A Transportation Capital Investment and Evaluation Simulation Model for the Northeast Megaregion (NEMR)

1. 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. Where comparable regions in other advanced economies have undertaken major investments in transport, the U.S. and NEMR have fallen further and further behind.

2. RESEARCH QUESTIONS
Some of this coordination problem is technical in nature. Each of the NEMR MPOs uses different modeling platforms already in wide use across the United States. Where comparable regions in other advanced economies have undertaken major investments in transportation, the U.S. and NEMR are falling further and further behind.

3. RESEARCH PURPOSE
The purpose of this three-year applied research project is to develop and test a robust travel demand and facility planning and evaluation model capable of simulating the costs and benefits of various multi-modal transportation investments as undertaken at the megaregional scale within the NEMR. Such investments might include high-speed, inter-city high-speed rail service, intra-regional bus rapid transit service, dedicated (and automated) freight movement facilities, new bridge and tunnel facilities, high-speed airport-city transit lines, and other projects to be determined. The proposed modeling procedures and datasets will be developed and implemented in TransCAD, a state-of-the-art modeling platform already in wide use across the United States.

4. RESEARCH SCOPE
The proposed project will build on and extend the traditional 4-step urban transportation planning procedures as embodied in TransCAD. These procedures include trip-generation, trip distribution, mode choice/assignment, and facility assignment.

The purpose of this 4-step process will serve as inputs into subsequent economic development and land-use and real estate development models so as to be able to explore the downstream and feedback effects of major transportation investments on regional economies and urban settlement patterns.

5. SIGNIFICANCE & CONTRIBUTION
While none of the procedures used in this project are new, per se, they have never before been used at this large a geographical scale or to model such a complex system of alternative modes, facilities, and transportation investments. Nor have they been so tightly linked to regional economic and land development models. In addition to providing new planning and evaluation capabilities to states and metropolitan areas involved in joint and long-term transportation facilities planning, this project will result in data, procedures, and joint knowledge that will make the current efforts of existing MPOs more productive. It will also serve as a functioning prototype for other U.S. megaregions facing similar challenges.

6. TIMELINE
This project is organized into three, one-year phases. In Phase I, we will create the basic data structures and modeling procedures necessary to construct a 4-step multi-modal passenger and freight transportation planning model for the NEMR. In Phase II, we will use the model to investigate the transportation costs, benefits, and impacts of a proposed series of 21st Century transportation facility investments. In Phase II, we will extend the transportation model to inform a megaregional scale economic development as well as metropolitan-level land use change and real estate development models.
## RESEARCH AGENDA

### 1. BACKGROUND

The objective of this project is to analyze how shifting residential location, demographics, economic activity, and preferences have contributed to changes in travel behavior in the Philadelphia Region over the past decade and a half. Cities and regions like Philadelphia have seen at the heart of national increases in the use of transit, bicycles, and walking at the regional, megaregional, and national level. The metropolitan area has experienced enough demographic and spatial change in a short period of time and has enough demographic and travel variation to begin to unpack questions about the relative importance of economic conditions, demographic change, and people's preferences in shifting travel patterns.

### 2. RESEARCH QUESTIONS

Since 2000, many once-declining cities in the United States have experienced an economic and population resurgence — but what does this mean for travel behavior and to what extent do changes in settlement patterns, demography, the economy, and preferences contribute to changes in metropolitan travel?

## FINDINGS

### 1. Millennials

The travel behavior of young people changed, but so did the travel behavior of older groups. In the Philadelphia region, Millennials are not unique in their declining travel by car. Similarly, car-ownership rates declined at about the same rate for all age ranges over the period. There was also little change in the commute to work by transit, as measured by the Census. Most notably, across all model specifications, we find that the independent effect of being young remains unchanged from 2000 to 2012, though this group was consistently the most likely age-group to be car-free and to not have traveled on the survey day.

### 2. Gender, race, and income

The changes we observed by age-cohort rate in comparison to the changes by gender, race, and income. Women were statistically significantly more likely than men to have a car-free travel day in 2000, but significantly less likely in 2012. In 2000, black respondents were statistically more likely to travel without a car than white and other respondents. But by 2012, there was no behavioral difference after controlling for other factors, he difference between low-income residents' and wealthier residents' travel behavior also shrank over time, although it remained substantial and statistically significant in 2012. Low-income residents were nearly three times as likely as wealthier residents to travel without cars in 2000, but only twice as likely in 2012.

### 3. The built environment

The local built environment appears to be more strongly correlated with car-free travel routines in 2012 than in 2000. As shown in the Table and Figure on the right, population density and Walk Score were weakly and statistically insignificantly associated with car-free travel routines in 2000. By 2012, however, living in a denser, more walkable neighborhood was a much better predictor of car-free travel.

## SUMMARY

Taken together, these three findings fit an overall narrative about how urban gentrification and the suburbanization of poverty have led to dramatic changes in urban travel patterns in Philadelphia.
Transportation and Land Use across US and Mexican Cities and Megaregions

RESEARCH AGENDA

1. BACKGROUND

Megaregions inherently cross borders, often national ones. Of the eleven emerging US megaregions identified by the Regional Plan Association in its seminal work, three include Mexican cities (Figure 1). Moreover, cross-border commutes, tourism, and economic flows are important components of local and metropolitan economies and cultures in places like San Diego, Tijuana, El Paso, and Juarez. According to the 2015 Intercensus (INEGI 2015), around 5-10% of Mexican commuters from border cities and municipalities work in the United States (Figure 2). Even in many central parts of Mexico, a sizable fraction of the workforce commutes to the United States.

Figure 1. Regional Plan Association map of emerging megaregions

Figure 2. Percent of commutes to the United States by Municipality

2. ROADMAP

While the study will include the hundred largest metropolitan areas from each area; particular attention will be paid to four megaregions: the Northeast, Central Mexico, the Texas Triangle plus Northern Mexico, and Southern California plus Baja California. The northeast and central Mexico are the most populous and economically productive parts of each country, while the border regions are mutually dependent and deeply economically entwined. Within this collaboration, we propose to 4 individual research tasks:

- Collect and summarize socioeconomic and travel data across the 200 metropolitan areas
- Define and analyze the cross-border megaregions with an emphasis on the importance of cross-border economic and labor flows
- Explore how the relationship between income, land use, and commute patterns vary by region and by country
- Analyze similarities and differences in commute strategies of the working poor

The first task will be to model the commute choice as a function of socioeconomic and geographic features using a hierarchical choice model that allows for variation across cities, regions. We will then test whether combining regions (both within across borders) improves model fits and where the relationship between predictor variables like population density or income is consistent or varies substantially. Particular attention will be given to identifying whether the travel behavior of Mexican and Americans in transnational border regions is more similar to one another than to commuters in the Northeast or central Mexico megaregions.

3. RESEARCH PRODUCT

This project will result in a report to the CM2 that describes the work conducted and findings presented. A subset of the analyses will be submitted for peer-reviewed publication in a leading transportation or planning journal. We will also present findings to the Transportation Research Board and other local and national conferences. The project will also lead to strengthened cross-border collaborations between the University of Pennsylvania and CentroGeo.

FINDINGS

The majority of low income US workers (81.95%) commute by driving, similar to the overall population. In Mexico, on the other hand, the highest proportion of low income workers use public transit to commute (48.66%): this is slightly higher than the overall proportion of transit riders (Figure 7).

Figure 5 & 6. Proportion of workers who commute by work by car against population density in Mexico and the United States (left); Traffic fatality rates against population density in Mexico and the United States (right)

Figure 7. Commute mode and time of the population with lowest income quintile in the US and Mexico
Equitable access to transit within and across megaregions

**RESEARCH AGENDA**

1. BACKGROUND

There is increasing concern about equitable access to transit within, and across, megaregions and what this means for access to jobs, amenities, and live in economically and racially diverse neighborhoods. The average household in the United States spends more on transportation than on any budget item aside from housing. How much they spend is strongly influenced by where they live. In many cases, cheaper housing is, by virtue of its location, offset by more expensive transportation. Concerns about location affordability date back decades, but have been gathering steam in recent years.

In this project, we explore how housing and transportation costs, and transportation time, varies by income and race across the nation, and then within three megaregions: Northeast (Boston-Washington); the Texas Triangle; and Cascadia (Seattle-Portland). Together, these three megaregions house a quarter of the national population, and all three regions are witnessing increased housing market pressures, which raise important concerns about equitable access to transit.

2. RESEARCH QUESTIONS

- Is incorporating location affordability into the siting of new subsidized housing projects tantamount to steering such developments into predominantly African American and Latino neighborhoods?
- Furthermore, does the answer vary across metropolitan regions, perhaps conditioned by differing spatial patterns of racial and ethnic segregation, housing costs, and transportation infrastructure?
- Finally, could the goal of decreasing transportation costs reduce a household’s ability to access amenities that directly affect household outcomes within and across markets. And how does this vary across mega-regions?

3. RESEARCH FRAMEWORK

This paper uses several databases to estimate housing costs, transportation costs, the location of existing and new subsidized housing, and household and neighborhood characteristics.

1) The Center for Neighborhood Technology’s housing and transportation cost index.
2) Tract-level neighborhood information about poverty rates, household income, and commute times, from the American Community Survey and data on school test scores and job-accessibility from various sources.
3) A national database of subsidized housing, including existing, new, and expired properties from various sources including: publicly available data from the U.S. Department of Housing and Urban Development (HUD); private data from HUD; and data from the National Preservation database.

We use these data to explore variation in housing costs, transportation costs, commute times, and access to neighborhood amenities, and how they vary across race and income by tract, city, metro, and megaregion level.

4. TIMETABLE

The research team has compiled the database and is in the process of developing descriptive statistics about transportation costs and the siting of subsidized housing at the metropolitan level.

Over the coming months we plan to expand our analysis to look at other neighborhood amenities and explore variation at the mega-regional level.

**ACHIEVEMENTS**

1. Developed a national tract-level database of transportation costs, household race, and subsidized housing.

   **Takeaway 1:**

   Properties developed through the Low Income Housing Tax Credit program tend to be located in areas that are more highly minority

   ![Graphs by tract](image)

   ![Filled values](image)

   **Takeaway 2:**

   Tracts with lower transportation costs tend to be more highly minority

   ![Graphs by tract](image)

   ![Filled values](image)
MOBILIZING INVESTMENT IN AMERICA’S TRANSPORTATION INFRASTRUCTURE

1. BACKGROUND

America urgently needs to invest in its infrastructure to fix the calamitous state of its roads, rails, bridges, highways, streets, airports, and ports. Decades of disinvestment and increases in population and economic activity have resulted in a system that is congested and rapidly deteriorating further, creating unsafe conditions for Americans and limiting capacity for future economic growth. Existing systems exacerbate income inequality and extend already long journeys to work into even longer durations, yet there has been no progress in Washington to marshal new and increasingly essential investments. Mobilizing to design and implement solutions targeting our aging transportation infrastructure is urgently needed.

2. RESEARCH QUESTIONS

Leaders across the United States will need to advance new strategies to guide the design and implementation of infrastructure initiatives. These strategies must consider the following questions:

- How should the federal role be redefined?
- How will the federal role be funded?
- What strategies must consider the following questions:
  - Get Federal Funding Right
  - Pay the Actual Cost of Congestion
  - Create and Capture Value
  - Provide Public Benefits Using Public Finance Authorities
  - Streamline Project Delivery
  - Use Open Data Platforms and Dynamic Traffic Management
  - Get Ahead of New Technology
  - Optimize the System
  - Invest in Logistics
  - 10 Plan Ahead for High-Speed and Intercity Rail

3. RESEARCH CONTENTS

We are long overdue for bold thinking about the future of America’s mobility system, and it’s time to get back on track. We propose 10 strategies to mobilize investment in transportation infrastructure:

1. Get Federal Funding Right
2. Pay the Actual Cost of Congestion
3. Create and Capture Value
4. Provide Public Benefits Using Public Finance Authorities
5. Streamline Project Delivery
6. Use Open Data Platforms and Dynamic Traffic Management
7. Get Ahead of New Technology
8. Optimize the System
9. Invest in Logistics
10. Plan Ahead for High-Speed and Intercity Rail

4. RESEARCH FRAMEWORK

The work of this studio was informed by site visits to two US metro regions Denver and Los Angeles, each of which has created new urban and regional rail networks over the past two decades. Our report describes how successive mayors each advanced the vision while creating new funding streams to support transportation infrastructure investment.

5. ROADMAP

Two specific examples of infrastructure investments from Los Angeles illustrate how these strategies will work in practice, but on a national scale and across the many geographies where we are proposing interventions, there are many other types of considerations to be made.

We propose project frameworks at different geopolitical scales to align decision-making, funding/financing, and governance with the geographies where problems occur and benefits accrue.

6. TIMETABLE

America’s infrastructure urgently needs new strategies targeting funding, efficiency, and vision for the next generation. A complete overhaul of the infrastructure planning and procurement process is required to lower costs and speed delivery of needed projects. The time for investment is now.

ACHIEVEMENTS

Transforming Mobility in Los Angeles

10 Strategies

Our congealed road networks, inadequate transit options, and clogged logistics hubs are unacceptable barriers to economic prosperity for millions of Americans. Each of these ten strategies supports one of three objectives that must be achieved to resolve the issues with our aging system and expand it to support the future growth of our nation: funding, efficiency, and vision. Although some strategies are cross-cutting, contributory to the achievement of multiple objectives, they are organized by the objective most closely aligned with their outcome.

LA Union Station

The historic Los Angeles Union Station was built in 1939 during the boom of the railway age – an era in which travel by train was prestigious, exciting, and glorified through architectural significance. Following the post-war decline of rail, the station, in a narrative shared by many infrastructure assets, weathered decades of disinvestment.

We envision Union Station not only as a hub for the Los Angeles transportation system, but also as a cultural hub for Downtown Los Angeles. The design of the station and the surrounding area serves to connect Union Station to nearby assets, such as the LA River, City Hall and other institutions, reknitting the surrounding areas into a unified community. We ultimately aim to establish Union Station not only as an inspiring experience for those who pass through it, but as an inspiration and a model for mobilizing investment in infrastructure across America. As we conceive it, this project will promote transit use and enhance the economic vitality of its surrounding neighborhood by spurring new development and providing connections to nearby attractions.

In our proposal for LA Union Station, we have aimed to accommodate expected ridership growth, provide an enriching and exhilarating experience for visitors, craft a focal point for the region’s future economic development and urban identity, and support a less automobile-reliant Los Angeles lifestyle. Aiming to reestablish transit’s position in the popular imagination, our vision for Union Station prioritizes and celebrates travel by transit and by rail - both regional and intercity rail as well as America’s first High-speed Rail network.