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SCAG

Transportation Data Analysis Technical Assistance Program

JULY 2026

Understanding Commute Patterns to Support Rideshare Programs

San Bernardino County Transportation Authority

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Transportation Data Analysis Technical Assistance Program Overview

The SCAG Transportation Data Analysis Technical Assistance (TA) Program was established to advance the use of emerging transportation data platforms in local and regional planning practice. The program operates under SCAG's Regional Pilot Initiatives Program, which carries out demonstrations of next generation technologies to guide the Southern California region toward a more sustainable region. The TA Program demonstrates how public agencies can utilize big data analytics to address complex transportation planning questions that support regional sustainability goals aimed at reducing transportation-related carbon reduction emissions.

To support this effort, SCAG procured a regional subscription to StreetLight Insight®, providing data access at no cost to local agencies through June 2026. This subscription enables access to multimodal origin-destination data, safety analytics, truck telematics data, near real-time speed data, transportation network company activity data, and integrated transportation network tools. This subscription enables public agency staff and regional stakeholders to analyze local and regional travel behavior patterns using big data analytics to inform decisions that reduce emissions, improve multimodal access and connectivity, mitigate safety risk, and ensure equitable access to the broader transportation system. The key objectives of the TA Program include:

- Encourage a culture of data-driven decision-making across the region.
- Bridge traditional and emerging planning approaches, integrating big data with established planning tools and policy frameworks.
- Appropriately scope and right size complex transportation research questions for big data analysis.
- Empower local partners through technical guidance, hands-on analytical support, and expanded access to advanced mobility datasets.
- Promote cross-platform validation, encouraging comparison between big data sources and traditional datasets to enhance data literacy and analytical reliability.
- Document best practices for leveraging big data in transportation planning and public sector decision-making.
- Equitably deliver data access and technical guidance, prioritizing capacity building among smaller and underserved jurisdictions.

SCAG solicited research questions from public agencies through a request for questions process. Selected case studies demonstrate practical applications of mobility analytics to address transportation safety, congestion, transit performance, demand management, and land use impacts on transportation.

Case Study Overview

San Bernardino County Transportation Authority (SBCTA) staff sought analytical support from the SCAG Transportation Data Analysis Technical Assistance (TA) Program to strengthen the effectiveness of Inland Empire (IE) Commuter Program's targeted marketing and identified the following primary question through initial discussions:

- **Case Study Research Question**: What is the rate of commute carpooling across selected congested segments, and how do trip attributes, traveler characteristics, and geographic factors vary among commuters?

Planning Context and Need

The IE Commuter Program is a regional rideshare and commuter support initiative jointly operated by the SBCTA and the Riverside County Transportation Commission, serving the Inland Empire region of Southern California, including San Bernardino and Riverside counties. The program promotes alternatives to solo driving—such as carpooling, vanpooling, public transit (including Metrolink), telework, biking, and walking—to address the region's long commute distances while reducing congestion, improving air quality, and lowering greenhouse gas emissions. Program participants may receive incentives such as $5 per day for new rideshare users, a "guaranteed ride home" benefit, and time-limited promotions, including up to 90 days of free Metrolink rides for eligible commuters. In addition, the program provides employer-facing services, including rideshare program support and assistance with compliance under South Coast Air Quality Management District Rule 2202 : On-Road Motor Vehicle Mitigation Options.

One of the primary goals of the program is to target users of highly congested corridors and encourage a shift toward carpooling. In support of these outreach and marketing efforts, this study applies big data analytics to key congested links within the program area to better understand user characteristics, trip attributes, and the spatial patterns of commute trips.

Analysis Framework

To address the proposed question by identifying travel segments, population groups, and geographic areas where carpooling potential is highest, the following study methodology was employed.

1. **Define Key Corridors:** Corridors were defined by SBCTA staff, with a focus on congested locations with high potential impact for shared-ride mode shifts. The analysis centers on the I-10/I-15 interchange, one of the most congested locations in the Inland Empire (Figure 1).
2. **Examine Travel Characteristics:** Traveler attributes, traffic characteristics, and carpooling rates along each selected link were examined using trip-level and person-level summaries. Origin-destination (OD) patterns for commute trips were also analyzed and visualized in maps to identify likely home and work locations associated with these movements.

While this study focuses on these two key ramps at a single interchange, this methodology can be applied by IE Commuter Program staff to other corridors and locations throughout the region.

Figure 1. Study Region (San Bernardino County and Riverside County) Highlighting the Key Study Interchange (I-10/I-15)

Role of Big Data

This study explored the capabilities of two big data platforms—StreetLight and Replica—in determining the most appropriate dataset for this case study.

StreetLight Data is a transportation big data platform that uses anonymized location and connected device data to measure travel volumes, traffic conditions, OD patterns, and route usage across roadway and multimodal networks. The platform enables analysis of where trips originate and end, how travel varies by day type and time of day, and which corridors or geographic areas generate the highest levels of activity, without reliance on traditional household surveys or fixed traffic sensors. Key StreetLight outputs include aggregated OD matrices, select-link analyses, and system-level trip metrics. These outputs are particularly useful for understanding overall mobility patterns, relative demand levels, and network-wide travel flows. However, person-level attributes or detailed passenger travel measures for transit trips or carpooling behavior is not available.

Replica is a synthetic population–based mobility modeling platform that simulates travel behavior across modes by combining anonymized location data with land use, demographic information, and regional calibration to observed travel conditions at the person-level. Replica produces OD trip tables with explicit mode attribution, including auto (with drivers and passengers reported separately), transit, walk, bike, and other travel modes. Importantly for this study, Replica allows users to analyze trips by specific mode (e.g.,

auto driver versus auto passenger), personal attributes, and home or work geography (such as census tract or ZIP code). Additionally, Replica features a "Primary Mode" variable for each person trip that distinguishes between auto driver ("Private Auto") and auto passenger trips. While this classification does not directly measure carpooling rates at the vehicle travel level, it provides a reasonable proxy for identifying shared-ride auto travel. Collectively, these features provide the capabilities needed to support SBCTA's commuter analyses.

It should be noted that the variable "Primary Mode" reported on specific roadway links within the Replica platform can vary substantially and, in some cases, exhibit unexpected patterns. As a result, it is recommended that link-level carpooling estimates derived from Replica be interpreted with caution and, where feasible, verified against independent ground truth data sources. Overall, although these big data platforms offer a wide range of datasets, their accuracy has not been formally evaluated against ground-truth data as part of this effort.

Accordingly, this study does not claim complete accuracy of the underlying data. Instead, it demonstrates how big transportation data can be leveraged to address the central research questions. Further validation against traditional data sources is strongly recommended to support interpretation and future application of the results.

Methodology

This study used **Replica Spring 2025 seasonal data** to analyze **weekday** travel patterns. The spring season was selected to reflect representative, non-holiday weekday conditions and typical commuting behavior. All analyses were limited to weekday travel to maintain consistency with standard work-trip patterns. Using StreetLight and Google traffic speed and delay data, two consistently congested routes were identified: **I-10 westbound to I-15 southbound** and **I-10 eastbound to I-15 northbound**. These two ramps are shown in dark red in Figure 2. A **Select Link Analysis** was conducted within the Replica platform to identify trips using two key freeway movement paths:

- I-10 Westbound to I-15 Southbound (Replica link ID: 15237441146798961099)
- I-10 Eastbound to I-15 Northbound (Replica link ID: 12627421888114044487)

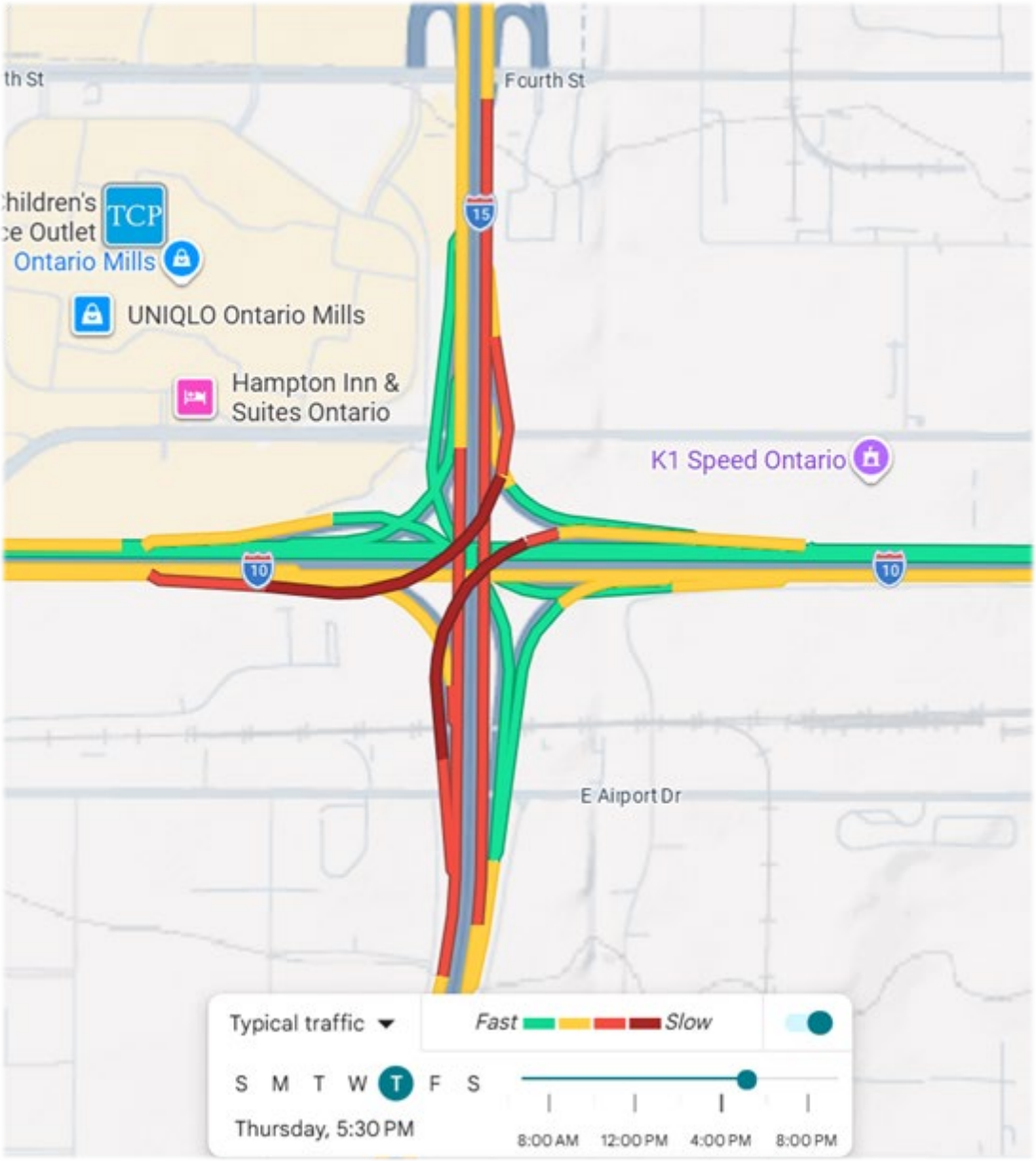
Trips included in the analysis were required to traverse the defined select-link paths, ensuring that all results reflect users of these specific freeway connections rather than broader regional travel. The analysis focused exclusively on **resident trips** and applied the following filters:

- **Trip type:** Home-based work (HBW) trips
- **Residency:** Residents within the study region

Trips were categorized as **"To Work"** or **"From Work"** based on trip purpose and directionality, allowing differences in commuting patterns to be examined separately. Both **home locations and work locations** were extracted and summarized at the census tract level. This spatial scale, recommended by San Bernardino County Transportation Authority staff, provides sufficient geographic detail to identify concentrations of travelers across the study region.

During the exploratory review, carpooling rates derived from "Primary Mode" variable differed substantially across roadway links, particularly when comparing between the links in a same interchange, resulting in unstable carpooling estimates. As a result, this study did not separate users by driver versus passenger status when summarizing home and work locations. Instead, all users of each select-link corridor were included collectively for the spatial analysis. This approach ensures more stable and interpretable results while still capturing the broader population using each freeway connection. Mode distinctions are presented separately in the trip attribute summaries but were not used to stratify home- or work-location mapping.

Figure 2. California I-10/I-15 Interchange: Color-Coded Traffic Conditions Around 5:00 PM on Thursdays (Source: Google Maps)



Results and Recommendations

This section summarizes the results of the Replica analysis for resident home-based work (HBW) trips using the two selected freeway connections, I-10 Westbound to I-15 Southbound and I-10 Eastbound to I-15 Northbound. Tabular results distinguish between to-work and from-work travel for each of the two study ramps, while spatial results present combined patterns across both directions to illustrate overall home and employment geographies associated with each ramp. All findings reflect aggregated weekday travel patterns from spring 2025.

Demographic Attributes

Table 1 presents person and household characteristics for travelers using each of the two study ramps, shown separately for to-work and from-work groups. It is assumed that individuals who use a given ramp on their way to work most probably won't use the same ramp on their way from work. Therefore, this analysis infers that to-work and from-work groups for each ramp represent different conditions. Across both links, the majority of travelers fall within the core working-age population. The size of the study sample across the four study groups is provided at the bottom of the table.

Household income distributions vary by corridor and direction. From-work trips on the WB-to-SB link are mostly made by higher-income households, while to-work trips cover a wider range of middle-income groups on the same link. Lower-income households make up a small proportion of users on both corridors. Compared to San Bernardino and Riverside counties specifically, where only 9 percent of households earn $200,00 or more, the study links have a much higher concentration of high-income commuters.

Primary household language shows a clearer distinction between corridors than between to-work vs. from-work trips. Across both ramps and directions (to-work and from-work), Spanish is the predominant language group, accounting for roughly half or more of commuters in most cases. The highest share of Spanish being the primary language for the commuters is observed for to-work trips on the I-10 WB to I-15 SB ramp, while English as the primary language for the commuters represents a substantial secondary group across all movements. In contrast, Spanish is the primary language of about 26 percent to 30 percent of the residents in the study area. English shares are generally higher for from-work trips than for to-work trips, particularly along the I-10 WB to I-15 SB movement. These patterns indicate that the two freeway connections serve distinct residential communities, which may be relevant when considering equity, outreach, or corridor-specific program design. Across both links, most travelers come from households with two or more vehicles, reflecting the auto-oriented nature of the corridors.

Trip Attributes

Table 2 summarizes trip characteristics for the same HBW trips. Private auto travel dominates across both corridors, though mode shares differ substantially between the two links. The WB to SB connection is largely characterized by auto-driver travel, while the EB to NB movement exhibits much higher auto-passenger shares. Given the observed variability in carpooling rates at the link level, mode distinctions are used here only to describe overall travel behavior and not for disaggregating spatial results. The size of the study sample across the four study groups is provided at the bottom of the table.

Trip length and travel time differ meaningfully between the two corridors. Trips using the WB to SB link tend to be longer and have greater travel durations, particularly for to-work travel, while EB to NB trips are generally shorter and more concentrated within moderate distance ranges. From-work trips show consistently longer travel times on both links, reflecting higher congestion levels during the afternoon and evening commute period. Start-time distributions follow expected commuting patterns, with to-work travel concentrated in the morning peak and from-work travel concentrated in the afternoon.

Spatial Patterns and Maps

The spatial patterns shown in figures 2 through 5 provide additional insight into the geographic context of these trips. Unlike the tables, the maps combine both to-work and from-work trips to show overall home and employment patterns associated with each freeway connection.

Home location map for the EB to NB corridor shows a relatively dispersed residential footprint toward north, with travelers originating from census tracts mostly located along the study corridors. In contrast, home locations for the WB to SB corridor are more dispersed to east and south from the freeway connection, indicating longer commute times.

Work location maps further distinguish between the two corridors. For EB to NB trips, work locations are more tightly clustered along north of the interchange, indicating a limited number of dominant employment centers served by this connection. WB to SB work locations, by contrast, are more geographically dispersed with multiple cluster points toward east and south of the interchange, suggesting a wider range of employment destinations. Shapefiles and high-resolution maps were created to assist with identifying commuters' household and work locations along the two study links.

Table 1. Person, and Household Attributes - I-10 WB to I-15 SB and I-10 EB to I-15 NB - Source: Replica

	I-10 WB to I-15 SB: From Work	I-10 WB to I-15 SB: To Work	I-10 EB to I-15 NB: From Work	I-10 EB to I-15 NB: To Work
Age				
Under 11	0.0%	0.0%	0.0%	0.0%
12-17	0.2%	0.3%	0.2%	0.3%
18-34	26.4%	**33.9%**	30.9%	33.0%
35-49	**36.8%**	33.3%	**38.1%**	**34.0%**
50-64	28.1%	25.6%	25.4%	24.9%
Over 65	8.5%	6.8%	5.3%	7.8%
Household Income				
$0-$15k	2.4%	3.0%	1.8%	3.4%
$15-$25k	1.1%	2.4%	2.3%	2.9%
$25k-$50k	6.7%	10.9%	10.0%	10.6%
$50k-$75k	11.6%	16.7%	11.6%	14.4%

	I-10 WB to I-15 SB: From Work	I-10 WB to I-15 SB: To Work	I-10 EB to I-15 NB: From Work	I-10 EB to I-15 NB: To Work
$75k-$100k	11.0%	16.0%	14.0%	14.1%
$100k-$150k	19.2%	**23.1%**	**23.5%**	**22.7%**
$150k-$200k	18.4%	13.2%	17.3%	14.4%
$200k+	**29.5%**	14.8%	19.4%	17.5%
Primary Household Language				
English	38.7%	28.8%	37.3%	30.4%
Spanish	**40.8%**	**63.5%**	**51.6%**	**54.9%**
Asian Pacific	14.2%	4.1%	7.4%	11.2%
Other	6.3%	3.6%	3.6%	3.5%
Household Vehicles				
0	0.7%	0.8%	0.8%	1.5%
1	10.8%	14.5%	11.6%	14.3%
2	32.9%	31.3%	33.1%	33.4%
3+	**54.8%**	**52.7%**	**54.3%**	**50.0%**

East-South: From Work – 4,149 trips from 3,885 trip takers

East-South: To Work – 6,516 trips from 6,168 trip takers

West-North: From Work – 7,407 trips from 6,970 trip takers

West-North: To Work – 4,018 trips from 3,844 trip takers

Table 2. Trip Attributes - I-10 WB to I-15 SB and I-10 EB to I-15 NB - Source: Replica

	I-10 WB to I-15 SB: From Work	I-10 WB to I-15 SB: To Work	I-10 EB to I-15 NB: From Work	I-10 EB to I-15 NB: To Work
Mode				
Private auto	**87.5%**	**81.8%**	35.5%	46.3%
Auto passenger	12.5%	18.2%	**64.5%**	**53.7%**
Distance (mi)				
Under 2	0.0%	0.0%	0.0%	0.0%
2-4	0.2%	0.0%	0.5%	0.1%
4-8	0.6%	0.9%	6.5%	2.7%
8-16	13.3%	13.5%	**32.2%**	24.8%

	I-10 WB to I-15 SB: From Work	I-10 WB to I-15 SB: To Work	I-10 EB to I-15 NB: From Work	I-10 EB to I-15 NB: To Work
16-32	**55.4%**	**34.9%**	31.0%	**40.9%**
32-64	22.6%	33.9%	22.6%	21.4%
64+	8.0%	16.8%	7.2%	10.0%
Duration (min)				
Under 5	0.0%	0.0%	0.0%	0.0%
5-10	0.4%	0.1%	0.7%	0.8%
10-20	8.7%	10.7%	17.2%	16.4%
20-40	**52.8%**	**36.9%**	**46.4%**	**50.3%**
40-80	30.2%	33.9%	25.5%	22.7%
80+	7.9%	18.4%	10.3%	9.8%
Purpose				
Work		100.0%	0.0%	100.0%
Home	74.1%		66.1%	
Shop	11.8%		15.8%	
Eat	6.0%		7.0%	
Other	8.2%		11.1%	
Start Time				
12am-6am	0.6%	19.4%	0.9%	10.6%
6am-10am	7.5%	**43.3%**	11.8%	**55.6%**
10am-2pm	24.0%	19.5%	28.9%	20.8%
2pm-6pm	**45.5%**	12.4%	**35.8%**	7.6%
6pm-12am	22.5%	5.4%	22.7%	5.4%

East-South: From Work – 4,149 trips from 3,885 trip takers

East-South: To Work – 6,516 trips from 6,168 trip takers

West-North: From Work – 7,407 trips from 6,970 trip takers

West-North: To Work – 4,018 trips from 3,844 trip takers

Figure 3. Home Locations of Home-Based Work Trips Using I-10 WB to I-15 SB

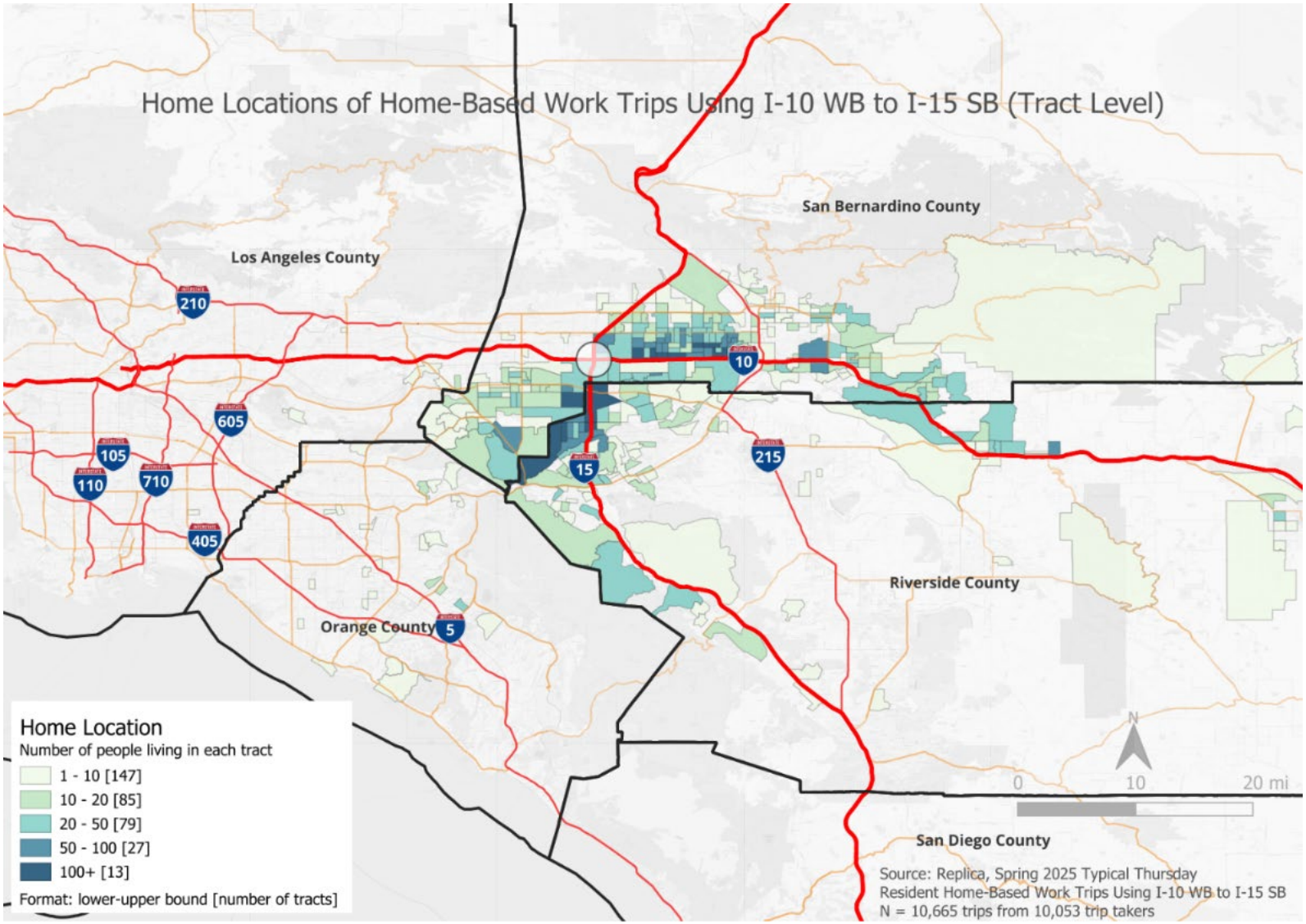


Figure 4. Work Locations of Home-Based Work Trips Using I-10 WB to I-15 SB

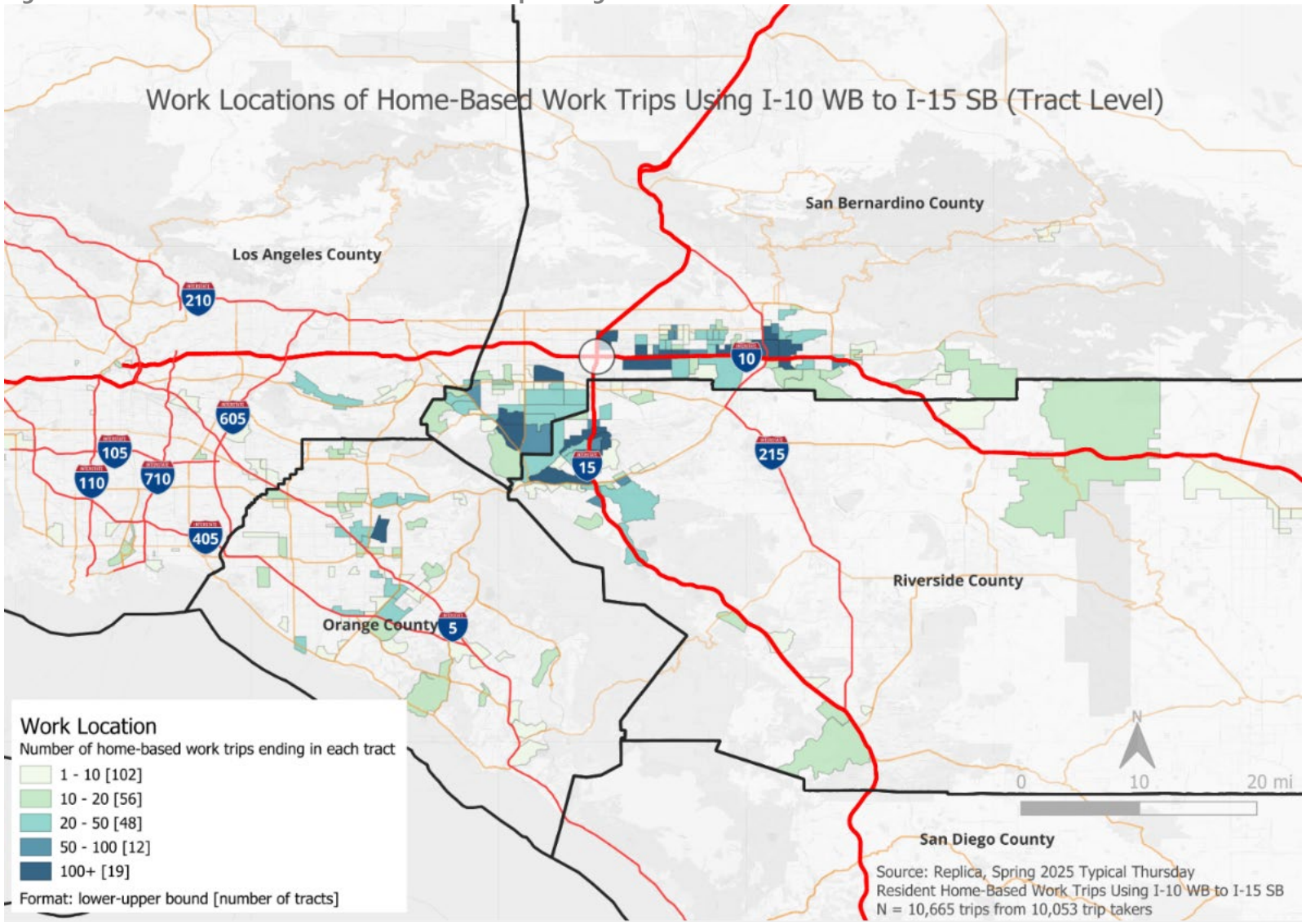


Figure 5. Home Locations of Home-Based Work Trips Using I-10 EB to I-15 NB

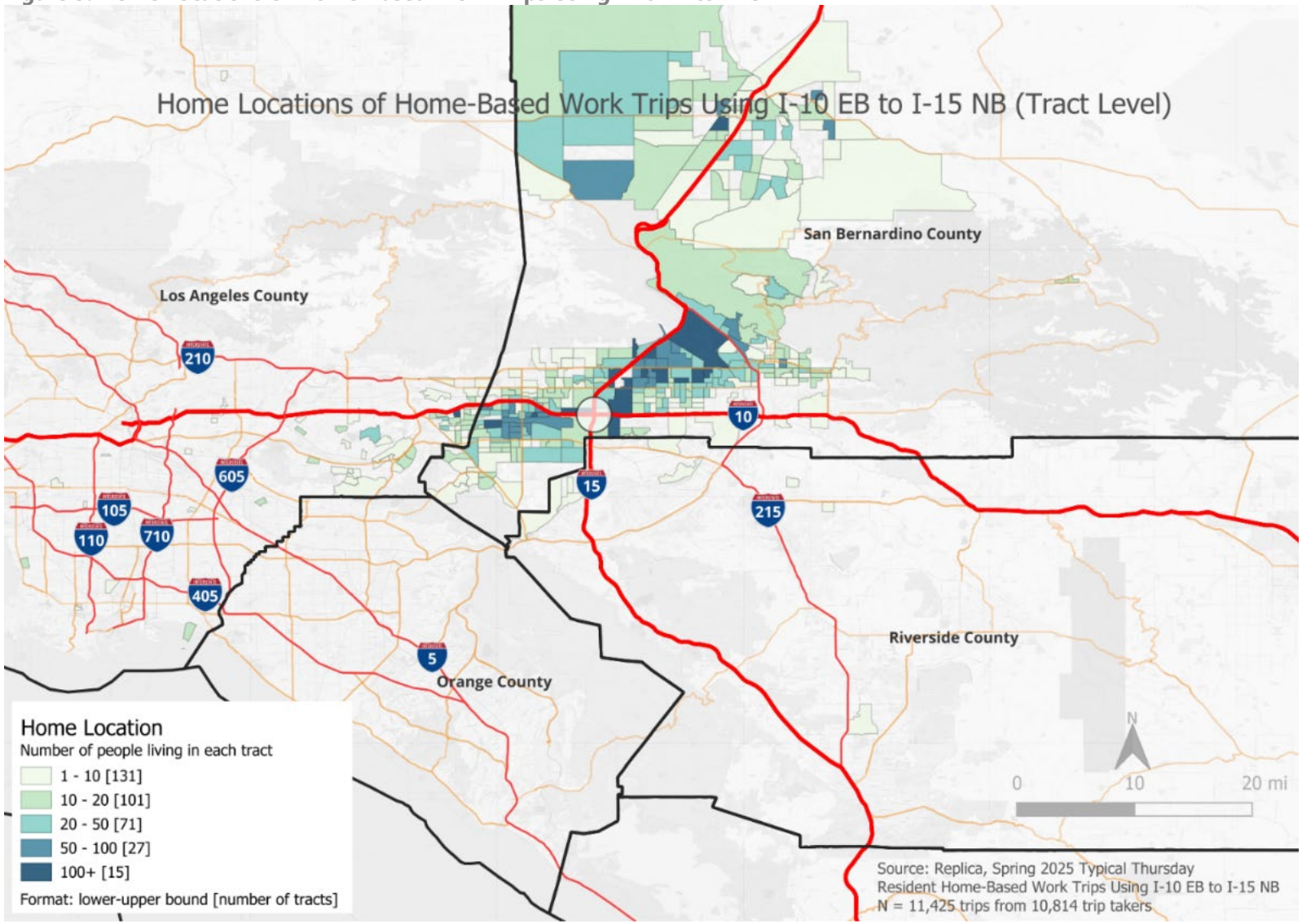
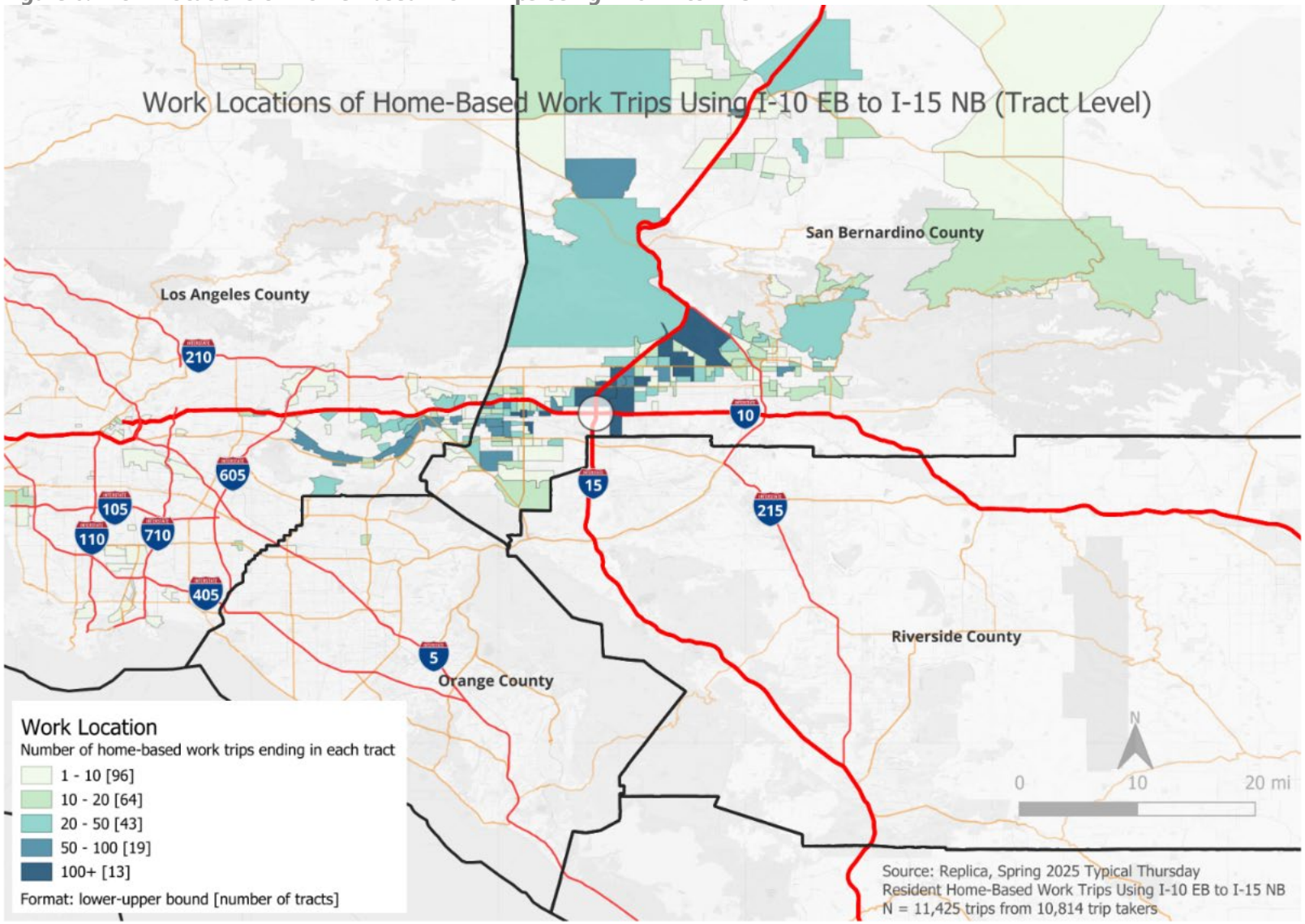


Figure 6. Work Locations of Home-Based Work Trips Using I-10 EB to I-15 NB



Key Takeaways

This study demonstrates how transportation big data can be used to understand commuter characteristics and commute spatial patterns along congested freeway corridors — I-10 westbound to I-15 southbound and I-10 eastbound to I-15 northbound. The primary objective of this study is to support the Inland Empire (IE) Commuter Program in San Bernardino County by serving as a case study that can be replicated for other congested corridors across the region. These findings can assist the IE Commuter Program with the development of marketing and communication strategies for potential participants. Based on this case study, the following recommendations for the IE Commuter Program are offered:

- **Prioritize corridor-based commuter strategies over mode-specific targeting.**
  The information from the studied big data sources is insufficient to draw reliable conclusions about carpooling activity at the corridor level. As a result, this analysis focuses on overall corridor users rather than distinguishing between carpoolers and solo drivers. To better understand the characteristics and geographic distribution of carpoolers, San Bernardino County Transportation Authority (SBCTA) may consider supplementing this analysis with additional data sources such as travel surveys, employer commute program data, or observational studies.
- **Use home and work location patterns to guide location-based planning and policy decision making and program design.**
  Differences in residential and employment catchments between the two corridors suggest opportunities for location-specific messaging, employer partnerships, and commute-based interventions that align with where corridor users are concentrated. Specifically, concentrations of work locations along each corridor indicate specific employment hubs where employer-based commuter programs may benefit the most from the rideshare matching. Aligning IE Commuter Program outreach with these clusters can improve program visibility and uptake among high-potential worker populations.
- **Incorporate language, income, and other community-specific outreach.**
  The high share of Spanish-speaking commuters across both corridors—particularly for to-work travel—suggests that outreach, marketing, and employer engagement materials may be more effective when tailored linguistically and culturally to corridor-specific commuter populations. Similarly, income is also an important variable considering the incentivized nature of the program. This insight can help prioritize translation, trusted community channels, and successful employer partnerships.
- **Establish a repeatable monitoring framework for high-congestion corridors using seasonal big-data snapshots.**
  Applying this methodology periodically (e.g., annually) can help SBCTA track shifts in commuter trends, and corridor use over time, supporting adaptive outreach strategies.
- **Pair big-data insights with selective ground-truth validation for program evaluation.**
  While big data platforms, such as Replica and StreetLight, offer scalable insights into corridor use and commuter patterns, targeted validation using employer surveys, commute benefit participation data, or localized counts can enhance confidence in the data evaluation.

Overall, this analysis demonstrates how big data can be effectively applied to identify where corridor users come from, where they work, and how far they travel along highly congested freeway connections such as the I-10/I-15 interchange. Within the context of the IE Commuter Program, the results provide a practical

foundation for developing more targeted, corridor-specific outreach strategies, employer partnerships, and program design decisions grounded in observed geographic and demographic patterns. At the same time, the study highlights important limitations—particularly the variability of link-level mode estimates—indicating that these data are more reliable for understanding travel patterns than for quantifying precise carpooling behavior. As such, the findings should be used to inform planning and decision-making while being supplemented with complementary data sources for validation when applying them to policy or program evaluation.

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