

## Creating a Framework to Determine Purpose and Need for Increased Travel Options in the Megaregion for Vulnerable (Environmental Justice) Communities

### RESEARCH AGENDA

#### 1. BACKGROUND

Megaregional travel crosses boundaries of political jurisdictions and typical planning boundaries. Detailed work is often done on specific projects (like high speed rail) with little or no attention to the needs of vulnerable populations. State DOTs consider environmental justice in project planning, but in a localized manner, not focusing on interregional travel needs.

It is important as megaregion planning matures that access to opportunities promoting equity across rural communities improves. There should be better connections and access to employment, health care and other trip purposes from rural to urban communities within the megaregions, especially for high need populations.

#### 2. 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 megaregions. 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 beyond traditional jurisdictional boundaries.

#### 3. RESEARCH CONTENTS

The study is designed to identify vulnerable populations in the Texas Triangle corridors coupled with an investigation of their mobility needs. The purpose is to link these communities with improved mobility to meet essential and desired lifestyle improvements. Work began on the smaller corridor connecting Houston and Austin to test the viability of the concept.

#### 4. RESEARCH FRAMEWORK

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 need. The need reflects the gap between the existing condition and the improvements essential for improved functioning of the transportation system necessary to support daily life.

Fainstein and Fainstein (2009) caution that reconsidering the geographic boundaries, as for megaregions, will not materially change the distribution of wealth, but has potential to improve life quality for some individuals. Positively addressing gaps in service and transportation experienced by vulnerable populations is most likely to occur in the context of megaregion discussion if the needs of these communities are clearly understood. A corridor in Texas connecting Houston and Austin provides the contest in which the question of purpose and need for vulnerable communities is examined.

#### 5. ROADMAP

**Developing a Model: Data Collection and Analysis**  
The methodology includes a multiple step process to determine the block groups most in need of transit in the Texas Triangle megaregion. Data collection began in the Texas Triangle with initial focus on the US 290 corridor. Identification proceeded of relevant vulnerable areas where low income, ethnic and senior communities are concentrated. Vulnerable communities were mapped using GIS per the data collection outcomes. The rubric detailing considerations for planners in preparing the assessment of purpose and need for vulnerable communities was developed.

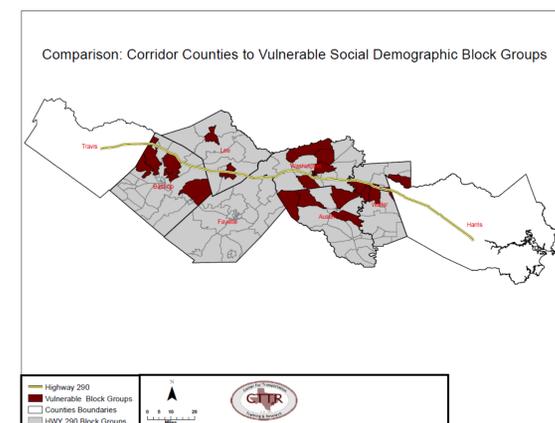
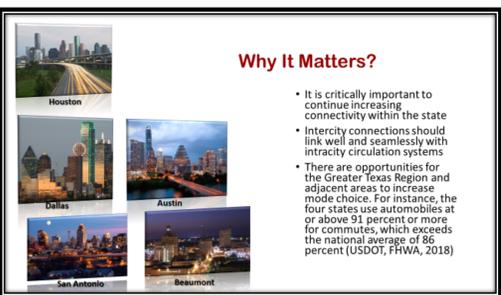
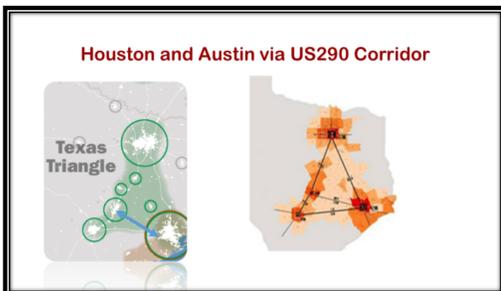
#### 6. TIMETABLE

The rubric is almost completed with the next step to apply the rubric to a corridor in the Texas Megaregion.

Task	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Task 1. Collect Data															
Task 2. Map using GIS															
Task 3. Identify Core Analysis Areas															
Task 4. Describe Available Transportation Options															
Task 5. Prepare the rubric analytical tool															
Task 6. Prepare Final Report & Tech Transfer															

### ACHIEVEMENTS

#### Texas Triangle Megaregion



#### Methods

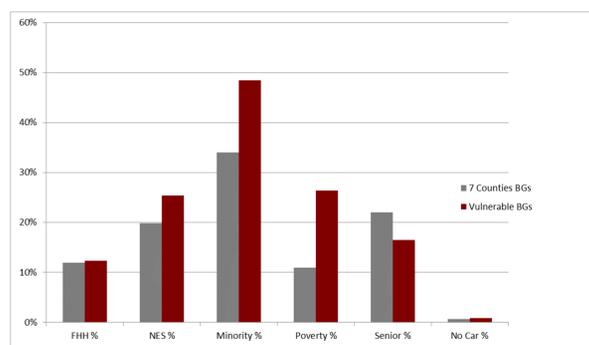
Variables	Definition
Minority Population	African Americans, American Indians, Asians, Native Hawaiians, and Hispanics or Latinos
Low-Income Population	Total income in the past 12 months below poverty level
Senior Population	Persons 65 years and older.
Zero Automobile Ownership	Households with zero automobiles available.
Female Headed Households	Households with more than one person, in which no male head of household is present.
Language Proficiency	Households that speak English less than very well.

The formula below was modeled from the Atlanta Regional Commission (ARC). In the formula when population was used, the sum of the variable was divided by the total population (Pop) and multiplied by 100. When household data were used, the variable is divided by the sum of total households (HH) and multiplied by 100. For example,

$$\frac{(\sum(\text{variable})/\sum(\text{Total Pop})) * 100}{(\sum(\text{variable})/\sum(\text{Total Households})) * 100}$$

The formula is repeated for each variable.

- Minority Population Distribution (MGP) =  $(\sum(\text{MGP}) / \sum(\text{Pop})) * 100$
- Low-Income Population Distribution (LiPop) =  $(\sum(\text{LiPop}) / \sum(\text{Pop})) * 100$
- Senior Population Distribution (SP) =  $(\sum(\text{SPPop}) / \sum(\text{Pop})) * 100$
- Zero Automobile Ownership Households Distribution (ZAO) =  $(\sum(\text{ZAOH}) / \sum(\text{HH})) * 100$
- Female Head of Households Distribution (FHH) =  $(\sum(\text{FHH}) / \sum(\text{HH})) * 100$
- Non-English Speaking Population Distribution (NES) =  $(\sum(\text{NESPop}) / \sum(\text{HH})) * 100$



#### References

Fainstein, Norman and Susan S. Fainstein, (2009) Social Equity and the Challenge of Distressed Places, MEGAREGIONS, (ed. Catherine Ross), Island Press.  
Ross, Catherine, Barringer, Joan, Amekudji, Adjo, 2009. Mobility in the Megaregion. Megaregions (pp. 140-165) Washington, DC: Island Press.  
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US DOT, Beyond Traffic, 2015. [http://www.dot.gov/sites/dotgov/files/docs/Draft\\_Beyond\\_Traffic\\_Framework.pdf](http://www.dot.gov/sites/dotgov/files/docs/Draft_Beyond_Traffic_Framework.pdf) (retrieved October 4, 2017)  
Watkins, Ryan, (2012) A Guide to Assessing Needs: Essential Tools for Collecting Information, Making Decisions, and Achieving Development Results (World Bank Training Series)

## Megaregion Truck Flow Estimation Model

### RESEARCH AGENDA

#### 1. BACKGROUND

Freight transportation has played a critical role in the development of megaregion economies. Trucks are the dominant mode of freight transportation and also one of the major contributors to roadway congestion and emissions.

To facilitate efficient freight transport, improve the competence of megaregions, and ensure the general success of the megaregional economy, it is necessary to gain a better understanding of the spatial and temporal patterns of megaregion truck movement. However, this important issue has not been thoroughly examined due to the lack of sufficient data and appropriate methods. Most studies of megaregions are still limited to academic interest; applied research on megaregional freight movement is still at an early stage.

#### 2. RESEARCH OBJECTIVES

The objectives of this research is to develop an analytical model for estimating megaregion truck flows, which helps to evaluate and improve freight mobility in megaregions. It reviews existing studies on this issue, identifies available and ready-to-use freight datasets, and develops the state-of-practice methods for truck flow estimation.

#### 3. RESEARCH CONTENTS

Based on the available freight data, this research intends to develop a replicable method to explore the spatial and temporal patterns of commodities moved by truck in megaregions. It develops an analytical framework to load the commodities carried by truck onto a road network, which is a spatial integration of the Federal Highway Administration (FHWA)'s Freight Analysis Framework (FAF) and the megaregion freight transportation facilities. It also estimates the amount of off-peak (night time) truck traffic within the Texas Triangle. It selects Texas Triangle as an empirical case to demonstrate the implementation of the megaregion truck flow model.

#### 4. RESEARCH FRAMEWORK

Similar to the freight models developed by Pan (2006) for regional freight movement, the analytical framework separates truck flows in a megaregion to the various inter-metropolitan and intra-metropolitan flows.

The model is an integration of the inter-metropolitan goods movement by truck in Federal Highway Administration (FHWA)'s Freight Analysis Framework (FAF) database and the intra-metropolitan freight flows for metropolitan area highway networks.

#### 5. ROADMAP

The project reviews and synthesizes the state of practice of freight transportation research, especially previous studies on freight movement at various spatial levels, such as megaregion, metropolitan areas, state, and interstate levels. It also examines existing freight databases, including those publically available and ready-to-use freight datasets. .

The research has developed an analytical framework for estimating the intra-metropolitan and inter-metropolitan commodity flows and loading the commodities carried by trucks to a roadway network within a megaregion based on the identified existing freight databases and sophisticated freight analysis mechanisms.

It implements the analytical framework to estimate truck flows in Texas through the Texas roadways.

#### 6. TIMETABLE

The research team has developed a work plan that consists of the five tasks to be accomplished over a period of 12 months, including literature review, data inventory, the development and implementation of an analytical framework for estimating truck flows in Texas Triangle, the documentation of findings and the preparation of a research report.

### ACHIEVEMENTS

#### 1. Development and Implementation of an Analytical Framework for Estimating Megaregion Truck Flows

An analysis framework is designed as a practice guide for calculating and loading truck freight onto a roadway network and estimating truck values by link. A user equilibrium freight model is developed to load truck freight into a roadway network.

The analytical framework is implemented to estimate inter-metropolitan and intra-metropolitan truck movement in Texas Triangle. The truck values by link are estimated by loading the truck freight into Texas Triangle's roadway network.

Truck values by link estimated in this study can help to support the evaluation of freight mobility and facilitate the decision making process of policy makers for megaregion freight transportation.

#### 2. Estimates of Night Time Truck Traffic

Nighttime lights and national land cover data (NLCD) derived by Visible Infrared Imaging Radiometer Suite (VIIRS) and Landsat TM have been used to estimate the volumes of ground trucks on highway network in Texas Triangle.

Spatial statistical analysis using spatial autoregressive model (SAR) and spatial error model (SEM) shows a potential and viable use of nighttime light data from satellite images to estimate truck volumes at night.

Statistical results show that nighttime light captured by VIIRS can be used as a proxy of freight volumes. Developed land uses by NLCD also help enhancing statistical models.

