Vulnerability Index.

TxDOT's report of rural transit noted that access to jobs that are not near their homes is important for people in these communities, as is their ability to access health care, social/recreational opportunities and other life necessities. It is critical that metropolitan planning organizations and councils of government more aggressively expand and increase transportation services, accessibility and connectivity to non-urban residents as in their mission and goal statements. The workshop conducted as a part of this research confirmed these deficiencies.

The two case study block groups showed a decrease in the number of residents from 2014 to 2016. They also showed high poverty levels, increasing percentages of minorities and increasing percentages of non-English speakers. These people spend a higher percentage of their incomes on transportation than their county or state counterparts. Meeting their travel needs can be given greater consideration if their vulnerability measure is given a higher value in the decision making process.

Motivation for people to remain in non-urban communities is a great challenge. Difficult access to employment, higher education and other life qualities is known to contribute to relocation decisions. Opportunities for necessities and amenities are far more considerable in the urban areas. From the megaregional perspective, reasonably priced transportation with attractive travel time to the nearest urban area would appreciably benefit rural and non-urban residents.

This research formulated a rubric for planners to show a ranked value for vulnerable populations. While designed for application in non-urban portions of a megaregion, there may be value in

assessing any vulnerable community using this tool. The rubric will assist decision making by providing an assessment strategy recognizing need as a partial reflection of percent of income spent on transportation.

It is important for attention to be paid to vulnerable populations in non-urban areas as technological advances occur to assure people in non-urban communities are not left even more behind if their current communities are not in the electronic commerce environment.

Appendix A. September 7, 2018 Workshop Summary

On September 7th, CM^2 (Cooperative Mobility for Competitive Megaregion) Texas Southern University (TSU) researchers sponsored local stakeholders in Winedale, TX for a full-day workshop on increasing travel options for vulnerable communities in the Texas Triangle megaregion. Workshop participants included representatives from Brazos Valley Council of Governments, Bryan/College Station Metropolitan Planning Organization, Houston-Galveston Area Council, Harris County Rides, Capital Area Rural Transportation System (CARTS), and the Texas Central Bullet Train. The workshop began with Lisa Loftus-Otway describing of CM^2's purpose and introduced attendees to its member institutions.

Dr. Carol Lewis, Professor and Emeritus Director of the Center for Transportation, Training, and Research (CTTR), and Dr. Gwendolyn Goodwin, Assistant Professor and Interim Director with CTTR, at TSU focused their year-1 CM^2 funded project along the 290 corridor that connects Houston and Austin. As a part of their project, "Creating a Framework to Determine Purpose and Need for Increased Travel Options in the Megaregion for Vulnerable (Environmental Justice) Communities", they have been gathering data to define transportation gaps in non-urban areas.

Purpose and need for transportation funding are typically defined by some level of congestion or lack of safety. But how should decision makers quantify transportation needs in non-urban areas where congestion is not necessarily an issue? For vulnerable communities in rural areas, factors such as cost, accessibility, and lack of internet/web access will continue to be barriers for transportation. As Dr. Lewis put it, "it is difficult to prove purpose and need when the need is simply that people need to get around."

To address this issue, Dr. Lewis and Dr. Goodwin are creating a rubric style tool to allow smaller, vulnerable communities to have a greater chance of receiving federal funding. Having this type of data will allow both academics and professionals in the industry to layer transportation options to address gaps in megaregional corridors.

At the workshop, CM2's Assistant Director for Research Lisa Loftus-Otway also presented her research project, "Issues in Setting an MPO Process for Megaregion and Multi-Jurisdiction Planning in the Texas Triangle". Ms. Loftus-Otway's research maps out MPO planning processes

and operating procedures to see where discrepancies may lie within the Texas Triangle megaregion. It also provides recommendations to enable MPOs to plan transportation investments on a megaregion scale, such as formalizing a megaregional planning focus between the MPOs and TxDOT during the next execution of planning agreements and using a megaregional framework to prioritize projects within the Metropolitan Transportation Plan.

Lack of rural transit options is a serious public health issue. As Dan Rudge from the Bryan/College Station Metropolitan Planning Organization pointed out, living far from medical care creates a number of problems. Not only does it hinder proper care but it also means that vulnerable individuals are paying the highest price for transportation to travel home when they are discharged. Increasing rural transit options could mean the difference between life and death for many vulnerable individuals. As Robert Anders of Harris County Rides explained, "[in the transportation industry] we may not save lives, but we take people to where ***they*** save lives."

Transit agencies that serve rural areas want to address deficiencies, but can be limited by lack of funding that results from lack of data. As Michael Parks from the Brazos Valley Council of Governments commented, "the funding is simply not there for the capacity that's needed." Throughout the state, transit agencies are also having trouble keeping transit drivers. But transit agencies are doing everything they can to serve the community. As Dave Marsh from CARTS said, "what you have in the rural transit industry is a lot of people who care."

Of course, the public sector does not need to go it alone. Michael Moore from the Texas Central Bullet Train discussed private sector interest in megaregion transit service. The Texas Central Bullet Train will provide high-speed rail access along the Dallas-Houston corridor. The corridor was chosen as the site of the first private high-speed rail corridor after a study of 97 city pairings, in which the Dallas-Houston pairing came out on top. High-speed rail between Dallas and Houston (including a stop in Brazos Valley) would offer a travel time of less than 90 minutes with departures every 30 minutes during peak periods of the day, offering Texas Triangle residents a convenient and accessible transportation option between these 3 major areas. It's possible that this project could lead to increased private investment in other inter-city transit options.

The workshop concluded with a modified SWOT (strengths, weaknesses, opportunities, threats) activity, in which participants divided into groups and discussed SWOC (strengths, weaknesses, opportunities, and a call to action.) The call to action prioritized communicating with elected officials. Because most legislators represent rural areas, they are more responsive if you can tie transit issues to rural issues. Other action steps included outreach to the public sector, ensuring flexibility to move money to match transportation goals, changing public perception of rural transit, and continued collaborative engagement

Workshop organizers asked those present if they felt there would be value to repeating the workshop in a year and the response was a resounding "***Yes"***.

Appendix B. Most Vulnerable Block Groups

County	BG_CenTract	Per_FHH	NES_Pop	Min_Pop	Per_Min_Pop	Pov_ Pop	Per_Pov_ Pop
Bastrop	Block Group 4, Census Tract 9502	10.25%	741	1032	85.64%	507	43.67%
Washington	Block Group 1, Census Tract 1705	8.99%	201	820	53.04%	653	42.24%
Waller	Block Group 2, Census Tract 6805	14.40%	1202	1375	72.94%	642	35.55%
Austin	Block Group 1, Census Tract 7605.02	12.06%	479	920	41.24%	782	35.05%
Waller	Block Group 3, Census Tract 6805	11.02%	638	1697	71.36%	795	33.43%
Waller	Block Group 2, Census Tract 6803	7.82%	168	694	93.53%	248	33.42%
Waller	Block Group 4, Census Tract 6805	10.57%	504	2182	73.37%	895	30.50%
Waller	Block Group 3, Census Tract 6803	16.31%	608	1062	48.38%	649	29.81%
Bastrop	Block Group 1, Census Tract 9502	16.24%	1108	1611	63.53%	681	28.21%
Bastrop	Block Group 2, Census Tract 9502	14.23%	366	1714	60.22%	801	28.14%
Waller	Block Group 5, Census Tract 6803	8.43%	978	1785	73.76%	680	28.10%
Lee	Block Group 3, Census Tract 4	9.81%	576	1187	64.37%	477	27.35%
Washington	Block Group 4, Census Tract 1704	7.77%	445	534	30.72%	455	26.18%
Austin	Block Group 3, Census Tract 7604	17.42%	81	376	28.72%	325	25.39%
Austin	Block Group 1, Census Tract 7605.01	8.48%	428	435	34.80%	314	25.12%

Appendix C. Vulnerable Block Groups Vehicle Ownership

County	Block Group and Census Tract	Households w/o a vehicle
Bastrop	Block Group 4, Census Tract 9502	0
Washington	Block Group 1, Census Tract 1705	31
Waller	Block Group 2, Census Tract 6805	0
Austin	Block Group 1, Census Tract 7605.02	52
Waller	Block Group 3, Census Tract 6805	0
Waller	Block Group 2, Census Tract 6803	0
Waller	Block Group 4, Census Tract 6805	0
Waller	Block Group 3, Census Tract 6803	17
Bastrop	Block Group 1, Census Tract 9502	21
Bastrop	Block Group 2, Census Tract 9502	29
Waller	Block Group 5, Census Tract 6803	5
Lee	Block Group 3, Census Tract 4	5
Washington	Block Group 4, Census Tract 1704	0
Austin	Block Group 3, Census Tract 7604	6
Austin	Block Group 1, Census Tract 7605.01	0

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