



Data-Driven Approach for Identifying Areas for Potential Public Transit Expansion In the San Diego Region

U.S. Census Local Employment Dynamics Partnership Workshop

Paige Pagaduan, Data Science Intern
Tim Garrett, Associate Regional Planner
Liang Tian, Ph.D., Principal Data Scientist
Wednesday, May 13, 2026

Agenda



Introduction



Research Objective



Data Sources



Methodology



Findings & Next Steps

About SANDAG

Metropolitan Planning Organization

- Federal Designation: Transportation funding – Regional Plan

Regional Transportation Planning Agency

- State Designation: Transportation funding – Regional Plan

Council of Governments

- State Designation: Regional Housing Needs Assessment (RHNA)

Consolidated Agency

- State Law: Plan and build transportation projects

Regional Transportation Commission

- TransNet Program: Oversight and funding



San Diego Region



3,315,362
total population



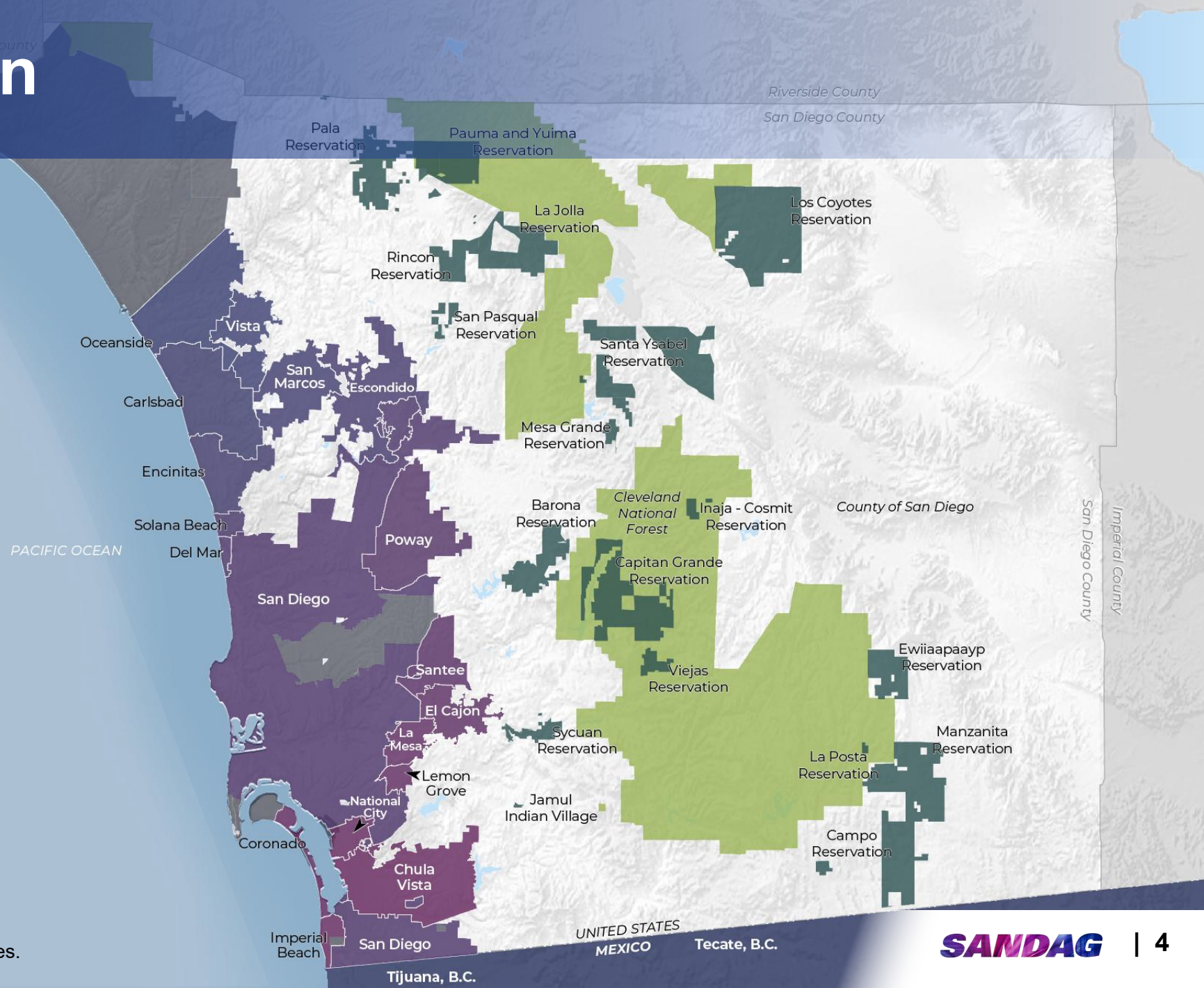
1,490,981
full-time and part-time jobs



1,255,169
housing units



\$106,083
median household income



Sources: SANDAG 2024 Population and Housing Estimates.

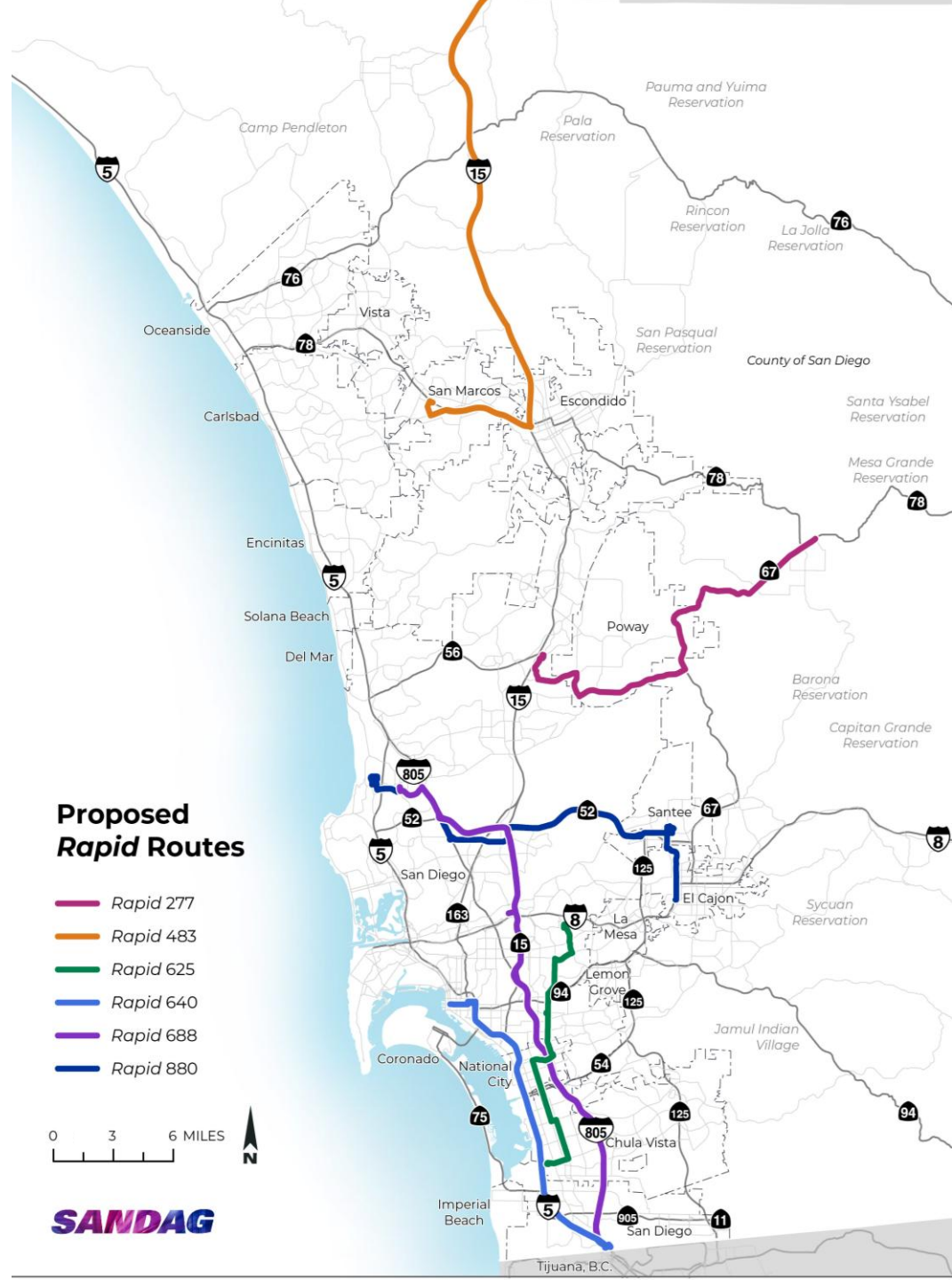
Regional Plan Key Components

- Transportation Projects
- Land Use & Housing
- Environment & Habitat Preservation
- Supportive Policies & Programs
- Financial Strategy
- Title VI
- Performance Measures



Proposed Rapid Routes with Current Funding

- \$26.6 million budgeted in October 2023 for planning and design of six Rapid Routes
- Work includes alternatives analysis, conceptual design, cost estimates and phasing, public outreach



Research Objective

- Investigate **transportation trends** to and from the workplace in different communities across San Diego County
- Discover gaps in **public transportation**
- Identify communities with the **highest opportunities** for public transportation infrastructure
- Further **prioritize** proposed Rapid Routes implementation

Data Sources

Commute and Geographic Data

Commute Pattern

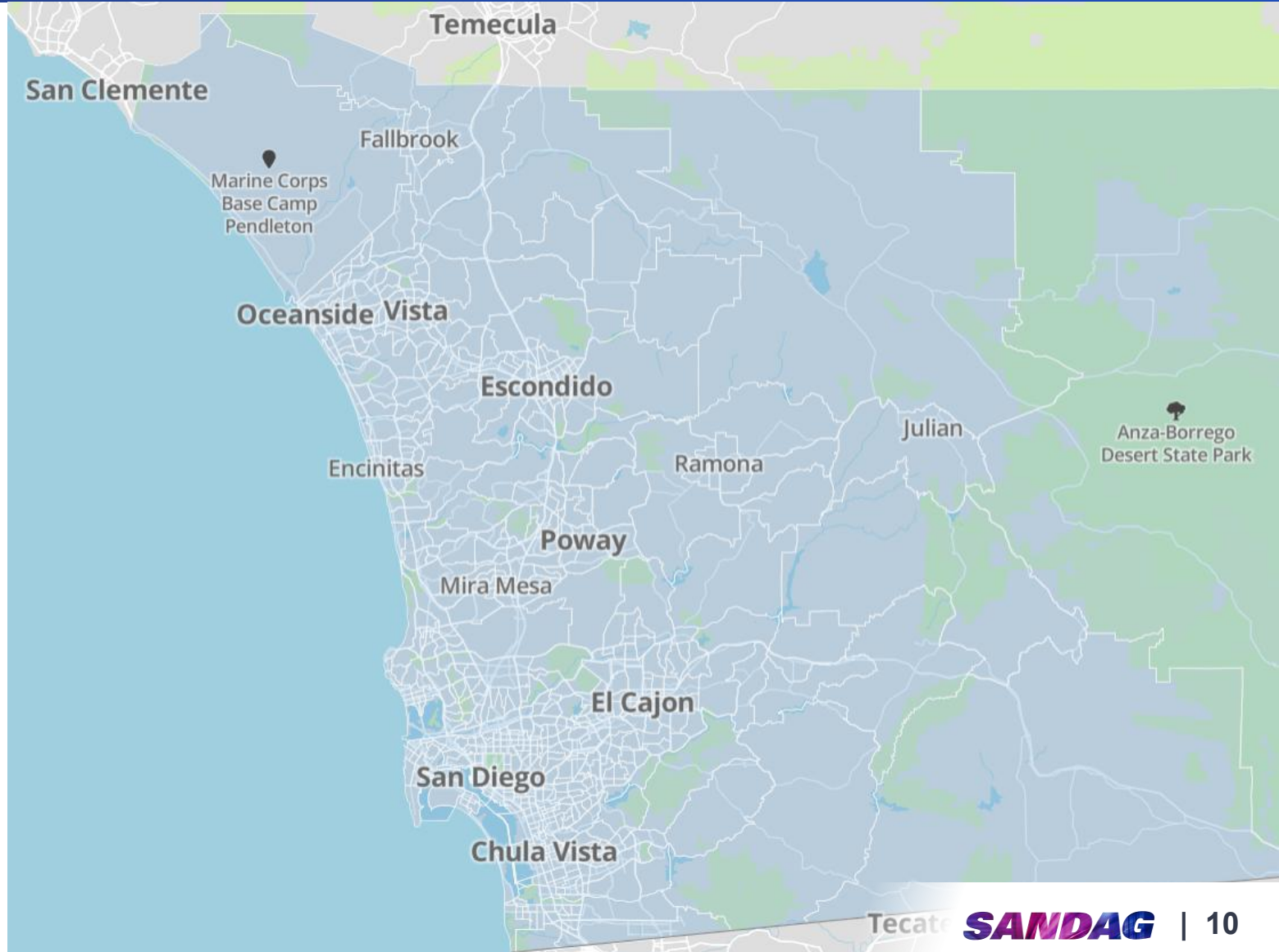
- U.S. Census Bureau, “ca_od_main_JT03_2023,” LEHD Origin-Destination Employment Statistics, 8.3, <https://lehd.ces.census.gov/data/lodes>, accessed on February 24, 2026.

Means of Transportation

- SANDAG ABM 3 Scenario Results
 - Mode Choice
 - Automobile Ownership

Census Tract

- U.S. Census Bureau, TIGER/Line Shapefiles (California)



Demographic and Employment Data

Household Income

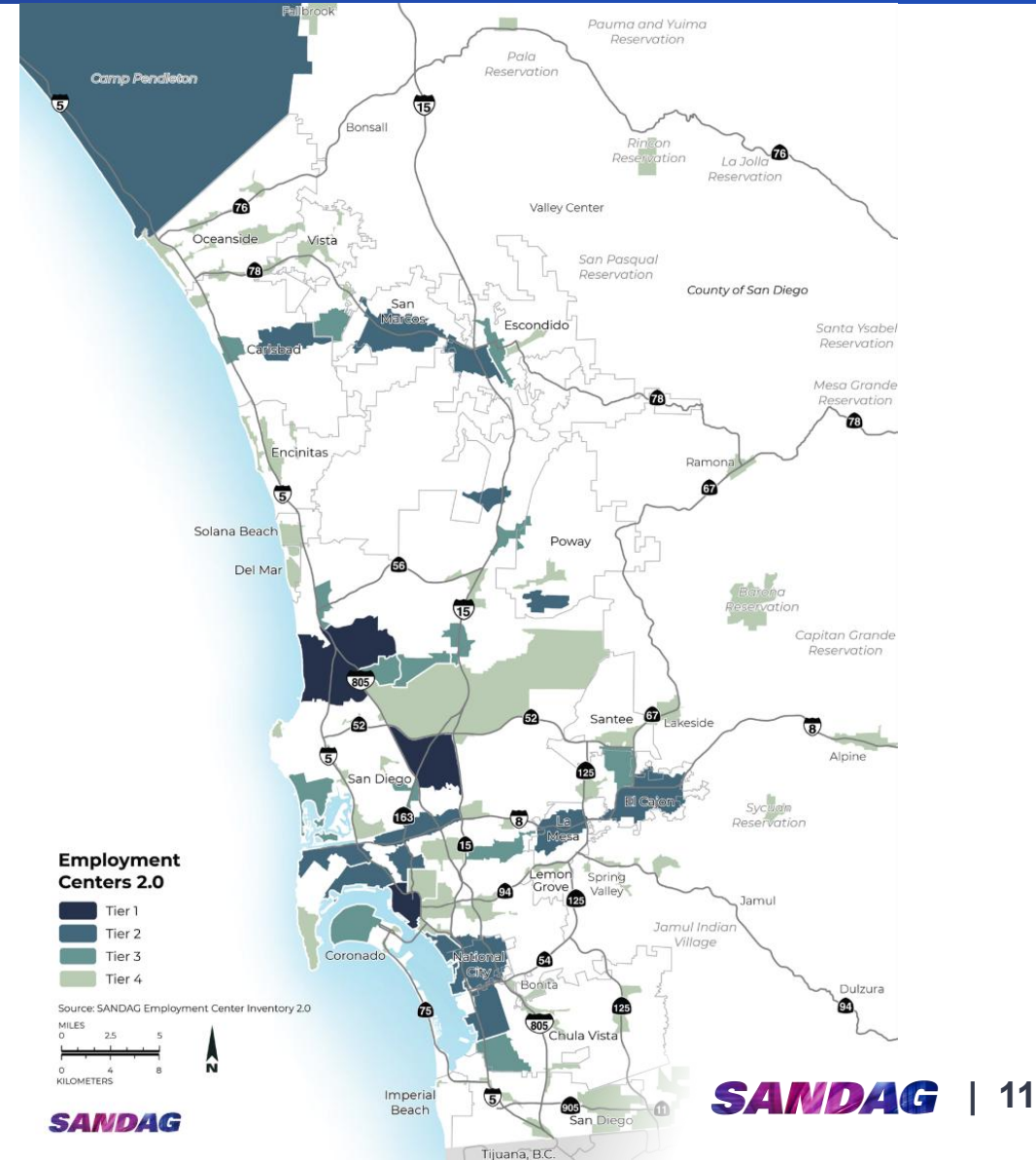
- SANDAG Population and Housing Estimates v24

Population

- SANDAG Population and Housing Estimates v24

Employment

- SANDAG Employment Centers v2.0



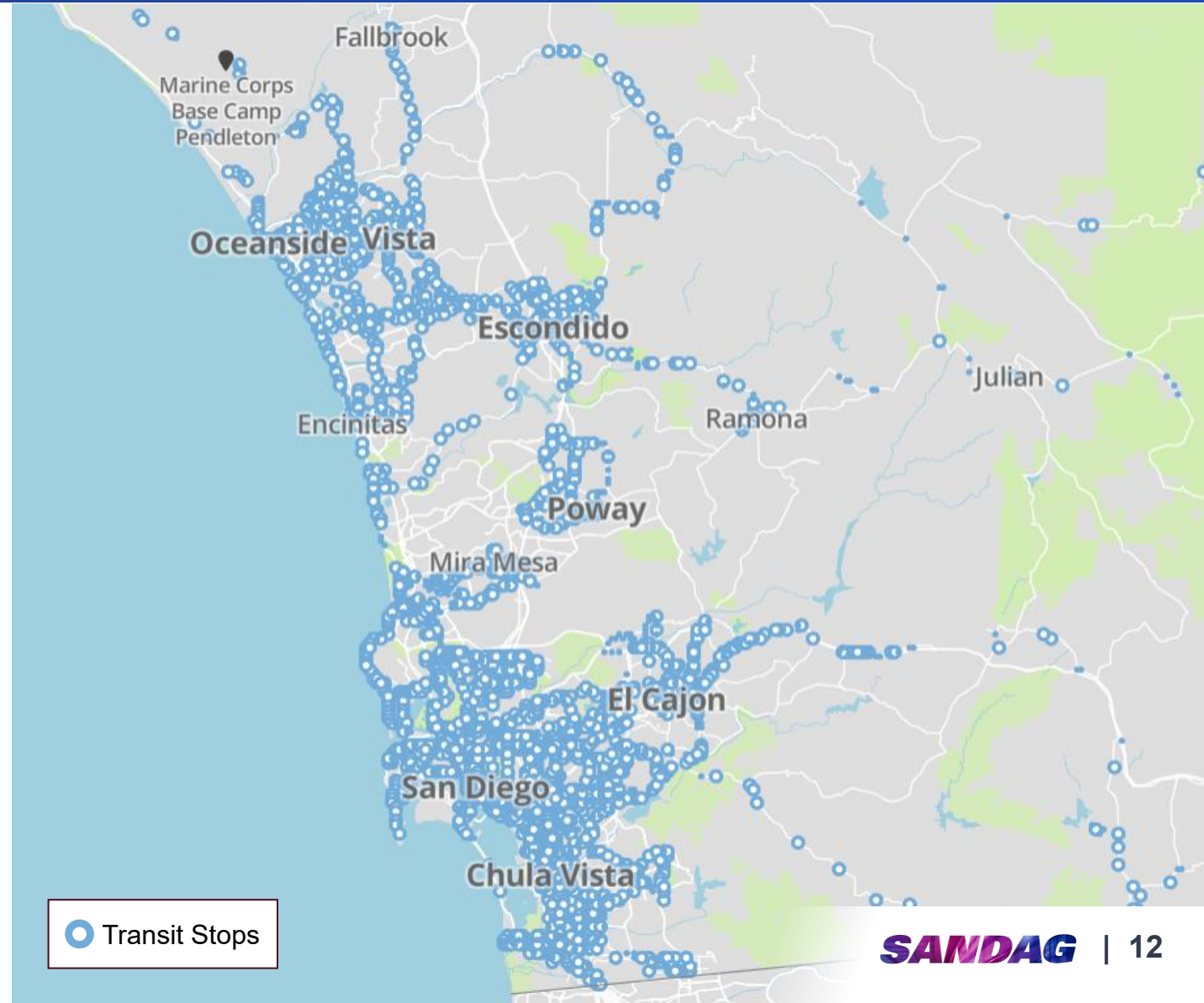
Transportation Infrastructure

Public Transportation Stops

- SANDAG Regional GIS Data Warehouse (Transit Stops) 2026

Rapid Transit Lines

- SANDAG 2025 Regional Plan



The background of the slide is a semi-transparent image of a woman wearing a hijab and glasses, holding a laptop. She is looking towards the right. In the background, another person is visible sitting at a desk. The overall color scheme is a gradient of purple and pink.

Methodology and Research Findings

Methodology

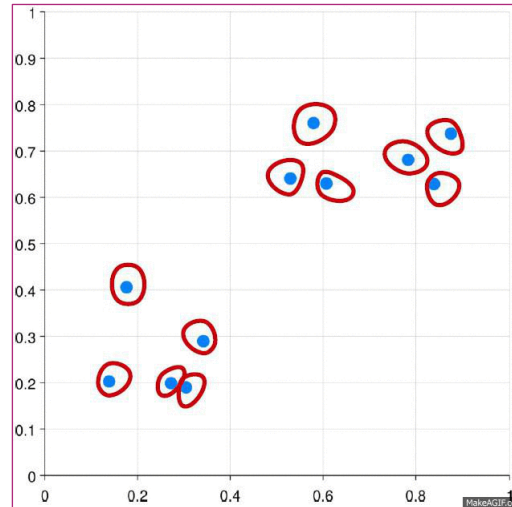
Data Processing

- *Filter data*
- *Validate geography*

Metric Calculation

- *Transit Service Opportunity*
- *Low-income Households*
- *Transportation Modality*
- *Population Density*

Geospatial Clustering



Route Analysis & Scoring

- *Obtain intersecting clusters*
- *Take average of cluster scores*

Identified Priority Routes

Metric Calculation

TRANSIT SERVICE OPPORTUNITY

SANDAG Transit Stops
+
LODES 8.0
+
SANDAG Employment Centers 2.0

LOW-INCOME HOUSEHOLDS

SANDAG v24 Population and Housing Estimates

TRANSPORTATION MODALITY

SANDAG ABM 3 Scenario Results: Mode Choice
+
SANDAG ABM 3 Scenario Results: Automobile Ownership

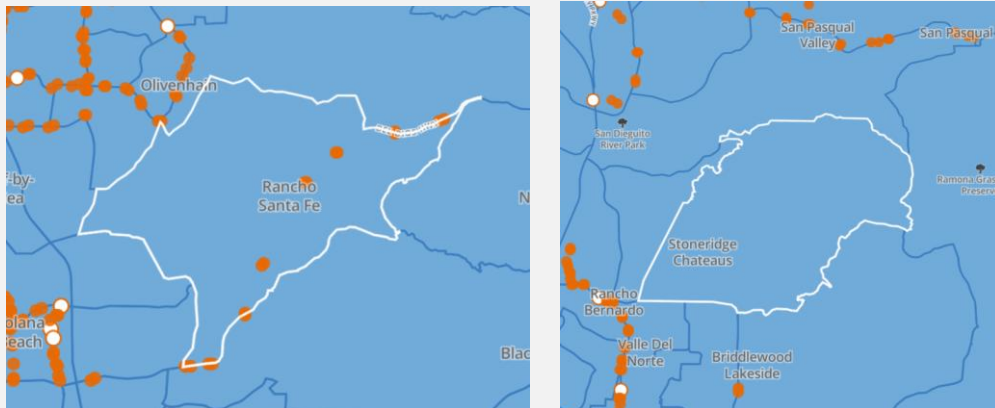
POPULATION DENSITY

SANDAG v24 Population and Housing Estimates

Metric Calculation – Transit Service Opportunity

Transit Stop Preprocessing

Transit Tracts
Census tracts containing transit stops

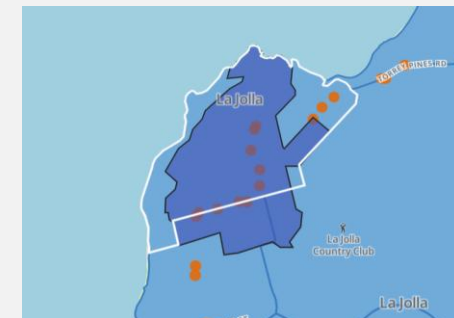


Origin & Destination Analysis

Calculate public transit gap for origin and destination tracts

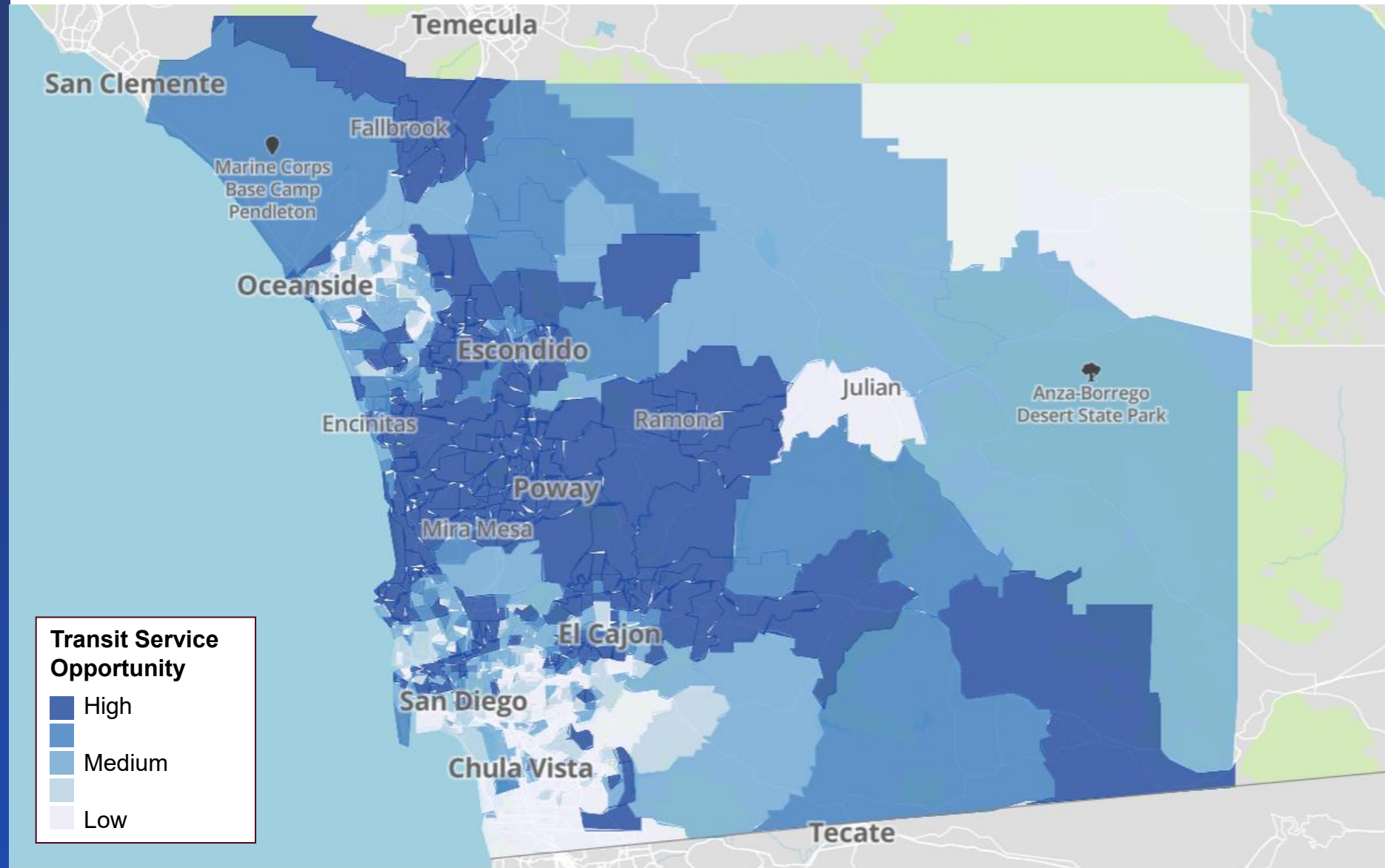
$$1 - \frac{\sum \text{trips from origin tract to transit tracts}}{\sum \text{trips from origin tract to all tracts}}$$

For destination only: apply weight by intersecting SANDAG Employment Center tier level



Transit Service Opportunity

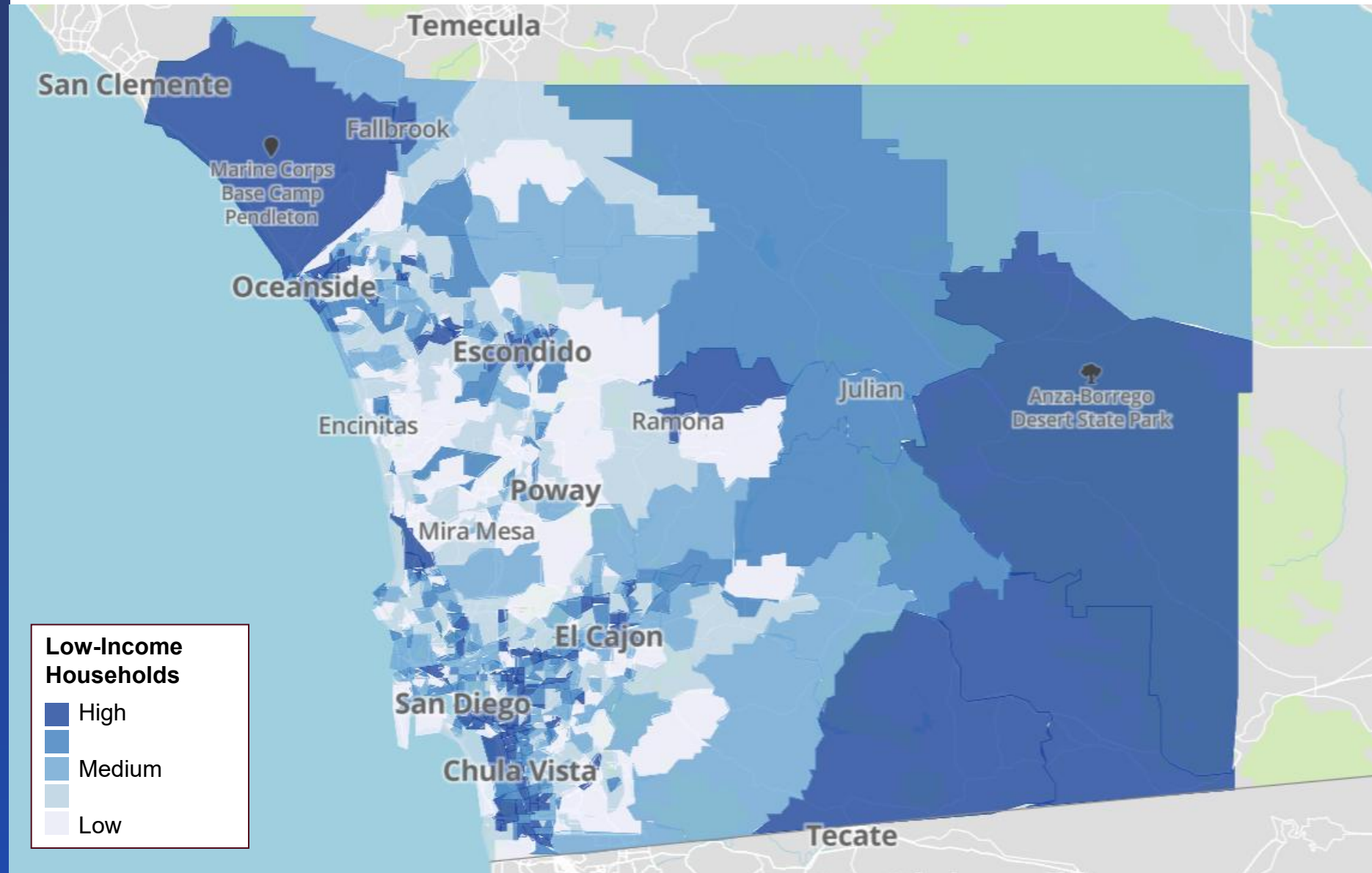
- Higher need in the center of the region
 - Tier 1 Employment Centers – Sorrento Valley and Kearny Mesa
- Less need in areas already served by public transit – Downtown San Diego and Chula Vista



Data: SANDAG Transit Stops;
U.S. Census Bureau, "ca_od_main_JT03_2023," LEHD Origin-Destination Employment Statistics, 8.3,
<https://lehd.ces.census.gov/data/lodes>, accessed on February 24, 2026; SANDAG Employment Centers 2.0

Low-Income Households

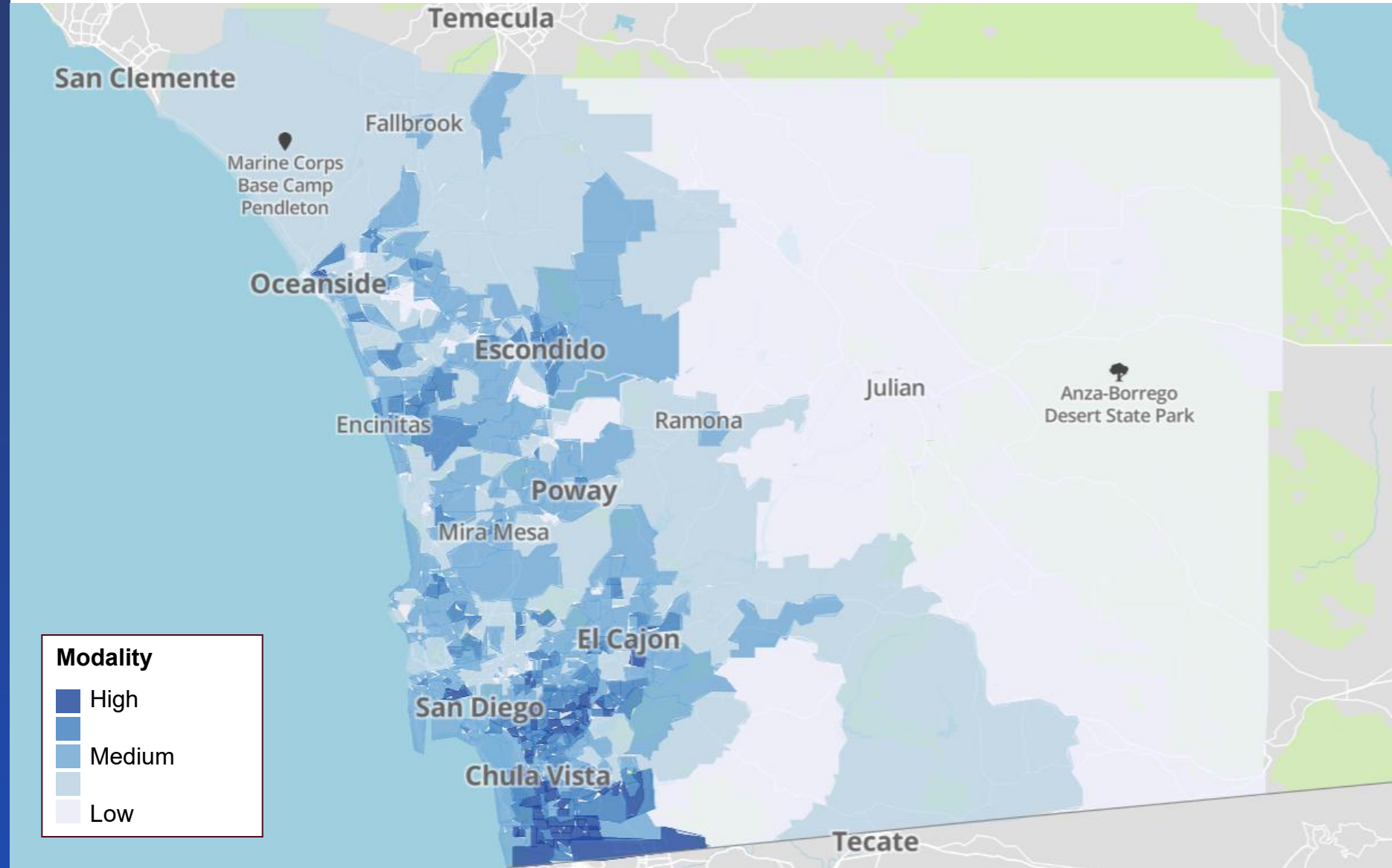
- Higher proportion of low-income households – Oceanside, Escondido, El Cajon, National City, and Chula Vista



Notes: Low-income communities are identified by the percentage of households earning \$44,999 or less annually. Sparse population density and vast land area likely contribute to the higher proportion of low-income households in the desert area.
Source: SANDAG v24 Population & Housing Estimates

Transportation Modality

- High public transit usage in the more urbanized part of the region – El Cajon, Downtown San Diego, and Chula Vista



Note: Mode choices analyzed include transit and carpool
Data: SANDAG ABM 3 Scenario Results – Mode Choice and Automobile Ownership

Population Density

- Higher population density areas have high housing density – Oceanside, Escondido, El Cajon, Downtown San Diego, Chula Vista, and some coastal areas



Geospatial Clustering Prototype

- 20 clusters generated
- Higher transit propensity in Oceanside, Escondido, Central San Diego, El Cajon, and Chula Vista

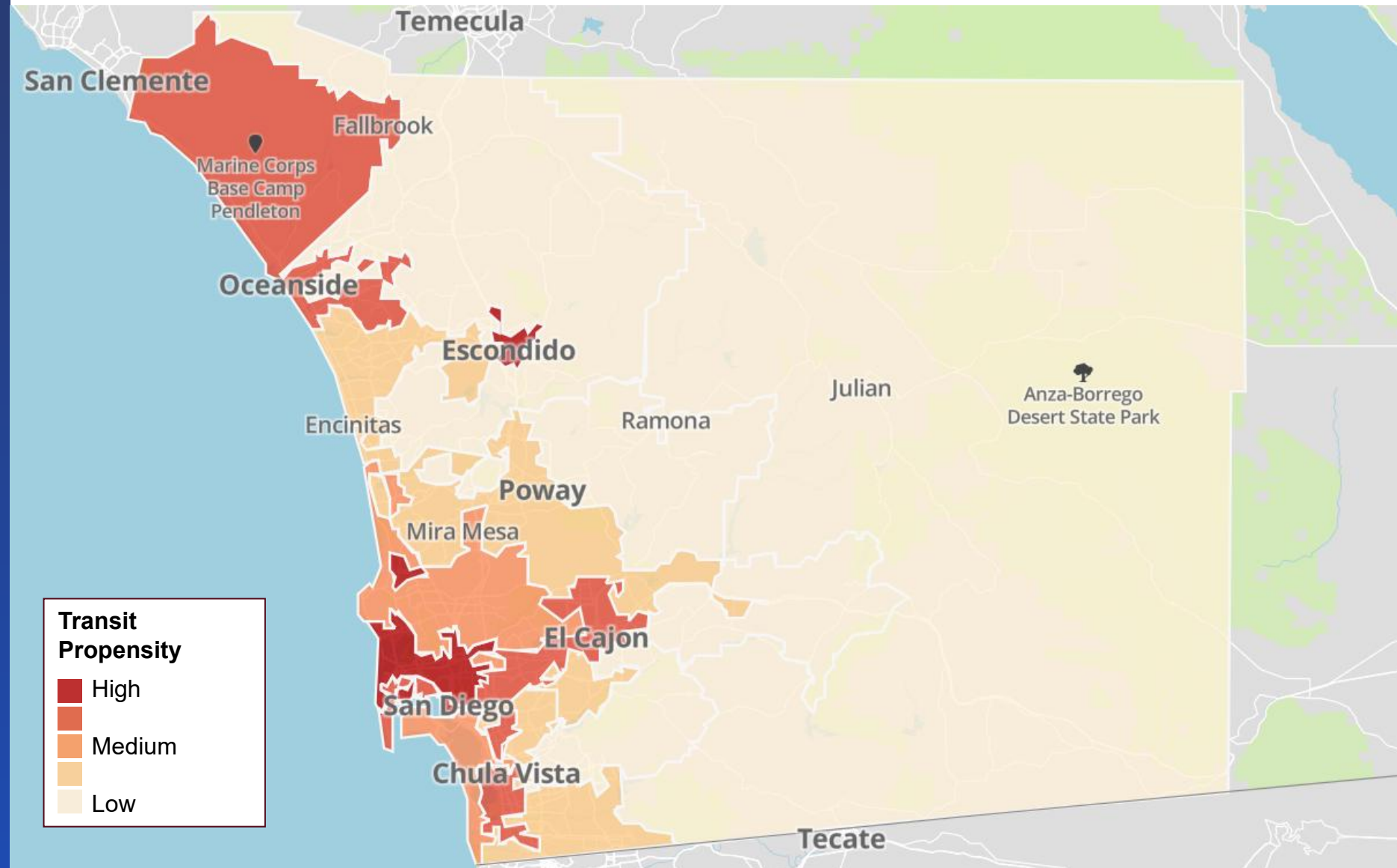
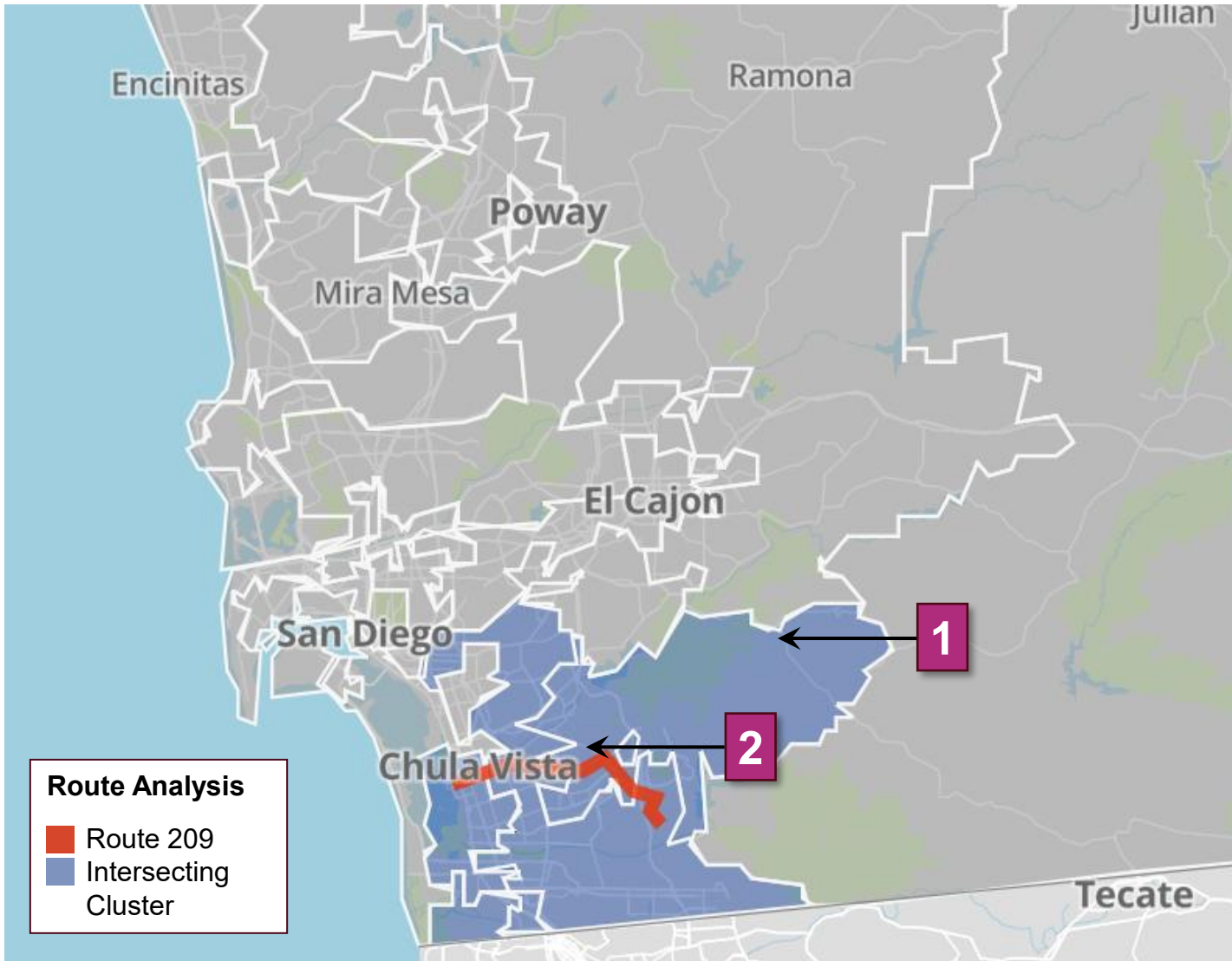


Illustration of Route Level Analysis



Note: Cluster boundaries may be outside of route service area.

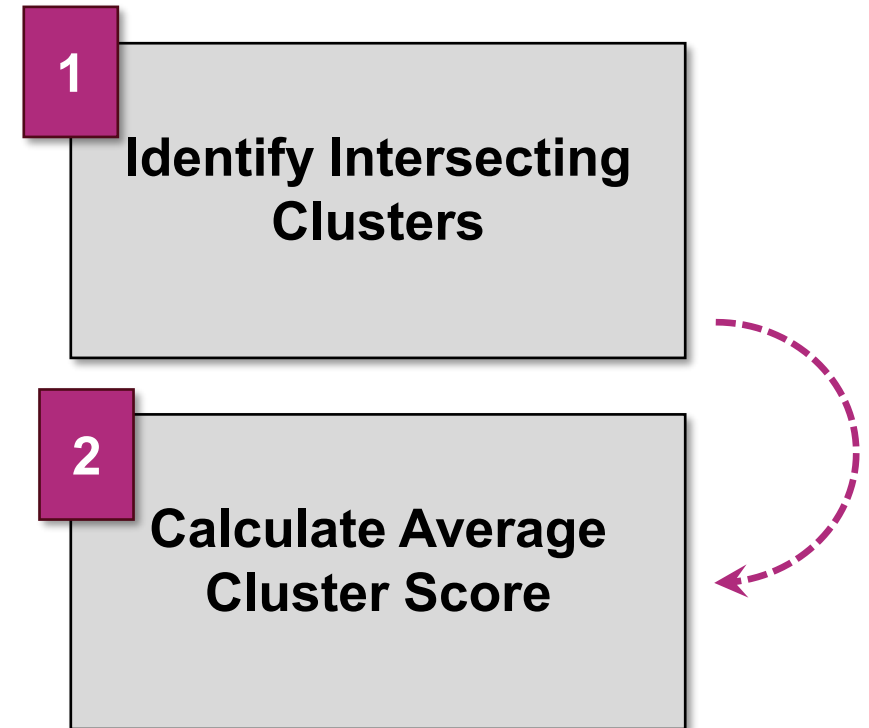
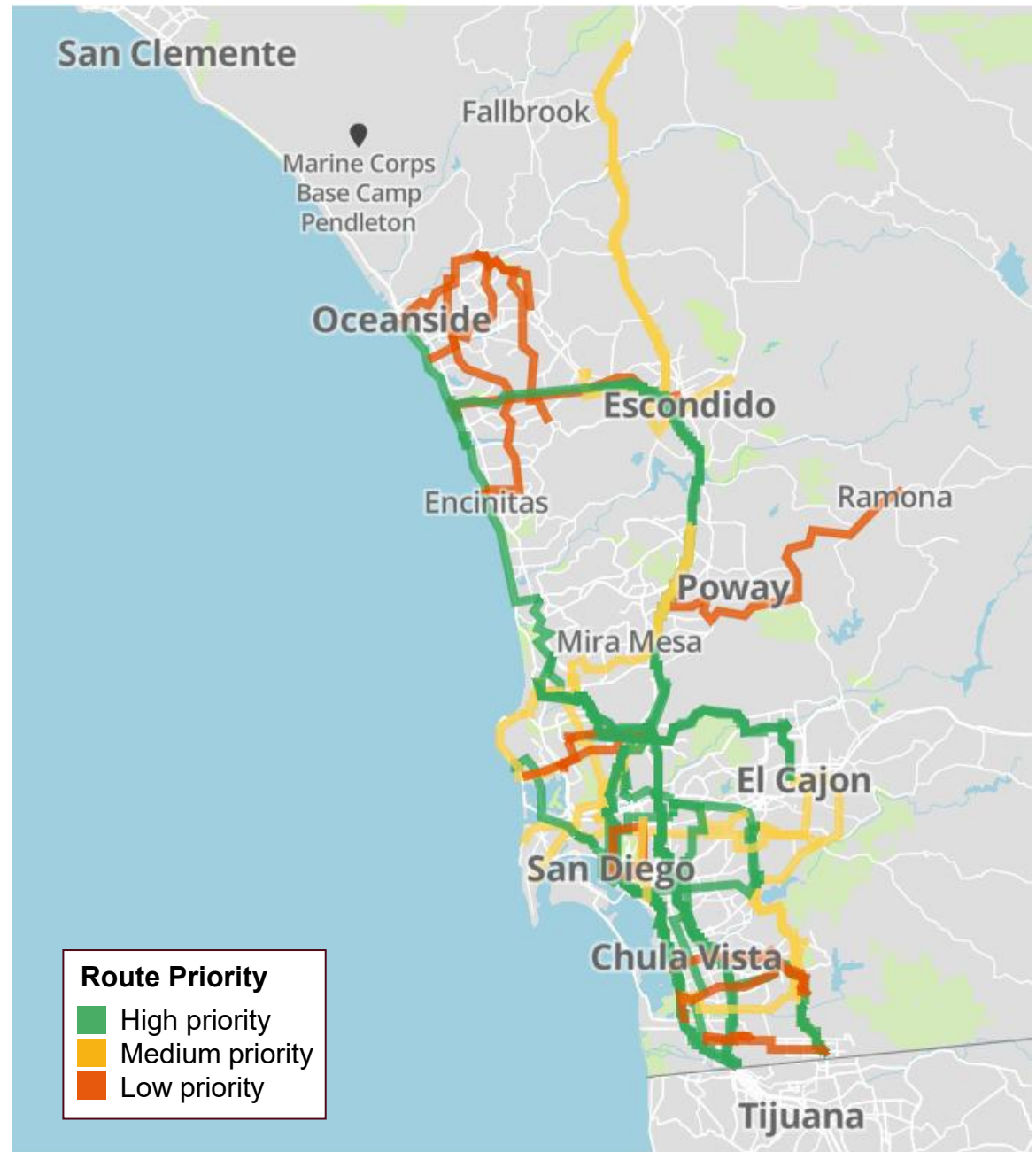


Illustration of Preliminary Prioritization

- Divided 36 Rapid Routes into 3 priority groups
- High priority routes are generally in the south/coastal areas
- 4 of 6 Rapid routes with current funding overlap with higher priority group



Note: Analyses are based on clusters fully contained within San Diego County.

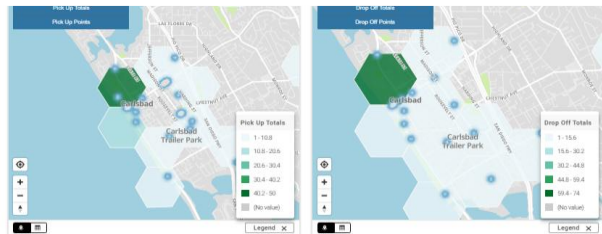
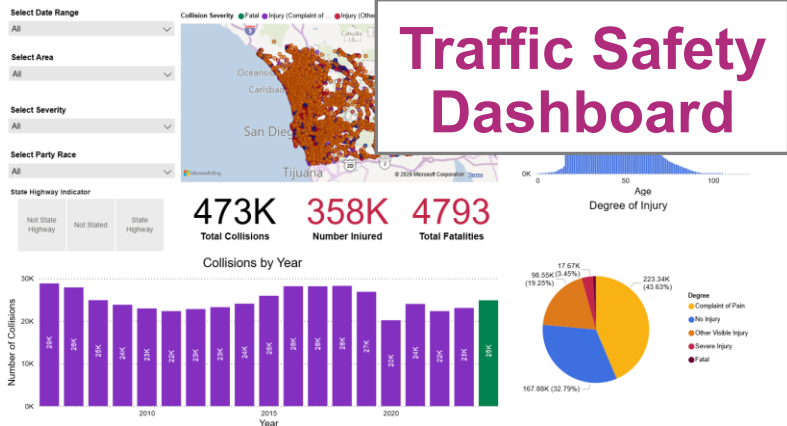
Potential Next Steps

- Six Rapid planning studies currently funded and underway
 - Cross-check areas identified through this study
- Collaboration with transit operators
 - Identify areas where resources can be reallocated
- Future work
 - Analyze within County sub-regions, e.g. transit agency service areas
 - Prioritize routes for funding and prepare 2029 Regional Plan

Resources on SANDAG Open Data Portal

Applications and Featured Stories

Traffic Safety Dashboard



Flexible Fleets

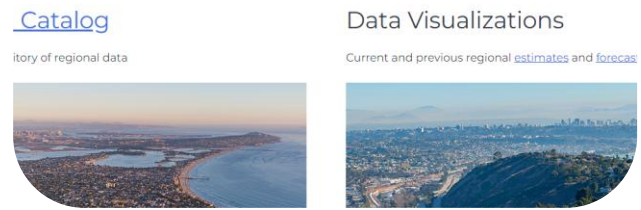


Unique Data & Original Research

Employment Centers 2.0

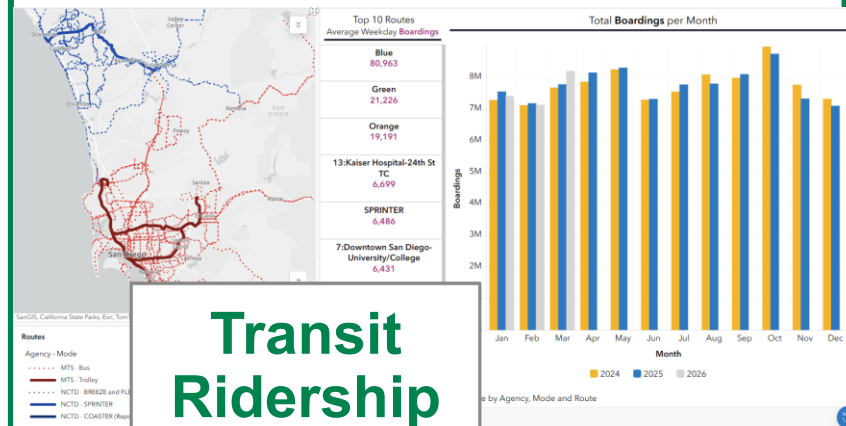
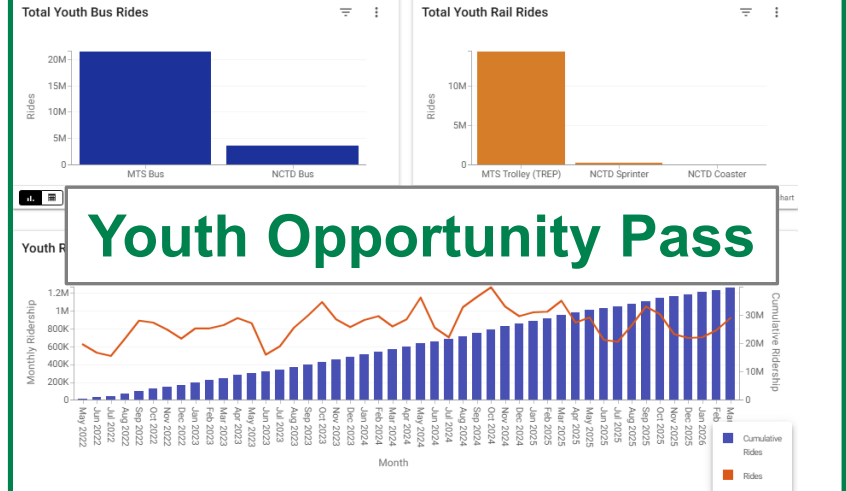


Census, Estimates, and Forecasts



Connecting Our Communities

Connecting Our Communities



Stay connected with SANDAG

➤ Explore our website

[SANDAG.org](https://www.sandag.org)



Explore our data

[OPENDATA.SANDAG.org](https://opendata.sandag.org)



Follow us on social media:

[@SANDAGregion](https://twitter.com/SANDAGregion) [@SANDAG](https://twitter.com/SANDAG)



Email: liang.tian@sandag.org
data@sandag.org



SANDAG