USDOT Tier-1 University Transportation Center

CM2 Cooperative Mobility for Competitive Megaregions

Summer Forum 2019

The University of Texas at Austin

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Multi-Modal Modelling: BIM Templates for Sustainable Hub Design and Networks

RESEARCH AGENDA

1. BACKGROUND

Optimizing a multi-modal transit hub can accomplish a dual mission: making a journey more enjoyable, while bringing immense benefits to accessibility and performance. Stops and stations are often where existing and potential riders first interact with a transit service, can provide essential information and more generally frame the level of comfort and satisfaction riders have with transit service (Transit Design Guide, 2017). The integration of transit modes, seamless modal transfers, and operational ease contribute to the sustainability and efficiency in planning of a multimodal hub.

2.RESEARCH QUESTIONS

A Building Information Model (BIM) software program supports the ability to coordinate, update, and share design data with team members throughout the design construction and management phases of a building's life. The spatial structure and layout plan of a multimodal transit hub includes modes of transit organized across levels and surfaces, in order to optimize pick-up and drop-off points, transfer passengers between different modes, with logistical and operational ease.

How can a BIM model template, with a set of components and their families, address the systems in multimodal transportation to optimize it for unique site conditions?

3. RESEARCH CONTENTS

The proposal aimed to further previous specialized research into the application of Building Information Modeling (BIM) technology for megaregion mobility. The planning methodology for smart infrastructure and multimodal transit hub design was explored through case studies of multimodal transportation hubs in various locations to determine performance metrics and how they could be incorporated into the BIM model.

4.RESEARCH FRAMEWORK

This research took explored the IFOPT (Identification of Fixed Objects in Public Transport) model and characterized each condition based on topography, accessibility, stop places and points of interface. These characteristics were tabled under a performance index, how they corresponded with transportation metrics, and what parameters would be particularly useful for multimodal hub design using BIM families.

A zone-based programmatic relationship was determined in the four conditions, termed as User-based Scenarios (UBS). These typical conditions include express transit between airports and city core, freight transfer from ships at port to freight boats, rail or trucks, inter-city rapid transit, and autonomous transportation via surface-level or elevated infrastructure, or via air.

5. ROADMAP

The BIM template was continuously reiterated through the design and curation of advanced custom 3D parametric components. These new additions to the template were categorized as vehicles, transportation infrastructure, landscape and recreational elements, points of interface and other entourage including people.
4D time based assemblies necessary for transfer nodes could start to include 5D cost implications and 6D schedule design of robust multi–modal time–tables. Thus, specific BIM properties and information related to sensors, cameras, and material assembly was detailed for particular special families of autonomous vehicle and container ship. In this manner, the UBS performed as a supplement to the template database structure by visualizing the systems-diagram of each UBS through organization of the BIM families and their potential for better performance in multimodal transportation.

6.TIMETABLE

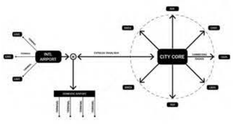
Research for this proposal began in fall of 2016. Creation of the proposed multi-modal transit template began in fall of 2017. This along with user based scenarios and advanced parametric continuously developed through the summer of 2018, after which it immediately disseminated and then integrated with a spring of 2019 design studio.

ACHIEVEMENTS

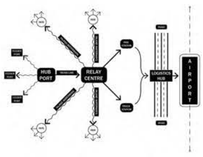
1. User-based Scenarios (UBS)

The four spatial scenarios explored conditions for multi modal transit hub. These scenarios demonstrate the complex networks for transfer and relay of goods and people between points of source and destination.

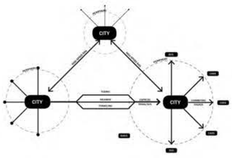
1.1 Airport to City Core



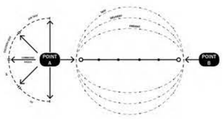
1.2 Freight Hub



1.3 Inter-City Junction



1.4 Autonomous Hub



2. UBS Component Assemblies in BIM

2.1 Airport to City Core

Multimodal hub to connect flight passengers from the airport terminal gates to city core areas via ground, air or subsurface modes.

2.2 Freight Hub Terminal

Loading and unloading of goods from container ships at ports into boats on the inland waterway network, freight railway, or trucks.

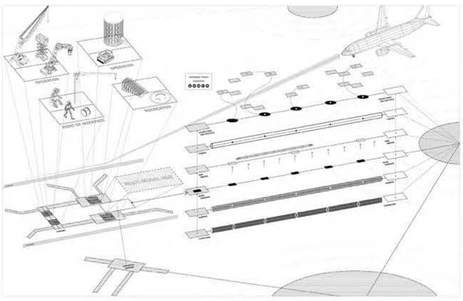
2.3 Inter-City Junction

Tunnelling and tubing connected towns between metropolitan cities.

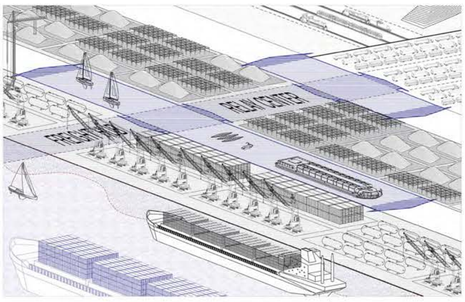
2.4 Autonomous Hub

Unmanned air taxis, drones, passenger vehicles and freight trucks create an autonomous network of plying goods and people.

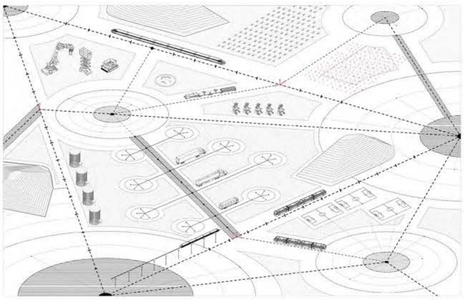
2.1 Airport to City Core



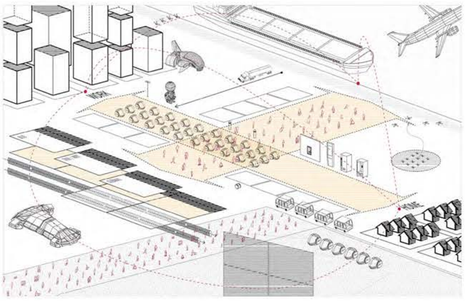
2.2 Freight Hub



2.3 Inter-City Junction



2.4 Autonomous Hub

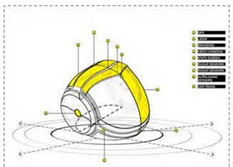


3. BIM Component Properties

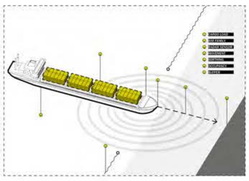
New BIM families added to the archive were identified for multiple properties of autonomous vehicles, industrial equipment and service bots, such as, sensor detection,

Autonomous vehicles, service bots and equipment

Autonomous Vehicle



Container Ship



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TEXAS SOUTHERN UNIVERSITY

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GRA(s): Tony Jin, Sasidhar Parasa, Jiwan Thapa

Develop a GIS-based Megaregion Transportation Planning Model

RESEARCH AGENDA

1. BACKGROUND

There are few academic studies or professional programs focusing on the development and implementation of megaregional transportation models. It is also a big challenge in the process of building such kind of models. This study intends to fill the gaps to develop a GIS-based model for megaregion transportation planning. It aims to balance the priorities in both the academic research setting and operational planning setting.

This research extends the spatial scale of a spatial planning model from region to megaregion, which accommodate larger areas, more passenger and freight trips, and more complex transportation networks. It will put together transportation models with economic input-output models and spatial allocation models to trace spatial socio-economic impacts and support policy analysis in megaregions.

2.RESEARCH OBJECTIVES

This research will develop an analysis framework for a GIS-based transportation planning model at megaregion level. It uses Texas Triangle as an empirical case to demonstrate the model development and implementation.

3. RESEARCH CONTENTS

This research extends the spatial scale of our regional planning model from a single metropolitan area to megaregion. It puts together economic input-output model, a spatial allocation model, and a travel demand model to trace spatial economic impacts in the megaregion,

This so-called Megaregion Transportation Planning Model (MTPM) will also endogenize traffic flows including both passenger flows and freight deliveries with an explicit representation of the transportation network. The capacity of the existing model will be significantly extended to handle the much larger and more complex passenger and freight flows in megaregions with a newly designed analysis zones. The functions of the regional model will also be redeveloped or updated to address more complex land use and transportation issues, like development pressures, peak load pricing or congestion tolls, and dynamic traffic patterns, etc.

4.RESEARCH FRAMEWORK

This MTPM model is an integration of the inter-metropolitan and intra-metropolitan planning model for passenger and freight movement. It is capable of estimating economic impacts of a policy, plan, or project in a megaregion.

5. ROADMAP

The research project reviews the state of practice of megaregion transportation studies on passenger and freight movement at various spatial levels. It also examines the existing transportation databases, including those publically available and ready-to-use transportation datasets.

The research develops an analytical framework for a GIS-based megaregion transportation planning model (MTPM) that estimates the intra-regional and inter-regional passenger and commodity flows, and then loads the passenger cars and commodities carried by trucks to a megaregion roadway network together based on the identified existing transportation databases and sophisticated transportation analysis mechanisms.

It implements the analytical framework to estimate passenger and truck flows in Texas Triangle.

6.TIMETABLE

The research team has developed a work plan that consists of the eight tasks to be accomplished over a period of 24 months. Four tasks are supposed to be finished in the first year, including literature review, the development of an analytical framework, development of GIS functions , the documentation of findings.

ACHIEVEMENTS

1. Literature Review and Synthesis of the State of Practice

1) Review existing studies on regional passenger and freight movement;

2) Identify available transportation datasets, including those publically available and ready-to-use datasets at different spatial levels;

3) Examine existing analytical methods for estimating passenger and freight flows.

2. Development of an Analytical Framework for Estimating Both Passenger and Truck Flows in a Megaregion

1) Construct a passenger trip module for both intraregional and interregional passenger movement in megaregions.

2) Construct a freight module for both intraregional and interregional freight movement in megaregions.

3) Develop a user equilibrium transportation model to load interregional and intraregional passenger and freight onto a roadway network.

4) Extend the regional impact analysis model and Incorporate policy analysis to the analytical framework.

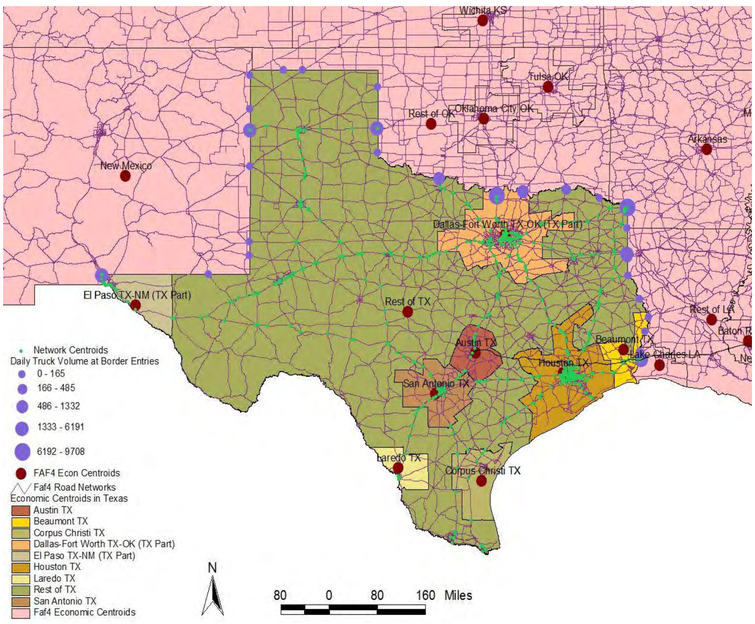
3. Development of GIS Functions to Support Transportation Modeling Practices and Facilitate Policy Analysis for Megaregions.

1) Develop GIS functions for transportation data processing.

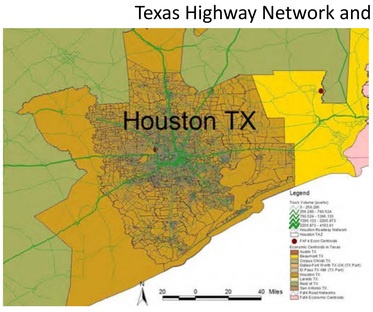
2) Construct GIS analytical functions for travel demand modeling in megaregions.

3) Create impact analysis function and decision support functions for policy analysis.

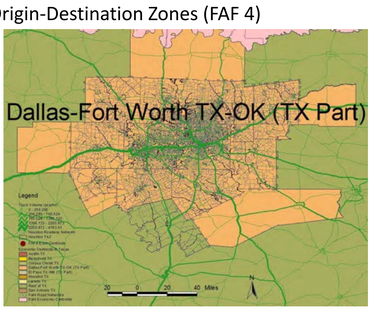
4. Documentation of Research Findings and Preparation of Research Report.



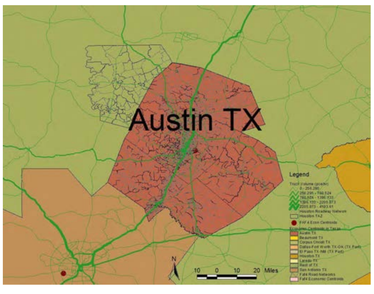
Texas Highway Network and Origin-Destination Zones (FAF 4)



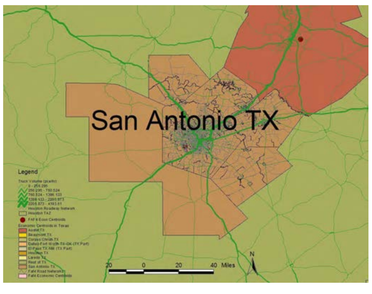
Highway Network and Zonal System in Houston



Highway Network and Zonal System in Dallas



Highway Network and Zonal System in Austin



Highway Network and Zonal System in San Antonio

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UNIVERSITY OF TEXAS AT AUSTIN

PI: Lisa Loftus-Otway

GRAs: Paulina Urbanowicz-Pollock, Roxanne Lin

Inter-regional Resilience: The Role of MPOs in Natural Disaster Planning and Response Preparation.

RESEARCH AGENDA

1. BACKGROUND & MOTIVATION

By 2050, two thirds of the nation's population is projected to live in a megaregion. Much of the argument for beginning to develop policies at the megaregional scale is to increase economic competitiveness of connected metropolitan areas. Any positive or negative shock to an economic system will be felt by all connected pieces. Economic engines and large populations in metropolitan areas are vulnerable to increasing numbers of natural disasters. As people continue to be drawn to populous metropolitan regions for employment opportunities and quality of life, the nation is developing concentrations of potentially vulnerable populations to natural disasters.

Transportation plays a critical role in increasing economic competitiveness of a region. The resilience of transport infrastructure impacts how quickly after a natural disaster people and goods can resume operations and how deeply economies are impacted. This research focuses on the role of MPOs in integrating adaptive and mitigate practices to enhance spatial resilience of regions, and subsequently megaregions. It also undertakes an introductory case study of megaregions surrounding the Gulf of Mexico to hurricane disaster events.

2.RESEARCH QUESTIONS

- How are different infrastructure types in a transport system impacted by natural disasters?
- What role can MPOs play in planning resilient transportation systems?
- How do disaster risks and threats vary across megaregions?
- What adaptive or mitigative resilience strategies are currently used by MPOs?
- How resilient are counties in the Gulf Coast megaregion in terms of population and total employment indicators?

3. RESEARCH CONTENTS

The report includes a two-page resilience profile for each megaregion and a case study. The two-pagers combine information from multiple sources to create a reference tool for future related research.

The case study provides a look into measuring resilience at the megaregion level and explores different mechanisms for similar types of future analyses.

4.RESEARCH FRAMEWORK

Since 2010, FHWA and has partnered with state DOTs and MPOs to fund pilot programs related to integrating resiliency strategies into transport system asset management, project selection, and operations. Since the FAST Act, FHWA and FTA implemented regulations to reflect these priorities in long-range visioning as well as during project prioritization process.

This research explores the role of transportation infrastructure during, before, and after natural disasters. It also delineates how different types of infrastructure are affected by natural disasters and explains how this issues threatens the economic competitiveness of a megaregion. As natural disaster events become more prevalent and increasingly severe, MPOs and state DOTs must work together to ensure that transport systems can recovery and facilitate the necessary flow of goods and flow of people. As many megaregions are located along coastal cities, this will become increasingly important in the coming years.

5.TIMETABLES

Project duration: September 2018 – August 2019

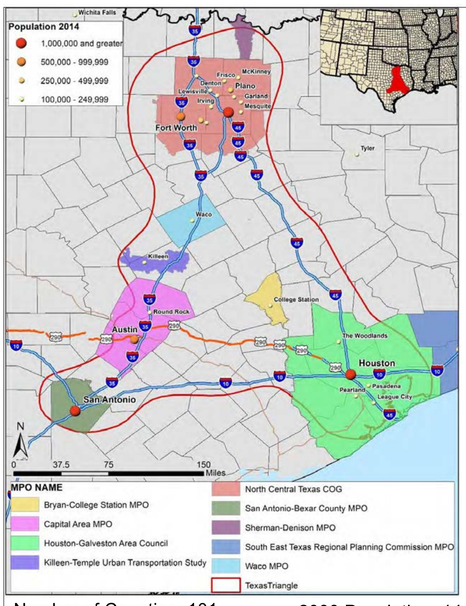
Core Pieces of the Report

1.Transport System Risks and Vulnerabilities

The transportation system plays many roles before, during and after a natural disaster event. This report explores the important role of a functioning transportation system throughout a natural disaster event and delineates how different types of natural disasters impact transport infrastructure. The resilience of transport systems can facilitate the recovery of communities in regions suffering from disaster events.

2. Megaregional Resilience Profiles and the role of MPOs

The report includes a two-page megaregion profile that identifies population information, the number of transport agencies at various organizational levels in the megaregion, and most common natural disasters. It also provides an overview of FHWA pilot programs that MPOs or state DOTs within the megaregion have participated in, the outcome of these projects, and highlights the work of a specific MPO as a best practice example. It also provides a map of the megaregion as originally depicted by the Regional Plan Association and identifies the location of MPOs within the megaregion. The two-pagers are meant to serve as reference guides for future megaregional research on disaster resilience.



Most common natural disasters risks: Wildfire, Tornado, Heatwave, Flooding, Hurricanes.

MPO projects from FHWA Resilience Pilot Programs:

In the 2013 – 2015 cycle, CAMPO received a grant to participate in a pilot program for Vulnerability Assessments and Adaptation Options.

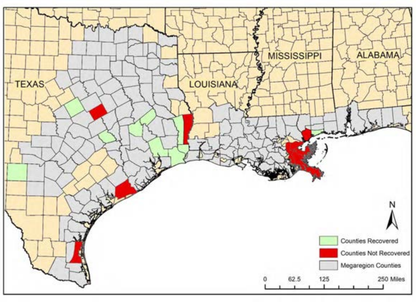
In the 2018-2020 grant program, HGAC received a grant for a pilot program to integrate Resilience and Durability to Extreme Weather into agency operations.

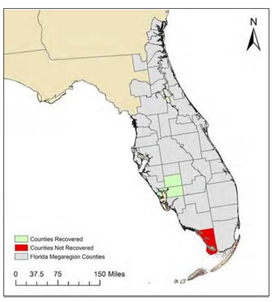
Number of Counties: 101
Number of States: 1
Number of MPOs: 8

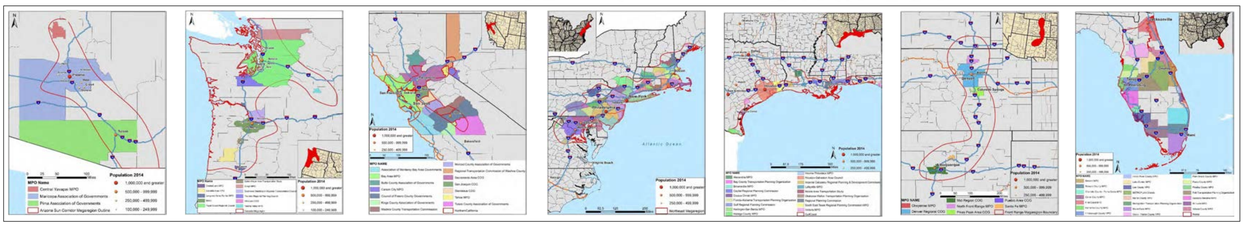
2000 Population: 14.8
2010 Population: 19.7
Projected 2050 Population: 35.5M

3.Spatial Resilience

The final chapter of our report conducts a case study of megaregions that border the Gulf of Mexico and the resilience of two indicators to hurricane disasters: population and total employment. The study evaluates the 2005 hurricane season for the Texas Triangle and Gulf Coast megaregions, and the 2004 hurricane season for the southern Florida megaregion. The study identifies counties that had not recovered pre-disaster levels of employment or population by 2017 and explores potential explanations for the phenomena identified.







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UNIVERSITY OF TEXAS AT AUSTIN

PI: Lisa Loftus-Otway
GRA: Alexander Hunn

Using State Government to Mitigate the Effects of Bracketing on Multijurisdictional Transportation Planning

RESEARCH AGENDA

1. BACKGROUND & MOTIVATION

- As the American population grows and becomes ever more interconnected across jurisdictional boundaries, transportation authorities need a streamlined, predictable framework of laws to make effective policy.
- The federal system of the United States emerged from a hotly contested debate about the role of the federal government, and the need for local autonomy which coalesced into the government we have today. Notably absent in the federal constitution, however, is any enumerated protection for the powers of local governments. Due to this of this absence, any and all delegation of power to these smaller governments are found only in state constitutions.
- In addition to the delegation of powers, which varies by state, nearly every state constitution has a form of restriction on "special" or "local" legislation (known as bracketing). That is, legislation targeted at one particular area or jurisdiction in the state, requiring state law to affect all members of a given class equally within the state. Interpretations of these provisions by courts have varied, and states have managed to circumvent court rulings effectively.
- Transportation law in many states has become highly inconsistent between jurisdictions, making cooperation more challenging. In transportation, bracketing has been used to restrict the activities that transit agencies can conduct, and some argue stymie efficient multimodal transportation options.
- Commuting maps also show that we are travelling within and between megaregion areas. Providing options to facilitate a multi-modal commuting choices in planning and funding, by reducing bracketing could provide multiple transportation agencies opportunities to more easily collaborate.

2. RESEARCH QUESTIONS

- This project will determine the extent to which these prohibitions have been applied by courts, investigate their applicability to transportation planning, and explore legal arguments that could be made in the future to use these provisions to facilitate multijurisdictional transportation projects. The project will:
- Review provisions within the Texas Triangle, Cascadia and Mid-Atlantic megaregions' state constitutions, legislation and regulations, and litigation surrounding bracketing.
- Compare within a matric to determine differences/similarities to map breadth and effectiveness in restricting efficient multi modal mobility options.
- Provide a comparative review of the effects of different levels of restriction.
- Conduct a critical legal analysis of case law on bracketing.
- Developing recommendations for effective megaregional multimodal planning.
  - Legal and policy recommendations
  - Juridical recommendations for interpreting provisions to facilitate smart transportation policy
  - Develop suggestions for how issues could be reconciled legislatively

3. TIMETABLE

Project duration: September 2018 – August 2019

Core Pieces of the Report

Findings from Texas Triangle

- Texas has a long history of bracketing.
- Article III, Section 56 of the Texas Constitution provides that "the Legislature shall not, except as otherwise provided in this Constitution, pass any local or special law," regarding a list of subjects, as well as prohibiting the passage of any local or special law in any case where a general law can be made applicable.
- The section treats equally local laws, which are those limited to a specific geographic region of the state, and special laws, those limited to a particular class of persons. See Maple Run v. Monaghan, 931 S.W.2d 941, 945 (Tex. 1996). This is to prevent advancement of personal projects.
- The Texas Supreme Court (TxSC) held that a law is not prohibited *"merely because it only applies in a limited geographic area."* The legislation *"must be broad enough to include a substantial class and must be based on characteristics legitimately distinguishing such class from others with respect to the public purpose sought by proposed legislation."* While the TxSC has sometimes given force to the special legislation clause of the Texas constitution, many statutes remain in full force despite a lack of compliance with these standards.
- In Texas, the *"ultimate test of whether a law is general or special is whether there is a reasonable basis for the classification made by the law, and whether the law operates equally on all within the class."* Rodriguez v. Gonzalez, 148 Texas 537, 540 (Tex. 1950).
- A special law is one which makes a classification *"not based upon a reasonable and substantial difference in kind, situation or circumstance bearing a proper relation to the purpose of the statute."* To make this determination, courts relies on a two-part test. Robinson v. Crown Cork & Seal Co., 335 S.W.3d 126, 189. (1) compares the purpose of the legislation to the delineated class; if the delineated class encompasses only a fraction of those the legislation could affect consistently with its objectives, the classification likely has no rational relation to the purpose of the statute; and (2) examines whether similarly situated parties are treated similarly, or arbitrarily excluded by the statute.
- Maple Run listed examples of types of specifications reasonably delineating a class. The court focused in on population, the factor most frequently used by the Texas Legislature to bracket legislation. Statutes applying only to counties or municipalities within a population range tend to be impermissible, particularly when the range is very small. Statutes merely specifying a minimum population tend to be upheld. For example, applying a state tax law only to counties with population between 125,000 -175,000 (affected a single county) was held an unreasonable classification. Miller v. El Paso County, 150 S.W.2d 1000, 1001 (Tex. 1941). By contrast, imposing special bail bond restriction in only counties with > 150,000 people was held a reasonable determination that they were only helpful in populous areas. Robinson v. Hill, 507 S.W.2d 521, 524 (Tex. 1974).
- Lack of standing may explain why bracketed Texas laws remain in force, despite failing the Rodriguez test. Especially for transportation where it can be difficult to draw a straight line between bracketed provisions and harm caused.
- **What does this mean?** Jurisdictional complexity and legal inconsistency between jurisdictions burden transportation planners ability to effectively plan for mobility and impact commuters who rely on them to provide network efficiencies.

Findings from Mid-Atlantic & Report Conclusions and Recommendations

Constitutional, Legislative and Case Law Reviews are being written up for Mid-Atlantic Megaregion, and conclusions and recommendations are being developed for write-up at time of this poster.

Findings from Cascadia

- Washington and Oregon have limited case law on bracketing.
- Article II, Section 28 of the Washington Constitution prohibits "private or special laws" in 18 specific cases.
- Only one of these provisions §28 (2 directly references transportation, prohibiting private or special laws "For laying out, opening or altering highways, except in cases of state roads extending into more than one county, and military roads to aid in the construction of which lands shall have been or may be granted by congress."
- The Supreme Court of Washington (SCW) interpreted Art. II, §28 and created the rule: *"A special law is one that relates to particular, as distinguished from a general law, which applies to all persons or things of a class."* Young Men's Christian Ass'n of Seattle v. Parish, 89 Wash. 495, 498 (Wash. 1916) to prevent a legislature from *"interfering with the government of municipal corporations" and to eliminate diversity of legislation upon a particular subject."* Island County v. State, 135 Wn.2d 141, 148 (Wash. 1998).
- The rule does not entirely prohibit the legislature from making classifications in laws but the SCW held that classifications must be based on *"substantially different characteristics"* which are *"reasonably related to the purpose of the legislative enactment."* . The test to determine this is whether *"any appropriate object is excluded to which the law, but for its limitations, would apply."* Seattle v. State, 103 Wn.2d 663, 675 (Wash. 1985)
- Exclusions must be rationally related to the purpose of the statute. The SCW has found population thresholds are rational, for example a statute subsidizing construction of baseball stadiums in counties over a million people was found to be permissible, despite only one county being affected at the laws passage. Clean v. State, 130 Wn.2d 782, 802 (Wash. 1996). This was because a high population was necessary for profitability and counties may become eligible.
- **In totality**, Washington state jurisprudence on special legislation has been enforced with moderate rigor. Transparent attempts at using bracketing to single out localities rarely succeed. Classifications, even those which only include a single subject at enactment, can survive with reasonable justifications. The most at-risk area for transportation bracketing in Washington would be King County and its county seat, Seattle, because high population floors can be justified by arguments that legislation is best suited to major cities
- Oregon Constitution Article 4, §23 addresses special legislation, enumerating specific cases in which such legislation is impermissible. The most relevant to transportation are prohibitions against special legislation "for laying, opening, and working on highways," and "for the assessment and collection of Taxes, for State, County, Township, or road purposes."
- The Supreme Court of Oregon has rarely discussed §23, and has not substantially defined the categories except by holding that they are exclusive., leaving the legislature residual power to make special/local laws regarding subjects not mentioned. La Grande v. Public Employees Retirement Board, 284 Ore. 173, 184 (Ore. 1978).
- A general rule of OR constitutional law is the constitution is not an exclusive enumeration of powers, but a list of specific limitations. Croft v. Lambert, 228 Ore. 76, 83.
- **In totality** applying the provision, the Oregon court held that to be general legislation, a law must affect a class distinguished by *"something of substance, ... attendant or inherent peculiarity calling for legislation suggested by natural reason of different character to subserve the rightful demands of governmental needs."* Tichner v. Portland, 101 Ore. 294, 299-300 (Ore. 1921). The court looks to the criteria used for classification and determines if it denotes a reasonable basis for classification
- **What does this Mean?** It is difficult to discern from case law analysis if, when or how bracketing has impeded efficient multimodal mobility opportunities.

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CM2 Cooperative Mobility for Competitive Megaregions

Summer Forum 2019

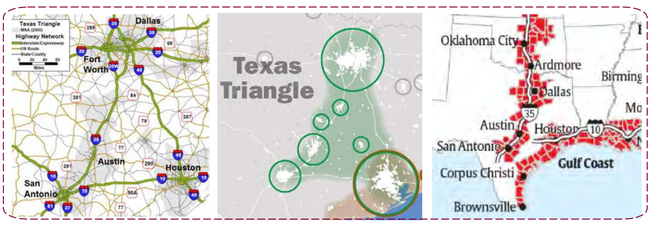
THE UNIVERSITY OF TEXAS AT AUSTIN

PI(s): Dr. Ming Zhang
GRA(s): Liang Chen, Ziqi Liu, Caleb I Roberts

An Anatomy of Megaregional Process
-- Case Study of the Texas Triangle

BACKGROUND

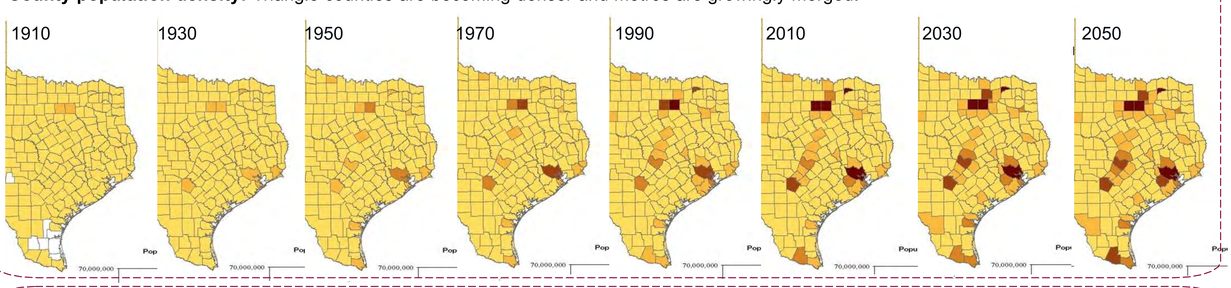
The Texas Triangle is geographically encompassed by the metropolitan areas of Houston, Austin/San Antonio, and Dallas/Fort Worth. Among the eleven megaregions initially reported from the continental U.S., the Texas Triangle has generated, arguably, the most controversy concerning whether the Triangle is simply a geometric coincidence or an integrated agglomeration. Fifteen years have passed since the initial identification of the Texas Triangle. Major changes in demographic, economic, and socio-political environment have taken place during this time period. This study aims to improve understanding of megaregions by interpreting megaregion as a process revealed by empirical data.



FIVE DIMENSIONS OF THE MEGAREGIONAL PROCESS

1. Interactively Agglomerating

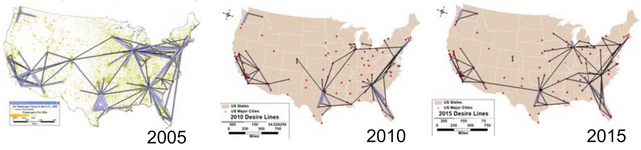
County population density: Triangle counties are becoming denser and metros are growingly merged.



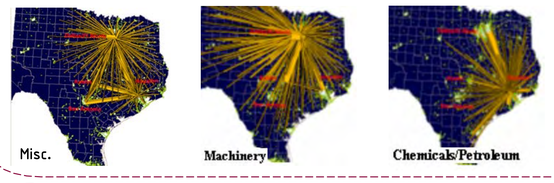
2. Networked Flowing

Strengthening economic linkage among Triangle metros revealed by freight and passenger movements and super commuting.

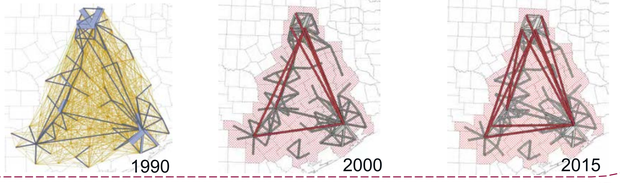
Density of air passenger flows



County-to-county truck flow

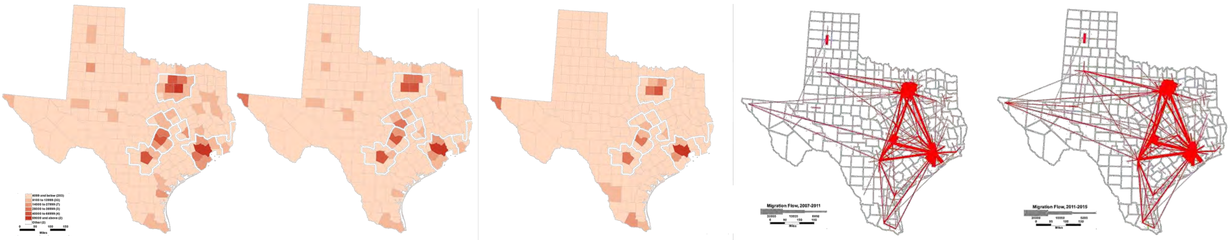


Super commute trend (50+mile or 90+ min. one way)



3. Territorial Re-sorting

There is a strong Triangle adherence suggested by the migration pattern.



Movers from different county | Movers from different state | Movers from abroad | Migration flows: 2007-2011 | Migration flows 2011-2015

4. Competitive Co-Producing

There is a trend of growing complementarity among the Triangle metros in their economic base sectors while competition also remains.

Industries	Austin	Dallas Fort-Worth	Houston	San Antonio	# of Metros Having the Industry as Part of their Economic Bases
Communications	1.17	1.82		1.96	3
Holding and other investment offices		1.16	2.10	1.72	3
Oil and gas extraction		**4.82**	**13.81**	**1.30**	3
Transportation services		**2.12**	**3.32**	**2.85**	3
Electric, gas and sanitary services			3.69	3.13	2
Electronic and other electrical equipment	**3.32**	**2.47**			2
Heavy construction			3.03	1.18	2
Industrial machinery and equipment	**3.69**		**1.26**		2
Insurance		1.16		2.35	2
Miscellaneous repair services		1.37	1.58		2
Real estate		1.54	1.27		2
Transportation by air		**2.49**	**1.40**		2
Wholesale trade	2.08	1.47			2
Auto dealers and service stations				1.28	1
Chemicals and allied products			**2.43**		1
Depository and nondepository institutions		1.16			1
Eating and drinking places				1.35	1
Engineering and management services			1.40		1
Federal civilian				1.84	1
General building contractors				1.16	1
General merchandise stores				1.19	1
Home furniture and furnishings stores		1.38			1
Legal services			1.34		1
Military				4.70	1
Miscellaneous manufacturing				1.18	1
Petroleum and coal products			**4.97**		1
Pipelines, except natural gas			6.78		1
State government	2.27				1
Trucking and warehousing		1.17			1
Water transportation			**3.38**		1

Industries	Austin	Dallas Fort-Worth	Houston	San Antonio	# of Metros Having the Industry as Part of their Economic Bases
Real estate	1.36	1.28	1.16	1.06	4
Heavy construction	1.88	1.21	3.17	4.08	4
Eating and drinking places	1.31	1.06	1.10	1.29	4
Auto dealers and service stations	1.03	1.10	1.03	1.22	4
Communications	1.09	1.67		1.07	3
Insurance	1.01	1.12		1.63	3
Home furniture and furnishings stores	1.18	1.16	1.06		3
Oil and gas extraction		**2.51**	**8.09**		2
Transportation services		**1.49**	**1.24**		2
Holding and other investment offices		1.19		1.85	2
Electronic and other electrical equipment	**2.13**	**1.76**			2
Wholesale trade		1.17	1.21		2
Transportation by air		**3.42**	**2.05**		2
Miscellaneous repair services	1.17			1.09	2
Trucking and warehousing		1.58		1.25	2
Depository and nondepository institutions		1.69		1.60	2
Engineering and management services	1.69		2.46		2
Legal services	1.22		1.06		2
General building contractors	1.05		1.15		2
Industrial machinery and equipment	**3.33**				1
Electric, gas and sanitary services			1.58		1
Pipelines, except natural gas			7.47		1
Petroleum and coal products			**4.47**		1
Water transportation			**3.32**		1
Chemicals and allied products			**2.12**		1
General merchandise stores				1.05	1
State government					0
Military					0
Federal civilian					0
Miscellaneous manufacturing					0

5. Identity Forming

"The Texas Triangle", one section of Missouri Pacific (MoPac)'s premier name services, "Sunshine Special" in 1936, from St. Louis and Memphis to link Dallas, Fort Worth, Houston, Austin, and San Antonio.

"Texas Triangle" now probably better known as the tough road trip facing NBA teams against *Mavericks*, *Rockets*, and *Spurs*. The culture identity of the Texas Triangle megaregion remains to be built.

IMPLICATIONS

- Functions and services: Expanded access and choices to employment, housing, and services at the megaregion scale
- Behavioral: Inter-metro travel → Intra-megaregion travel; daily travel decision frame → weekly travel decision
- Spatial (in)equality trend, increasing or decreasing along with the megaregional process?
- Growth of demand for large volume, high-speed, and better services
- Megaregion/Super-City Region/City-Cluster agglomeration, a shared phenomenon in the global urbanization trend;
- These agglomerations develop at different stages, reflecting both the status and the process;
- Countries are taking different approaches to embrace the process, making sense to their respective economic and institutional settings ;
- Think ahead: strategic transportation infrastructure investments (HSR).

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THE UNIVERSITY OF TEXAS AT AUSTIN

PI(s): Dr. Ming Zhang
GRA(s): Evan Scott

Bike Georgetown

Bike Planning & Funding for Small Cities in Metropolitan Suburbs

A CM²-Match Project for Tech Transfer and Community Services

BACKGROUND

Small communities across the country area aspiring to improve their cycling and walking environments to provide a better quality of life for residents. However, they often face greater challenges to cycling than large cities. This is especially true of small Texas communities in metropolitan suburbs. Georgetown, TX is about 30 miles north of Austin, and is home to approximately 63,000 people (2017). The city partnered with the University of Texas at Austin in 2016/2018 to create a full bicycle master plan.

THE SUN

Vol. 142 No. 20 GEORGETOWN, TEXAS • OCTOBER 3, 2018 One Dollar

Bike master planners pedal into action

By CHARLOTTE KOVALCHUK

Eric Lashley has been biking to work for a decade now.

"I've seen changes and a lot of improvements in the last 10 years. The bike and hike trails have taken off," the Georgetown Public Library director said.

But rivers and Interstate 35 are barriers to cyclists, he said, calling them "the most dangerous parts of the city for cyclists."

Mr. Lashley said he wants safe ways to travel east, west, north and south.

With a city-wide bike master plan in the works, Georgetown soon will have a vision to help make that happen.

Ed Polasek, transportation planning coordinator, updated council members on the plan at a city council workshop September 25.

The plan is designed to help alleviate traffic and improve safety. City council members approved a $65,000 contract in August with the University of Texas to develop the document. Researchers will come up with a proposed bicycle network that would make it easier for cyclists to safely traverse the city. The plan will also feature a list of proposed projects.

Eleven UT students are helping develop the plan, inside and outside the classroom. They biked around town September 25 and conducted surveys with residents to get to know the community and learn cyclists' needs. If you missed them, not to worry. Their professor, Ming Zhang, said they'll be back. He encouraged people to interact with students, who will cover as much of Georgetown as possible, including downtown Georgetown, a few blocks outside the Square, the southeast quadrant and west in Sun City.

Developing a master plan that creates a vision or a goal is the best way to address bicycle safety, Mr. Polasek said.

"People are not taking the bike on a trip to the store. They don't feel safe. They don't have the right routes to get there. Once we identify all the barriers to bicycling in the community, we can turn that into projects to improve bike access."

"We see a growing interest in improving transportation and mobility not just by car, but by biking and walking," Mr. Zhang said.

In addition to improving safety, the professor said a master plan with proposed projects will enhance bicycle tourism, resulting in more economic development.

A survey in English and Spanish requesting feedback from the community on bicycle safety was posted online this week.

Public outreach consists of surveys, feedback from participants at On the Table discussions October 2 and public meetings in mid-October. Based on input, researchers will identify the top 10 projects regarding street sections for potential bike plans and come up with cost estimates.

Paulina Urbanowicz

Louis Alcorn, left, is helping develop a bike master plan for Georgetown. Mr. Alcorn and his professor, Ming Zhang, stopped to check out the flood-damaged bridge in San Gabriel Park.

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METHOD AND PROCESS

The project team engaged with the Georgetown community extensively through public workshops, online surveys, and neighborhood intercept surveys. The team led stakeholder meetings with City and County staff and representatives of regional and state agencies, and conducted field investigations. In addition, the team completed a SWOT analysis,12 case studies of best practices, and 11 topical reports on bicycle level of stress analysis, crash analyses, cost estimates, funding study, and other issues.

SWOT ANALYSIS

A Strengths, Weaknesses, Opportunities, and Threats analysis was conducted based on information gathered from public engagements and field investigations.

Safety, Connectivity, Equity, Economy, and ***Culture*** are key themes that emerged from the SWOT analysis. These themes have become key attributes of the ***Vision*** and direct the formulation of ***Goals and Objectives*** of the Plan.

RECOMMENDATIONS

Vision Statement

Georgetown will have a safe, well-connected bicycle network that is accessible to all ages, abilities, and backgrounds, supports the local economy, and promotes a bicycle friendly culture.

Goals

Goal 1: Ensure Safety
Goal 2: Improve Connectivity
Goal 3: Enhance Equity
Goal 4: Support the Economy
Goal 5: Foster Bicycle Friendly Culture

Objectives

Five sets correspond to the five goals.

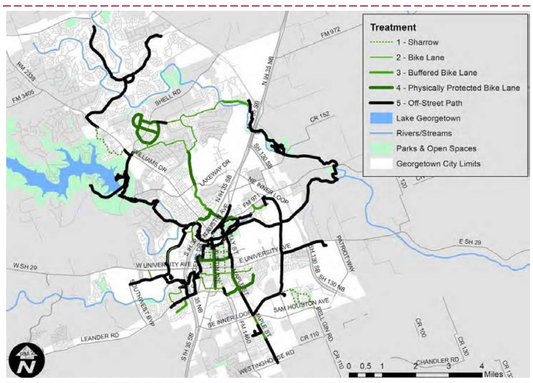
Obj.1	• Plan a bicycle network that minimizes conflicts with vehicle traffic • Design intersections that prioritize protected bicycle and pedestrian crossings • Increase awareness of and respect for cycling through education and enforcement
Obj.2	• Build bicycle corridors to connect all neighborhoods with the city center and major places • Connect to and integrate with regional trails and bicycle networks • Overcome barriers at critical crossing points to provide connectivity in the City and beyond
Obj.3	• Balance the needs and interests of cycling groups and the general public; Improve SR2S • Promote cycling as an easy, inexpensive way to enhance public health • Embracing cycling for enhanced multimodal transportation services to all ages and abilities
Obj.4	• Strengthen Downtown vibrancy through cyclist and pedestrian-oriented urban design • Promote bicycle tourism by fostering partnership with private business, and NPOs • Attract bicycle-oriented business
Obj.5	• Educate residents about proper bicycling behavior for cyclists, drivers, and pedestrians • Develop bicycle friendly codes; Pursue a Bicycle Friendly Community Designation • Provide bicycle network maps and install better wayfinding signage

Plan and Bicycle Treatment

It is not feasible nor economical to provide bicycle treatment on all streets, roadways, and intersections. The plan aims to achieve the most safety, connectivity, and broad benefits with least resource requirements.

The essential elements of the proposed system can be characterized using the **"5-4-3-2-1"** framework: **5** types of bicycle infrastructure, **4** sets of critical connections, **3** closed bicycle loops, **2** corridors in central Georgetown, and **1** central core in the downtown district.

Five bicycle infrastructure treatments: *off-street paths, physically protected bike lanes, buffered bike lanes, striped bike lanes,* and *sharrows*.



Implementation: The 5 E's

Engineering
- Adopt a Complete Streets policy
- Adopt NACTO guidelines in manuals

Education
- Train City engineers in bicycle facility design
- Partner with bicycle advocacy groups

Encouragement
- Create a bicycle advisory committee
- Aim at a Bicycle Friendly Community

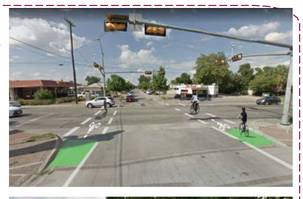
Enforcement
- Educate Policy officers about bicycle safety
- Enhance local laws/regulations for safety

Evaluation
- Create a bicycle/ped. monitoring program
- Implement performance measures

Cost Estimates and Funding for Top Ten Projects

Network Element	*Quantity*	*Unit Cost*	*Total Cost*
Bike Lane	9.84 miles	$4,382	$43,119
Bike Lane - Buffered	3.95 miles	$10,560	$41,712
Protected Bike Lane	10.83 miles	$1,322,000	$14,317,260
Pavement Markings	4 markings	$249	$996
Shared use path	19.07 miles	$65,000	$1,239,550
Crossing Bike Boxes	1 marking	$11,000	$11,000
Total:			$15,653,637

Funding Sources	*Grant Categories*	*Application Efforts*
Federal	BUILD, TIFIA, INFRA	Medium to High
TxDOT	SR2S, On-system	Low to Medium
CAMPO	TA Set Aside	Medium
Local	TIRZ, CIP, Bonds	Low to Medium
Private/Nonprofit	People4Bikes,Walmart	Low to Medium



STUDENT TEAM MEMBERS

(2016) Jackson Archer, Samuel Day-Woodruff, Neha Diggikar, Jolene Holland, Andres Junca, Qian Li, Megan Mulhall, Akik Patel, Sara Sadeghi, Stephen Sharpe, Annie Stocklin, Nirav Ved
(2018) Louis Alcorn, Chris Bischak, Kyle Smith, Liang Chen, Robert Davila, Madison Graham, Sydni Ligons, Ziqi Liu, Nicole McGrath, Paulina Urbanowicz, Rachel Thomas

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CM2 Cooperative Mobility for Competitive Megaregions

Summer Forum 2019

UNIVERSITY OF PENNSYLVANIA

PI: Erick Guerra

GRA(s): Luke Hassall, He Zhang, Anna Cheyette, Jialin Wang

Predicting Cycling Commutes in U.S. and Mexican Urban Areas

RESEARCH AGENDA

1. INTRODUCTION

Weather, socioeconomic attributes, and urban form have all been identified as factors that are related to cycling. However, existing research predominantly focuses on individual geographies, or on geographies that are particularly similar to one another. Studies also often focus on geographies that exhibit high levels of cycling, such as the Netherlands, rather than areas with lower cycling rates.

We reviewed predictors for cycling identified for developing and developed countries. For the former, the literature on predicting cycling in China and Latin America has found a weak connection between population density and certain other urban form measures and cycling rates (Zhao, 2013. Cervero et. al., 2009). One possible explanation is a uniformly high level of densities and mix of uses in these geographies. The significant factors, however, include proximity to transit, street density, bike infrastructure, etc. Moreover, demographics, particularly gender, are also found to be related cycling rates (Trang et. al., 2012).

Contrary to the evidence above, studies from developed countries have found a positive correlation between population density and cycling (Parker et. al., 2011).

Men are also more likely to cycle in most developed countries, but the significance level varies depending on the study and location (Pucher & Buehler, 2010.) Most studies we found also identified a significant positive relationship between bike infrastructure and cycling rates. (Parker et. al., 2011). Moreover, the presence of sloping terrain has been well documented as a negative predictor of cycling (Ma & Dill, 2015.)

Because of the focus on single or similar geographies of previous studies, it is not clear how broadly applicable these results are to other geographies. Our study attempts to fill this gap through a large-scale metropolitan-level analysis covering two countries, the United States and Mexico.

2. DATA

The Household and Individual data for the U.S. was obtained from the U.S. Census Bureau, chiefly from the American Community Survey (ACS) and Public Use Microdata Sample (PUMS) datasets. The Mexican data was obtained from the 2015 Mexican Intercensal Survey provided by the national statistics agency. Metropolitan areas are identified separately in each geography. We identified major cities and their surrounding suburbs in Mexico using the Mexican Population Council's National Urban System, and utilized the Metropolitan Statistical Area (MSA) for the U.S. Data is primarily from the 2010 Census of the U.S. and the 2009 Economic Census of Mexico, complemented by other sources such as the NOAA global station climate data.

3. METHODS

We modeled the factors and their associations with cycling using logistic regression. The response is binary (cycling/ non-cycling); the explanatory variables include individual, household, and urban form factors. We chose only several urban form indicators due to the sample size of metropolitan areas (100 for each country), with the help of Principal Component Analysis.

To better capture the effects of the variables studies, we incorporated random effects in the models, including random intercepts by metropolitan area and random slopes for different housing types by metropolitan area. The housing type is regarded as a proxy for local built environment.

ACHIEVEMENTS

1. DEMOGRAPHICS AND SOCIO-ECONOMICS

We found that men consistently cycle more than women in both countries, with the gender gap larger in Mexico than in the U.S. While the elderly had low likelihood of cycling in both countries, in Mexico the middle-aged were the most likely to cycle, creating an inverted-U relationship, while in the U.S. cycling consistently declined with age. In Mexico, cycling consistently declined with education, while in the U.S. those with at least a bachelor's degree were most likely to cycle. Finally, in the U.S. service industry workers were most likely to cycle, while in Mexico agricultural workers were the most likely to cycle. This too may reflect urban form, with agricultural jobs more likely to be located in peripheral areas of a metropolitan area, and service jobs often concentrated in the core and in key hubs.

2. URBAN FORM

We found population density strongly associated with cycling in different ways in the two countries. In the U.S., cycling is most likely to be a commuting mode where density is medium. By contrast, the suburbs and densest areas most favor bike commuting in Mexico. Apart from densities, road structure is a significant indicator in the U.S. and precipitation is one in Mexico. Our analysis of local urban form through the proxy of housing suggest cycling is a more suburban phenomenon in Mexico and a more urban one in the U.S.

Moreover, the random intercepts capture unobserved differences among the geographies. For example, Portland-Vancouver-Hillsboro has the highest cycling probability in the U.S. and San Francisco del Rincón in Mexico. The random slopes of housing types are greater in less cycled areas (e.g. Philadelphia-Camden-Wilmington) and smaller in the most cycled areas (e.g. Portland-Vancouver-Hillsboro). This could indicate a greater impact of local urban form in less cycled places.

3. DISCUSSION

To understand the differentiated effects of population density on cycling in different geographies, further analysis is needed to identify what modes substitute cycling as the density changes, such as walking, public transit, or private vehicles. To extend the value of large sample metropolitan analysis, we also recommend incorporating greater granularity in urban form, i.e. the neighborhood form. Finally, If metropolitan-level cycling infrastructure data could be incorporated, which is at present not available, it would shed considerable light on its role across different metro areas and countries.

Table 1: Random effect model results for the U.S. and Mexico

	Dependent variable: Cycling (1/0)			
	U.S.	U.S. (without car ownership)	Mexico	Mexico (without car ownership)
Male	0.930***	0.936***	1.852***	1.806***
	(0.015)	(0.015)	(0.012)	(0.012)
Age/100	-4.893***	-5.102***	2.234***	1.658***
	(0.299)	(0.298)	(0.116)	(0.115)
(Age/100)^2	3.008***	3.204***	-2.417***	-2.012***
	(0.351)	(0.350)	(0.138)	(0.137)
Log household income	-0.090***	-0.185***	-0.076***	-0.116***
	(0.009)	(0.008)	(0.004)	(0.003)
Secondary school	-0.084*	-0.144***	-0.245***	-0.295***
	(0.046)	(0.046)	(0.008)	(0.007)
High school	-0.387***	-0.507***	-0.674***	-0.787***
	(0.041)	(0.040)	(0.010)	(0.010)
BAplus	0.157***	0.027	-1.663***	-1.896***
	(0.041)	(0.040)	(0.017)	(0.017)
Live in Multi Family	0.428***	0.440***	0.072**	0.115***
	(0.060)	(0.062)	(0.030)	(0.030)
Live in Apartment	0.640***	0.780***	-0.346***	-0.268***
	(0.040)	(0.043)	(0.045)	(0.045)
Live in Other Types of Housing	0.015	0.020	-0.092***	-0.068**
	(0.089)	(0.091)	(0.035)	(0.032)
Manufacturing Occupation	0.031	-0.017	-0.153***	-0.101***
	(0.113)	(0.113)	(0.010)	(0.010)
Service Occupation	0.398***	0.393***	-1.000***	-0.998***
	(0.112)	(0.112)	(0.011)	(0.011)
Car Ownership	-1.514***		-0.608***	
	(0.020)		(0.007)	
Gini Jobs-population imbalance (scaled)	-0.072	-0.074	0.083	0.062
	(0.061)	(0.061)	(0.093)	(0.094)
Weighted mean density/100	7.804***	8.202***	-3.967**	-4.283**
	(1.471)	(1.466)	(2.002)	(2.167)
(Weighted mean density/100) ^2	-6.260***	-6.178***	1.992*	2.215*
	(1.222)	(1.218)	(1.164)	(1.298)
Road length per capita (scaled)	0.073	0.069	-0.085	-0.103
	(0.065)	(0.065)	(0.090)	(0.090)
Share of local road	4.297***	4.100***	-0.454	-0.364
	(1.436)	(1.432)	(1.925)	(1.928)
Heating degree days (scaled)	-0.068	-0.050	-0.120	-0.144*
	(0.063)	(0.063)	(0.078)	(0.078)
Precipitation (scaled)	0.082	0.099	-0.217**	-0.195**
	(0.065)	(0.065)	(0.095)	(0.095)
Rail transit length per capita (scaled）	-0.003	-0.004	-0.279	-0.288
	(0.077)	(0.077)	(0.233)	(0.239)
Intercept	-7.175***	-7.532***	-1.374	-1.107
	(1.137)	(1.134)	(1.753)	(1.777)
Observations	3,303,944	3,303,944	2,341,191	2,349,388
Log Likelihood	-118,275.90	-120,805.00	-381,353.90	-386,358.20
Akaike Inf. Crit.	236,615.90	241,672.00	762,771.80	772,778.40
Bayesian Inf. Crit.	237,032.20	242,075.30	763,177.10	773,171.20

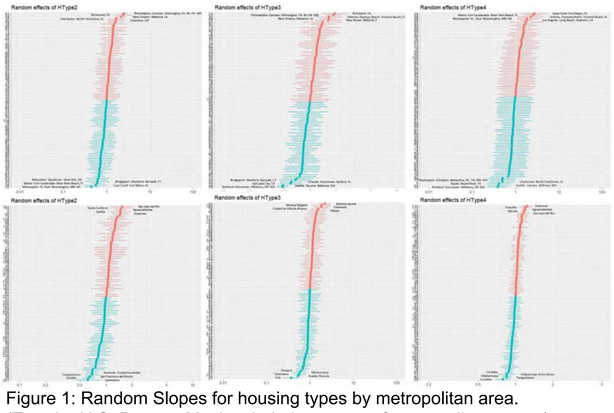

Figure 1: Random Slopes for housing types by metropolitan area.
(Top: the U.S. Bottom: Mexico. Labels: names of metropolitan areas.)

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CM2 Cooperative Mobility for Competitive Megaregions

Summer Forum 2019

UNIVERSITY OF PENNSYLVANIA

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Urban form, transport supply and the commute behavior of the low-income commuters: evidence from US and Mexico

RESEARCH AGENDA

1. BACKGROUND

Housing and transportation are households' two largest types of expenditures in most cities and regions. Due to pervasive income inequality and increasing transportation and housing costs, low-income residents often face particular challenges related to access to employment (Suárez et al., 2016; Blumenberg and Manville, 2004).

Moreover, urban structure and transportation supply strongly influence low income commuters' commute choice. For example, in the United States, even the poorest commuters in most cities generally drive. Relatively low-density urban form, extensive highway systems, and unreliable transit make car travel a near necessity (Blumenberg and Manville, 2004). Nevertheless, low-income people are more transit-dependent compared with wealthier people and may select to live in transit-rich city centers (Glaeser et al., 2008). In high-density cities in the Global South, in contrast, low-income people either live in the outer suburbs or urban fringes to reduce housing costs, or work for nearby employers to reduce transportation costs (Suárez et al., 2016).

Despite a large amount of studies on the commute behavior of low-income population (Suárez et al., 2016; Hess, 2005; Guerra, 2017; Hu and Wang, 2017), studies comprising variations between metropolitans and countries on commute strategies of the poor remains rare. Filling up this research gap sheds light on how national and local transportation and land use policies may shape the outcomes of low-income workers.

2. DATA AND MEASUREMENTS

In this study, we examine commute mode choice and commute times of low-income workers as a function of metropolitan urban form, road supply, and the individual attributes of commuters in the largest metropolitan areas using data from the American Community Survey (ACS) Public Use Microdata Sample (PUMS) One Year Data (2012-2015) and the 2015 Mexican Intercensal Survey.

We use three criteria (**Table 1**) to define the low-income workers:

- **National poverty line approach:** Defined as households which have at least one person being employed, but are still below the national poverty line.
- **Bottom quintile approach:** Defined as households in the 20 percent bottom of all the households in two national data sets.
- **Metro bottom quintile approach:** Defined as households in the 20% bottom of the all households in every metropolitan and urban area (considering the variations in economic development in different regions).

We only report results using the third approach here. **Table 2** demonstrates the definitions and descriptions of urban form, transport supply and commute variables.

3. METHODS

Four separate logistic models are conducted to examine the correlates of urban form and the commute behavior of the low-income commuters in two countries:

- **Commute mode models:** two multinomial logistic models of commute mode choice, which regards the mode choice of the working poor in two countries as a function of various urban form and socio-economic attributes (the category "others" is excluded in the model).
- **Commute time models:** two ordinal logistic model taking commute time as a function of travel mode choice, urban form and socio-economic factors.

With most of urban form measured at the metropolitan level, we report clustered standard errors. We run models with and without car ownership to account for its endogeneity with other variables.

FINDINGS

4. SUMMARY

- A higher population density is associated with lower probability of driving relative to taking public transit in both countries. It is also associated with higher possibility of active travel in US.
- A higher population density is associated with longer commute time in Mexico, but not significantly related to commute time in the US.
- A higher jobs-housing imbalance is associated with a higher commute time in the US, and less possibility of commuting by walking and bicycle in Mexico.
- A higher clustering of job opportunities is associated with higher possibility of commuting by public transit in both countries. Nevertheless, it is also related to longer commute time.
- Roads per capita is associated with shorter commute time in the US, but not significantly related to commute time in Mexico.
- Residents living in apartments in both countries are more likely to commute by public transit and have shorter commute time than those in single-family houses.

5. NEXT STEPS

- Convert parameter estimates to elasticities for greater comparability across models in US and Mexico
- Run models on all three measures of low income household
- Provide simulations of estimated mode shares from randomly assigning population from each country to the other country's metropolitan areas.
- Summarize implications for public policy and research into the relationship between urban form and travel behavior.

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Table 1 Three approaches to define low-income workers

	National poverty line	Bottom quintile	Metro bottom quintile
US			
Monthly household income		9166	
Threshold	$11770 ($14720 for Hawaii) for one-person household to $40890($51120 for Hawaii) plus $4,160 ($5200 for Hawaii) for an additional person	3711.14	
#	157711	694090	695030
% of the population	4.54	20.00	20.03
Average monthly household income	1209.357	2341.82	2425.83
Mexico			
Monthly household income		1537.4	
Threshold	2542 pesos/person/month	601.43	
#	490608	559267	569811
% of the population	17.17	19.57	19.94
Average monthly household income	588.91	378.7	399.01

Table 2 Data descriptions

Virable	Measurement	US		Mexico	
Urban form and Transport supply		**Mean/#**	**S.D./%**	**Mean/#**	**S.D./%**
Population density	the number of population per hectar in census tracts weighted on population, continuous	28.94	30.638	99.23	39.847
Jobs-housing balance	the value of job-housing imbalance Gini coefficient of every metropolitan (0-1, with 0 denotes perfect balance, 1 denotes perfect imbalance)	0.48	0.045	0.23	0.082
Jobs-area balance	a value denoting the clustering of job opportunities in a metro area. 0 denotes the even distribution of jobs across the metro area, 1 denotes all jobs clustering in a single census tract.	0.60	0.098	0.47	0.041
Roads per capita	the length of the roadways per capita at the metropolitan level (meters per capita)	15.77	8.696	2.57	0.987
Share of the arterials	the share of arterials in all roadways of every metropolitan(%)	8.90	2.000	11.50	3.500
Share of highways	the share of highways in all roadways of every metropolitan (%)	13.20	2.900	8.10	2.300
Share of the local roads	the share of local roads in all roadways of every metropolitan (meters per hectar)	77.90	3.600	80.40	4.000
Single-family	=1 if the respondent lives in a single-family house, otherwise=0	300841	43.28%	402230	70.59%
Single-family attached	=1 if the respondent lives in an attached single-family house, otherwise=0	56420	8.12%	118663	20.82%
Apartment or condo	=1 if the respondent lives in an apartment or a condo, otherwise=0	304862	43.86%	42230	7.41%
Others	=1 if the repondent lives in other types of housing units, otherwise=0	32907	4.73%	6688	1.17%
Travel Mode					
Public Transit (PT)	=1 if the respondent commutes by public transit, otherwise=0	70550	10.15%	234198	48.61%
Car	=1 if the respondent commutes by car, otherwise=0	551048	79.28%	70360	14.60%
Active travel (AT)	=1 if the respondent commutes by foot or bicycle, otherwise=0	37767	5.43%	162799	33.79%
Work at home (Home)	=1 if the respondent works at home, otherwise=0	27555	3.96%	6879	1.43%
Others	=1 if the respondent takes other travel modes, otherwise=0	8110	1.17%	7524	1.56%
Travel Time					
<15 min	=1 if the one-way commute time is within 15 minutes, otherwise=0	265532	39.78%	131916	28.62%
15-30 min	=1 if the one-way commute time is between 15 and 30 minutes, otherwise=0	246989	37.00%	158074	34.30%
30-60 min	=1 if the one-way commute time is between 30 and 60 minutes, otherwise=0	128490	19.25%	113378	24.60%
60-120 min	=1 if the one-way commute time is between 60 and 120 minutes, otherwise=0	16747	2.51%	45321	9.83%
>120 min	=1 if the one-way commute time is longer than 120 minutes, otherwise=0	9717	1.46%	12156	2.64%

Table 3 Selected regression results

	US				Mexico			
	PT	AT	Home	Time	PT	AT	Home	Time
Population density	+	+	+		+			+
Jobs-housing balance			(+)	+		-	-	
Jobs-area balance	+	(-)	-	+	+	+	+	+
Roads per capita	-		-	-	-	-	-	
(Share of the arterials)								
Share of highways	(+)	+	+					
Share of the local roads	+	+	+					
(Reference: Single-family)								
Single-family attached	+	+	-		+(/)	+	+(/)	-
Apartment or condo	+	+	-	-	+	+(/)	-	-
Others	-		-	+		+		

Note: results without parentheses are results without car ownership. Only results with significance lower than 0.1 are shown. + shows positively related to the variable, - shows negatively related to the variable. Results with parentheses are results with car ownership. / denotes not significant at 0.1 level. The reference group of the mode choice models is car.

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The Northeast Megaregion Transportation Planning and Investment Simulation (NEMR-TP&IS) Model

BACKGROUND

The thirteen-state Northeast Megaregion (NEMR) extends along the I-95 corridor from Portland, Maine to Richmond Virginia, and includes more than 15% of the country's residents and 14% of its jobs. This makes it America's largest and most productive megaregion by far. It also includes 38 Metropolitan Planning Organizations, or MPOs, each of which is responsible for coordinating transportation planning and investment activities in its metropolitan area.

This plethora of MPOs, and the resulting fragmentation of transportation investment decision-making has compromised the NEMR's ability to undertake needed transportation investments within and across modal categories, generating productivity and quality-of-life bottlenecks across the region.

1st & 2nd-YEAR PROGRESS

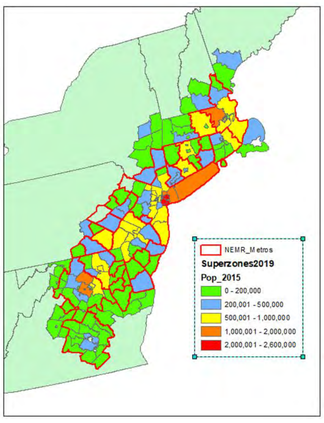
The first two years of work were focused around five sets of tasks: (i) building appropriate zone systems and populating them with available activity and survey data; (ii) developing highway and transit networks incorporating accurate LOS information; (iii) developing current and future (Year 2030) trip generation rates and totals by purpose and geography; (iv) developing robust trip distribution models; and (v) using national and metropolitan travel survey data to develop baseline mode share totals. All of these activities make use of TransCad modeling and data integration procedures.

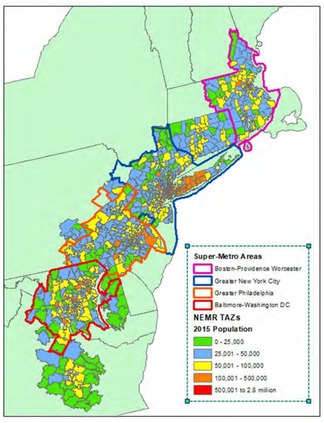
3rd-YEAR RESEARCH PROGRAM

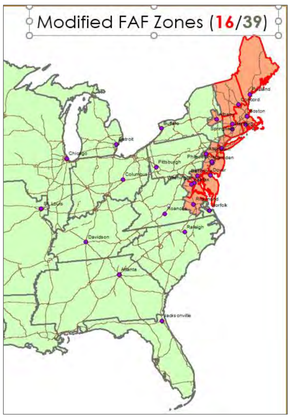
Work during the remainder of 2019 will involve developing multi-modal multi-facility traffic assignment procedures; testing the effects of new megaregional and metro-level facilities and investments on future travel patterns and facility use; exploring the potential impacts of new facilities and services on metropolitan economies and real estate markets; and developing TransCad modeling procedures to enable local MPOs to use the NEMR-TP&IS model for their own planning purposes.

Three Complementary Modeling Geographies

	Megaregional Model	4 Super-metro Models	National Freight Model
System Elements	162 County-based Zones Purposes: HBW, HBO, NHB Modes: Highway, Amtrak, commuter rail, inter-city bus, air	916 Zipcode-based Zones: Purposes: HBW, HBO, NHB Modes: Highway, commuter rail, subway & LRT, local bus, bike-ped.	39 (16 in NEMR) Metro & State-based Zones 27 commodity types Modes: Truck and rail (and air and pipeline).

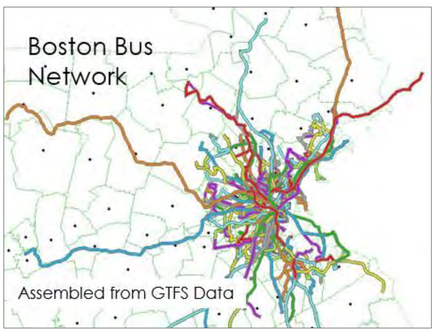






An Augmented 4-Step Modeling System

Step	Megaregional Model	Metro Models	National Freight Model
1. Trip Generation	Uses NCHRP 365 method to estimate zone-based Productions and Attractions for HBW, HBO, NHB trips based on HH demographics, auto ownership, and total and retail employment.		Updates 2012 FAF commodity flows based on 2% annual GDP growth and projected population growth at destination zones.
2. Trip Distribution	Single gravity model for each trip purpose.	Separate gravity models for each trip purpose and super-metro.	
3. Mode Share	Uses 2017 National Household Transportation Survey data to identify primary, secondary and tertiary mode shares by origin type, trip purpose, and trip length.	Uses local travel survey data to identify primary, secondary and tertiary mode shares by origin type, trip purpose, and trip length.	Most commodities types are tied to a single mode. For those that are not, regression models of mode shares based on origin zone location and trip length.
4. Route Assignment	All-or-nothing by mode and trip purpose based on fastest time.	All-or-nothing by mode and trip purpose based on fastest time (one transit transfer allowed).	All-or-nothing based on fastest time (truck) and shortest path (rail).



Origin Zone Type	Trip Distance	Trip Purpose	Top Mode	Share	2nd Mode	Share	3rd Mode	Share	4th Mode	Share
CBD	<1 mile	HBW	Bike-ped	96%	Car	4%				
CBD	<1 mile	HBSchool	Bike-ped	100%						
CBD	<1 mile	HBOther	Bike-ped	85%	Local Bus	6%	Car	4%		
CBD	<1 mile	HBMedical	Bike-ped	91%	Local Bus	9%				
CBD	1-3 miles	HBW	Car	45%	Bike-ped	28%	Local Bus	17%	Taxi	10%
CBD	1-3 miles	HBSchool	Subway/Trolley	50%	Bike-ped	30%	Local Bus	10%	other	10%
CBD	1-3 miles	HBOther	Bike-ped	32%	Car	26%	Local Bus	21%	Subway/Trolley	10%
CBD	1-3 miles	HBMedical	Car	50%	Bike-ped	33%	Local Bus	17%		
CBD	3-5 miles	HBW	Car	67%	Bike-ped	33%				
CBD	3-5 miles	HBSchool	Car	50%	Subway/Trolley	50%				
CBD	3-5 miles	HBOther	Car	43%	Bike-ped	30%	Subway/Trolley	18%	Local Bus	8%
CBD	3-5 miles	HBMedical	Car	100%						
CBD	5-10 miles	HBW	Car	80%	Bike-ped	20%				
CBD	5-10 miles	HBSchool	Commuter Rail	100%						
CBD	5-10 miles	HBOther	Car	100%						
CBD	5-10 miles	HBMedical	Car	100%						
CBD	10-15 miles	HBW	Commuter Rail	16%	Car	5%	Subway/Trolley	5%		
CBD	10-15 miles	HBSchool	Bike-ped	100%						
CBD	10-15 miles	HBOther	Car	53%	Commuter Rail	35%	Local Bus	6%	Subway/Trolley	6%
CBD	15-20 miles	HBW	Commuter Rail	100%						
CBD	15-20 miles	HBOther	Car	71%	Taxi	29%				
CBD	25-30 miles	HBW	Car	71%	Bike-ped	14%	other	14%		
CBD	25-30 miles	HBOther	Car	75%	Bike-ped	13%	other	13%		
CBD	40-50 miles	HBW	Car	100%						
CBD	40-50 miles	HBOther	Bike-ped	50%	Car	50%				
CBD	50+ miles	HBOther	Bike-ped	40%	Car	40%	Commuter Rail	20%		

Future-casting

	Megaregional Model	Metro Models	National Freight Model
Projections and Alternatives	(i) Alternative state and county-based population and job growth projections; (ii) Add new links and nodes as needed to represent new services; (iii) Pivot mode share percentages around current shares.	(i) Alternative zone-based population and job growth projections; (ii) Add new links and nodes as needed to represent new services; (iii) Pivot mode share percentages around current shares.	(i) Alternative destination-based population growth projections; (ii) Add new links and nodes as needed to represent new services.
Remaining Issues	How to incorporate pricing and congestion sensitivity into mode choice/share model?	How to represent new transportation service types in mode share calculations?	How to parse truck-based freight flows into discrete truck trips?

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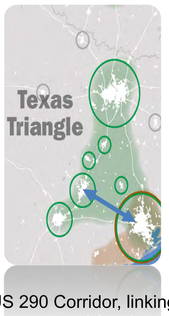
Determining Purpose and Need for Vulnerable Communities in the Megaregions

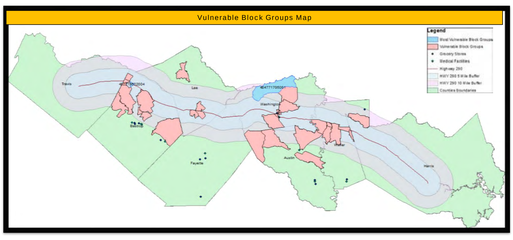
1. BACKGROUND

Rural and low density area residents in the Texas Megaregion (Houston, Dallas, Austin/San Antonio) are challenged with meeting travel needs.

- These residents are inadequately considered in transportation planning and decision making.
- Work, medical, shopping, recreation, and other trip purposes may be difficult.
- Federal process mandates a statement of need or purpose in order to address consideration of financing for transportation improvements.
- Displaying need where congestion or safety are not problems often lacks a convincing, well-established process.
- Additional challenges are created when transportation needs require crossing jurisdictional boundaries.



US 290 Corridor, linking Houston and Austin



2. RESEARCH OBJECTIVE

This work will develop a rubric that assesses vulnerability and can be applied to decision making. The case study is US 290 Corridor connecting the Megaregion cities, Houston and Austin.

3. STUDY PURPOSE

The intent is to better connect residents to:

- Jobs
- Transportation Options
- Health Care and Health Maintenance
- Recreation and Entertainment
- Social Contacts

4. METHODOLOGY

- Designate interstice counties.
- Assess socio-demographic variables by block group.
- Identify poverty level.
- Conduct a case study on the two most vulnerable block groups.
- Calculate percent of income spent on transportation.
- Develop rubric

4. FINDINGS' HIGHLIGHTS

- There are six rural counties along the U.S. Highway 290 Corridor between Houston and Austin. Thirty-four (34) of 39 block groups within the study area reflected some level of vulnerability. Some residents have to drive up to 20 miles for grocery shopping or to seek medical care. People in these communities are spending a disproportionate amount of their income on transportation. The percentages of income spent on transportation are shown for the two most vulnerable block groups.

Most Vulnerable: Percentage of Income Spent on 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

Findings' Highlights Cont.

- There were 34 vulnerable block groups within the study area.
- The block group with the highest poverty rate was in Bastrop County at 44%.
- There were 23 grocery stores and 21 medical facilities in the study area.
- 9 of the 23 grocery stores were inside a vulnerable block group.
- There is only one public transit provider in the interstices serving Bastrop County (CARTS). Megabus provides intercity service, but a trip to the nearest urban area could be $20.
- Public transportation is a tremendous void in the megaregion communities.
- Improved public transportation access is necessary and desirable for interstice communities to travel within and to proximate triangle cities.

Vulnerable Block Group Demographics

Block Group (BG)/Census Tract (CT)	County	Percent Poverty	Percent Minority	Percent Elderly	Percent No Automobile
BG 4, CT 9502	Bastrop	44%	86%	27%	0%
BG 1, CT 1705	Washington	42%	53%	15%	2%
BG 1, CT 1702	Washington	36%	47%	19%	0%
BG 2, CT 6805	Waller	36%	73%	20%	0%
BG 1, CT 7605.02	Austin	35%	41%	13%	2%

THE RUBRIC

The Rubric is a composite vulnerability value 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.

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

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Multimodal Demand Analysis for the Texas Triangle

RESEARCH AGENDA

1. BACKGROUND

Multiple National Household Travel Surveys have shown that private vehicles dominated intra- and inter-megaregion travel in the United States, a travel pattern that is not efficient from both the individual and the societal perspective. An efficient mobility supply for megaregions aims to achieve multi-modality that optimizes the combination and utilization of different modes (automobile, rail, bus, and air) for megaregional passenger and freight movement.

This paper presents a case study of the Texas Triangle to simulate future scenarios in which changes in system performance (e.g., rail operating speed), demographic dynamics, and travellers' attitude may result in a more or less balanced modal split in megaregions.

2.RESEARCH QUESTIONS

▪What are the composition of travel modes in the Texas Triangle?

▪ How would the emerging of HSR change the future travel market?

This study would assist future long-range transportation planning in the Triangle. The goal of the study is to investigate how traditional modes would perform with the impacts of HSR.

3. RESEARCH CONTENTS

This study utilizes the mode choice model from National Cooperative Rail Research Program Report 4. Household attributes from NHTS 2017 long-distance trips(50-500 miles) in Texas are inputs for the model and mode choice results are calculated from an excel spreadsheet.

The study also extrapolates the system performance for the Texas Triangle and calculates indicators (total household tours and person tours) to have a better sense of the travel demand within the region.

4.RESEARCH FRAMEWORK

We have developed a number of socio-economic and psychological scenarios and explored how mode shares fluctuate under different scenarios. (see table on the right)

Scenario 1 is the base scenario where there are no changes occurred to the future transportation system while scenario 2 imagines the emerging of HSR. Scenario 3 catches the demographic changes in the Triangle from 2012 to 2017, and we assume that the changes will continue. Scenario 4 is the opposite of scenario 3. Pessimistic case (Scenario 5) assumes that all people have negative attitudes for rail while optimistic scenario tells an antithetical story.

By investigating the coefficient behind the mode choice model, it also helps planners understand important factors in shifting people away from driving.

5.SCENARIO DESIGN

Scenario 1: Business-as-usual	Scenario 2: HSR	Scenario 3: Demographic 1	Scenario 4: Demographic 2
Input Triangle data; Existing parameters	Decrease Rail travel time and costs; increase rail service frequency	Travel time and cost indices same as HSR; Decrease Under 35 cohort by 5%, 35-44 by 2%; increase 45-54 cohort by 2%, 55-64 cohort by 3%, not college graduate by 5%;	Travel time and cost indices same as HSR; Increase under 35 cohort by 5%, 35-44 cohort by 3%, 45-54 cohort by 2%, non-college graduate by 10%; decrease 55-64 cohort by 9% on average

Scenario 5: Pessimistic	Scenario 6: Optimistic
Travel time and costs indices and demographic same as Scenario 2; Auto-oriented, technology and urbanism attitude same as over 65 cohort, privacy attitude same as under 35 cohort	Travel time and costs indices and demographic same as Scenario 2; Privacy attitude same as over 65 cohort, auto-orientation, technology and urbanism same as under 35 cohort

ACHIEVEMENTS

1.Mode Share Outputs

The share of auto-mobile is about 80% in no-business case, and rail is the lease favorable method because of its poor service system. Introducing HSR would significantly improve the rail ridership and divert a large proportion of drivers to public transports.

The current demographic change is positive for rail and air. Meanwhile, psychological factors have heavier influence on modal shifts.

2. Future Travel Demand

Based on the metrics from Long-distance NHTS Texas trips, long-distance person-tours are expected to grow from 269 million to 392 million by 2035. Both household-tour and person-tour estimations still need validating.

3. Remarks

When compared with European countries, the modal shares seem optimistic. The KITE model developed by Frei et al(2010) indicate that the long-distance (70 kilo-meters) rail shares for train are 10% for Germany, 28% for Switzerland and 22% for Czech Republic.

It is unrealistic to predict that the HSR would prompt changes in rail ridership to European level. Our region itself has a number of issues to deal with.

First and foremost, the authorities in the Triangle should take into account the dependency of car in the region and promote education addressing this issue.

Next is the lack of incentives for such change within transportation agencies and general public. Initiating major state-wide project is under scrutiny especially after SH-130, and private-led HSR construction would have many problems to overcome.

A successful marketing strategy from the government is necessary to reverse public attitudes on public funded infrastructure constructions. The utilization of HSR could lead to a sustainable future where less the region would have less VMT or Greenhouse Gas emissions.

Scenario 1: Business-as-usual

Mode	Business	Vacation	Visit	Other	Total
Car	74.3%	75.2%	83.9%	85.6%	79.3%
Bus	10.2%	14.8%	8.0%	3.6%	10.4%
Rail	**1.2%**	**2.5%**	**1.1%**	**3.4%**	**1.9%**
Air	14.2%	7.5%	7.0%	7.4%	8.4%

Scenario 2: High-speed Railway

Mode	Business	Vacation	Visit	Other	Total
Car	58.3%	67.2%	76.7%	78.0%	70.4%
Bus	7.0%	12.6%	6.7%	3.9%	8.7%
Rail	**26.6%**	**15.4%**	**12.2%**	**13.1%**	**15.8%**
Air	8.1%	4.8%	4.3%	5.0%	5.2%

Scenario 3-5 (Compared with scenario 2)

	Demographic 1	Demographic 2	Pessimistic	Optimistic
Car	-0.3%	+0.4%	+4.3%	-3.6%
Rail	+0.8%	-1.1%	-2.5%	+2.7%
Air	+0.4%	-0.5%	-0.2%	No change

Long-distance Travel Demand (Person-tours) Growth estimates from 2015 to 2035

Work	Leisure	Personal business	School	Others	PMT	Average Miles Travelled
77M	147M	31M	5M	9M	280 billion	14,429

Work	Leisure	Personal business	School	Others	PMT	Average Miles Travelled
112M	215M	45M	7M	13M	407 billion	13,905

Long-distance Travel Demand (Household-tours) by Modes in 2035: No-business vs. HSR

No-business →

Mode	Business	Vacation	Visit	Other	Total
Car	13,684,052	19,044,432	20,478,065	12,152,266	65,269,326
Bus	1,883,694	3,739,042	1,949,351	511,848	8,599,589
Rail	220,323	642,947	273,604	476,930	1,584,902
Air	2,621,799	1,887,866	1,711,908	1,056,250	6,880,558

HSR →

Mode	Business	Vacation	Visit	Other	Total
Car	10,737,272	16,998,977	18,731,696	11,077,739	57,946,936
Bus	1,288,395	3,197,226	1,639,207	547,304	7,145,888
Rail	4,888,457	3,893,761	2,987,647	1,861,103	12,971,725
Air	1,495,743	1,224,323	1,054,378	711,148	4,269,827

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CM2 Cooperative Mobility for Competitive Megaregions

Summer Forum 2019

University of Texas at Austin

PI: Michael Oden
GRA(s): Evan Scott

Collaboration Between Metropolitan Planning Organizations at the Megaregional Scale – National Survey of MPOs

RESEARCH AGENDA

1. BACKGROUND

Metropolitan Planning Organizations (MPOs) are the most significant and durable institutions operating at the metro-regional scale and they have specific planning and implementation powers designated by federal and state governments. If megaregional planning promises to be more than just a new construct, its meaning and potential should be recognized by MPO managers.

To evaluate the current significance and potential for megaregional planning, we analyze the results of a summer, 2018 survey of 377 designated MPOs, This survey is complete and garnered a nearly 57 percent response rate.

2.RESEARCH QUESTIONS

1. Do MPO directors view collaboration and planning at the megaregional level as a meaningful framework and an important means to address interregional transportation and land use challenges?
2. In what ways do MPOs actively collaborate and/or cooperate with other MPOS in their state or at larger regional scales?
3. What are the legal, regulatory or institutional barriers to greater collaboration or joint project planning and implementation between MPOs at the state or megaregional scale?

3. RESEARCH CONTENTS

This work aims to establish the degree to which a key set of regional institutions, MPOs, understand megaregional concepts and actively plan at this geographic scale. The survey results provide evidence from the directors and senior staff of MPOs about current forms and degrees of collaboration. The results also highlight what the respondents view as major barriers to increased collaboration at the megaregional scale.

4.RESEARCH FRAMEWORK

Spatial fix arguments for the megaregional scale require demonstrating that human, environmental, socioeconomic and infrastructural interactions are significantly concentrated in a megaregional spatial geometry. As the megaregional discourse has progressed, analysts homed-in on a relatively discrete set of relationships including infrastructure systems, economic linkages, settlement patterns and land use.

It is this domain where MPOs currently constitute the most salient institutional actors. This survey project asks a detailed set of questions about types and degrees of collaborations between MPOs at the megaregional and other scales.

5.TIMETABLE

This survey of MPOs was completed between April and June of 2018. The results are now being analyzed in more detail the determine how the sample and respondent characteristics might influence the results.

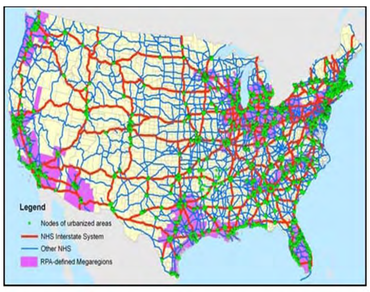

Figure 8. The National Highway System (ESRI, 2006; Bureau of Transportation Statistics (BTS), 2007)

ACHIEVEMENTS

Basic Survey Response Characteristics:

214 responses, 211 completed - 56.7% response rate

#	Answer	%	Count
1	200,000 or less	48.34%	102
2	200,000 – 1 million	40.28%	85
3	Over 1 million	11.37%	24
	Total	100%	211

Is your MPO area within, or adjacent to, one of the nine U.S. mega-regions designated in the above map?

Answer	%	Count
Yes	74.06%	157
No	25.94%	55
Total	100%	212

3. MPO Collaboration at Megaregional Scale

Question	Other MPOs in Our State	Other MPOs in Adjacent State(s)	Other MPOs in Non-Adjacent States	Planning Organizations in Other Countries	Total
Met with leadership and staff of other MPOs and/or organizations in our mega-region to exchange information and discuss issues of mutual interest.	47.77%	28.03%	12.10%	22.93%	157
Collaborated with other MPOs and/or organizations to identify joint challenges, strategies and priorities in our mega-region.	38.22%	20.38%	10.19%	17.83%	155
Collaborated with other MPOs and/or organizations to produce joint studies or recommendations about common issues or projects in our mega-region.	25.48%	7.64%	1.27%	10.19%	151
Have adopted memorandum of understanding (MOUs) with other MPOs and/or organizations in our mega-region.	22.29%	8.28%	1.91%	10.19%	153
Worked with other MPOs and/or organizations in our mega-region to propose joint projects and investments advancing mega-regional goals in our Long Range Transportation Plans (LRTP).	16.56%	6.37%	1.27%	6.37%	151
Included projects identified through collaboration with other MPOs and/or organizations in our mega-region into our Transportation Improvement Plan (TIP).	14.65%	2.55%	0.64%	7.64%	150

What topics and/or project areas at the mega-regional scale have been a focus of your collaborations with other MPOs and/or other organizations in your mega-region?

Answer	Percent	Number
Congestion Management Issues	17.83%	154
Major Transportation Corridor Issues	***43.31%***	***156***
Intelligent Transportation Systems/Operations	16.56%	150
Intercity Passenger Rail Service	24.84%	151
Intercity High Speed Rail Service	21.02%	155
Intercity Passenger Bus Service	14.65%	148
Multi-modal Freight Issues and Services	***43.95%***	***152***
Planning for Potential Future Growth in Driverless Vehicles	12.74%	150
International Border Transit and Crossing Issues	5.10%	151
Air Quality Issues	21.02%	153
Other Environmental Issues	5.73%	148
Coordination of Transportation and Land Use Planning Issues	18.47%	151
Economic Development Issues	26.11%	154

In light of the other planning and implementation priorities of your MPO, how would you rank the importance of your collaborations with other MPOs and/or other organizations to address transportation and related planning issues at the mega-regional scale?

Answer	%	Count
Not very important	26.77%	34
Somewhat important	33.07%	42
Important	27.56%	35
Very Important	12.60%	16
Total	100%	127

In your view, what are the major barriers to more extensive collaboration with other MPOs and/or other organizations to address transportation and related planning issues at the mega-regional scale?

Answer	%	Count
Working with other MPOs and/or other organizations on issues at the mega-regional scale is not a major priority given other demands on our time and resources.	47.13%	74
Working with other MPOs and/or other organizations on issues at the mega-regional scale is not facilitated by the planning frameworks and requirements of our State Department of Transportation.	16.77%	52
Working with other MPOs and/or other organizations on issues at the mega-regional scale is not facilitated by the planning frameworks and requirements of the Federal transportation agencies.	22.93%	36
There are not sufficient financial resources for staff to engage in more extensive collaborations on mega-regional issues.	50.32%	79
There are not specific funding sources to support joint projects at the mega-regional level with other MPOs and/or other organizations.	43.95%	69

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How Does Regional Transportation Governance and Capacity Influence Investment Outcomes?

Creating a Robust Dataset for MPO Research

RESEARCH AGENDA

1. BACKGROUND

Regional and megaregional transport systems enable the economic and social interactions that make metro regions significant engines of growth and innovation. Governance of our regional scale transportation systems attracts limited attention from researchers, however.

One persistent research challenge is the lack of readily available data about the organizations responsible for regional transportation governance. Federal transportation law requires that urban areas have a state-designated metropolitan planning organization (MPO) to coordinate transport planning and spending for the region. The MPO is usually governed by an appointed board, most members of which hold local elected offices in the region. Members and staff work together on MPO committees to advance plans for the region. To receive federal transport dollars, the MPO must approve a short-range Transportation Improvement Plan, or TIP—a capital program identifying federally funded projects in the region—and a long range plan on which the program is based. The MPO uses travel demand models to anticipate its future needs and evaluate potential investments.

2.RESEARCH QUESTIONS

This research sets the stage for a series of explorations into the influence of regional (and megaregional) transportation governance and capacity on transportation investments and outcomes. The project develops a database capturing key MPO governance variables. For instance, in asks whether transit agencies and airport interests are represented on the board, what MPO committees exist for non-auto modes, and what its travel model capabilities are. It also asks whether MPO decisions on flexible federal funding favor transit or not.

3. RESEARCH CONTENTS

The database includes information that indicates transit agency and airport representation in comparison to total board composition; whether or not MPOs have standing committees or advisory groups for active transportation, airport or transit; and the type of travel demand models currently used by MPOs. Other information includes if board representation in MPO areas is weighted, and modes currently modeled by travel demand models used.

4.RESEARCH FRAMEWORK

Initial stages of this research project include determining the most informative and objective variables accessible through MPO websites and travel demand model documentation. After establishing necessary variables, the database can be used to investigate indicators of board composition, transit representation, airport representation, and advancement of travel demand modelling.

5. ROADMAP

The research is collecting robust baseline data on MPO governance. All relevant information is assembled by consulting MPO websites and information on board membership, as well as data on transit operators from the National Transit Database. In addition, data from the Government Accountability Office has been collected to identify flexible funding transfers favoring transit in metropolitan areas. Finally, data on transit operators' MPO participation will be merged with flexible funding data and used to explore and model the relationships between transit operator involvement in MPO decision-making and relative extent of flexible funding transfers.

ACHIEVEMENTS

1.MPO Board Composition History and Hypothesis

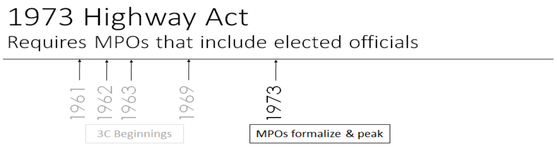
The first MPO's were designated in the 1960's with the beginning of comprehensive, coordinated, and continuous regional transportation planning in the Federal Aid Highway Act of 1962. Every urban region with more than 50 000 people is required to have an MPO, and there are currently 404 MPO's across the country. MPO's control regional access to federal transportation project funding, but the governance structures of MPO's vary substantially. This research hypothesizes that MPO's with voting or committee representation for non-automobile modes will provide more flex-funding for non-automobile projects. To test this hypothesis, the research has focused so far on creating a first-of-its-kind comprehensive database of MPO governance structures.

2. Database Creation Process

The project explored the possibility of alternative methods--like surveys--for developing a robust baseline data on MPO research. Consulting MPO websites was preferred as the most viable option to assemble the wide range of available information. Along with the websites--MPO bylaws, MoUs, Long Range Transportation Planning report and modelling documentations were also reviewed carefully for a more nuanced information such as voting structure, whether a transit agency is represented directly and/or indirectly on the MPO board, modelling approach they follow, whether the agency participates through MPO technical advisory committees and other MPO committees, forums, and studies or activities.

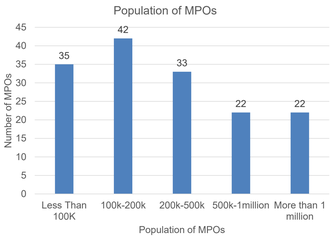
3.Preliminary Results

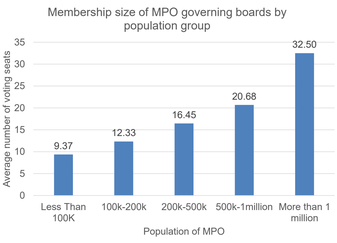
With the MPO data already compiled in the database, it is possible to start looking at common trends. There appears to be a relationship between region population and board size. Very large boards (greater than fifty members) are common in the largest metropolitan areas (over a half million people). 41.6% MPOs have transit representation in their voting boards. On aggregate level, transit comprises about 3.5% of the total voting seats. As might be expected, the vast majority of MPO's are using the classic four-step model; around half of MPOs develop their travel demand models in-house.

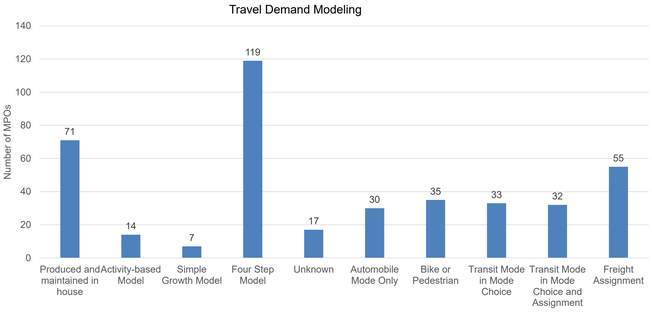


Preliminary Findings Based on 154 MPOs (~40%):

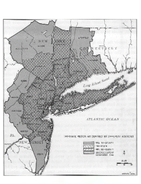
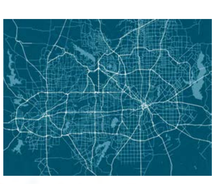
Based on 154 MPOs		
Average Voting Members:	16.62	Ranges from 3 to 112
Weighted Avg Voting Members:	32.48	
	MPOs	**%**
Has Voting Transit Representation	64	41.6%
Has Voting Airport Representation	17	11.0%
Airport Committees	3	2.0%
Pedestrian or Bicycle Committees	43	27.9%
Transit Committees	20	13.0%







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GRA(s): Chris Bischak, MSCRP 2019

The Impact of Transportation Network Companies on the Texas Triangle

RESEARCH AGENDA

1. BACKGROUND

Transportation Network Companies (TNCs) like Uber and Lyft are relatively new forms of transportation in which online platforms are used to connect drivers to riders.

In recent years these services have experienced explosive growth. Between 2016 and 2017 the number of rides took on Lyft's platform grew by 130%.[1] Conservatively, TNC market penetration is estimated to have reached 24% in the United States as of 2018.[2]

Despite their explosive growth TNCs are still a significantly under researched form of transportation, particularly from the perspective of why people choose to use them. Moreover, very little is understood from an academic perspective about the differences between heavy users of TNCs and lighter users of TNCs.

2.RESEARCH QUESTIONS

This research focused on three research questions:

How are people in Texas using Uber/Lyft?

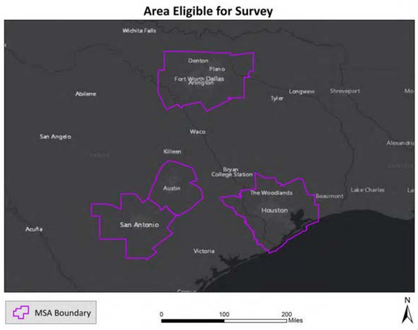
Why are people in Texas using Uber/Lyft?

What are the characteristics of heavy TNC users?

3.RESEARCH FRAMEWORK AND METHDOS

To better understand how TNCs are impacting the Texas Triangle megaregions we conducted a survey in the 4 largest metro regions in Texas (Austin, Dallas-Ft. Worth, Houston, and San Antonio). These are shown below. A survey was used because very little empirical data is available about TNC usage due to lack of data sharing.

The survey was conducted by the survey firm QuestionPro using their online platform. 250 responses were collected from each of the MSAs in Texas.



6.TIMETABLE

This research has been completed as of May 2019. Future research will focus on the impact of other shared mobility services like e-scooters on urban transportation. This research is being submitted to a journal for publication.

7. References

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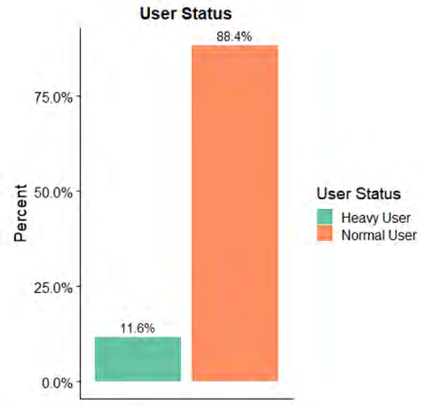
Molla, Rani. "Americans Seem to like Ride-Sharing Services like Uber and Lyft. But It's Hard to Say Exactly How Many Use Them." Vox, June 24, 2018. https://www.vox.com/2018/6/24/17493338/ride-sharing-services-uber-lyft-how-many-people-use.

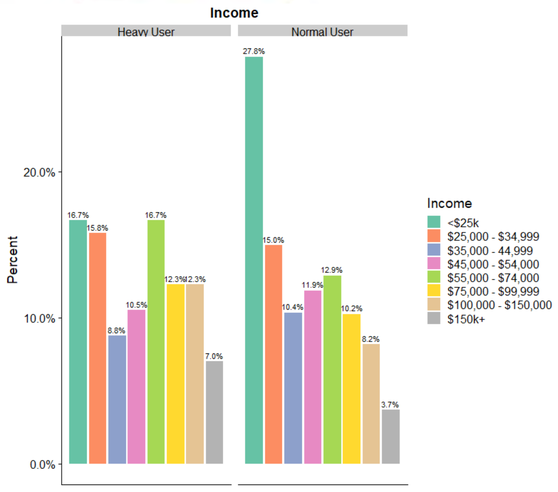
ACHIEVEMENTS

Survey Results

From the panel survey we obtained 1000 complete responses and 983 valid responses.

71.44% of respondents were female and 28. 56% were male. No single age category was dominant, but a plurality of users responded that they were between 36 and 45. About half of the respondents were white. The next largest demographic group was Hispanic/Latino (23.8%). Regarding income, 26.55% of respondents made less than $25,000 dollars last year, which was the largest single choice. The rest of the responses were fairly evenly distributed, except only about 4% of respondents made $150,000 or more last year. Exactly half of all respondents had less than a bachelor's degree. Finally, 87.69% of respondents reported that they have regular vehicle access.



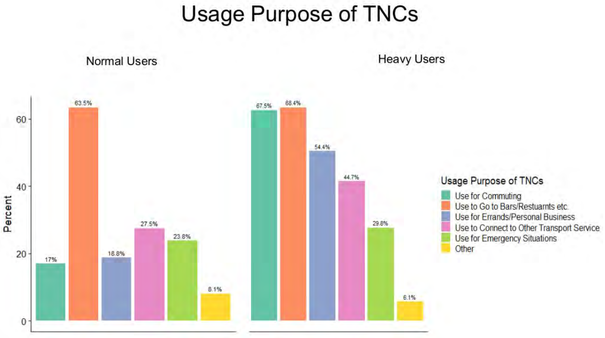


User Segmentation

In order to understand the differences between heavy and 'normal' users we segmented the responses. We classified a heavy user as someone who used a TNC two times a week or more As shown in Figure 2b we can see that 88.5% of users were normal users and 11.5% of users were heavy users. We then compared our survey results between the two groups.

Heavy users have much different patterns of use compared to normal users. Table 3 details the demographic differences between these types of users. Heavy users have a much greater preference for using these services during weekdays, as compared to normal users. 69.3% of heavy users use TNCs primarily on weekdays whereas normal users display opposite patterns of usage. About 29% of normal users use TNCs on work days and 63% of them use them on non-work days. Heavy users are far more likely to use TNCs for commuting purposes as shown in Figure 3.

In terms of demographics the differences between the two groups are displayed below in Table 3. We find that overall heavy users tend to be wealthier, somewhat more educated, and to have less vehicle access. Heavy TNC users are less white than normal users overall. Such a finding needs to be further explored in additional research and surveys and suggests an interesting direction of investigation.



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Creating Neighborhood Walkability Metrics to Represent the Needs of Older People

RESEARCH AGENDA

1. BACKGROUND

Over 75% of US seniors live in low density neighborhoods with few places to which they can safely walk yet seniors walk for an increasing share of all trips as they age. There are multiple guides and metrics to measure and promote neighborhood walkability but many either miss issues important to seniors OR emphasize elements that might serve younger people but are actually viewed by seniors as barriers to walking. Most existing walkability guidelines and indices also do not link directly to specific infrastructure improvements and supportive programs; they merely measure deficiencies.

2. OBJECTIVES

- Synthesize useful and powerful walkability metrics that directly address the needs, resources, and perceptions of older people;
- Develop a concise typology of focused metrics that allow planners to effectively identify the barriers to walkability for seniors;
- Link neighborhood deficiencies identified by these metrics to specific policy and infrastructure solutions, allowing planners and seniors to advocate for targeted neighborhood changes.

3. APPROACH AND METHODS:

- Review, evaluate, and synthesize the body of interdisciplinary literature on how seniors view the walkability of their neighborhoods, the reasons why they walk, and the improvements they seek to facilitate additional walking;
- Identify, compare, and contrast major existing walkability indices and metrics, determining how well they include the elements of walkability that respond to senior needs and concerns and avoid those that create barriers to walkability for seniors;
- Conduct multiple focus groups with diverse seniors in the mega-region to assess their perceptions of neighborhood walkability;
- Develop a concise set of powerful metrics capturing the most relevant and important features of the built environment supporting walkabiltity for diverse seniors;
- Link deficiencies in neighborhood walkability for seniors to actionable policies, improvements, and programs.

5. TIMETABLE:

Summer 2019 Completion

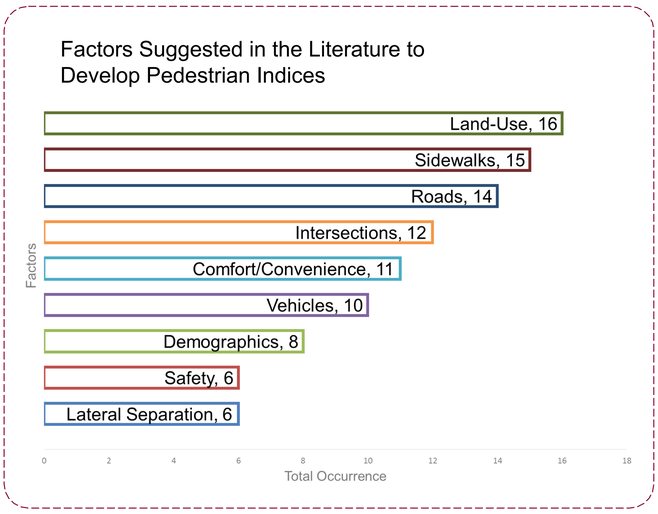
ACHIEVEMENTS

1. Literature Review

Many walkability metrics focus on the needs of younger travelers walking for transportation, that is to specific destinations. Seniors tend to walk for recreation, to socialize, for physical activity, and to maintain a connection to their neighborhood; they may have no set destination or the destinations are incidental. Walkability metrics should acknowledge senior walkability needs and perceptions by identifying: 1) those needs and desires they share equally with others; 2) those that they value very differently, and 3) those factors and situations sought by other travelers that seniors find difficult or frightening.

2. Focus Groups

We showed images of five different pedestrian environments to active seniors no longer in the work force in focus groups in Austin and San Antonio, asking what elements encouraged or discouraged walking. We began with the most varied and dense environment and ended with a very suburban area with no destinations and limited intersections and traffic. We show three of the five images below. We found: 1) important gender differences--men were far more likely to favor active environments than women; 2) serious concerns about both safety (falls, crashes) and security (crime, harassment) in all environments but particularly the most active; 3) fears that businesses and retail establishments indicated sketchy neighborhoods; 4) a general dislike of intersections and requests for traffic signals and heavily marked crosswalks at all intersections; 5) a sense that busy bustling places were for young people, posing too much danger to seniors; and, 6) substantial concern about any amount of auto or bike traffic (even if parked). We have completed all but two planned focus groups.



3. Missing the Mark

Many of the factors suggested by the literature were either not important to the seniors we interviewed or they placed a very different value on these pedestrian attributes. They were not concerned about destinations and were worried about the kind of land uses often recommended to encourage walking. They were critical of almost any intersection treatment, even if there were traffic lights (unlikely to be feasible for all intersections). They wanted extremely wide sidewalks unencumbered by other travelers but asked for somewhere to sit. They tended to see many amenities, from places to shop to attractive vegetation, as ugly or potentially dangerous (slips and falls and places for criminals to hide)

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Weequahic Crossing

An Equitable Growth Plan for Newark NJ and the Newark Liberty International Airport (EWR)

Airport City Redevelopment Plan

1. BACKGROUND

Leading industries in the New York-New Jersey regional economy are increasing demand for airport services. The Port Authority & regional stakeholders seek to leverage EWR's unique geography to create a world class airport.

This dual architecture and planning project aims to design a new landside terminal for Newark Liberty International Airport. It reactivates the isolated communities around the airport and promotes new economic opportunities for the city and its residents. It establishes an aerotropolis styled innovation district which converts underutilized land around the airport into multi-modal, pedestrian scaled mixed-use development.

2.Land Use & Design Concept

Current land use around EWR contain large parcels, used mostly for parking and some airport support services.

Aligned with Kasarda's Aerotropolis concept, rezoning contiguous areas to facilitate land-uses that host support activities, new office spaces and commercial activity promote diversified Aerotropolis-centric employment clusters.

3. Transportation & Economic Growth

There is no pedestrian or bus access to the Airport Station and no direct rail or bus service between Lower Manhattan and EWR. Our proposal adopts the RPA'S Trans-Regional Express (T-Rex). On the eastern side of the railroad tracks, the headhouses are designed to process fast-moving regional traffic quickly whereas on the west side of the train tracks, they serve local traffic within the City of Newark. The Express Bus proposal addresses the lack of bus service between the new airport city, South Ward, Downtown Newark, and other major destinations. This Express Bus system is an extended local bus service more like BRT rather than a peak period commuter bus.

4.Landside Terminal Designs

This studio proposes two terminal-headhouse designs, each of which has its own benefits.

i. Oasis

The key idea of the Oasis design is to provide a connection between the Weequahic Park and the airside concourses with the landside terminal being the anchor of the airport city. Based on this concept, the studio extended and abstracted the conceptual control lines to drive the form finding process of the design.

ii. Triad

In the Triad Concept, the studio implemented some of the ideas from Utrecht Station in Amsterdam in order to allow passengers to seamlessly flow from Weequahic Crossing into the headhouse, making it a part of the local urban fabric. In the end, the final shape has three wings with a shared public space in the middle, known as 'the vortex'.

5. Master Plan Concept

In both schemes, the area immediately surrounding the terminal buildings are filled with public spaces to be utilized by the community, and newcomers we aim to attract. Public markets, cafes, and beautiful landscapes occupy the space in front of the headhouse, creating an interactive town square that draws both community members and visitors passing through Newark airport. Intended to replace the underutilized industrial space along the west side of Frelinghuysen, south of the proposed headhouse, a large-scale mixed-use development will be constructed.

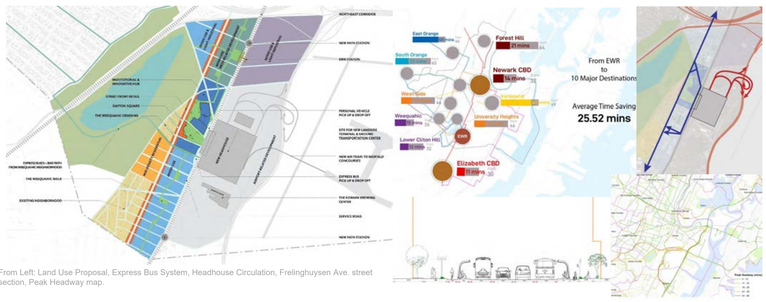
Effectively, this plan returns the street of Frelinghuysen to the people of Newark, turning an avenue of derelict and neglected space, into a center for activation, commerce and community engagement.

Design Proposals

1. Land Use & Transit Oriented Development

Identifying the most suitable land for redevelopment, the studio prepared concept diagrams to show how the character of Weequahic Crossing could evolve with sustained investment and new growth.

The studio proposes a dual-pronged transportation strategy based around (1) Efficient Headhouse Accessibility and (2) Enhanced Home-Work Connectivity for Local Residents.



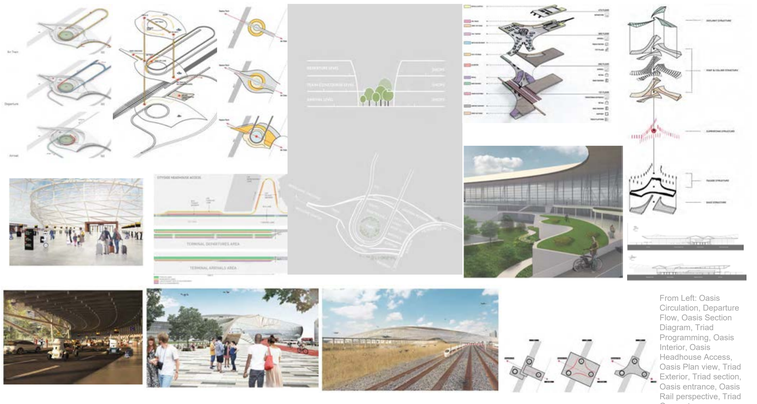
From Left: Land Use Proposal, Express Bus System, Headhouse Circulation, Frelinghuysen Ave. street section, Peak Headway map.

2. Oasis Headhouse Terminal Designs

Central to this studio's proposal is the development of a new, world-class landside terminal for Newark Liberty International Airport. As previously introduced, this landside terminal should consolidate the three existing terminals into one and be relocated to sit atop the Northeast Corridor Rail Line.

Co-locating the terminal with a rail headhouse will improve regional accessibility to the airport increasing rail use as a mode of airport access and egress.

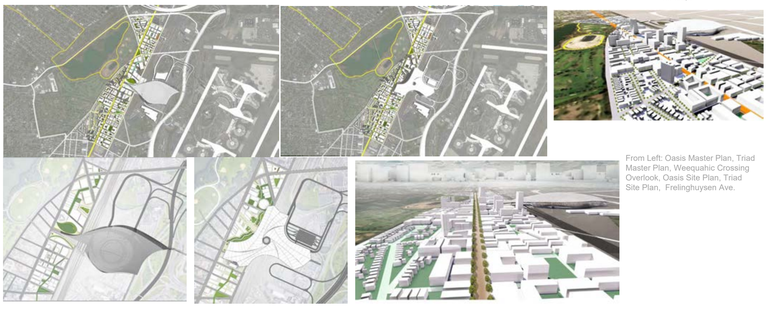
Adoption of new technologies allow traveler flow and operational programs to be significantly simplified. As a result the future space needed per passenger is greatly reduced.



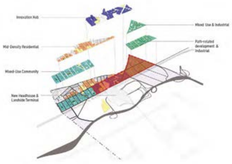
From Left: Oasis Circulation, Departure Flow, Oasis Section Diagram, Triad Programming, Oasis Interior, Oasis Headhouse Access, Oasis Plan view, Triad Exterior, Triad section, Oasis entrance, Oasis Rail perspective, Triad Concept.

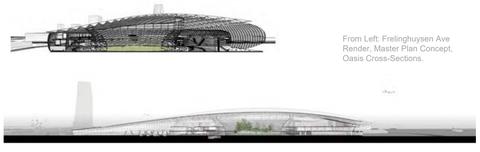
3.Master Plan

A large-scale mixed-use development will replace underutilized industrial space along the west of Frelinghuysen, south of the proposed headhouse. These blocks will host residential, office and retail uses, connected by a 2,400ft linear pedestrian path, which weaves through the center of the blocks, away from the vehicular activity on Frelinghuysen. North of the headhouse, at the intersection of Frelinghuysen and Dayton, are a series of triangular blocks dedicated to institutional and innovation hub uses.



From Left: Oasis Master Plan, Triad Master Plan, Weequahic Crossing Overlook, Oasis Site Plan, Triad Site Plan, Frelinghuysen Ave.





From Left: Frelinghuysen Ave Render, Master Plan Concept, Oasis Cross-Sections.

TEXAS The University of Texas at Austin
Penn University of Pennsylvania
LSU Louisiana State University
TSU Texas Southern University

USDOT Tier-1 University Transportation Center
CM2 Cooperative Mobility for Competitive Megaregions
Summer Forum 2019

UNIVERSITY OF PENNSYLVANIA
PI(s): Bob Yaro, Frederick Steiner
GRA(s): Isobel Lingenfelter, Neil Reid, Alex Baum
Yuchen Yuan, Yufei Yuan, Yang Wang, Jiaqi Suo
Laura Culp

New Prospects for New England: Fast Tracking High-Speed Rail and Regional Economic Renewal in Connecticut and Rhode Island

RESEARCH AGENDA

1. BACKGROUND

the 2019 studio builds upon the conclusions of the 2016 Rebooting New England studio which proposed the creation of a modern passenger rail network linking New York City to Boston, that would link all of New England's disinvested mid-sized cities to each other and to these two global cities. The 2016 studio proposed that a new inland high-speed rail right-of-way be created to bring Hartford into the Northeast rail network. This new route would also provide redundancy in this system when the current coastal route is threatened by sea-level rise and storm surges as a result of climate change. The studio proposed that this rail network be used to underpin a broader economic development strategy for these places to the benefit of the entire New York-New England region.

The 2016 studio estimated that the proposed $100 billion rail investment could result in $500 billion to $1 trillion in economic benefits over a 40-year period, providing a 2.5:1 benefit-cost ratio. The Rebooting New England studio also proposed that the vast majority of necessary capital funds be provided by the federal government, most likely through debt financing. The current studio has not attempted to replicate this analysis or these recommendations. Instead, the 2019 studio focused on the feasibility of siting a new inland rail alignment between Hartford, Connecticut and Providence, Rhode Island.

2.RESEARCH FOCUS AREAS

The New Prospects for New England studio recognizes that to build a new inland rail right-of-way broad support will need to be garnered from Connecticut's residents. Therefore, it focuses on the benefits that can be created for Connecticut separated into three key elements:

• It proposes two new alternative high-speed rail rights-of-way linking Hartford, and Providence; an inland alternative to the coastal route abandoned by the Federal Rail Administration in its 2017 NEC Future Tier I Environmental Impact statement. ;

• It recommends how this new rail corridor could be integrated into the landscape of The Last Green Valley National Heritage Corridor in Eastern Connecticut, and the measures that could be taken to both mitigate its negative impacts and seize the economic opportunities it would create for the Heritage Corridor's communities and residents; and

• Finally, it outlines how the proposed high-speed rail line —and the proposed 50-minute travel times to both New York and Boston it would make possible— could transform downtown Hartford, Connecticut and repair some of the damage done more than half a century ago, when Interstates 84 and 91 were jammed through this historic urban center, and the city was cut off from the Connecticut River.

3. PRECEDENTS

The studio's key recommendations are based in part on precedents it observed in the North of England, where the UK government is investing more than $100 billion in high-speed rail links and the broader Northern Powerhouse economic development initiative to revitalize the region's left behind cities. The studio traveled to Manchester, England in February 2019 to meet with local officials and experts involved in the region's Northern Powerhouse economic development initiative. The studio witnessed the remarkable economic transformation already underway in Manchester, Liverpool Leeds, and Sheffield, a transformation that began as soon as funds were committed to building the HS2 high-speed rail link between London, Manchester, and Leeds. The studio believes that a similar transformation could be achieved in Downtown Hartford and other New England cities as soon as commitments are made to the New York - Boston high-speed rail link.

While in England, the studio also visited the Peak District National Park to learn how the proposed Northern Powerhouse high-speed rail line and improved motorways will be sited in and around the Park. The studio also learned how new economic and tourism synergies are being created between the National Park and nearby urban areas.

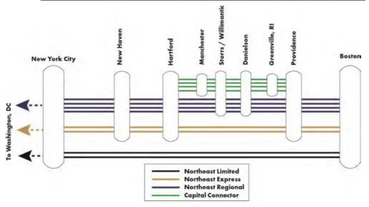
ACHIEVEMENTS

1. Identifying Alternative Rail Alignments

The studio proposes two alternative high-speed-ready rail alignments between Hartford and Providence; two capital cities which previously have had no direct interstate or rail connection. One alignment runs through Willimantic, CT. It runs with the contours of the landscape which reduces costs by cutting down necessary tunneling and bridging. The second alignment runs through Storrs, CT and while it requires more tunneling this helps avoid impacts on the environment and historic buildings. This alignment also avoids the Scituate Reservoir, Providence's primary source of drinking water. A service plan was also produced by the studio.

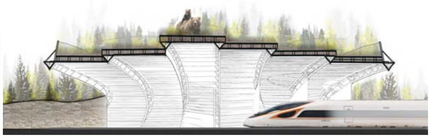
Impact Analysis - What will be impacted

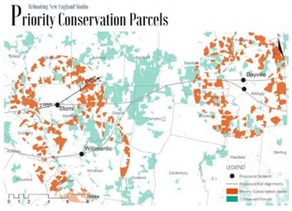
	Willimantic Alignment	Storrs Alignment
Locally Protected Land	16 parcels	11 parcels
Protected Land Owned by an NGO	5 parcels	3 parcels
Privately Owned Protected Land	4 parcels	3 parcels
National Parks	0 parks	0 parks
State Protected Land	16 areas	15 areas
Protected Wellheads	1 wellhead	1 wellhead
Critical Habitats	1 habitat	2 habitats
Natural Diversity Areas	9 areas	6 areas
Protected Aquifer	0 aquifers	1 aquifer
Buildings	98 buildings	72 buildings

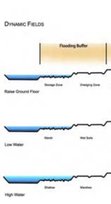


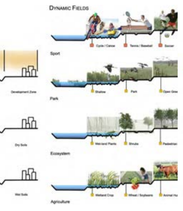
2. Exalting Ecology

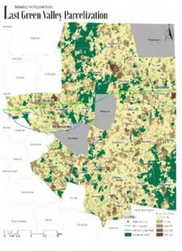
For high-speed rail to work for Connecticut it cannot just work for the cities and towns where the trains stop. High-speed rail must work for the landscape it travels through. The studio recommended a raft of growth policies and design interventions to protect the environment: an endowment to provide funding for conservation, technical planning assistance, and main street revitalization; complementary zoning to centralize development around stations and protect open space from development; priority conservation areas; dynamic flooding design interventions; and animal crossings designed to attract all types of animals to use them.











3. Revitalizing Metropolitan Hartford

To harness the economic development that would occur in Hartford under speculation from the announcement of a new high-speed rail line the studio proposed a number of strategies. Supporting small cap, incremental development to infill parking lots would allow Hartford to grow in a manner that would distinguish it from other New England cities and towns. Furthermore, tunneling the rail alignment under Hartford would allow the use of the historic Union Station, turning it into a multi-modal hub for residents. Finally, it is recommended that the I-94 highway be moved to the other side of the Connecticut River, allowing Hartford to reconnect to its riverfront.

TEXAS The University of Texas at Austin
Penn University of Pennsylvania
LSU Louisiana State University
TSU Texas Southern University