Reconnecting Communities Study

2025

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1 Executive Summary

Transportation infrastructure shapes how people and communities reach jobs, services, schools, parks, health care, and other daily destinations. Although highways, rail lines, ramps, and interchanges can support regional travel, they can also create physical barriers that divide neighborhoods, lengthen local trips, and limit access to opportunities. Many communities in the San Diego region were and continue to be negatively affected by transportation infrastructure that fragmented communities and created physical barriers to mobility, access, and economic opportunities. This study builds off the federal Reconnecting Communities Pilot Program (RCP), which was established in 2021 to help reconnect communities divided by transportation infrastructure. The program's goals are to restore community connectivity through the redevelopment of transportation infrastructure, advance health and equity for underserved communities by removing barriers, improve access to opportunity, create opportunities for affordable housing, and advance community-based transportation planning. States, including California, have advanced parallel programs and funding sources that pursue similar goals.

To better address impacted communities and establish areas of focus in the region, staff developed an index measuring level of disconnection along major transportation networks. This effort developed standardized indicators, or metrics, to calculate a score, accounting for accessibility, safety, mobility, and social equity (environmental health, low-income, disinvestment). SANDAG's Reconnecting Communities Study will utilize this analysis to prioritize focus areas and identify potential projects to reconnect communities divided by major transportation infrastructure. This study is a first step towards building solutions to address transportation impacts, reconnect communities, and enable neighborhoods in San Diego County to benefit from community-supported projects.

2 Background

Transportation projects have lasting impacts on communities, so where we plan and build them matters. Historically, transportation infrastructure—such as highways, rail lines, and highway interchanges—has connected people, and at times, harmed existing communities by displacing residents and local businesses. Large construction projects can physically divide once connected, vibrant neighborhoods. A **report** from the U.S. Department of Transportation observed that highway routes have often been located where land costs were lowest or political resistance was weakest, disproportionately affecting low-income neighborhoods and communities of color. Today, Reconnecting Communities is an urban planning effort focused on understanding where highways, rail lines, ramps, interchanges, and other major transportation infrastructure have divided communities or made it harder for people to access daily needs and key destinations.

To understand where to best prioritize projects to reconnect communities in the region, staff set out to define a "disconnected community." With support from SANDAG's Social Equity Working Group[1] and for the purpose of the project, a "disconnected community" is defined as a low-income community that is physically separated and/or displaced by transportation infrastructure such as highways and railways that has created barriers to access and opportunities such as work, education, open spaces, medical services, and retail, further burdened by safety, health, mobility impacts, and historical disinvestment.

Below outlines more information on the concept of reconnecting communities as it relates to our definition of a "disconnected community", the metrics it highlights, and the baseline understanding and assumptions of the index.

2.1 Negative Impacts of Highways on Communities

The negative impacts of highways on communities can be categorized into the following key areas: (1) reduction of vital services and economic opportunities; (2) neighborhood decline and economic disinvestment; (3) damage to historical cultural ties; and (4) increased risk to pedestrian and cyclist safety.

2.1.1 Reduced Access to Essential Services and Economic Opportunities

Highways can create barriers and prevent access to essential services and opportunities such as schools, employment, health care, and parks. The physical infrastructure of highways can greatly lengthen travel times and restrict routes available to individuals searching for medical treatment (Delamater et al., 2012), as well as further limiting access to specialty care (Cyr et al., 2019). Highway systems often function as barriers that disrupt communities. Policies privileging highways over public transit have contributed to greater residential segregation, and income inequity (Civil Rights Project UCLA, 2003).

[1] The SANDAG Working Group was active between 2022 – 2025, when this study began.

2.1.2 Neighborhood Decline and Economic Disinvestment

Physically isolated communities are also likely to experience economic disinvestment and decay. Highways can cause urban decay and blight and longer-term effects such as economic and social disruption (Bradbury, 1982). While highways were intended to improve regional and national mobility and contribute to regional prosperity, in many instances they have resulted in concentrated regional economic distress and neighborhood decay in the urban neighborhoods they cut through.

Disinvestment is a process where some communities receive lower levels of investment in public and/or private services and infrastructure. Generally, communities are prioritized by how valuable they are to investors. In the context of real estate, banks and other private investors, prioritized areas are consistent with higher affluence, potential high-income customer traffic, and/or preferable living conditions which have resulted in many low-income communities continuing to be neglected and having limited success in improving their neighborhoods.

2.1.3 Disruption of Historic and Cultural Connections

Beyond limiting opportunities, the transportation infrastructure can influence historically and culturally rich-forming points. One example of this is Barrio Logan, a predominantly Mexican - American neighborhood within the City of San Diego, which is home to Chicano Park, located under the junction of the Coronado Bridge and I-5. The bridge and interstate construction displaced 5,000 residents transforming park land into a highway enforcement station. However, the community pushed back and created Chicano Park, a thriving symbol of perseverance and cultural identity (Metropolitan Planning Council, 2023).

Another example is Harlem of the South, a historically Black cultural hub within Miami's Overtown community. It was severely affected by the construction of the I-95 in the 1960s, with homes and businesses destroyed and many residents displaced. Generally, highway construction has dismantled urban infrastructure such as social, cultural, and economic institutions that predominantly served minority communities (Evans, 2023; Dertien, 2020).

2.1.4 Increased Risks to Pedestrian and Cyclist Safety

Approximately 19% of all traffic deaths are due to pedestrian and bicycle fatalities, with approximately 6000 pedestrian fatalities and 850 bicyclist fatalities each year in the United States (FHWA Highway Safety Programs). A similar trend is observed in California, where the California Office of Traffic Safety (OTS) reported a 9.4% increase in from 1,013 pedestrian deaths in 2020 to 1,108 pedestrian deaths in 2021 (California OTS Quick Stats).

The San Diego region mirrors national traffic safety trends with more severe crashes being most densely clustered in low-income and minority communities. This is in part due to development in communities featuring high-speed and high-volume facilities. Disadvantaged communities, as defined by a Federal DOT tool, cover 19% of the San Diego region but account for 40% of all fatal and serious injury crashes. Pedestrian fatal and serious injury crashes occur five times as frequently in disadvantaged communities compared to other areas, and bicyclist fatal and serious injury crashes occur three times as frequently (FHWA 2024).

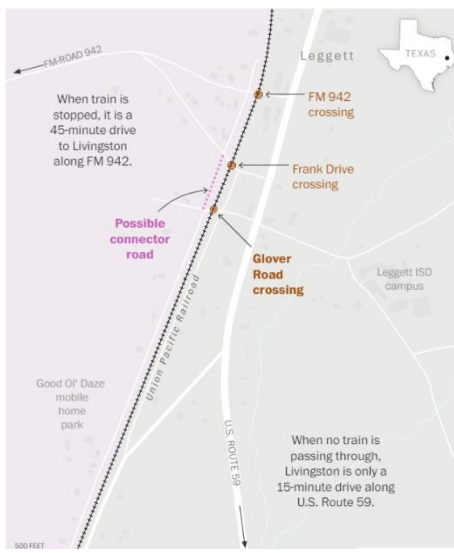
There are several factors that enhance the vulnerability of cyclists and pedestrians, including high speeds of vehicles, poor visibility, and the unavailability of safe crossroads. This has further isolated communities on either side of highways, cutting communication lines, lowering accessibility to vital resources, and alienating residents from others.

2.2 Negative Impact of Railways on Communities

Like highways, heavy rail has disrupted communities for similar reasons however, usually to a lesser degree. Light and heavy rail systems often bisect transportation infrastructure, creating physical barriers to transportation and emergency services, while limiting connectivity. Heavy rails may create more significant separation, but both systems can severely delay emergency responders for example. These delays can occur when responders have limited opportunities to cross tracks or are not allowed to cross the tracks if an active vehicle (train, trolley, etc.) is present. In some cities, this issue is exacerbated when responders have no alternative route to reach their destination (Salcedo et al., 2024). A primary example is in-use railways that may have a significant impact on mobility and efficiency (as shown in Figure 1).

Rail has also divided and disinvested communities. For example, in Wasco, California, a low-income and mostly Latino community, the state rail network divides the center of the city, limiting the potential for housing and businesses to thrive in the community (Joffe, 2021).

Figure 1: Road Crossing in Texas Impacted by Railway (No Connector Roads)



2.3 Strategies for Reconnecting Communities

Several innovative strategies and projects have been developed and implemented to reconnect fragmented communities: (1) infrastructure interventions; (2) urban design and planning; and (3) community engagement and empowerment. The infrastructure interventions include modifications to existing structures, the introduction of new connectivity solutions, and the complete reconfiguration of transportation networks.

2.3.1 Highway Caps and Decks

This approach involves constructing a deck over a freeway and reclaiming underused over-head space for park space, retail and commercial space. One example is Klyde Warren Park, in Dallas, Texas, which sits atop the Woodall-Rodgers Freeway. The park reconnects previously walled-off parts of the city and serves as a hub for recreation. According to the FHWA, the park has had $2.5 billion in economic impact for Dallas. Additionally, according to the Landscape Architecture Foundation's Case Study briefing, 90.9 % of surveyed park users reported that the park significantly improved their quality of life, particularly through reduced stress, a stronger sense of place, and more access to outdoor recreation

Another example is Teralta Park, located in San Diego's City Heights neighborhood. The park sits above a freeway that divides nearby neighborhoods. It shows how infrastructure can be a means of reconnecting and strengthening neighborhoods that have been bisected by highways.

2.3.2 Highway Removal Projects

Some cities have chosen to fully eliminate portions of freeways and build boulevards that integrate more seamlessly into the community's street grid. One example of this conversion is the San Francisco Embarcadero Freeway and Central Freeway. After the 1989 Loma Prieta earthquake, the Central Freeway was replaced by a multi-modal surface street called Octavia Boulevard that weaves through the east side of the city, and the Embarcadero Freeway was supplanted with a new boulevard complete with streetcar and light rail lines.

2.3.3 Pedestrian Bridges and Enhanced Crossings

Pedestrian bridges and elevated crosswalks can connect neighborhoods that highways have divided, providing safe and clear access across roads. One distinctive example is San Diego's Harbor Drive Pedestrian Bridge, which links downtown San Diegowith its Embarcadero waterfront. It serves as an example of how walking routes can be both functional and beautiful.

2.3.4 Urban Design and Planning

Urban planning and design enable the efficient reunification of communities separated by highways. Integrating parks, trails, and sidewalks into neighborhoods, along with robust public transportation, can make a more livable and well-connected urban space. One of the best examples of how a typical street can change into a complete one is the Broadway corridor project in Long Beach, which has successfully reduced travel lanes, added bike lanes and improved pedestrian crosswalks and traffic signals.

2.3.5 Community Engagement and Empowerment

This process involves engaging community members early in decision making process, allowing them to identify priority areas and the formulation of plans that address their concerns. The Metropolitan Planning Council (MPC) carried out a study in Chicago in 2022 to explore methods to minimize the negative impacts of large transportation corridors. The study identified the areas most affected by transportation infrastructure, and suggested ways to restore connectivity and improve public space. MPC created a public, interactive web-based platform and allowed community members to describe the historic impacts caused by transportation infrastructure and drop pins on a map, upload photos and share ideas. In these efforts community partners promoted the platform through community organizations and educational workshops. The project outcome includes proposed future updates like transit facilities, pocket parks, underpass community spaces, etc.

3 Data Sources

To better understand the negative impacts of highways and railways and potential strategies for reconnecting communities, staff developed the data index. The following data sources were identified to support the decision-making, classification, and model development used to define “disconnected communities.” The definition of a “disconnected community” helps shape the analysis, focusing on areas where harmful transportation infrastructure has the greatest impact.

3.1 Overview

3.1.1 San Diego Geographic Information Source (SanGIS) – Highway/Rail Networks (2024)

SanGIS provides geographical data for the entirety of San Diego County including its transportation networks. The data used for this project includes freeway, highway, and rail datasets, encompassing all major interstates and highways as well as heavy rails and light rails (Trolley lines).

3.1.2 San Diego Geographic Information Source (SanGIS) – Parks (2024)

The SanGIS parks dataset provides the geometries and identifiers of public parks within San Diego County, including open space parks and preserves. It consolidates park data from the County, cities, port district, and state parks.

3.1.3 SANDAG Licensed Third-Party Movement Pattern Data (Replica) (2022)

Replica tracks and analyzes transportation activity nationwide, providing insights into the number of trips within a given timeframe. It also offers more granular information, such as trip origins, destinations and purposes.

3.1.4 California State Employment Development Department (EDD) (2021)

California EDD provides general employment and business statistics for the entire state of California.

3.1.5 SANDAG School and College Inventories (2022)

SANDAG keeps records of all educational institutions in the San Diego County, including elementary, middle, and high schools—accounting for public, private, and charter schools. It also maps all college and university institutions for the region, including community colleges.

3.1.6 California Health and Human Services Agency (CalHHS) – Facilities and Services (2024)

The CalHHS provides datasets on a variety of topics related to medical facilities and services including staff and other amenities such as the number and type of beds, and records and locations of facilities including hospitals.

3.1.7 SANDAG Land Use and Dwelling Unit Inventory (LUDU) (2023)

SANDAG maintains an annual parcel-level land use and dwelling unit inventory in the interest of providing robust and accurate inputs to SANDAG's Regional Demographic, Economic, and Land Use Models. The land use information is updated using parcels from SanGIS, aerial photography, the County Assessor Master Property Records file, and other ancillary information.

3.1.8 SANDAG Population and Housing Estimates (2022)

Each year, SANDAG produces estimates of population and housing for the San Diego region, utilizing several demographic data sources such as the U.S. Census Bureau and the California Department of Finance. These estimates contain information on demographic identifiers such as ethnicity, age, sex, household income, and housing units by type and occupancy.

3.1.9 SANDAG Licensed Third-Party Commercial Real Estate Data (Costar)(2024)

CoStar Group is a leading provider of commercial real estate information, analytics, and online marketplaces. The company collects, verifies, and maintains extensive real estate data, which includes property listings, tenant information, sale and lease comparables, and market analytics. For this study, their Property Listings data was utilized, which contains information about commercial properties including data on office, industrial, retail, and multifamily properties. The data spans multiple years, enabling insights into how properties in different block groups have evolved over time by use and assessing the alignment between forecasted rental costs, the actual quality of the properties, and the current property rent.

3.1.10 SANDAG Vision Zero Action Plan (2024)

The Vision Zero Action Plan's Safety Focus Network highlights roadway segments with high concentrations of fatal injury crashes and includes scoring for different modes of transportation such as bikes, pedestrians, motorcycles, and motor vehicles.

3.1.11 US Environmental Protection Agency (EPA) - Environmental Justice Screening and Mapping Tool (Version 2.3)

The Environmental Justice Screening and Mapping Tool (EJScreen) uses national data to identify locations with higher environmental burdens and vulnerable populations. It encompasses a range of nationwide environmental and demographic data and indexes representing estimates for a range of inequities.

3.2 Limitations

The study highlights opportunities to best reconnect communities by first identifying where in the region to focus efforts. However, there are some limitations to the data used in this analysis. While these may not be ideal, through significant and thorough review by various teams, working groups, and individuals, there remains confidence in the available data to accurately identify priority areas across the region.

3.2.1 Geographical Boundaries

The communities examined for this study were at the Census block group level. Ideally, the communities would be at a smaller, more granular level to get a more localized representation of communities bordering major transportation infrastructure. However, currently available data restricts the geographic scale to the block group level. Furthermore, some demographics and data points are not easily differentiable for this geography level. For example, roadways that border two or more block groups impact all bordering geographies roadway safety level even if a block group may not utilize the given road segment.

Census block groups do not adhere to the half mile buffer zones around the major transportation infrastructure. Since the data was at the Census block group level, the identified communities reflect the demographics and conditions across the entire block group and not just the immediate community within the buffer zone.

3.2.2 Data Availability

There are limitations with data availability that reduce the impact of certain metrics and/or prevent the inclusion of other indicators in the final scoring results. For instance, some data is not updated regularly or tracked over time, which made some metrics like disinvestment more difficult to track over time; however, utilizing consistent data was still a critical measure to include for this study.

4 Methodology

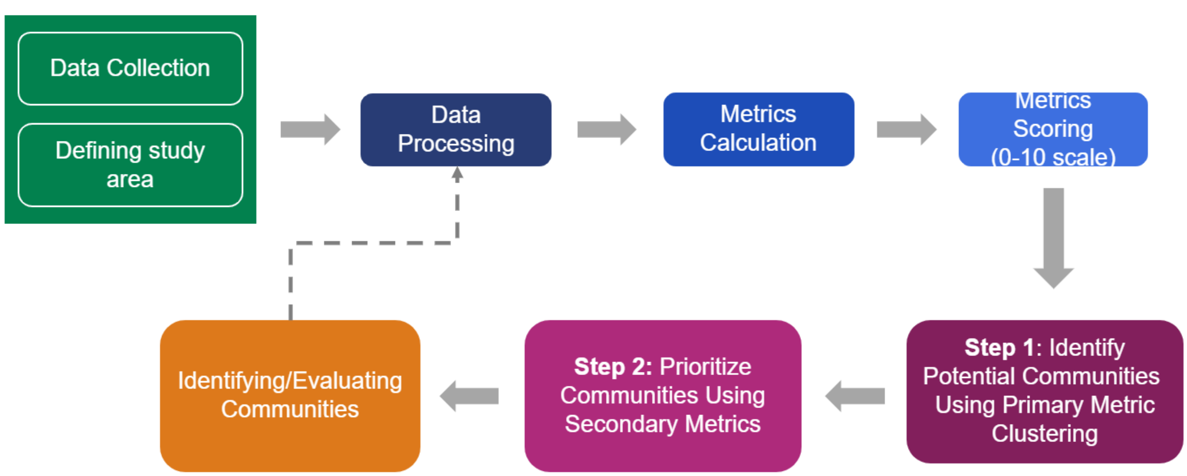
To effectively address the challenges of reconnecting communities, a systematic approach was established to identify and prioritize disconnected communities. The methodology described below outlines the steps taken to ensure that solutions are data-driven and equitable.

The process began with the collection of data from public and licensed third-party sources. Then, the study area for the project was defined based on transportation infrastructure. Each data source was thoroughly examined and structured for use in analysis. Then, specific metrics for each criterion were defined. Since each metric possesses its own unit, min-max scaling, a data preprocessing technique to allow each criterion to fall within a fixed range, was applied to map them onto a 0-10 scale.

To identify disconnected communities, a two-step process was designed. In the first step, impacted communities were identified using metrics that measure the primary negative impacts of the transportation network on these areas; accessibility, mobility, and environmental health. In the second step, other socio-economic and safety metrics are used to further prioritize the communities identified in the first step.

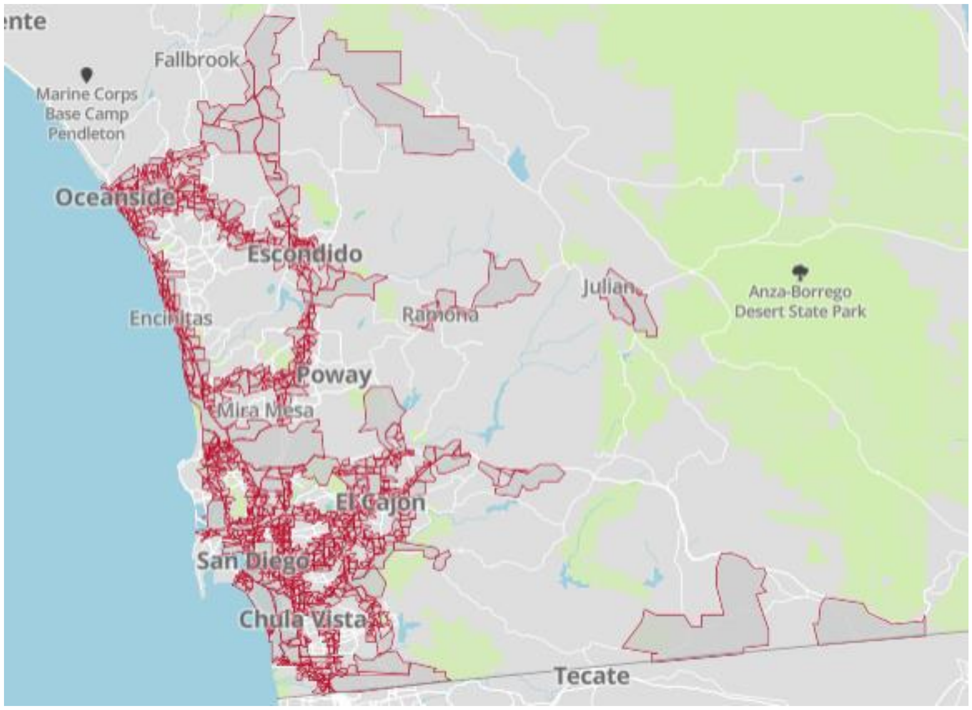
The final step involved reviewing the outcomes to determine the priority areas. The SANDAG Data Science department evaluated the methodology to confirm its accuracy and reliability in identifying disconnected communities, including hosting two Peer Review Process meetings. Additionally, SANDAG's Social Equity Working Group provided feedback to help ensure the process addressed community concerns and interests. After presenting the methodology, the project team adopted a High-Medium-Low prioritization approach to represent the identified areas of concern. This approach allows for narrowing options to a more granular level, facilitating the next stage of the study: selecting seven focus areas and making corresponding recommendations. The following subsections provide a detailed description of the study area, metrics, and processes.

Figure 2: Overview of Methodology



4.1 Study Area

Figure 3: Census Block Groups Included in Study Area



The study area for the 'Reconnecting Communities' project encompasses a 0.5-mile buffer on either side of San Diego's major transportation networks, including highways and railways. This buffer was chosen to prioritize proximity to noise and air pollution exposure. Census block groups were overlaid with this buffer, and block groups with at least 25% of their area within the buffer zone were selected as the study area.

4.2 Metrics

4.2.1 Accessibility

The accessibility metric evaluates how well communities in the study area can reach essential services and opportunities, such as work, education, healthcare, retail, and recreational spaces. To assess this, the project team utilized SANDAG's licensed third-party movement pattern data from Replica. This data helps to map the actual travel distances compared to direct distances between origins and destinations crossing the transportation infrastructure and within the study area. These comparisons are then used to calculate an accessibility score that quantifies the efficiency of the transportation network in enabling or hindering access to essential services.

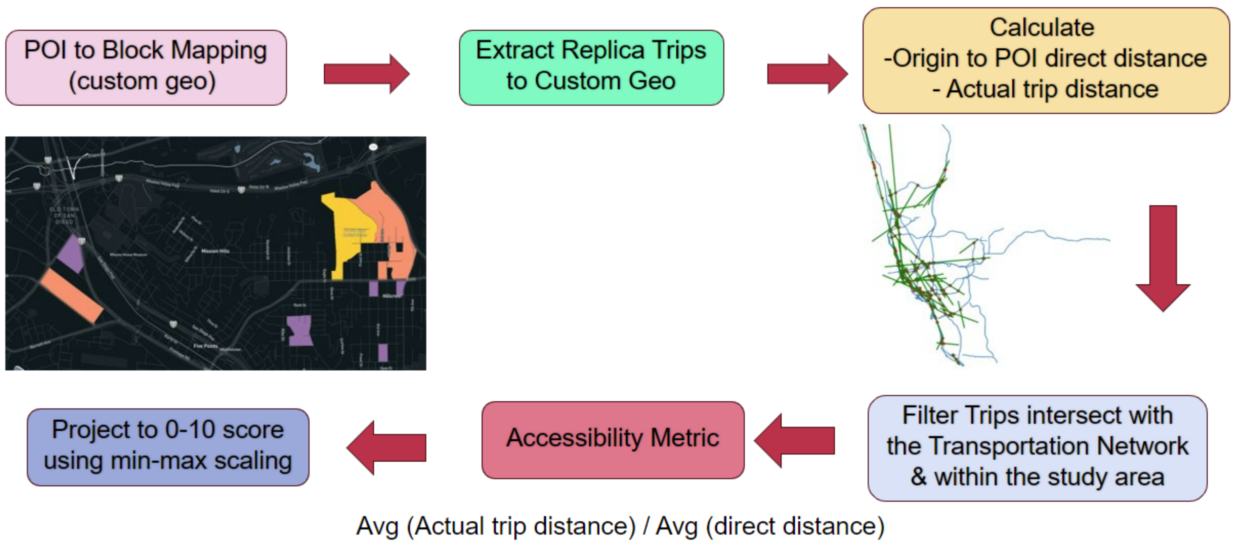
After extracting Replica trip data using custom geographies, Euclidean distances between origin and destination (in miles) were then computed. The Replica trip data was then further refined by filtering for trips within the study area, as well as trips that traverse the transportation network at least once.

After processing, the Replica trips data is then aggregated by 2020 Census Block Groups and the final accessibility metric computed as follows:

Accessibility Metric = Avg(Actual Trip Distance) / Avg(Direct Distance)

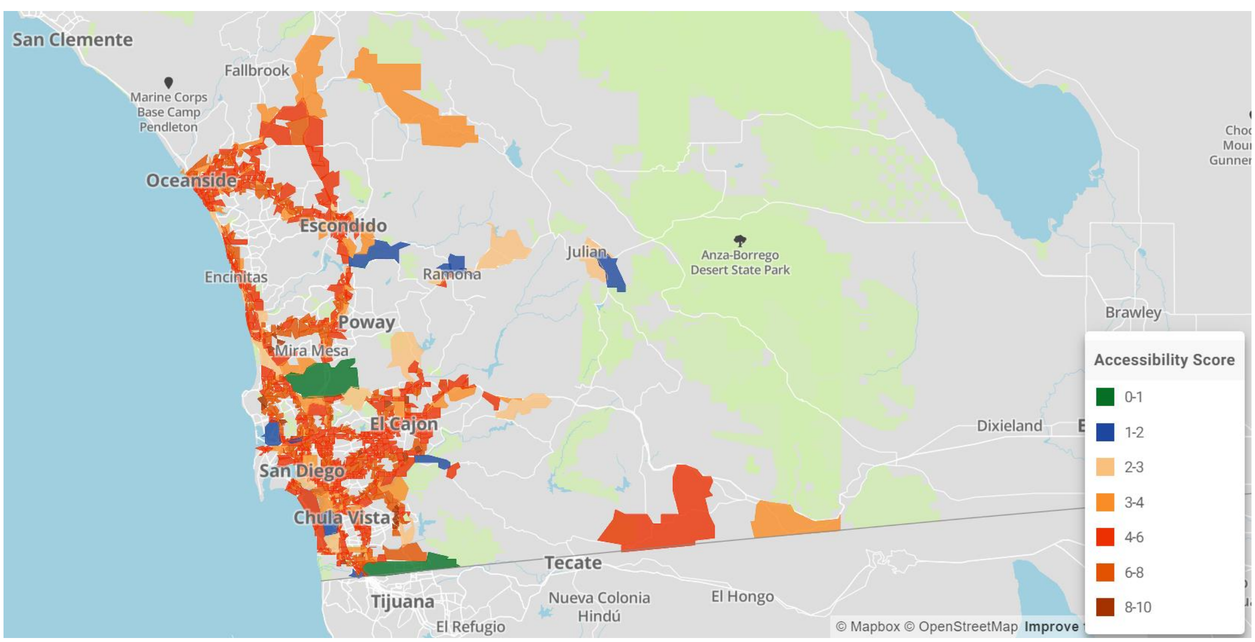
Note: Actual Trip Distance is calculated using the distances traveled through the transportation network. Direct Distance is calculated using the Euclidean distance between origin and destination.

Figure 4: Overview of Accessibility Metric



In Figure 5 below, the final accessibility score can be seen in the study area, with moderate scores of 4 to 8 being the most prevalent; higher scores indicate worse accessibility.

Figure 5: Accessibility Metric Map

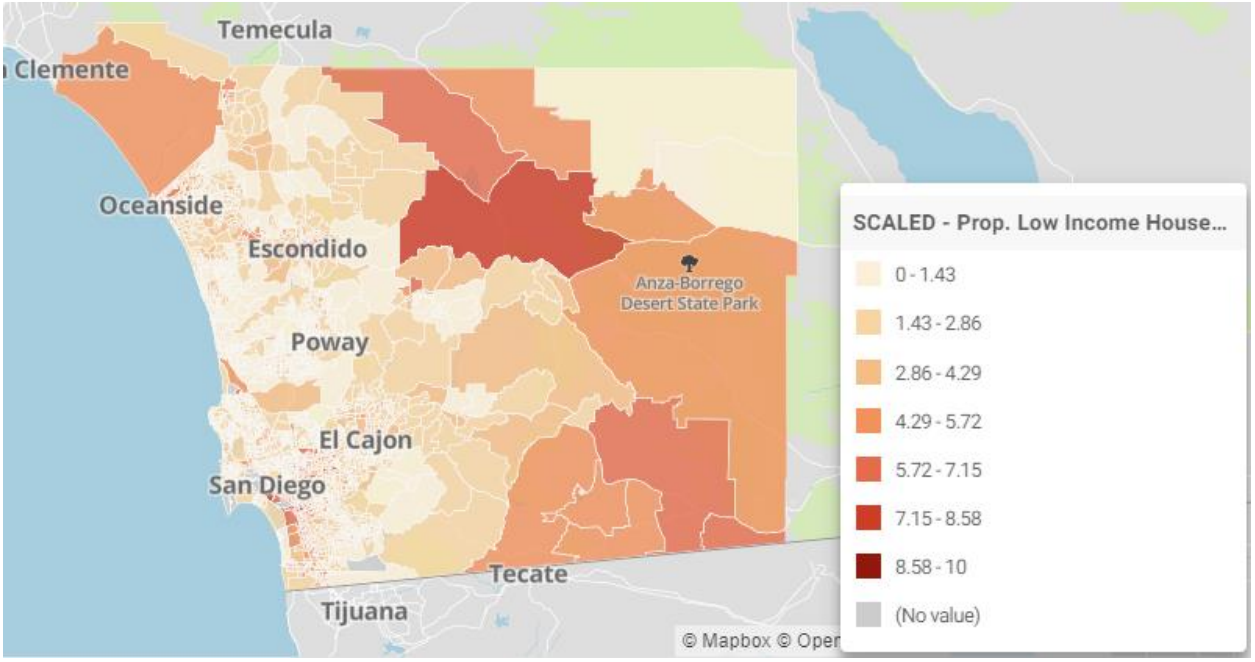


4.2.2 Social Equity

4.2.2.1 Low-Income Communities

For this study, low-income households were defined as those households whose annual household income was $44,999 or less in 2022. SANDAG 2022 Estimates data was used to calculate the percentage of low-income households by census block group to measure low-income communities.

Figure 6: Low-Income Metric Map



The number of low-income households was summed for each block group, which included: "Less than $15,000," "$15,000 to $29,999," and "$30,000 to $44,999." Next, the total number of households by block group was obtained, regardless of income. The percentage of low-income households were projected to a 10-point scale for scoring, with higher values reflecting a greater prominence of a low-income community for a particular block group.

4.2.2.2 Disinvestment

Disinvestment occurs through a historical pattern of reduced funding for public services, infrastructure and development of the private sector in certain communities. To assess disinvestment, this study relied on third-party real estate data, and analyzed commercial properties including office properties, industrial, warehouse, retail, specialty and multi-family housing.

Properties were assigned to block groups based on their location, and the total rentable building area (usable square footage) was aggregated for each block group.

The analysis focused on properties developed or significantly renovated since 2000 and included only those rated 4+ on CoStar's building quality scale to capture above-average development. Block groups with minimal or no new development during this period were identified as experiencing higher levels of disinvestment.

Figure 7: Disinvestment Metric Map

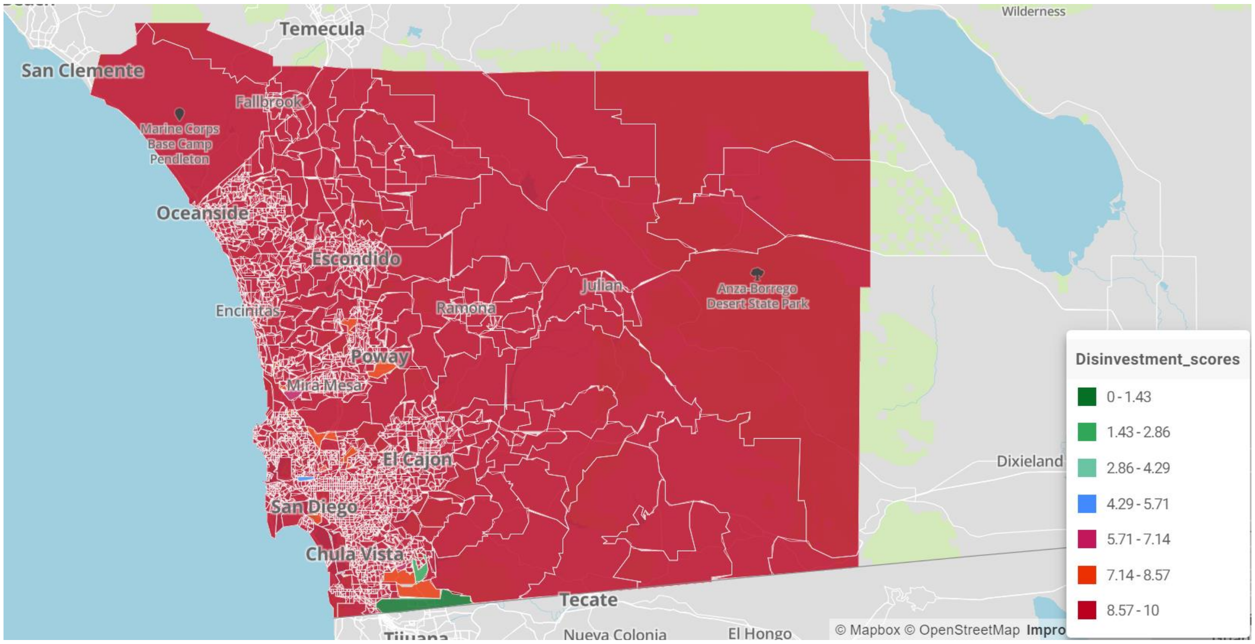


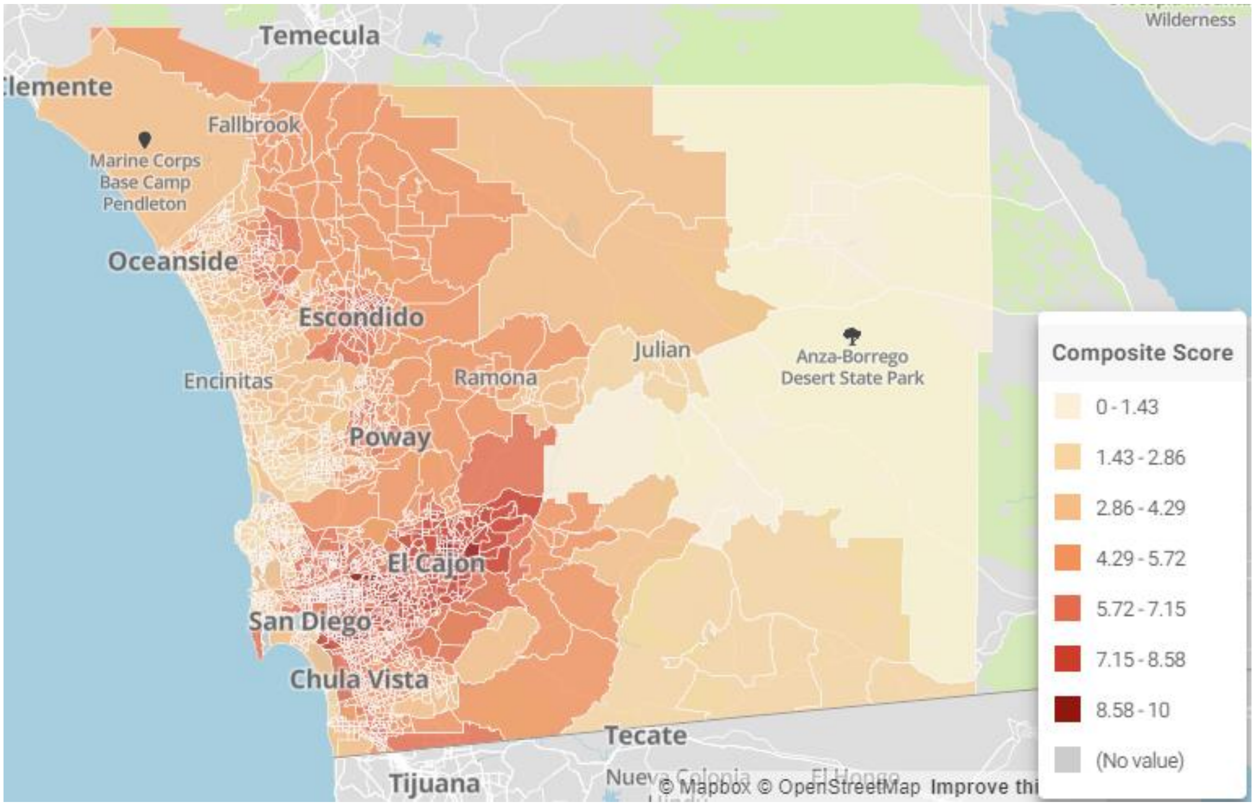
Figure 7 above shows that the majority of block groups fall into the highest level of disinvestment (8.57-10). This outcome is largely due to the metric's lack of granularity in evaluating land use and the availability of developable land within block groups.

While this metric effectively demonstrates the quantity and quality of recent development, or lack of development, it does little to explain why disinvestment occurs. For example, it doesn't separate block groups that are fully built out with single family detached homes and those that still have vacant land available for development. Also, zoning and land use considerations were also not incorporated into this stage of the analysis, but will be examined in later phases of the study.

4.2.3 Environmental Health

The environmental health metric measures the impact of transportation infrastructure on air quality and the associated health outcomes in the community. This metric incorporates data from the EPA's Environmental Justice Screening and Mapping Tool (EJScreen), which provides indicators such as particulate matter (PM2.5), ozone levels, diesel particulate matter, air toxins cancer risk, and asthma prevalence. These indicators are analyzed to assess the level of unhealthy particulates that residents are exposed to, directly correlating to their proximity to major transportation routes. Each indicator is scaled and aggregated to reflect the overall environmental health risks faced by the communities.

Figure 8: Environmental Health Metric Map



A total of five indicators were selected for the Environmental Health Index to assess the impact of highways on air quality and health outcomes in nearby communities. These indicators were sourced from the EPA's Office of Air Quality Planning and Standards (QAQPS), and the CDC Places database, utilizing the EPA's EJScreen tool.

Table 1: Environmental Health Metrics

Indicator	Description
Particulate Matter 2.5 (PM2.5)	Annual average of PM2.5 levels in the air (ug/m^3)
Ozone	Annual average of the top 10, maximum 8-hour concentrations (ppb)
Diesel Particulate Matter	Level of diesel particulate matter in the air (ug/m^3)
Air Toxins Cancer Risk	Lifetime cancer risk from inhalation of air toxic materials (%)
Asthma Prevalence	Prevalence of asthma in residents

Source: US Environmental Protection Agency EJScreen Tool

4.2.3.1 Particulate Matter 2.5

The PM2.5 indicator measures inhalable particles that are 2.5 micrometers or smaller. This indicator was measured through monitor data and Community Multiscale Air Quality (CMAQ) modeling, with census tract values being mapped to the block group level. The raw values are measured as micrograms per cubic meter.

4.2.3.2 Ozone

The Ozone indicator measures the annual mean of the 10 highest ozone concentrations ("peak concentration metric"). This indicator was also provided through monitor data and CMAQ modeling of QAQPS data being mapped to the block group level.

4.2.3.3 Diesel Particulate Matter

The Diesel Particulate Matter indicator is the estimated concentration of Diesel PM from the 2020 EPA AirToxScreen mapped to block groups. The raw values are in micrograms per cubic meter.

4.2.3.4 Air Toxins Cancer Risk

The Air Toxins Cancer Risk indicator combines EPA modeling with CDC Places data to estimate the lifetime cancer risk within a given block group. Each value represents the number of individuals, per one million people, who are significantly more likely to develop cancer if continuously exposed to measured pollutant levels. Notably, the EPA calculated risks to only one significant figure.

4.2.3.5 Asthma Prevalence

Asthma prevalence encapsulates the ratio of resident adults aged 18 years and older who have been officially diagnosed with asthma by a health professional out of all resident adults.

The Environmental Health Index is based on census block groups, where each block group receives a value for each of the 5 indicators which are then used to determine its index score. All indicator values were standardized to 0 to 10 using min-max scaling. The final Environmental Health Index scores were obtained by averaging all standardized indicators for a given block group.

4.2.4 Safety

This metric aims to measure the traffic accident densities (car, pedestrian, bike, motorcycle) on each street segment and aggregated to block group level. The SANDAG Vision Zero Safety Action Plan was used to assess safety impacts. The Safety Focus Network in this plan identifies and rates road segments with the highest concentration of fatalities and injuries across all forms of transport. The road scores were then aggregated to their block group level. The extension of segment scores to block group scores was calculated by measuring the length of each road segment, multiplying it by its assigned value, and then dividing the total by the overall length of the Safety Focus Network Road within that block group. Figure 9 shows an example of the aggregation process from segment scores to block groups and Figure 10 presents the safety score results at the block group level where dark areas indicate higher safety score, signifying more traffic safety issues.

Figure 9: Road Segments with Recorded Fatal Crashes in a Block Group

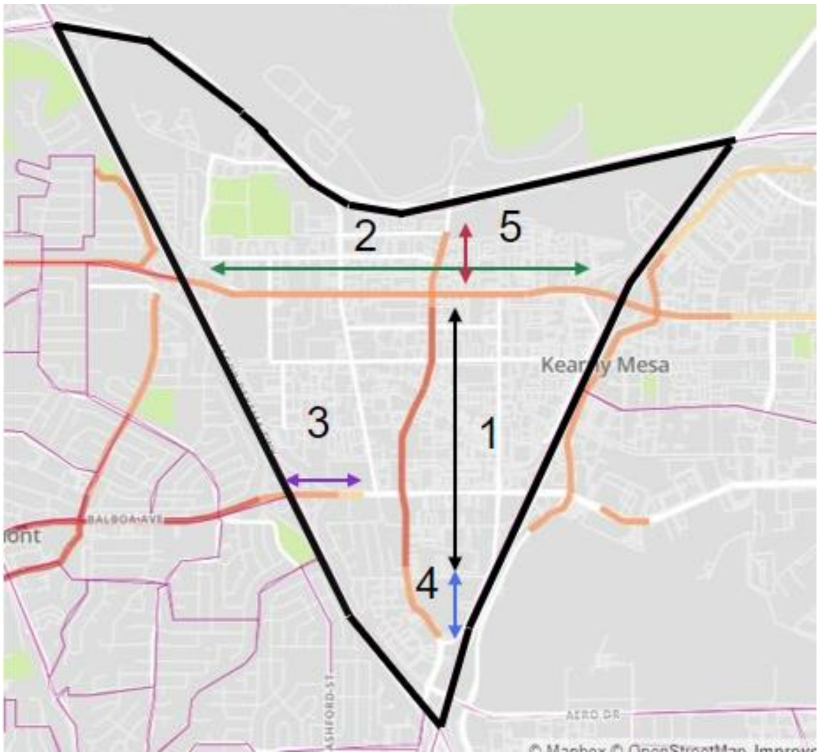
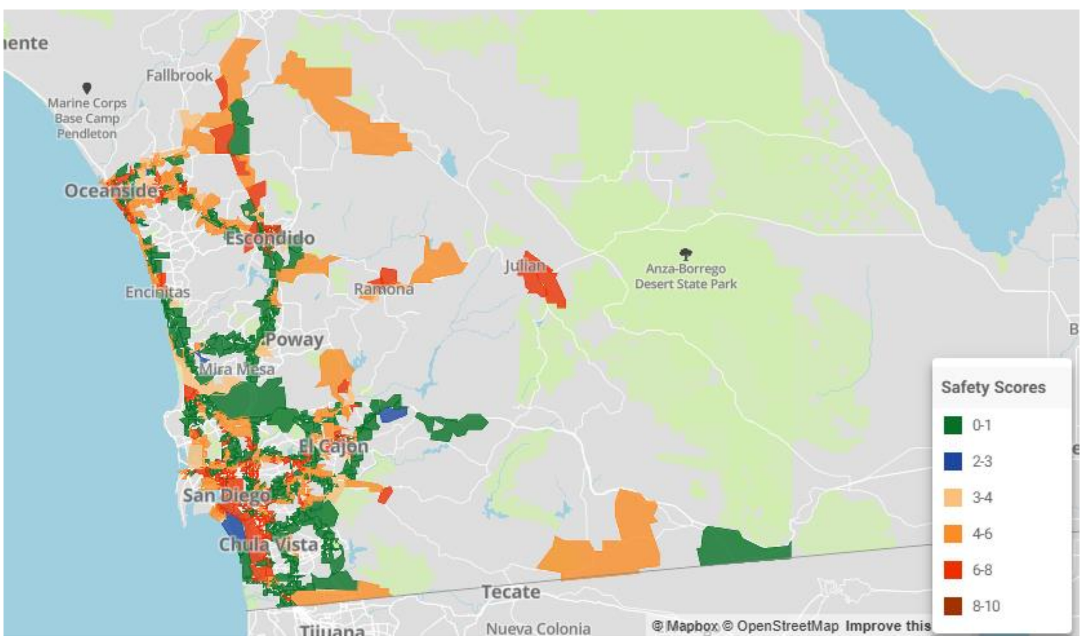


Figure 10: Safety Metric Map



4.2.5 Mobility

4.2.5.1 Car Trips for Short Distance

To evaluate mobility, a metric was developed to measure access to nearby locations without reliance on private cars. This was based on trip data segmented into direct distance and actual travel distance to cross the transportation system (Figure 11). A threshold was set to characterize short trips based on walking distances estimated from Replica data. The analysis found the region's average walk trip distance was about 0.8 miles, which was adopted as the limit of a short trip. The proportion of short trips completed by car was calculated. This ratio was then converted to scaled scoring, which represents short-distance car dependency in the community. This method gives valuable insights on mobility and private car dependencies.

Figure 11: Shortest Distance vs. Actual Distance of Car Trip

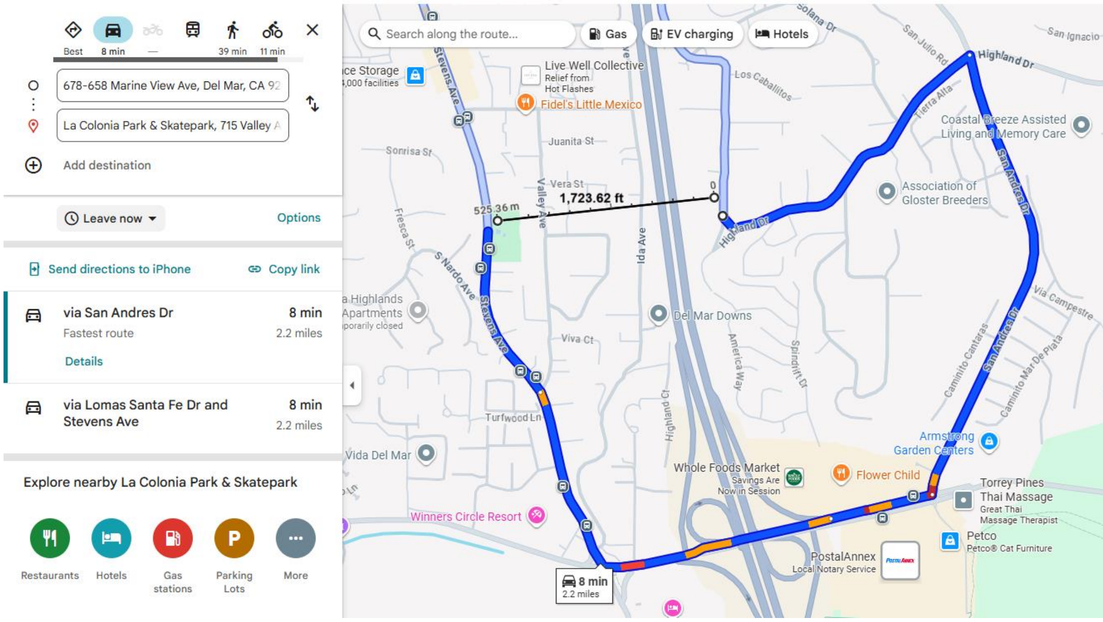
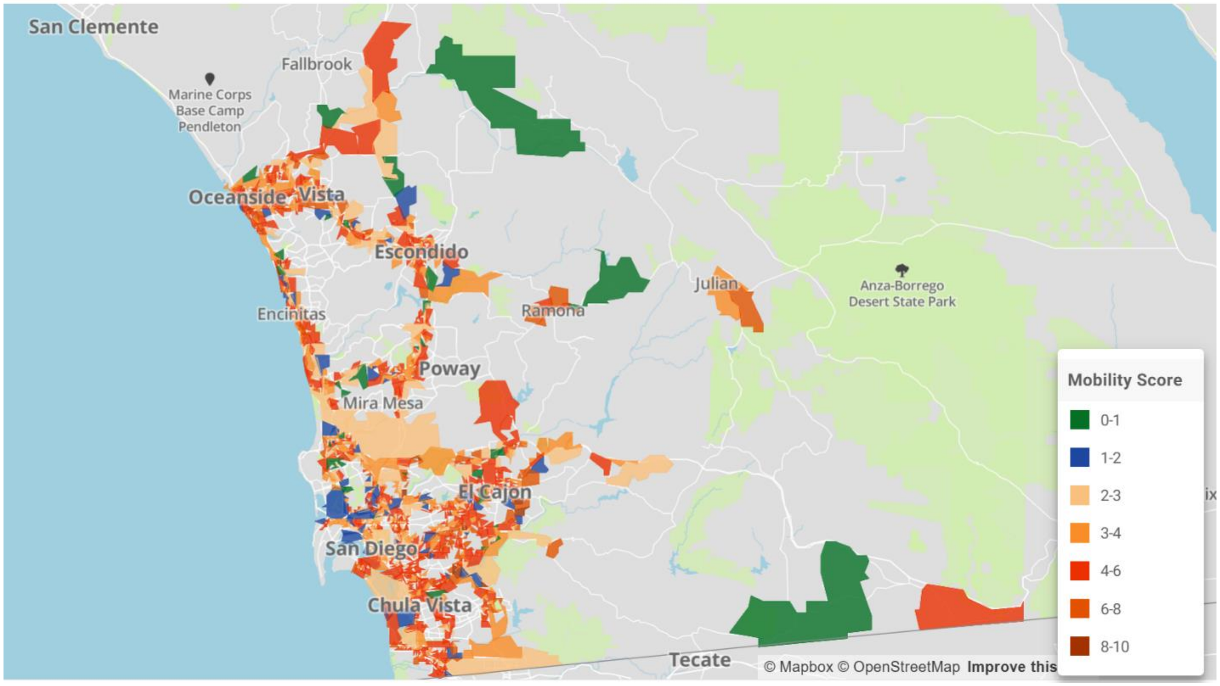


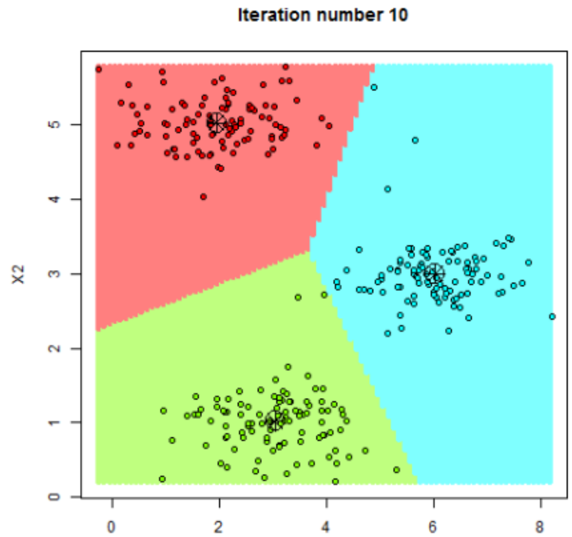
Figure 12: Mobility Metric Scoring Map



4.3 Clustering

The first phase of the methodology aims to identify the most isolated communities using various metrics that indicate the adverse impacts of transportation infrastructure on accessibility, mobility, and environmental health. In this step, the process employs a machine learning algorithm, k-means clustering, which groups census block groups having similar metric composite scores into clusters by repeatedly minimizing the distance between data points from their respective cluster centers. The process iterates until data points converge into their closet cluster center. With this data-driven approach, the groupings are derived from empirical evidence rather than being based on a subjective interpretation. This phase identifies neighborhoods with a high rate of disconnection, and it is the basis for the next phase of the study. As shown in Figure 13, the k-means clustering algorithm detects clear clusters based on the common characteristics, thereby detecting patterns within the dataset.

Figure 13: Example Decision Boundaries of K-Means Clustering Algorithm



4.4 Prioritization

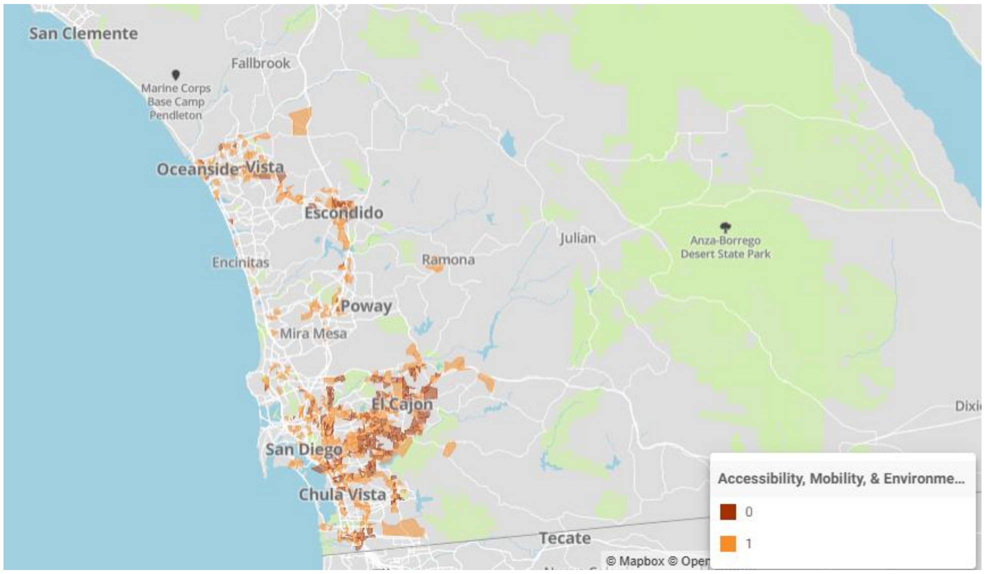
In this step, communities identified in the clustering process were prioritized. All metrics used in the prioritization step were measured and projected to a numerical value ranging from 0 to 10, in accordance with the methodology that had been established during the initial phase. This structured scoring approach has been implemented to ensure that evaluations remain consistent and impartial when applied to communities.

After the composite scores are calculated, communities are sorted into three different priority levels: high, medium and low. This framework aids in the efficient allocation of resources helping to focus efforts for this study on the most impacted communities.

5 Identified Communities

Clustering was done based on accessibility, mobility, and environmental health metrics in the study area to understand how transportation infrastructure today impacts communities as, identified as in Figure 14. Block groups with a score of 0 (red) indicate greater disconnection than 1 (orange).

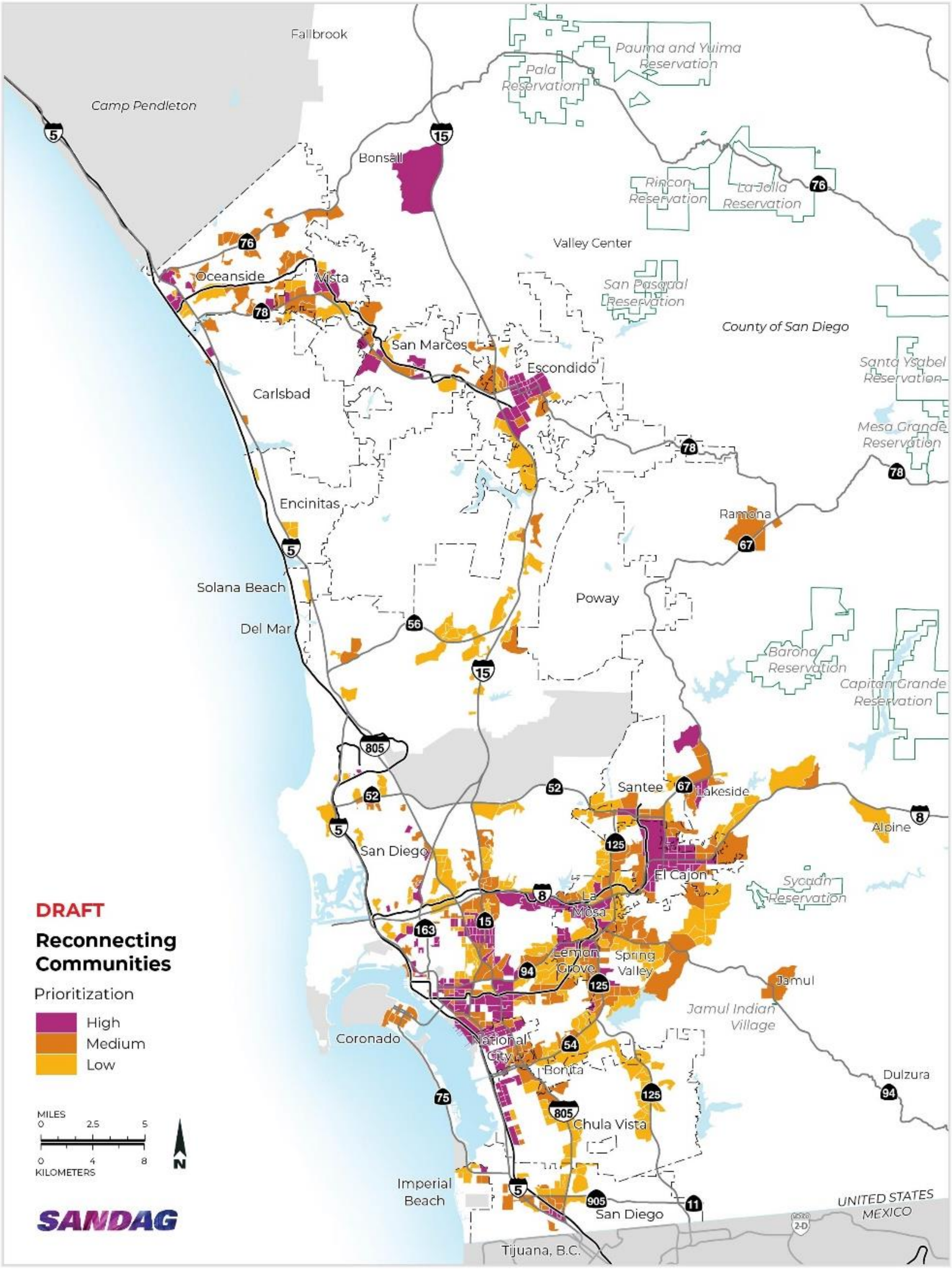
Figure 14: Clustering Results from Transportation Impacts (related to Accessibility, Mobility, and Safety)



These communities were then categorized into three priority groups: high, medium, and low, based on the aggregate score of the clustering results and the remaining metrics: traffic safety, low-income, and disinvestment. This prioritization process indicates which communities should have greater research on transportation infrastructure, current impacts, and opportunities for reconnection efforts. Figure 15 details the High-Medium-Low Prioritization Map determining, based on the analysis, where to prioritize projects to reconnect communities.

Next steps include identifying seven (7) focus areas for further analysis and project recommendations based on the High-Medium-Low Prioritization Map. This will include a Study Area Memo documenting how the seven focus areas were determined for further analysis and priority. The study will move forward through the various tasks such as Existing Conditions, Best Practices Research, Implementation Solutions and Strategies, and the Final Report.

Figure 15: Impacted Communities – High – Medium – Low Prioritization Map



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Appendix A: Maps and Other Considerations

Transportation Network

Metrics Considered but Not Used

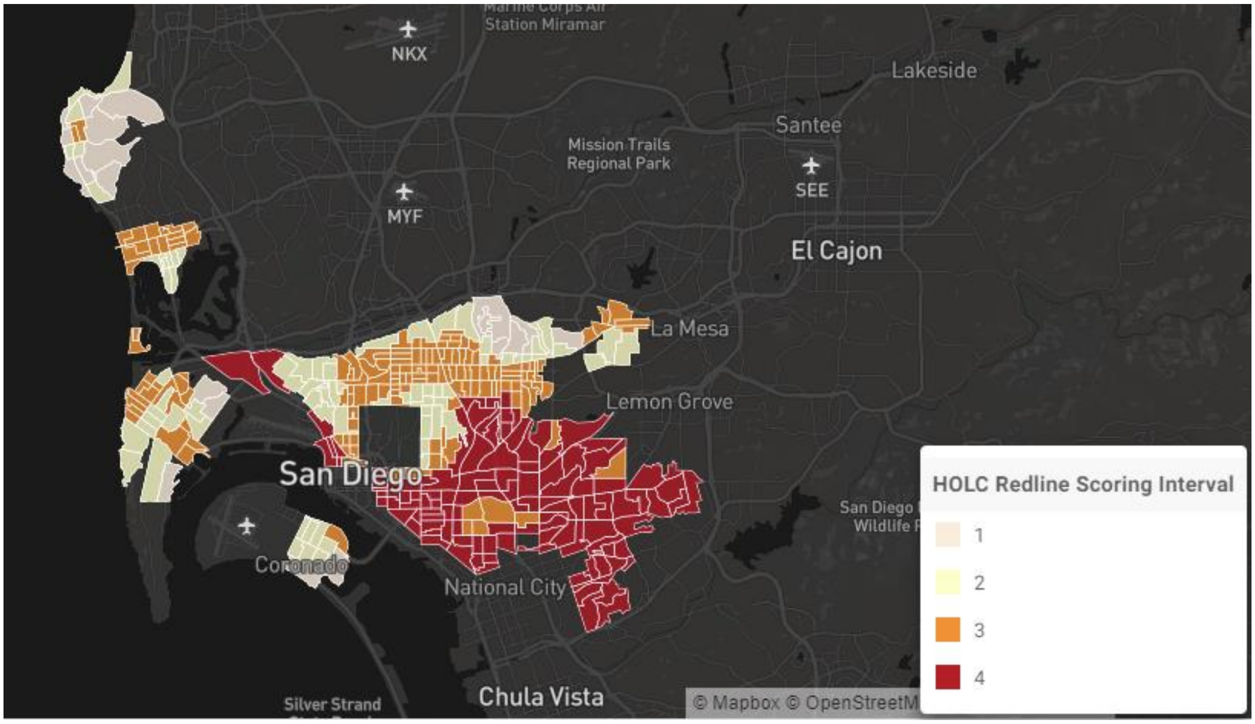
These metrics were considered but not ultimately used due to lack of data availability across the region and lack of recent data, and the fact that it doesn't reflect recent socioeconomic conditions.

Historical Disinvestment

Historical disinvestment data was taken from the Home Owners' Loan Corporation neighborhood-level rankings from the 1930s. To convert this to a more granular level, methodology was taken from the National Community Reinvestment Coalition (NCRC) and adjusted to the Census block group level.

HOLC neighborhoods were overlayed with Census block groups, with an assigned numerical value to each HOLC grade: 1 for "A", 2 for "B", 3 for "C", and 4 for "D". Then, the percentage of graded area was calculated for each block group, discarding regions with less than 20% of its region being graded. Then out of the graded area for each block group, the total area by each grade was determined; this was then utilized to determine the percentage of each grade in a block group. For example, if a block group had equal parts "A" and "C" grading, both "A" and "C" would be assigned a percentage of 50 percent each.

The weighting factors for each grade was then multiplied by its corresponding area percentage. The weighted proportions of each grade for a block group were added up to create a final redlining score for each geometry. Values closer to 1.00 indicated lower disinvestment or redlining, whereas values closer to 4.00 indicated high disinvestment.

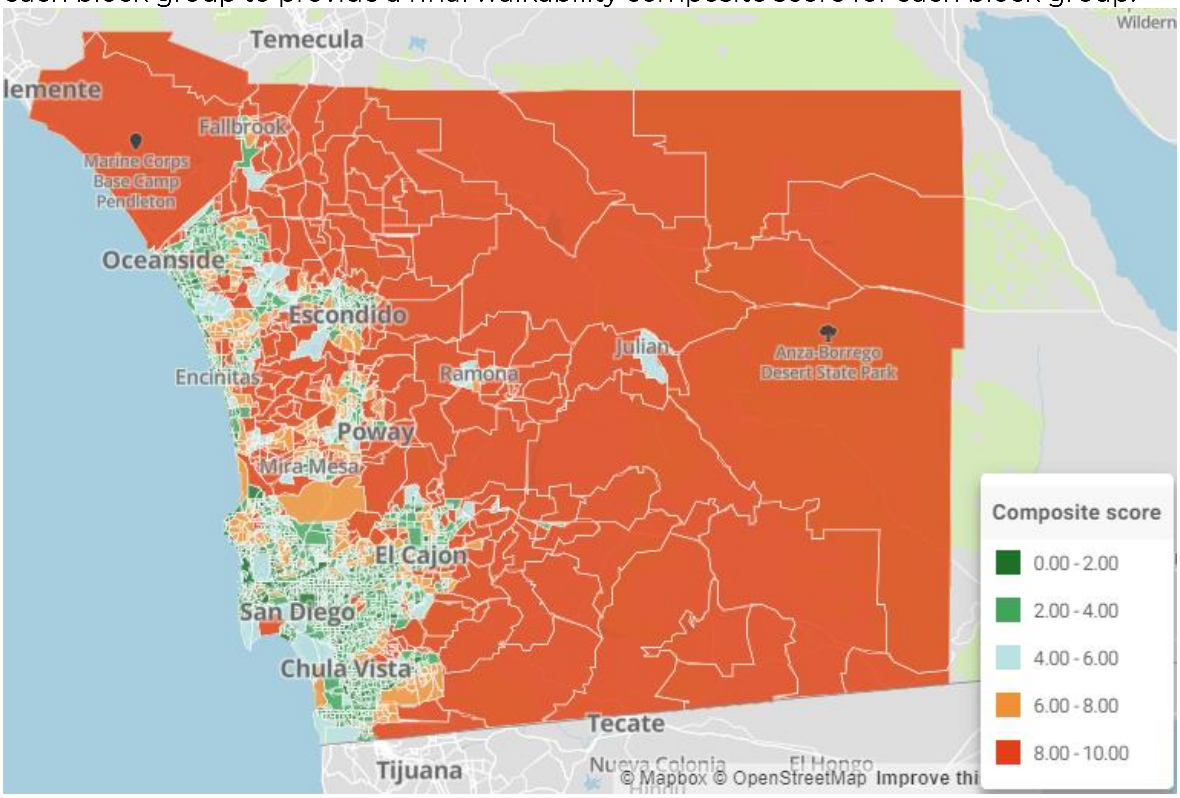


Home Owners' Loan Corporation (HOLC) (1935)

In the 1930s, the federal government funded the Home Owners' Loan Corporation to grade neighborhoods in over 200 cities across the country to reflect loan risk. Each zone was determined through collaboration from HOLC staff as well as local lenders, developers, and appraisers with the following grading options: (1) A or Best; (2) B or Still Desirable; (3) C or Definitely Declining; and (4) D or Hazardous. Better scores indicated lower risks for loans, resulting in areas graded C and D to be refused loans or receive them on a conservative basis. This includes a set of neighborhoods based around downtown San Diego, La Jolla, and parts of Coronado.

Walkability

Walkability scoring was determined by (1) proximity to nearest transit stops and (2) number of intersections within a block group. These metrics were initially ranked 1 to 20, with higher scores indicating better walkability; since higher numbers indicate worse conditions in other metrics, scoring was first reversed to have 1 be the best walkability and 20 be the worst walkability. Then, each metric was scaled from 0-10 before being added and divided by 2 for each block group to provide a final walkability composite score for each block group.



US Environmental Protection Agency (EPA) – National Walkability Index (2021)

The National Walkability Index measures the relative walkability of communities across the United States at the Census block group level. It accounts for intersection density, proximity to transit stops, and land use to help determine various walkability scores to rank how accessible different block groups are by foot.