National Impacts of Community-Level Strategies to Improve Convenience of Mobility

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EEMS128

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Overview

Timeline

- Project start date: 10/01/23
- Project end date: 09/30/26
- Percent complete: 40%

Budget

- Total project funding: $2.75 M
  - DOE share: $2.75M
  - Contractor share: $0
- Funding for FY 2025: $1.3 M
- Funding for FY 2026: $1.0 M

Barriers

- U.S. DRIVE VMSATT Roadmap (2023)
  - *"…consider how underlying relationships—such as land constraints and implications for where people live, work, and travel—and specific variable assumptions—such as modal travel preferences—are translated from conceptual narrative to model implementation Input from external experts with complementary perspectives (e.g. land use, city planning) will be solicited, as appropriate."*
  - *"New modeling capabilities for mobility system research will consider mobility technologies to provide a systems point of view to maximize desirable outcomes such as throughput, efficiency and accessibility and/or minimize undesirable outcomes such as delay, energy consumption and emissions."*

Partners

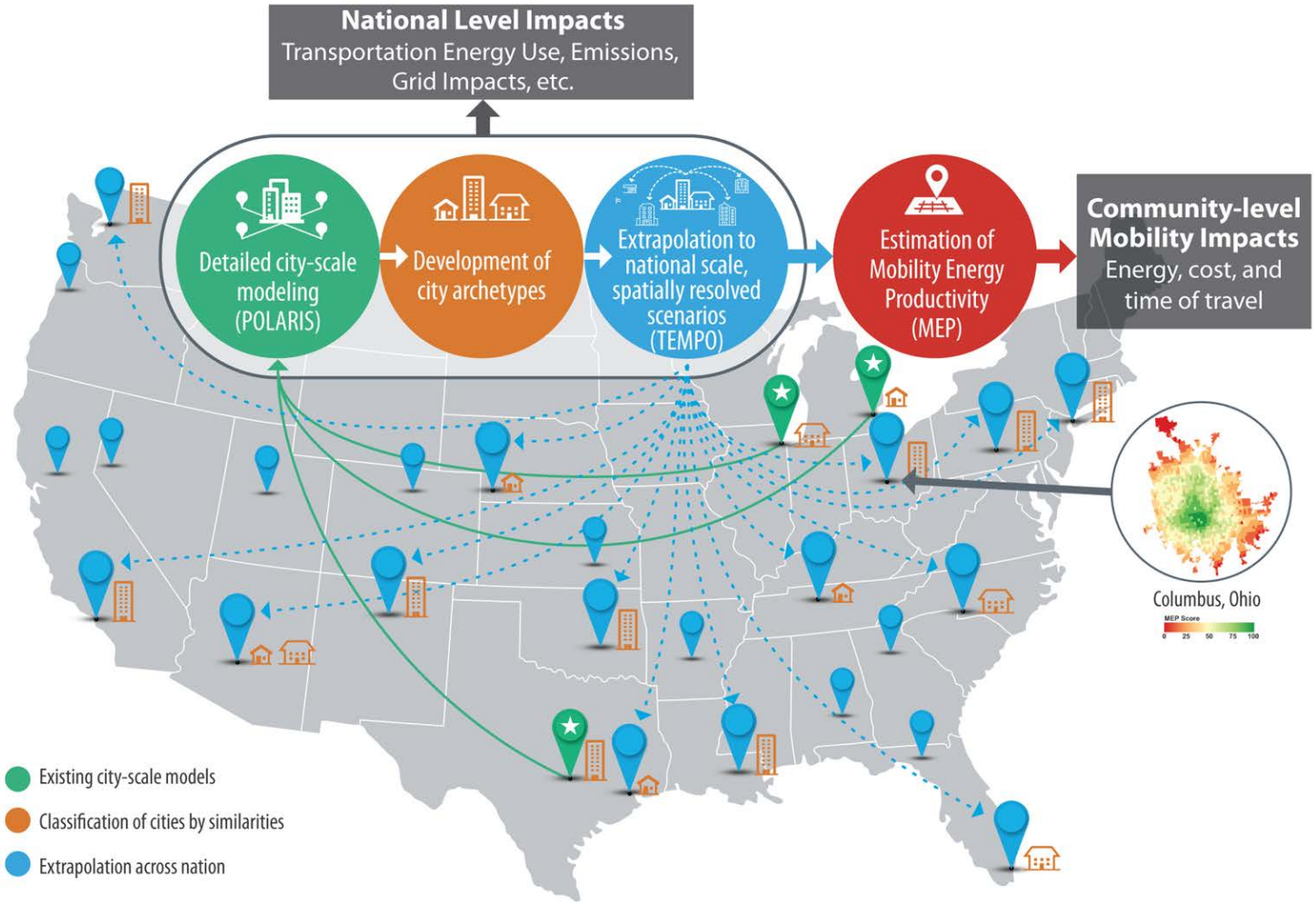
- Project lead: NREL
- Lab Partners: ANL & LBNL
- Collaborations: Project Steering Committee with representatives across various federal, state, non-profit, academic, & private institutions

Relevance

This project fills a strategic gap by linking key transport modeling tools (**POLARIS**, **GTT**, **TEMPO**) from three National Labs to facilitate assessment of convenience-focused strategies at community and national scales.

Convenience-focused strategies can include:

- Urban & Land Use Planning
- Telework & E-Commerce
- Travel Demand Management
- Active & Public Transit



Milestones

Quarter	Milestone	Progress
FY25 Q1	Preliminary POLARIS & TEMPO model runs in at least two of the three selected regions for one scenario.	100%
FY25 Q2	Preliminary POLARIS & TEMPO model runs in (a) all three of selected regions for one scenario , and (b) in at least one region for a second scenario.	80%
FY25 Q2	Using available modeled outputs (baseline and at least one scenario) for all currently modeled regions in both models, an initial mapping will be constructed to regionalize parameters in MEP calculations.	80%
FY25 Q3	Preliminary POLARIS & TEMPO runs in all regions and scenarios to enable final typology mapping to TEMPO modeling of all scenarios, and an overview of preliminary TEMPO inputs that utilize typology-classified outcomes from POLARIS.	20%
FY25 Q4	Final POLARIS model runs for all scenarios and regions.	0%
FY25 Q4	Preliminary TEMPO results for all scenarios for the overlapping POLARIS regions.	20%

FY25 Go/No-Go: Validating TEMPO results for at least three out-of-sample POLARIS regions

Quarter	Milestone
FY26 Q1	Preliminary results for TEMPO runs for all US Counties
FY26 Q2	Preliminary MEP results of decarbonization strategies for cities in regions simulated
FY26 Q3	Final results for TEMPO runs for all US Counties
FY26 Q4	Final MEP results for decarbonization strategies for major cities in all regions simulated

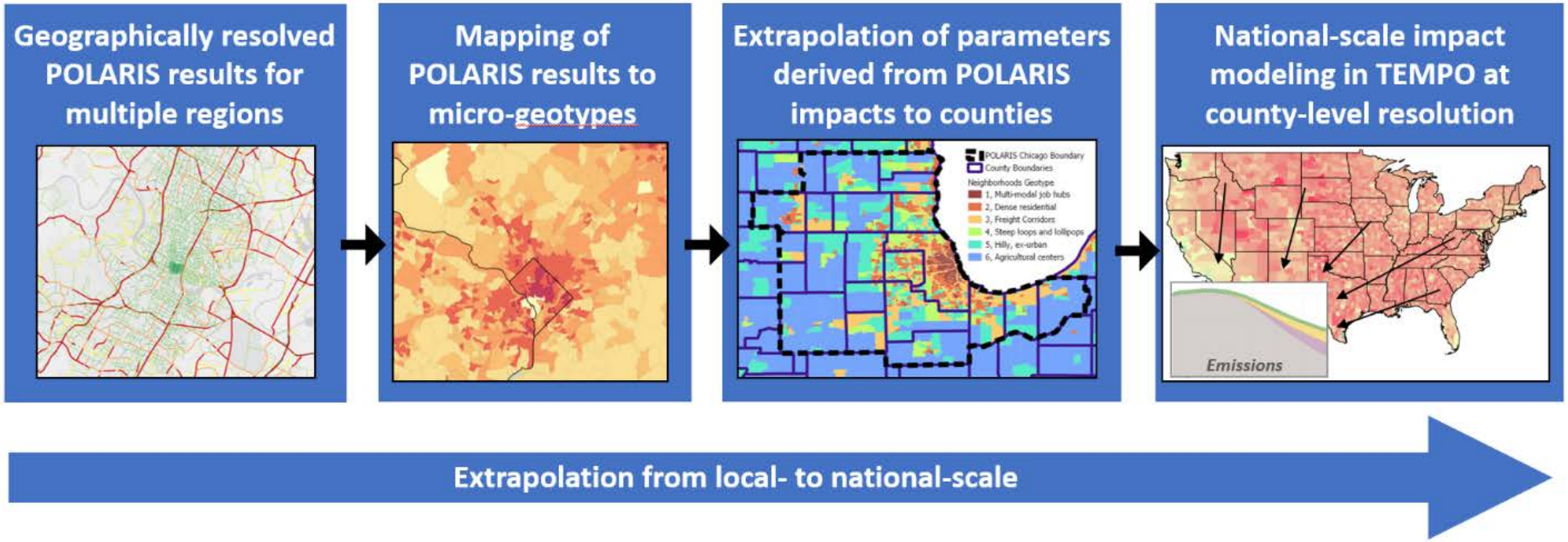
Approach

Past work (FY24 Q1 & Q2):

- Set up and engaged project steering committee to guide project priorities
- Determined study regions (POALRIS + GTT)
- Begin evaluating GTT mapping between TEMPO and POLARIS inputs/outputs

New work (FY24 Q3 to FY25 Q2):

- TEMPO county-level transit enhancement with GTFS
- Transit (TOD) scenario design aligned for both models
- Baseline + Transit scenarios simulated in Chicago & Atlanta in POLARIS and TEMPO
- Validation of modeling results and preliminary comparisons of trip demand and county-level travel trends



Model Mapping Approach Flow Chart

Scenario design & TEMPO implementation:
Based on literature, steering committee engagement, etc., scenario(s) are scoped out and implemented in TEMPO at the county-level

- TOD example: increase households with access to transit and increase transit service (e.g., 10% more households near stops, reduce headways all of bus stops by 10%)

TEMPO

POLARIS scenario implementation:
Using the TEMPO input scenario design (data & assumptions), POLARIS designs

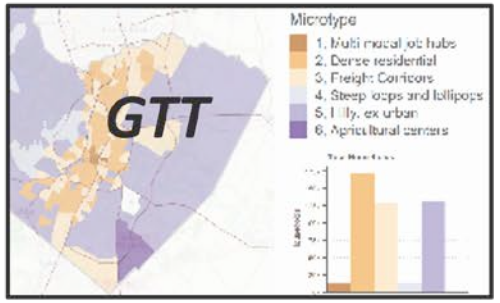
- TOD example: POLARIS replicates increased households with bus access and increased service with the same average parameters with more detailed granularity

POLARIS

TEMPO & POLARIS simulate aligned scenario

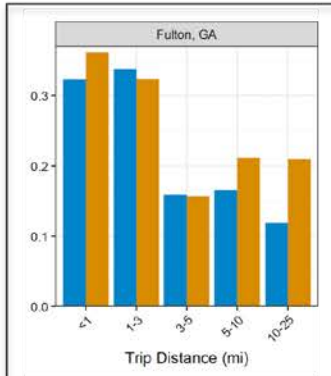
POLARIS

TEMPO



Map Identified POLARIS Outcomes by GTT for TEMPO:
For key mechanisms that are not being captured or need to be refined, TEMPO will either be modified to endogenously capture or exogenously track the resulting phenomenon

- TOD example: map increased attractiveness of bike/walk for households that have increased transit access by GTT dimensions



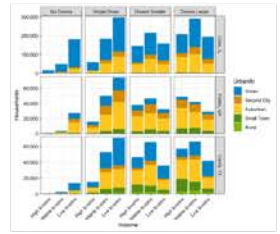
TEMPO and POLARIS results compared overall and across GTT micro/geo types
Key metrics to determine model scenario alignment & gaps

- inputs: ensure alignment
  outputs: mode share, total trips, VMT, etc.

Revise Scenarios & Test in TEMPO:
Update TEMPO inputs and/or modeling logic to account for these mapped trends

- TOD example: walk/bike parameters are modified to capture increased attractive across TEMPO dimensions

TEMPO



Ensure Alignment in Outcomes:

- Ensure TEMPO aligns POLARIS across key metrics across scenario
- Begin testing in counties/regions outside of POLARIS regions
- Validate trends with out-of-sample comparisons and third-party data

(Previous Accomplishment): Scenario Themes into Scenario Design

Based on steering committee feedback, the four scenarios will focus on drawing from the following topics of top interest and priority:

Land Use/Zoning

1. changes in housing/land use

Transit

1. service enhancements

→ **TOD Scenario (#1 + #2)**

Travel Demand Management (TDM) / Pricing

1. e.g., congestion/parking pricing
2. e.g., leveraging FHWA pricing work

→ **TDM Pricing (#1 + #2)**

Tech Accomplishment: Building TEMPO Transit County Representation

TransitLand

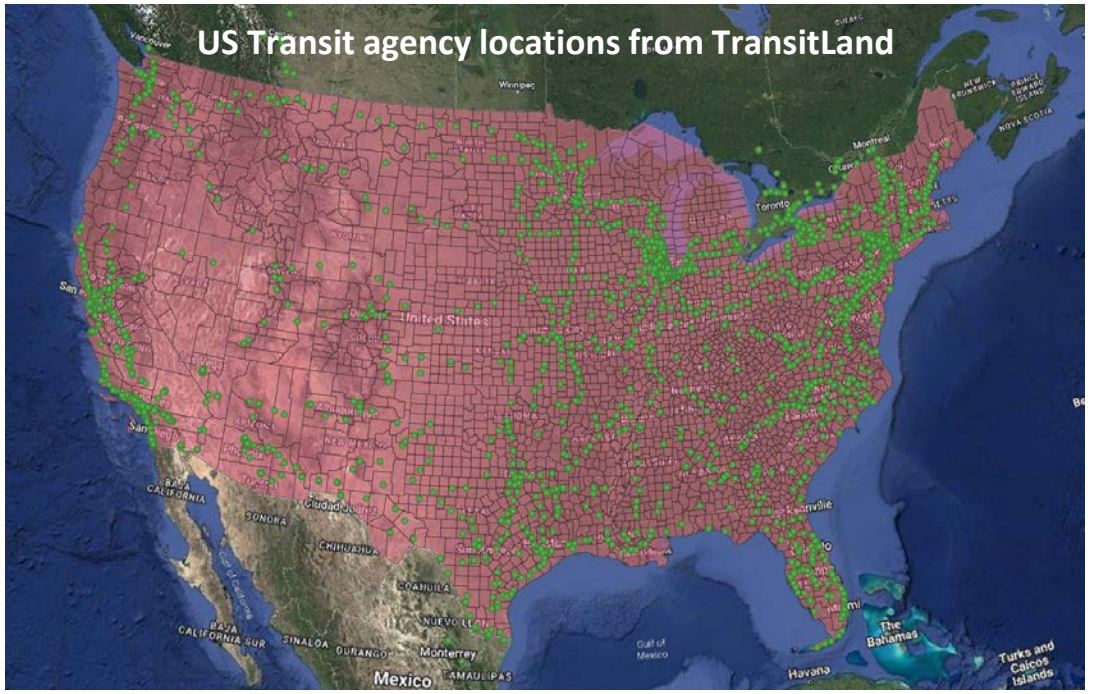
- 1,089 static GTFS feeds in continental US
- Between 2017 and 2024, the frequency of GTFS updates has increased, more than doubling since 2017, with a median of 2.1 updates per year per agency.

MobilityDatabase.org

- 861 static GTFS feeds in continental US

National Transit Database (NTD)

- The Federal Transit Administration (FTA) and Bureau of Transportation Statistics manage the National Transit Map (NTM), which compiles GTFS data from US transit agencies.
- NTM lacks service and schedule details, limiting its application for accessibility and service quality assessment

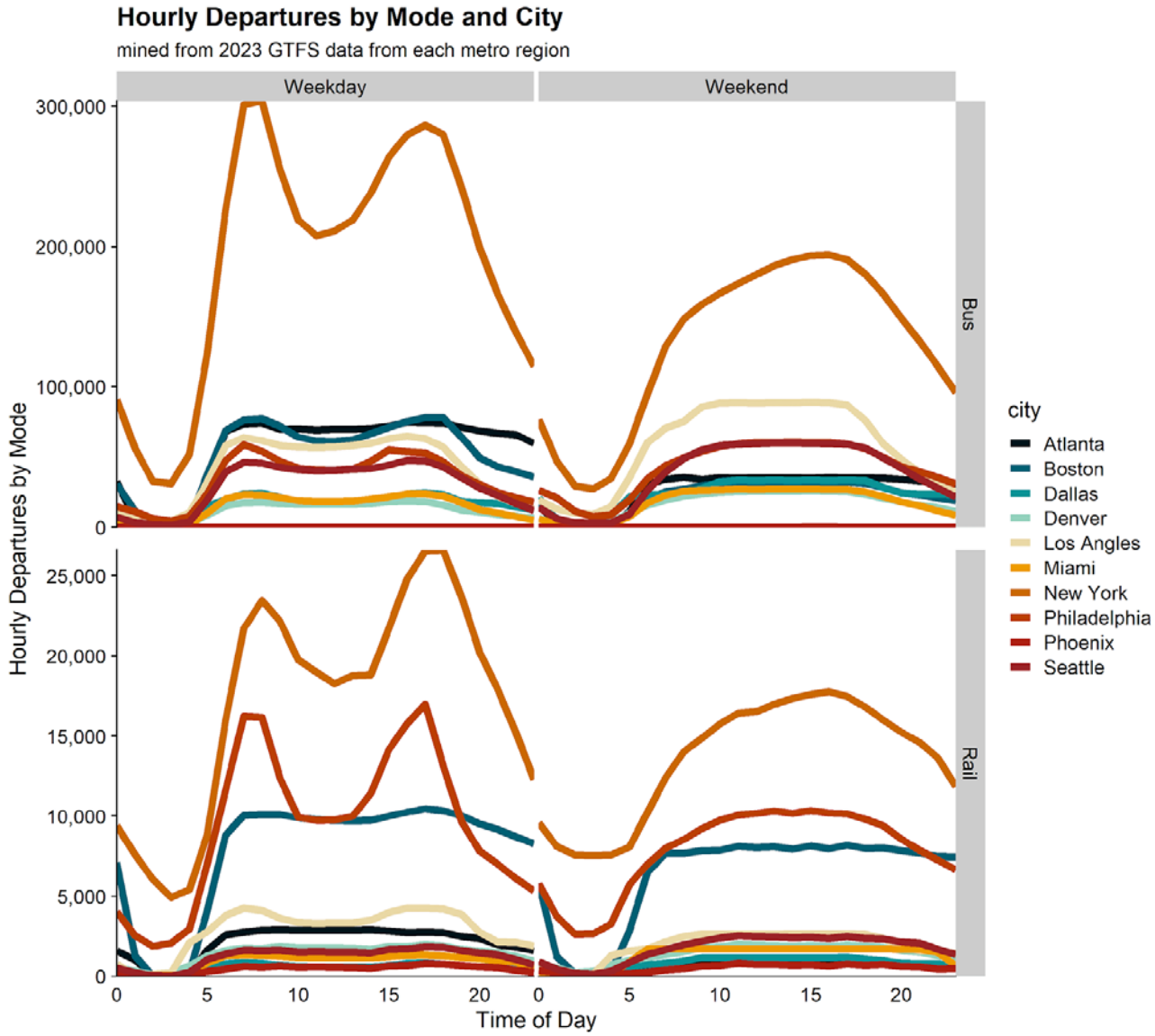


All rely on crowd-sourcing for updates and may lack quality historical data. Preliminary comparisons indicate ~75% of feeds match across sources.

Tech Accomplishment: Building TEMPO Transit County Representation

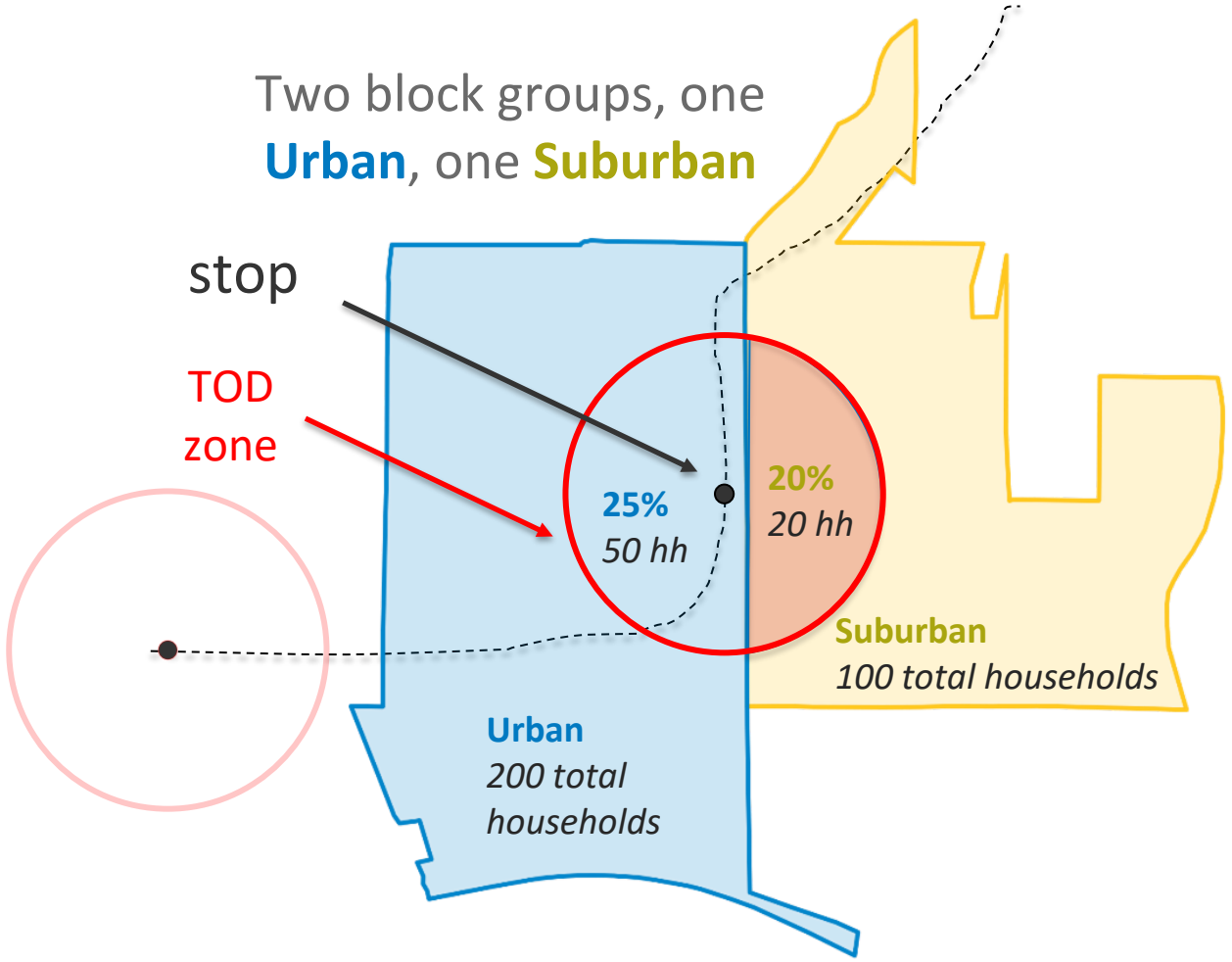
Developed methodology to comprehensively examine **transit service** characteristics includes the following:

- **Frequency & Headway Calculation:** Calculating departure frequency and average headways at each stop using arrival and departure times.
- **Calendar Data Analysis:** Creating a calendar table (or utilizing the existing one in a dataset) to ensure that the analysis characterizes the service based on the day of the week.
- **Average Speed Calculation:** Calculating the average speed at each stop by averaging the speed of every route that serves the specific transit stop.



Tech Accomplishment: Building TEMPO Transit County Representation

Developed methodology to comprehensively examine **transit availability**:



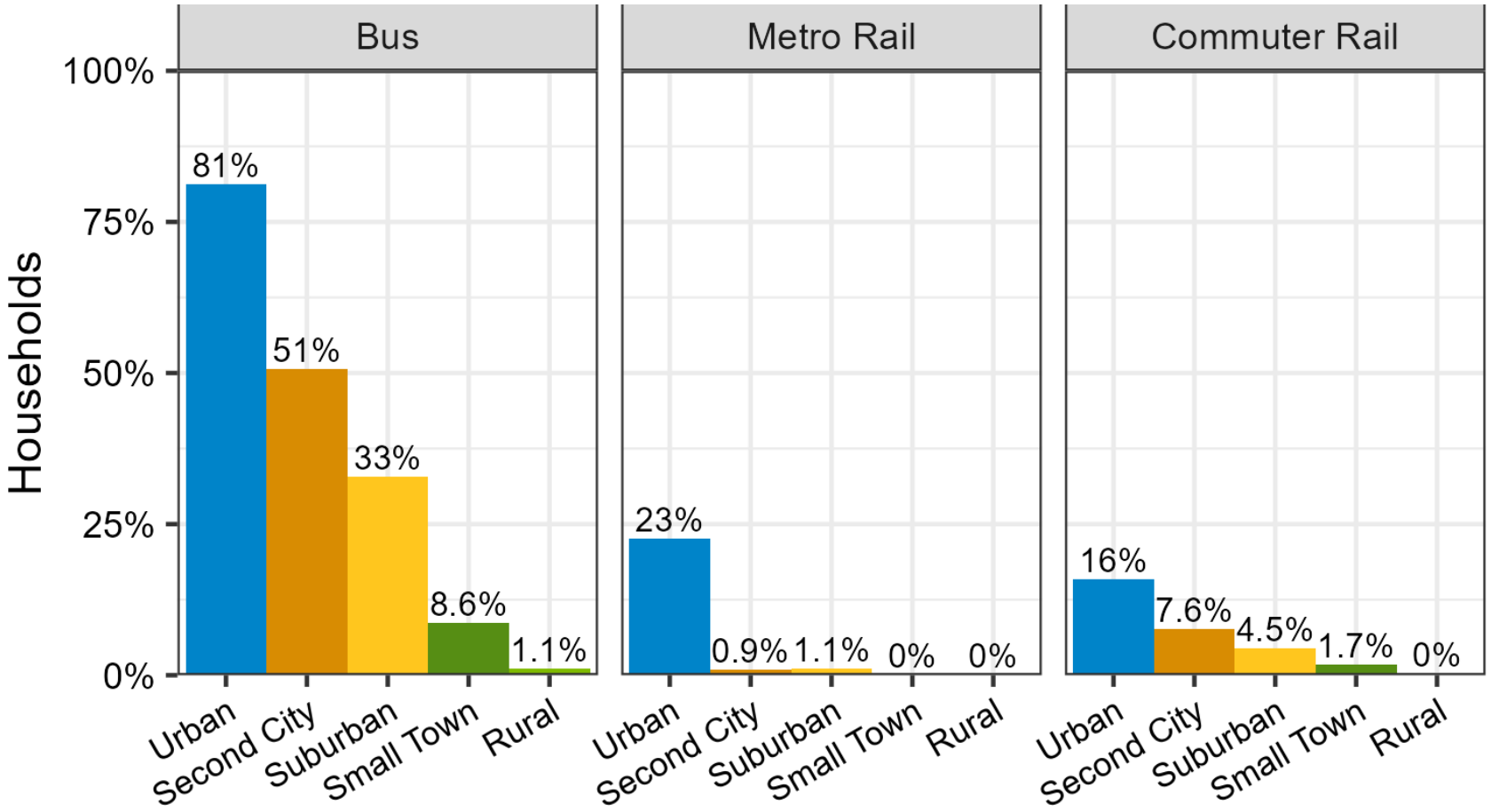
Imagine a county is made up of only 2 block groups, and one transit stop lies within.

In this example,

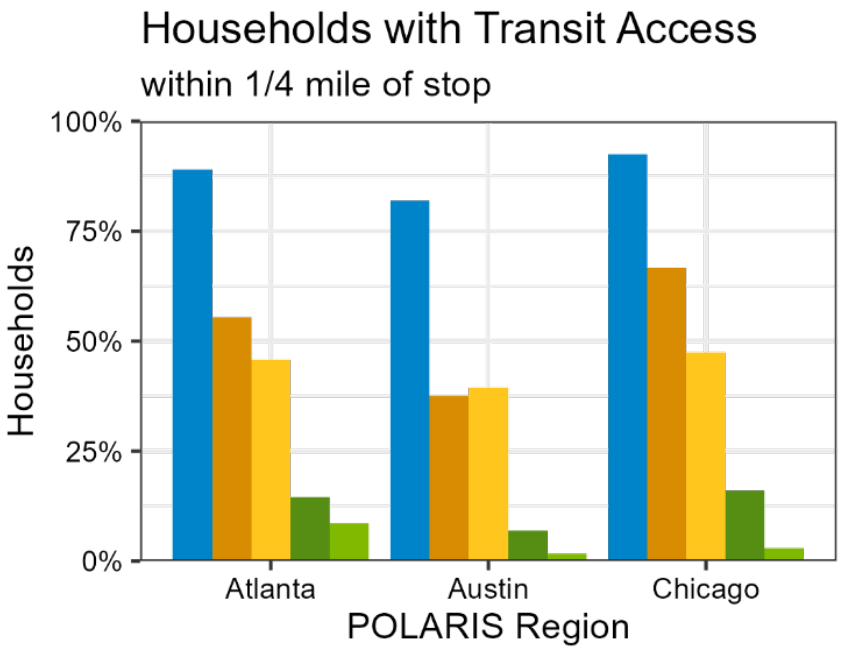
- 20% of **Suburban** households would have access to transit (20 total households)
- 25% of **Urban** households would have access to transit (50 total households)

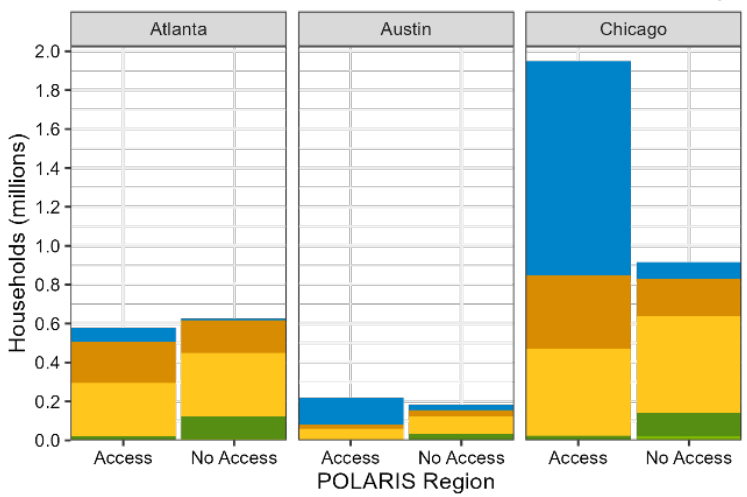
Tech Accomplishment: Building TEMPO Transit County Representation

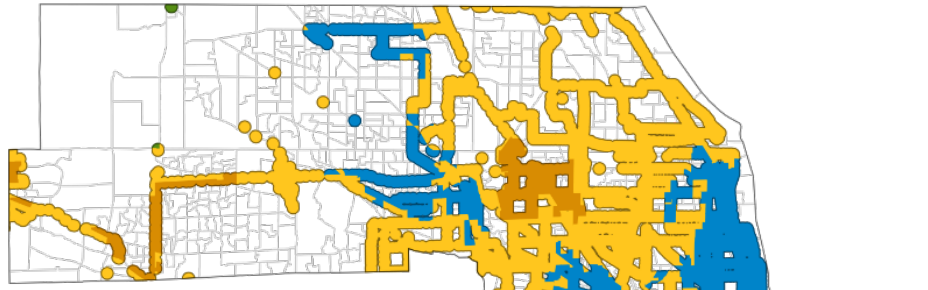
- Based on 2024 GTFS from TransitLand
- Households within:
  - Bus = ¼ mi
  - Metro = ½ mi
  - Commuter = 1 mi
- Validation of align TEMPO baseline transit ongoing, approach may be updated to improve alignment



Tech Accomplishment: Building TEMPO Transit County Representation

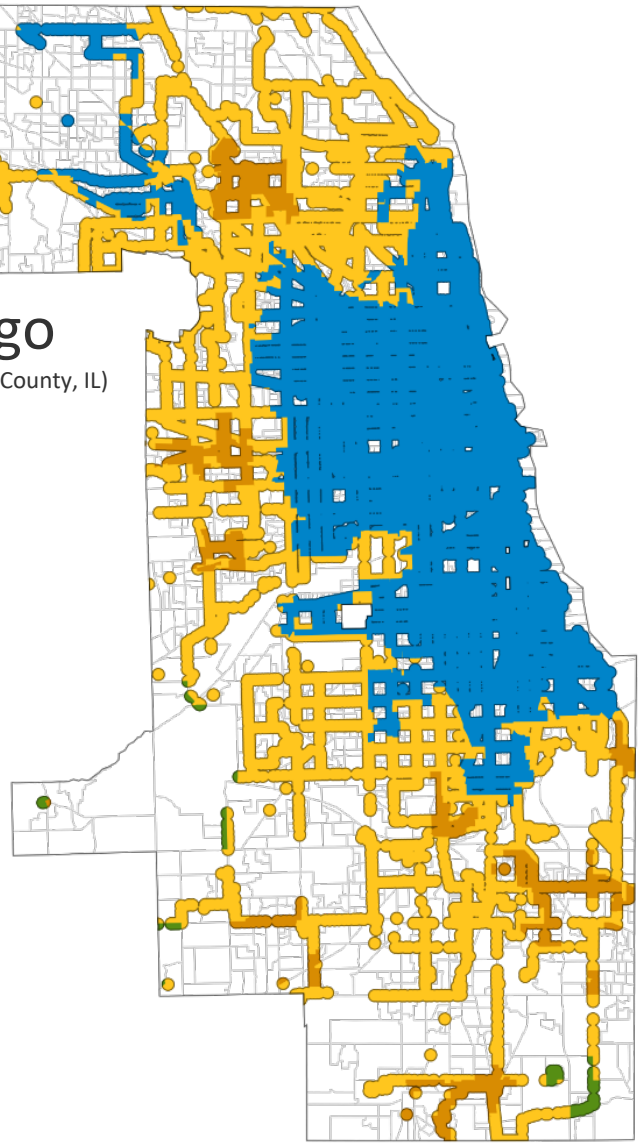


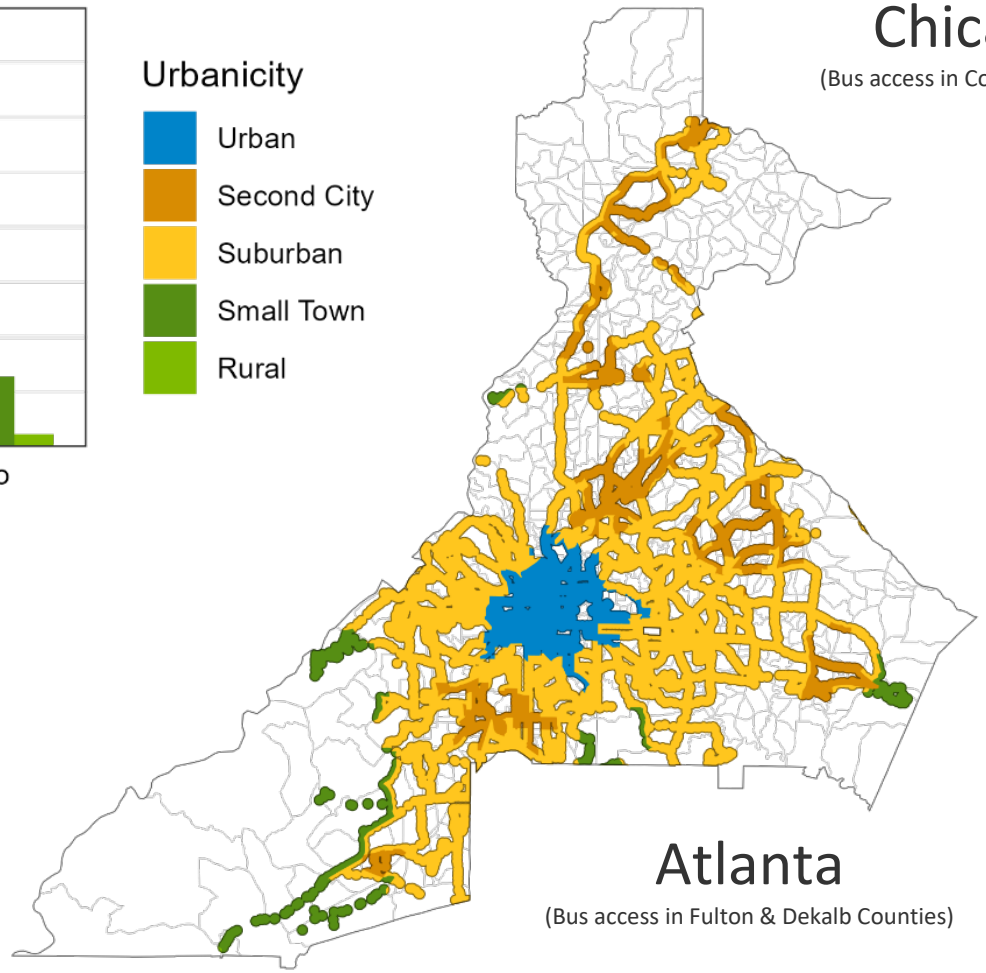




Chicago

(Bus access in Cook County, IL)



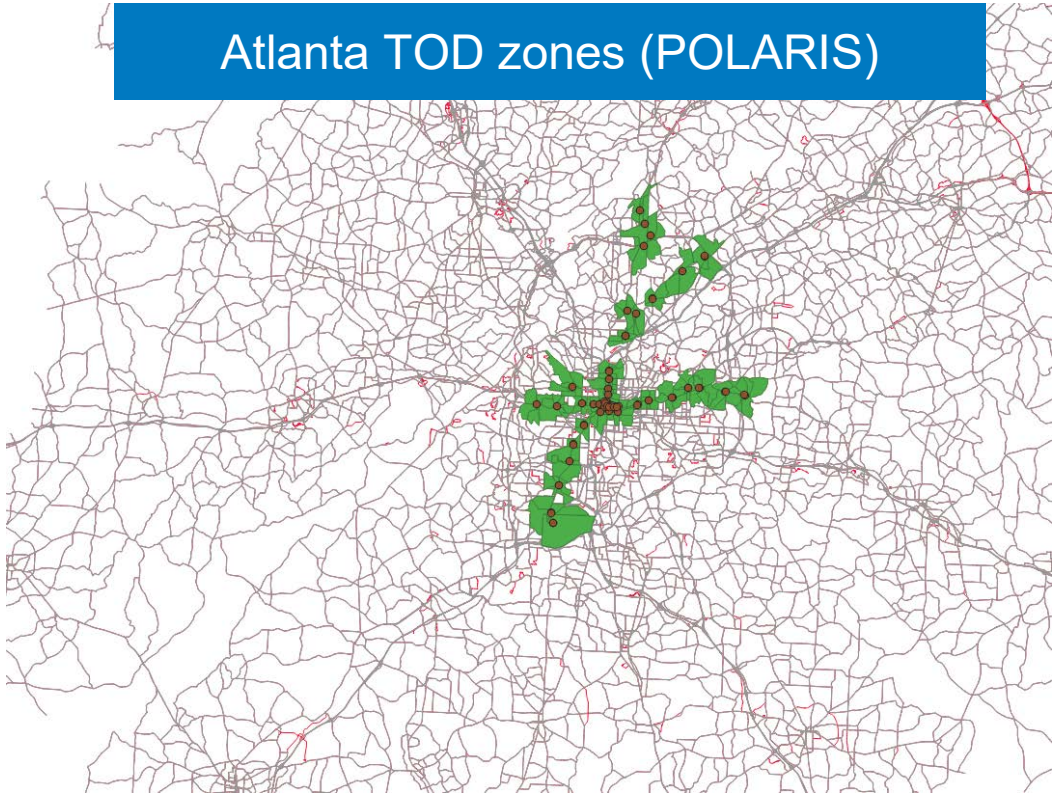


Atlanta

(Bus access in Fulton & Dekalb Counties)

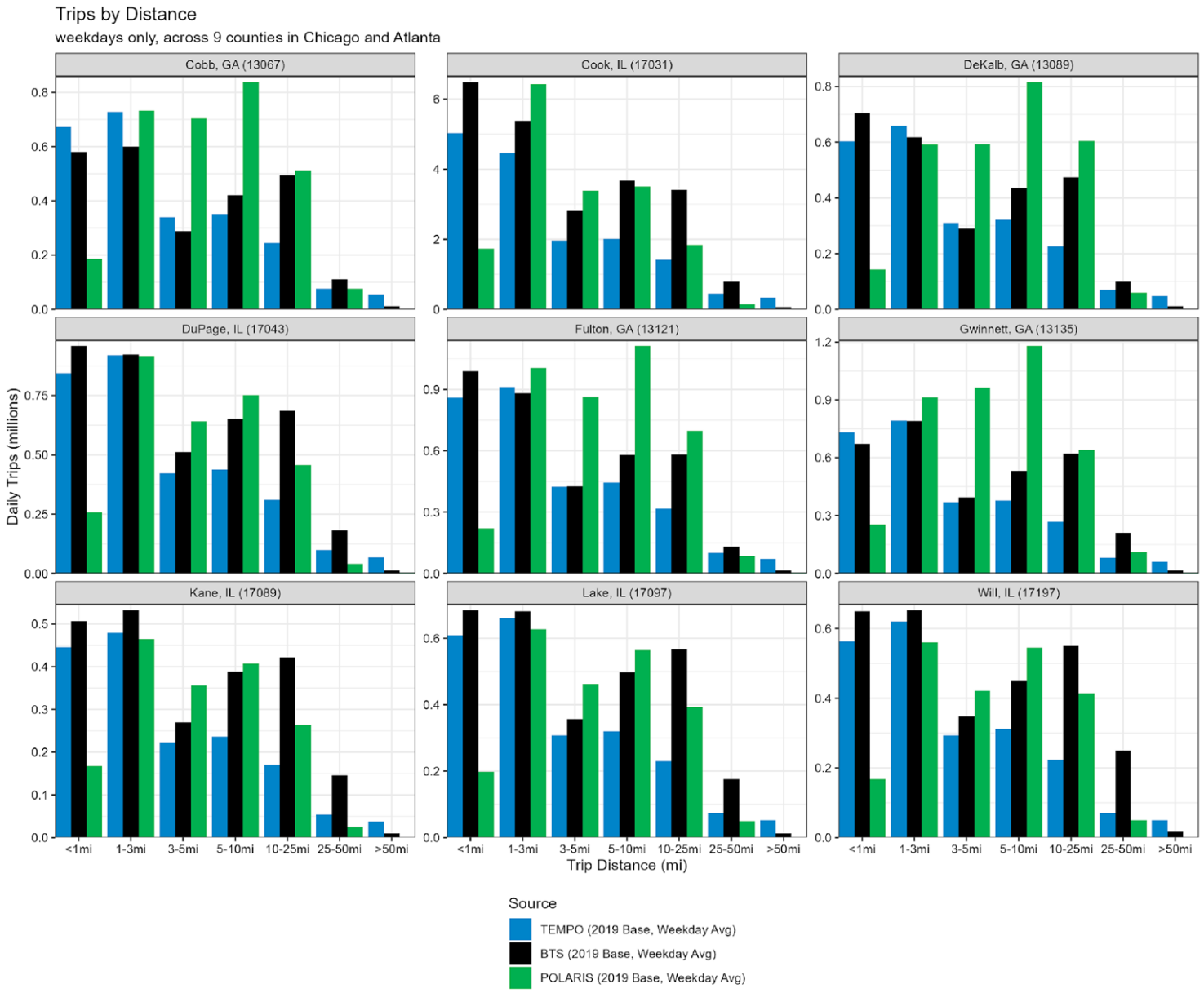
Transit Oriented Development Preliminary Scenario Design

- Previous transit focused scenarios from POLARIS in Chicago and Atlanta were chosen for testing of TEMPO alignment
- TOD defined as:
  - POLARIS: within 0.5 mi of rail station or 0.25 mi of BRT stop (right map)
  - Final TOD scenarios will likely assume more areas eligible for TOD growth (i.e., TAD – transit adjacent development)
- Current assumptions increase population in TOD zones 50% by 2050 (and decrease in all other zones proportionally to maintain forecast population).

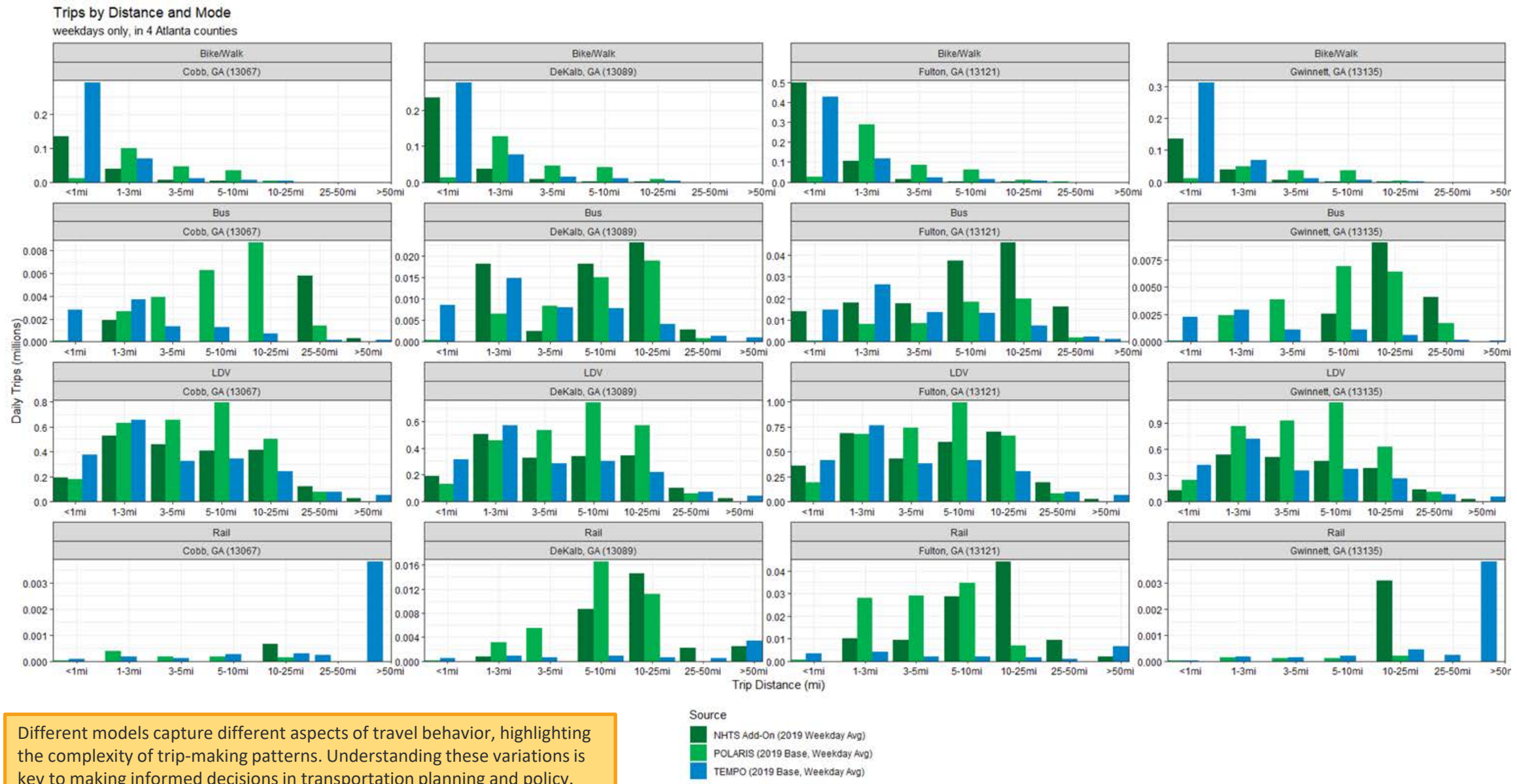


Progress: Insights from Preliminary Model Comparison & Validation

- The best alignment in total trip demand across modeled GA and IL counties is for 1-3 mile distances. This is the most crucial bin for transit demand.
- Explaining and/or adjusting <1 mile trips will be crucial.
- Both models are capturing county-level heterogeneity, but some discrepancies in overall travel demand will need to be explained.

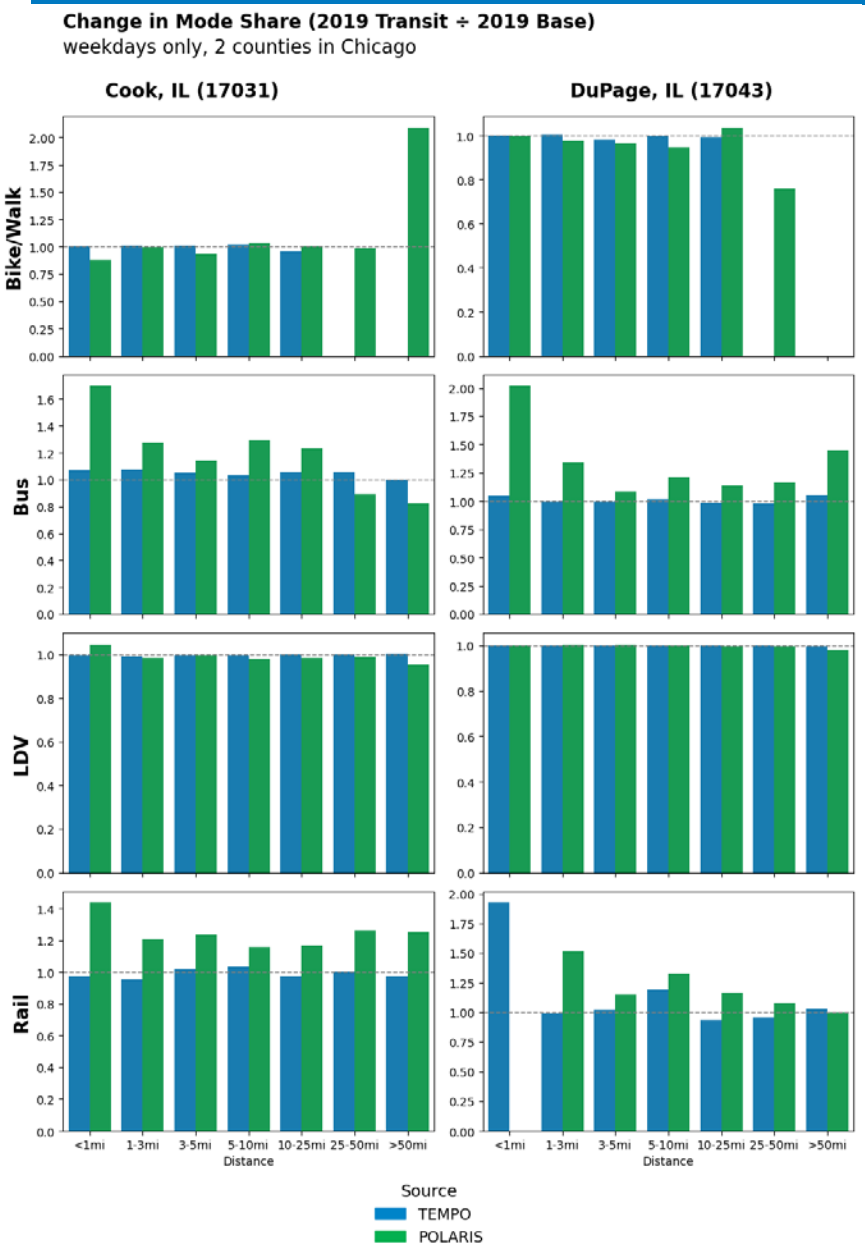


Progress: Insights from Preliminary Model Comparison & Validation



Different models capture different aspects of travel behavior, highlighting the complexity of trip-making patterns. Understanding these variations is key to making informed decisions in transportation planning and policy.

Progress: Insights from Preliminary Model Comparison & Validation



- For the **short distance travel** of <1 mile, POLARIS simulates less trips. This is in-part due to not simulating very short local trips in exurban or outer lying counties for a region.
- For **mid-range travel** range of 5-10 miles, and 10-25 miles, TEMPO has lower share of trips than POLARIS and BTS
- For **long-distance travel** (>50 miles), TEMPO estimate significantly higher VMT compared to POLARIS. However, both models are primarily focused on urban daily travel, so long-distance trends are less important for alignment.
- To recalibrate baseline VMT and trip estimates between TEMPO, POLARIS, and BTS, focus on counties with over 50% of tracts in the densest downtown city center neighborhoods (microtype 1) in **Geotype A** and **Geotype F** regions.

Collaboration and Coordination

The project is a multi-lab collaboration (NREL, ANL, LBNL). Additionally, the **project steering committee** guides model development and application and consists of members from **government organizations, industry, research institutions, and academia.**

Project Steering Committee (SC) members:

- Mona Asudegi, USDOT Office of Transportation Policy
- Liya Rechtman; USDOT Office of the Secretary-Policy
- Tina Hodges, USDOT, Office of the Secretary-Policy
- Gretchen Goldman, USDOT Climate Change Research Director
- Aaron Hula, US EPA, Office of Transportation & Air Quality
- Chris McCahill, Managing Director of SSTI / U of Wisconsin
- David Straus, Exec Director, ACT
- Andy Keeton, VP Global Strategy at Commutifi
- Jessica Alba, Stanford
- Amanda Pietz, Oregon DOT
- Thomas Joyce, Colorado DOT
- Madeleine Parker, HUD
- Michael Criag, HUD
- Natalie Covill-Fontaine, FTA

Steering Committee expertise covers interest in

- Land Use / Planning (HUD, DOT)
- Transport & Emissions (EPA, DOT)
- Traditional TDM & commuting (ACT, Commutifi)
- Transit (FTA)
- State DOTs (ODOT, CDOT, SSTI outreach)

*SSTI = State Smart Transportation Initiative; ACT = Association of Commuter Transporation; ODOT = Oregon DOT; CDOT = Colorado DOT.

Collaboration: USDOT Partnership

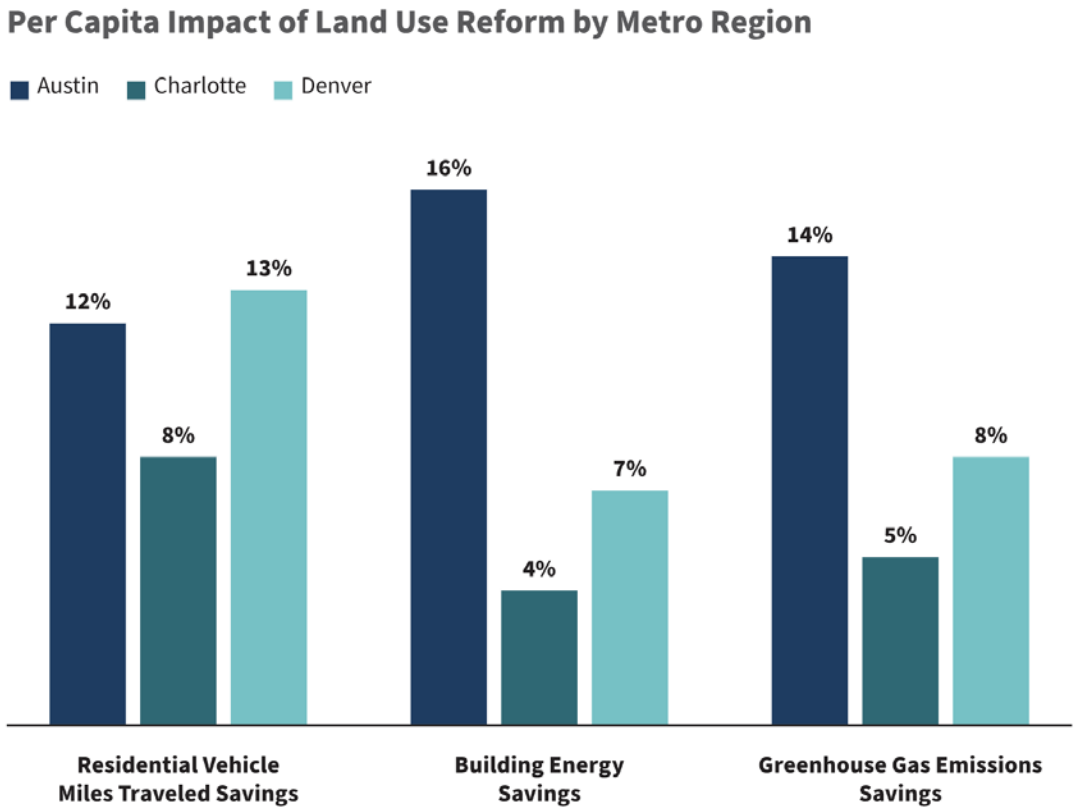
We are also collaborating with the USDOT to extend scenarios to consider transportation planning and land use scenarios to support travel demand management.

Some key studies the project and DOT team is reviewing:

- **Austin (Project Connect)**:
  Mixed-use buildings up to 90 ft along transit corridors could reduce per capita VMT by **34%** within city limits and **15% regionally** by 2045.
- **Denver (Transit-Oriented Development)**:
  Focus on TOD and infill development along light rail and bus networks.
  Upzoning West Colfax Ave could create **24,500 new housing units** near 5 light-rail stations.
- **Arlington County, VA**: Transit-oriented policies led to a **30% reduction in VMT** from 1980-2005 and **47% of commutes** now use transit or active transportation.

Key Takeaways:

- **VMT Reduction**: Strategic land use reforms drive major reductions in vehicle miles traveled.
- **Sustainable Growth**: TOD and mixed-use zoning promote efficient and affordable urban travel in growing regions.



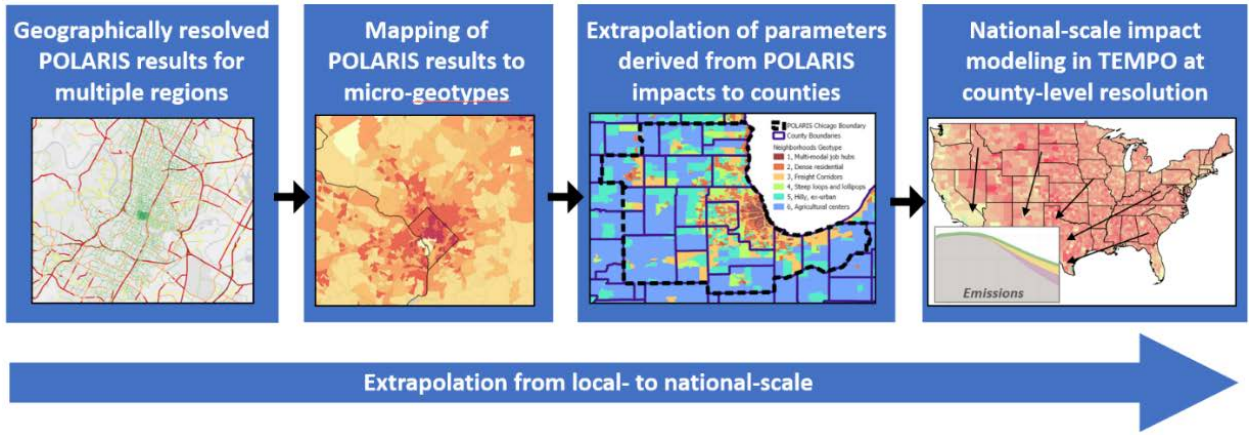
Source: RMI Report on Urban Land Use Reform

Any proposed future work is subject to change based on funding levels

Proposed Future Research

FY 2025 Q3 & Q4

- Running final TOD scenarios in all three regions (adding Austin + refinements)
- Ongoing validation across models
- TEMPO US-wide county input pipelines finalized
- Demonstrating initial MEP integration in existing POLARIS regions



FY 2026 (final year)

- TEMPO scaling to all US counties
  - Baseline scenarios first + validation
  - Scaling and exploring convience scenarios across all counties
- Mobility Energy Productivity integration
  - Modeling outcomes will inform MEP energy-efficient access calculations (e.g., improved transit service impacts)
- Dashboard development
  - Shiny platform, interactive visuals
  - Summary results from POLARIS (3 regions) will be included as well as county-level results for TEMPO and MEP

Any proposed future work is subject to change based on funding levels

Thank You

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