DOCKETED	
Docket Number:	22-EVI-03
Project Title:	National Electric Vehicle Infrastructure Deployment Plan Development, 2022-26 for CEC and Caltrans
TN #:	243989
Document Title:	CA DOT RFI - CA NEVI Draft Plan Replica Comment Letter
Description:	N/A
Filer:	Spencer Kelley
Organization:	Replica
Submitter Role:	Public
Submission Date:	7/11/2022 1:22:54 PM
Docketed Date:	7/11/2022

DocuSign Envelope ID: B9371291-52D1-4252-ADF3-AF34F969A314

In response to the California Department of Transportation's Request for Information on Electric Vehicle Charging Infrastructure Development

June 2022

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Executive Summary

In response to the California Department of Transportation (Caltrans) and California Energy Commission's (CEC) Draft Deployment Plan for the National Electrical Vehicle Infrastructure Program (Draft Plan) , Replica is pleased to share the following comments as the State of California examines ways in which it can meet is greenhouse gas (GHG) emissions reductions goals in the transportation sector through the widespread adoption of zero-emission vehicles (ZEV), including accelerating the number of electric vehicles (EV) on the road.

Within the next ten years, the United States will see an even greater rise in the adoption and use of electric vehicles due, in large part, to ambitious federal spending and investment programs focused on increasing EV charging infrastructure and readily accessible charging away from one's home or workplace. The Bipartisan Infrastructure Law, enacted as the Infrastructure Investment and Jobs Act (IIJA), Public Law 117-58 (Nov. 15, 2021), created the new National Electric Vehicle Infrastructure (NEVI) Formula Program to put the United States on track to build 500,000 electric vehicle chargers by 2030. With an identified need of 250,000 public chargers by 2025 and 1.2 million by 2030, California is also proposing to invest heavily in EV infrastructure to support the transition to ZEVs, including $3 billion over five-years with another $1 billion from utilities regulated by the California Public Utilities Commission.

To achieve the intent of these programs, Replica encourages policy makers and planners to incorporate a wide variety of data sets to ensure EV infrastructure is deployed in an efficient and equitable manner. As such, our comments focus on ways that data can guide decision-making and support the deployment of an electric vehicle charging infrastructure program in the State of California.

In the following document, we focus on four areas for California to consider as it develops its state electric vehicle charging plans:

1. Performing equity analyses to ensure California's plan adheres to the Justice40 guidelines outlined in the NEVI formula program requirements as well as California's state goal of investing more than 50 percent of Clean Transportation Program funds in disadvantaged and low-income communities.
2. Addressing rural disparities and range anxiety for long-distance travelers.
3. Examining coverage gaps and identifying proposed locations based on the mobility needs of both local residents and pass-through travelers.
4. EV charging access on evacuation routes.

In the following document, we focus on the planning and data considerations we believe to be essential to the successful development and deployment of California's Deployment Plan for the NEVI Program especially given the State's ongoing climate action and resiliency planning efforts.

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About Replica

Replica provides data about how people interact with the built environment. Our mission is to make this information accessible, valuable, and actionable for the policymakers, planners and operations teams who shape our communities. With data insights spanning mobility, land use, demographics, and economic attributes, Replica empowers public agencies to achieve better outcomes in their work to create more sustainable, equitable, and livable places.

Replica is trusted by public agencies and private companies across the United States, including the California Department of Transportation (Caltrans), Illinois Department of Transportation, and New York's Metropolitan Transportation Authority (MTA), the country's largest transit agency. Agencies rely on our data to inform decisions about projects that include easing traffic congestion, reducing environmental impacts of transportation, improving access to opportunity, maintaining reliable transit service during the pandemic, and more.

Replica builds high-fidelity simulations that model the movements of people and goods. Data from these models supports researchers and public agencies in better understanding activity in the built environment, and enables equity-oriented, data-driven decisions when making changes to services, operations, and infrastructure.

In 2021, we completed the nation's first activity-based travel demand model that covers the entire contiguous United States, allowing our products to support transportation planning work in large and small cities, remote rural areas, and across state and jurisdictional boundaries.

The same tools can be used to inform the deployment of publicly available EV charging infrastructure, specifically with regards to the sites chosen for charging stations and the way those places interact with the transportation network, people's mobility patterns, and the economies around them. Below, we outline some key ways that our data can inform considerations about the deployment of EV infrastructure and also help public agencies meet the climate and equity goals written into the Infrastructure Investment and Jobs Act.

Using Data to Understand People, Mobility, and EV Infrastructure

As indicated by the recently proposed rules on the NEVI Program, deciding the best locations for EV charging infrastructure is about more than simply knowing how far EVs can travel before needing to recharge. Effective decision-making should be informed by comprehensive data that can answer critical questions about not just the *where* of mobility, but also the *who, how,* and *why.*

Public agencies can use these tools to conduct detailed analyses of trip-taking activity at specific sites, along certain routes, and throughout geographic regions. To make effective decisions about siting EV charging infrastructure, we believe it is important for public agencies to have disaggregate, privacy-sensitive data, down

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to the level of individual trips, trip-takers, and network links; this includes attributes such as:

- Network link volume
- Network VMT
- Residential VMT
- Origins, destinations, and full routing for each trip
- Trip distance, duration, and start and end times
- Trip mode (including freight)
- Trip purpose (including Home; Work; Errands; Eat; Social; Shop; Recreation; Commercial; School)
- Race and ethnicity
- Household income
- Home and work locations
- Vehicle ownership status
- Resident or visitor status

With tools like Replica, it's possible to study, for instance, how many trips near a potential charging station are starting or ending at a nearby home — and could therefore be more likely to charge an EV at home than at a station — compared to how many are part of a longer journey that might require a stop to recharge.

This powerful information can inform California's efforts to first target and fill in gaps on existing Alternative Fuel Corridors (AFC), upgrade existing sites to meet current AFC standards, and identify and nominate additional corridors with an emphasis on rural locations and historically disadvantaged and low-income communities to ensure a fully built-out system of charging infrastructure for light-duty vehicles.

The Replica screenshots below show information for pass-through trips in the selected census tracts in Pasadena, California; the choropleth map shows the distribution of home locations for people taking trips that pass through the selected census tracts. Such information on trip distances, purposes, and home locations could inform decision-making around where to site EV charging infrastructure.

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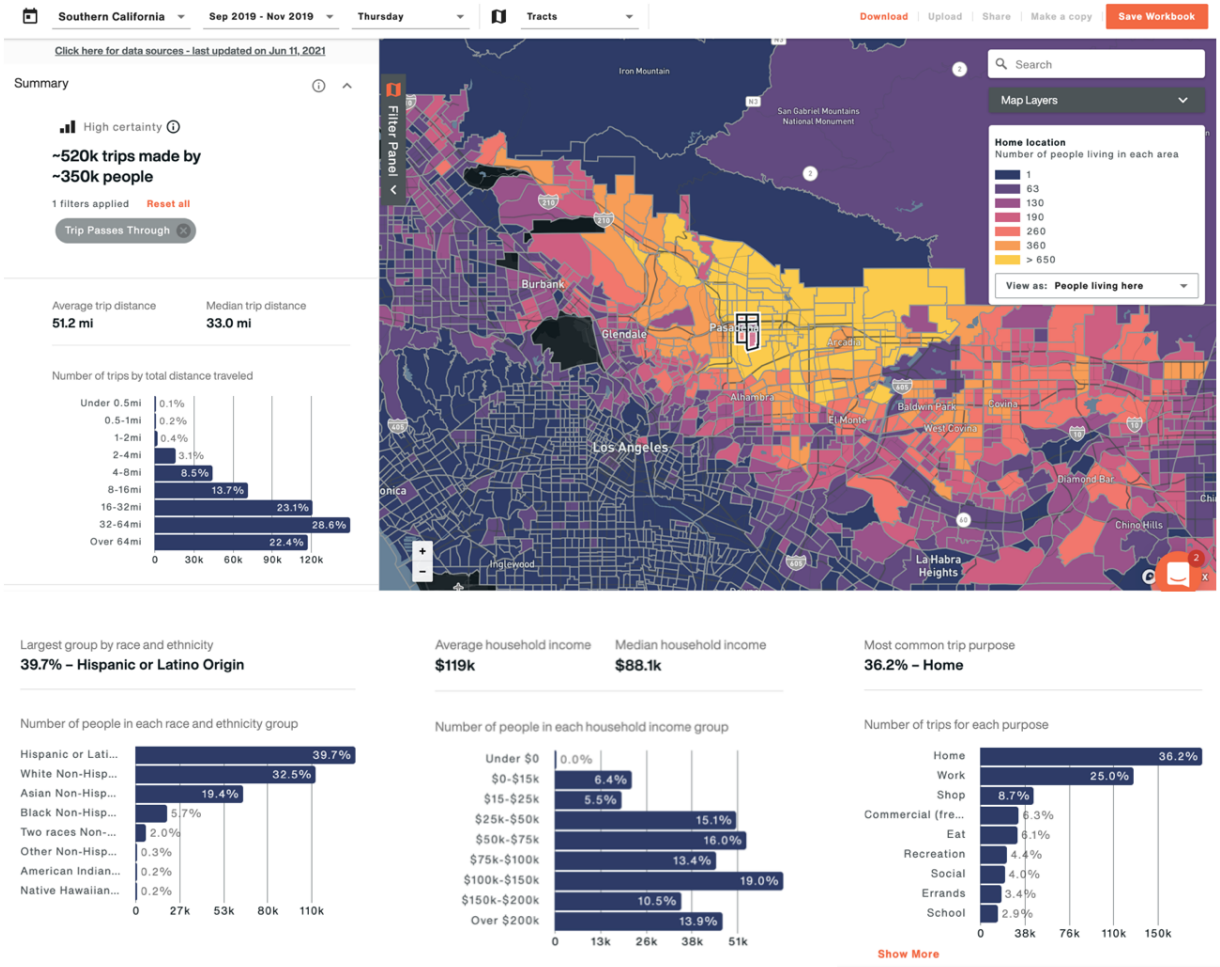
Pass-through trips in selected census tracts in Pasadena, California



Similarly, by incorporating demographic and income attributes with trip purpose data, large-scale simulations like Replica make it possible to conduct entirely new kinds of assessments that are relevant to an equitable roll-out of EV charging infrastructure such as the need for publicly available EV charging infrastructure in rural corridors and underserved or disadvantaged communities.

Replica's models also include land use data, which will enable public agencies to identify places where commuters might have greater need for publicly available charging stations due to the existing housing stock or type of parking available in their neighborhood. Data tools like Replica also make it easy to identify places where residents tend to drive for work or shopping trips – this information is critical for identifying high-impact locations for charging station accessibility in neighborhoods where many people don't have access to a private parking spot with electricity. It's also possible to study traffic volumes at the individual road link level, giving planners the ability to see where people are traveling to and from, and why, when they travel along those links.

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We understand that each place and each public agency will have its own needs regarding EV infrastructure, and that there is no simple one-size-fits-all solution to its rollout. We believe it's important for public agencies to have the tools and data they need to understand the full picture of activity around potential EV charging locations if they are to achieve the best outcomes for their regions and communities.

Leveraging Data to Build Equitable EV Charging Infrastructure

Underserved or disadvantaged communities face distinct challenges related to the adoption of electric vehicles. Replica is encouraged to see that the equity components built into the IIJA will work to address inequities that already exist and prevent new ones.

As electric vehicles become more affordable and more prevalent, disadvantaged communities that are already underserved by EV infrastructure risk being left out of the energy transition without data-driven interventions that prioritize equitable outcomes. Those who can afford to purchase an EV in underserved communities may still find it impractical or impossible to own one because of other inequities in the built environment, including their personal mobility patterns and needs.

Additionally, the Administration's Justice40 Initiative set a goal that at least 40 percent of the overall benefits of IIJA investments, including the NEVI program, must flow to disadvantaged communities including the 4,168 "Transportation Disadvantaged Census Tracts" in California. Replica data can help determine if a state's plan meets this requirement. The draft CA NEVI plan goes one step further and urges 50 percent of overall benefits going to disadvantaged and low-income communities.

The Justice40 Guidance defines a "community" as either a group of individuals living in geographic proximity (such as census tract) or a geographically dispersed set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions.

With Replica's disaggregate data, which can be filtered by individuals' demographic and economic attributes, it's possible to conduct analyses that fit either or both of these definitions.

The federal government has already released some data that can support this work, including GIS shapefiles of disadvantaged communities and EV charging locations from the U.S. Department of Energy's Alternative Fuels Data Center.

Replica's activity-based travel data is designed to be integrated with these datasets and others, allowing planners to analyze the travel behaviors of residents within these defined disadvantaged communities. Having the dynamic travel behavior of these residents — and not just their static home locations — allows agencies to more accurately evaluate whether or not 40% of the NEVI program benefits people who live in disadvantaged communities.

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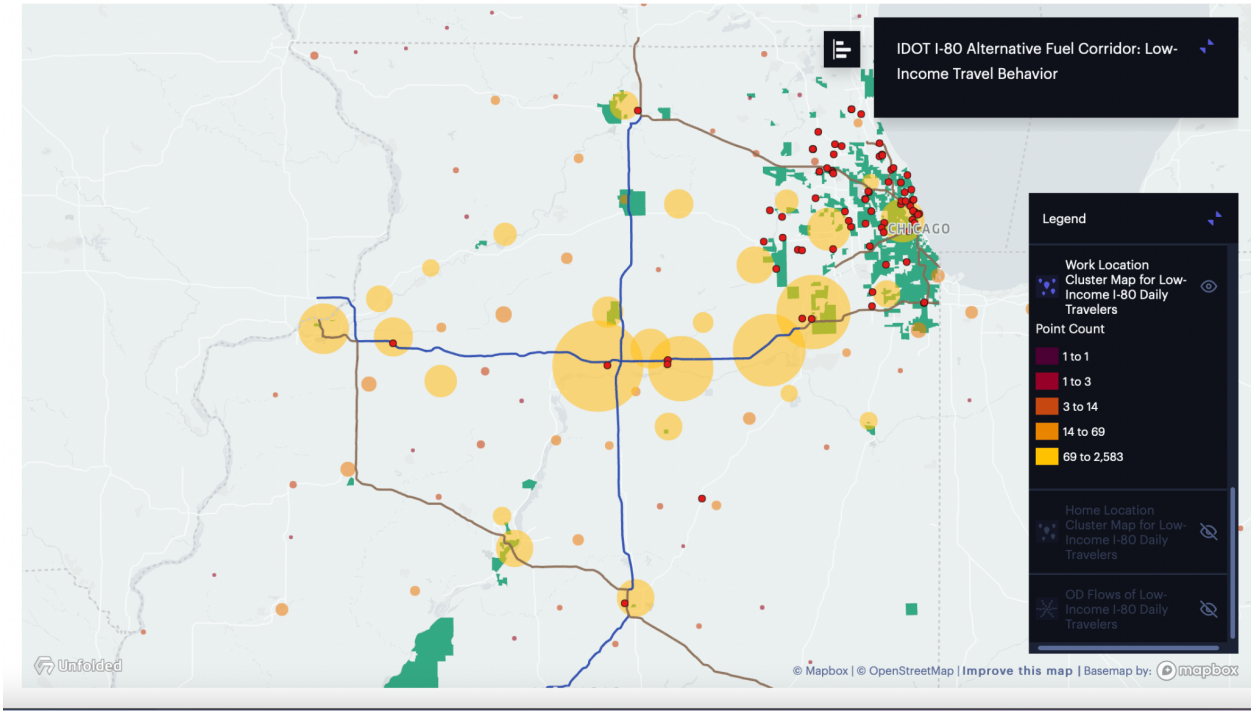
To demonstrate, we created an interactive map for the Illinois Department of Transportation that shows low-income travel behavior along I-80, a federally designated Alternative Fuel Corridor. The map highlights low-income commuters' work locations (yellow clusters) and home locations (green clusters) along I-80.



This clustering analysis method enables planners to identify sites that maximize NEVI program benefits for residents in disadvantaged communities. Replica's models include other useful attributes as well, including a household's private auto availability, consumer spending at gas stations and parking facilities, land use (and housing dwelling type), and more. These data points can all be used to measure a plan's outcomes against program guidelines.

EV charging access on evacuation routes

The federal government's Electric Vehicle Charging Action Plan calls for a national network of 500,000 publicly accessible EV chargers in eight years. As of January 2022 there are almost 113,600. Florida has been crafting its Electric Vehicle Roadmap with hurricane evacuations in mind, weighing how to prioritize investments that can serve residents well on typical days and be useful during evacuations. Similarly, as the draft California NEVI plan points out, the State is vulnerable to nearly every climate change stressor and extreme weather threat. Increasing temperatures, larger wildfires, heavier rainstorms, extended periods of drought, and rising sea levels and storm surges pose a significant risk to the state's infrastructure including EV charging stations. Moreover, utilities have started to power down during high-wind events to prevent wildfires. During these events it is important to have charging infrastructure that is accessible in the event of evacuations; particularly in vulnerable communities that may not be well-served with multiple transportation options.

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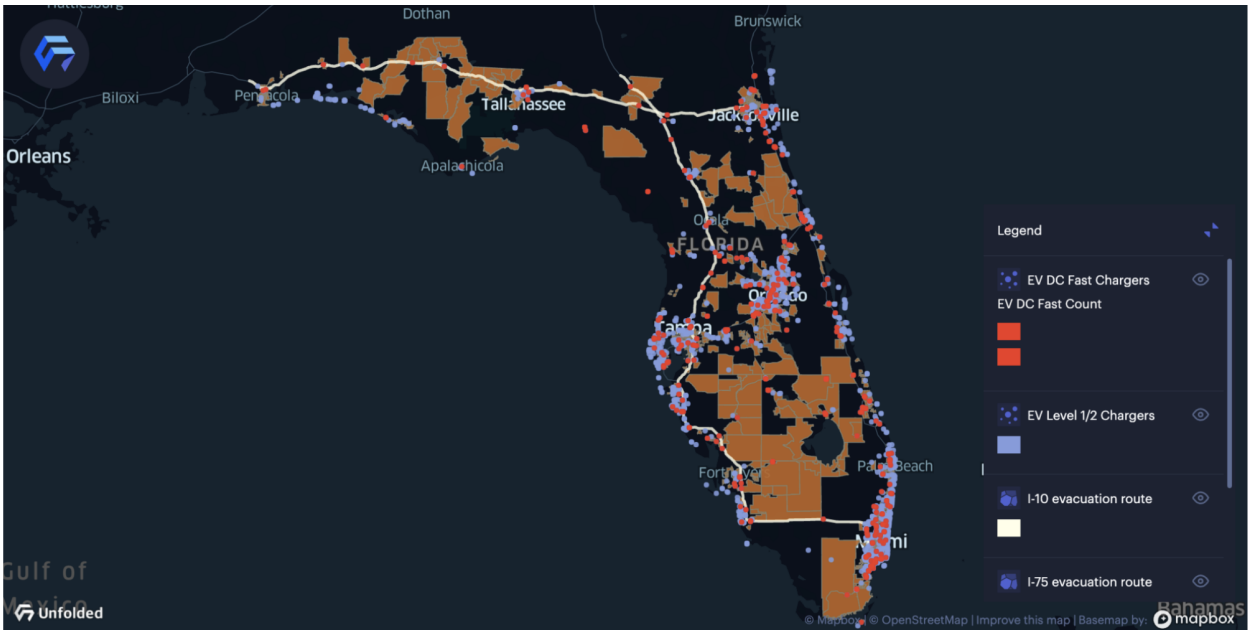
So, in order to plan an equitable deployment in line with the federal Justice40 Initiative, planners need to know how potential charging locations fit into the mobility activity of people around them. Using Replica data, we can see how Florida's EV charging network serves the state along two primary evacuation routes that cross the state — I-10, going east-west, and I-75, going north-south — as well as the state's disadvantaged communities.

Below, we look at:

- How state evacuation routes are served by EV chargers today
- Attributes of trips and people traveling along state evacuation routes
- How existing and planned EV chargers and mobility patterns overlay with disadvantaged communities
- How mobility and gas-station spending change during extreme weather



The map above shows a one-mile buffer zone around the I-10 and I-75 evacuation routes, plus the locations of Florida's DC fast chargers, which can provide a full charge in about 30 minutes, depending on the type of vehicle. Replica can also provide the locations of slower EV chargers (Level 1 and Level 2) and geographies for disadvantaged communities as defined by the Justice40 initiative.

It's not surprising that large gaps exist in the current EV network: the technology is relatively new, EVs are still only a fraction of all cars on the road, and most EV owners are able to charge their cars at home. But when assessing emergency preparedness, it's important to note that

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drivers would have few options for accessing fast chargers (Level 3) directly along evacuation routes.

That's especially clear in the stretches of I-10 on either side of Tallahassee and on I-75 when it crosses the state between Fort Lauderdale and Naples. Chargers are mostly concentrated within cities, which might be helpful for those starting a journey, but could require time-consuming detours if needed in the middle of an evacuation.

Similar analyses can and should be done for the State of California as it deploys limited capital to serve the State including its most vulnerable residents living in areas with limited access routes yet high climate change stressor and extreme weather threats.

Assessing EV infrastructure needs in rural corridors

Rural communities and corridors have their own set of circumstances that are important to consider for EV infrastructure, and high-quality data about the trips and trip-takers in these areas can provide valuable insights for selecting effective locations.

While people who live in rural areas tend to take longer trips, it's also possible that they have more access to EV chargers at home as compared to people in higher density urban areas. However, trip-takers passing through rural areas on long trips will need publicly available charging stations in rural corridors where there may be less demand among local residents. Data tools allow detailed analyses of different groups of travelers — such as local residents vs. those passing through on long journeys — and can provide important insights about who will be served by new EV charging locations.

Studies of these factors should rely on high-fidelity data products that offer VMT metrics, network link volumes, trip origin and destination points, full routing tables, and the ability to parse such information by length and purpose of trip, attributes of the trip-takers, and more.

The map below shows daily VMT per capita and EV charging stations in the rural northern stretches of Los Angeles County.

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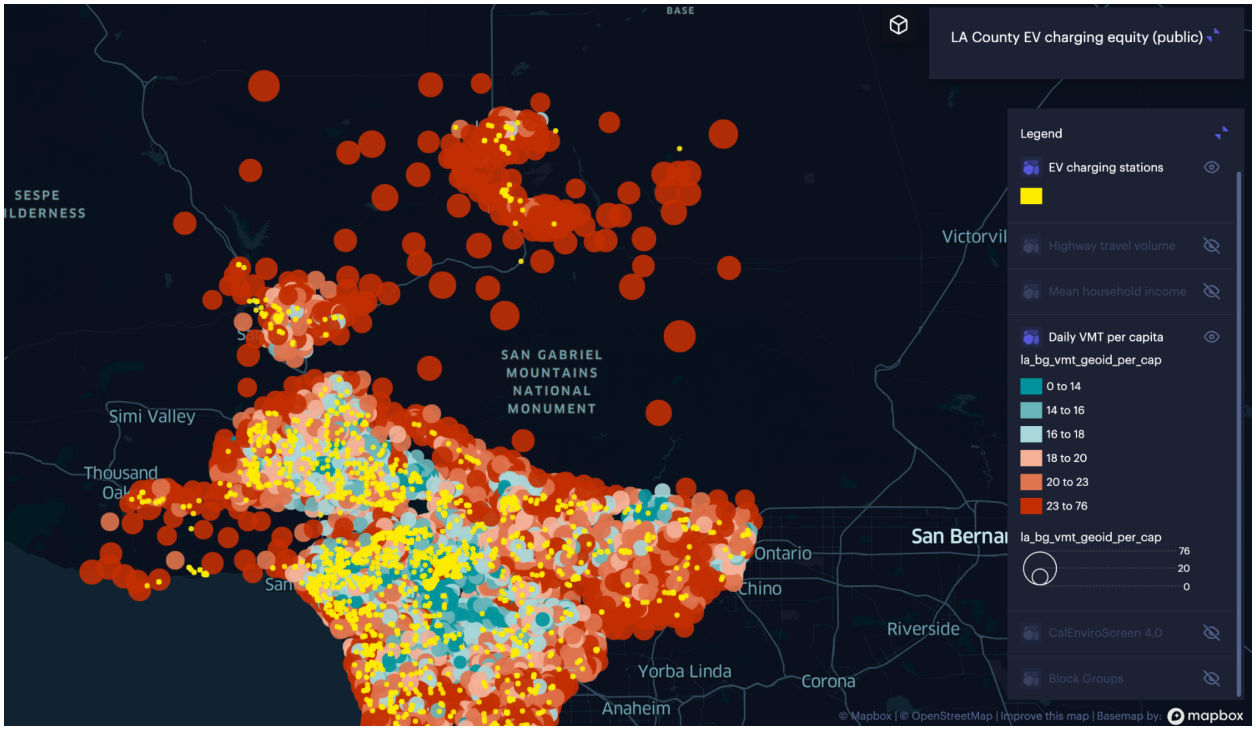

Many census block groups in the most rural parts of the county show daily VMT per capita above 45 — nearing half the range of many of today's least expensive EVs. Replica data shows that the Palmdale area, north of the San Gabriel Mountains, has a high number of long-distance commuters who also have low household incomes, in an area with relatively few publicly available charging stations.

In the Replica user interface, we analyzed trips along a rural stretch of California State Route 138 just east of Palmdale. The screenshots below from Replica's Places interface show trip-taker data as well as the distribution of origin points for trips along this corridor, which we have chosen for demonstration purposes only.

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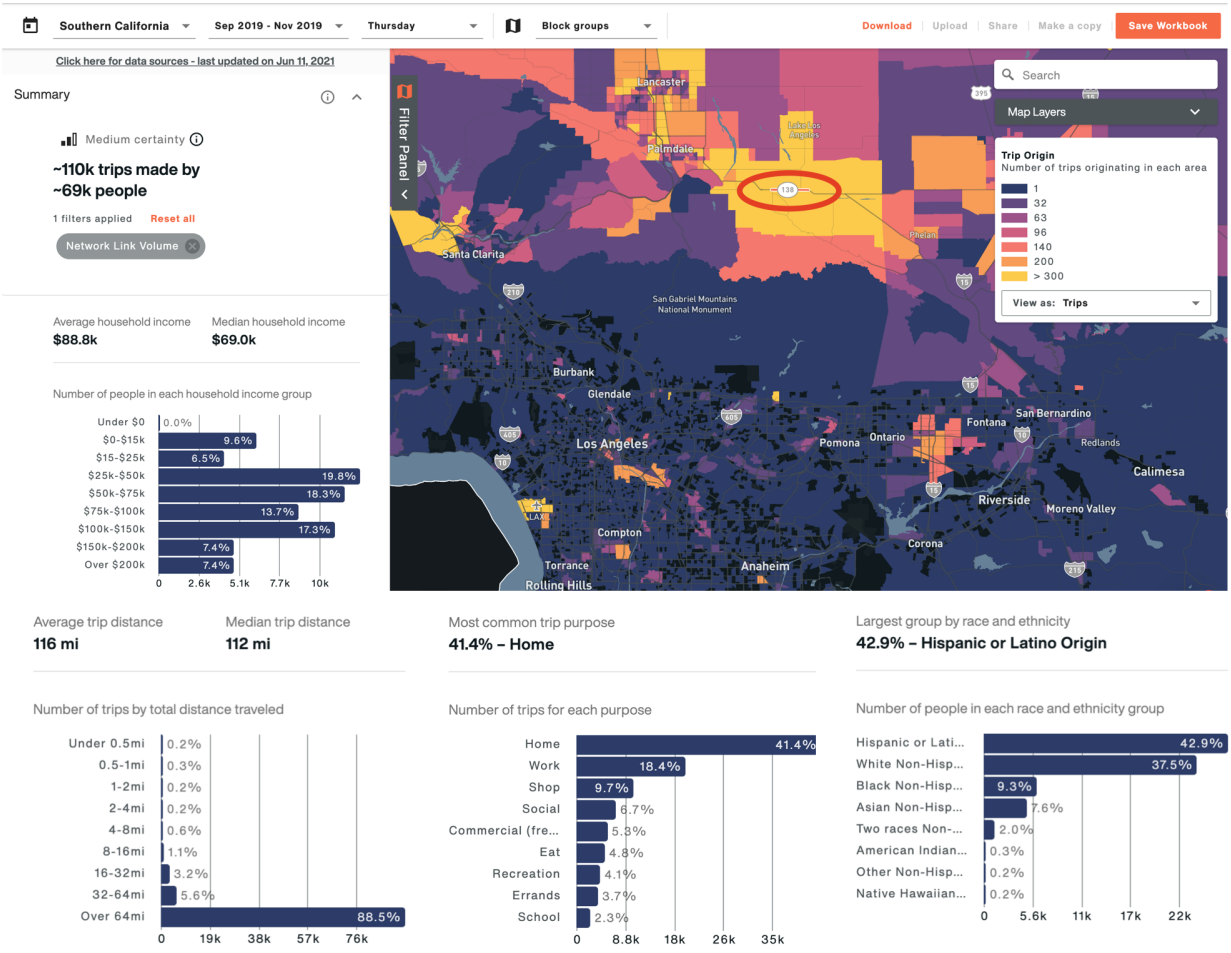
Trip Origin Data by Distance, Purpose and Race/Ethnicity



On an average day in Fall 2019[1], this stretch saw 110,000 trips with an average distance per trip of 116 miles. More than 88% of all trips were greater than 64 miles. The median household income of the trip-takers was $69,000, and 36% made less than $50,000. Most trips were people traveling to their home (41.4%) or work (18.4%). Freight accounted for 5.3% of all trips. For an agency determining the best use of investments in EV infrastructure along rural corridors, this data could power analyses of potential site locations and deliver greater confidence in decision-making.

Similarly, Replica's weekly Trends data offers recent and historical data on mobility and consumer spending, enabling public agencies to track changes in trip-taking and spending activity down to the census tract level. This information can be used in tandem with higher-fidelity Places data to establish baseline conditions and track results in near-real time during and after implementation. The charts below show weekly trip activity as well as gas

[1] Spring 2021 was released in June 2022. Replica's Places product releases at least one season per year, allowing in-depth analysis of changes over time. Replica's Trends product updates weekly with fresh data at a higher level of aggregation.

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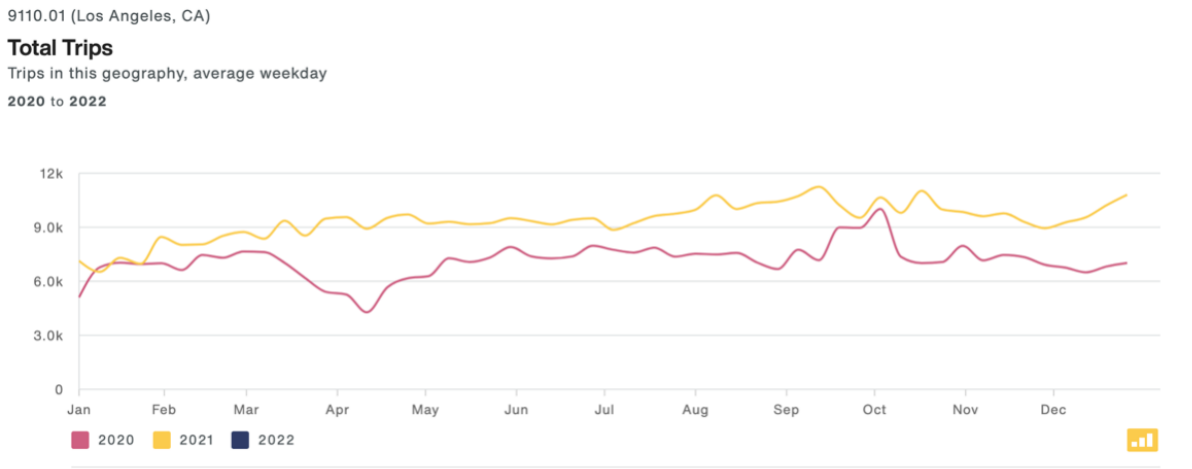
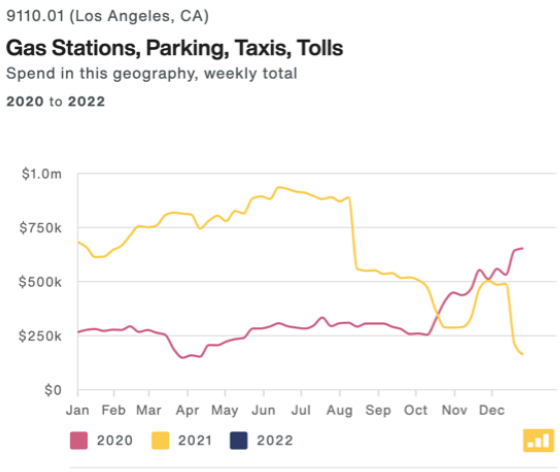
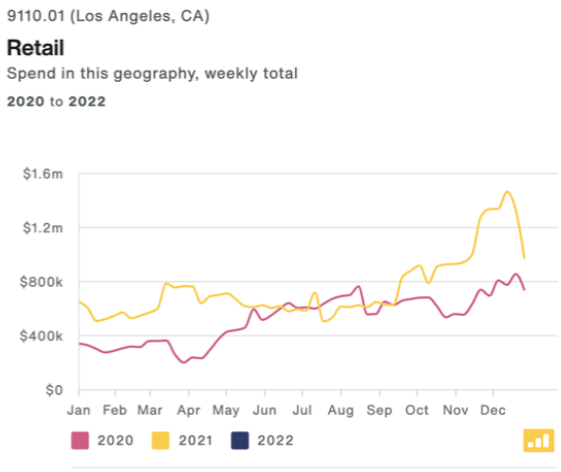
station spending and retail spending in the census tract containing the road segment analyzed above.

Weekly Trip and Selected Spend Activity







Assessments like the ones we've demonstrated above bring new dimensions to decision-making that can help public agencies of all kinds gather the insights they need quickly, coordinate with other agencies and private-sector partners, make decisions that drive better outcomes, and monitor the effects of those decisions over time.

We believe guidance for public agencies about effective and equitable EV infrastructure investments should recognize that each place will have its own unique needs and considerations, and that powerful new data technologies can take the guesswork out of learning and responding to those unique circumstances.

A full description of Replica's data products and capabilities are included in the following appendix.

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Appendix: Replica Product Overview

Activity-Based Modeling

Replica produces high-fidelity activity-based mobility models that cover the United States at "megaregion" scale (~30 million people), with disaggregated data outputs down to the network-link level. We do this by running large scale, computationally intensive simulations. Rather than simply cleansing, normalizing, and scaling individual data sources, Replica uses a composite of data sources to:

1. Create a synthetic population that matches the demographics of a given region
2. Train a number of behavior models specific to that region
3. Run simulations of those behavior models applied to the synthetic population in order to create a "replica" of transportation and economic patterns
4. Calibrate the outputs of the model against observed "ground-truth" to ensure quality. An associated quality report offers transparency into our calibration and validation processes and allows customers to understand the model and how to apply the outputs to their work.

This methodology is how Replica delivers granular data outputs that match behavior in aggregate but don't surface the actual movements (or compromise the privacy) of any one individual.

In our models, origin-destination pairs are consistent with human activities. Population demographics are accurate and correlate with appropriate movement. Recurring activities are coherent over time and capture a pattern of life. Routing between locations is consistent with local road networks and transportation options. And the scale of population and number of trips is appropriate for a given geographic extent. Compared to similar products in the market, Replica offers an easy-to-use interface with dashboards and reports, as well as more detail on trip purposes, spending data, consumer market data, and land use.

Our Tools: Places and Trends

Replica's data platform features two tools that offer deep insights into mobility patterns.

Replica Places is a series of seasonal activity-based models that are delivered at megaregion scale.

The output of each simulation is a complete, disaggregated trip and population table for an average weekday and average weekend day in the subject season (e.g., Spring 2021). The model represents a 24-hour period with second-by-second temporal resolution. In essence, each row of data in the simulation output reflects a single trip, with characteristics about both the trip (e.g, origin, destination, mode, purpose, routing, duration) and trip taker (e.g., age, race/ethnicity, income, home location, work location). In aggregate, the output dataset reflects the complete activities and movements of residents, visitors, and commercial vehicle fleets in the target region and season on a typical day.

Each year, Replica produces a spring simulation and a fall simulation for each megaregion. Each completed model also includes an associated quality report, which compares the outputs of the simulation to ground truth data, enabling comparisons between modeled outputs and observed counts.

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Replica Trends features near-real-time and historical data, updated weekly, showing mobility and economic activity nationwide down to the census-tract level.

Through the combination of Places and Trends, Replica's platform offers both seasonally and weekly updated data. The two datasets are described in detail in the table below.

Datasets	

Replica Places Data	Twice each year, Replica publishes its **Places** dataset. The Places dataset is a complete trip and population table for an average weekday and average weekend of the subject season in the selected region with data down to the network link level. This disaggregate data can be filtered, viewed, and downloaded at a number of standard geographic levels including census tracts, census block groups, zip codes, cities, counties, elementary school districts, and transportation analysis zones (TAZs). Our users also have the option of uploading custom geographies to analyze.
	
	The data included in these tables are summarized below.
	
	The Places trip table includes:
	• Origin and destination points
	• Trip distance
	• Trip duration
	• Trip routing
	• Start time and end time
	• Mode, with the following categorizations:
	  ○ Private auto: Driving; Private auto: Auto passenger; TNCs; Public transit; Freight; Walking
	  ○ Biking
	• Purpose, with following categorizations:
	  ○ Home; Work; Errands; Eat; Social; Shop; Recreation; Commercial; School
	• A unique person identifier
	• A unique activity identifier
	
	The Places person table includes:
	• A unique person identifier
	• A unique household identifier
	• Age
	• Sex
	• Race
	• Ethnicity
	• Home location
	• Work location
	• Employment status
	• Household income
	• Vehicle ownership
	• Resident or visitor status

Replica Trends Data	The **Trends** dataset is published weekly for each census tract and aggregation of census tracts in the United States. Users receive access to data for every census tract in the country, providing the ability to look at other areas for comparison purposes. Users also have the option to upload custom geographies to analyze. Data is available from January 2019 onwards, enabling year-over-year comparisons. The data points published weekly are included in the following list:

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	• Complete hourly nationwide origin-destination table, representing an average weekday and weekend day in the prior week
	• Mode Split, including the following:
	  ○ Private auto: Driving
	  ○ Private auto: Auto passenger
	  ○ Public transit
		• Trip Purpose, including the following:
		  ○ Home; Work; Errands; Eat; Social; Shop; Recreation; Commercial; School
		• Dollars of Consumer Spend, both in aggregate and broken down in the following sectors:
		  ○ Retail, Grocery, Gas Stations, Restaurants & Bars, Airline, Hospitality, & Car Rental, Entertainment & Recreation
		• COVID-19 Cases

Replica Trends and Places data outputs are available in the following ways:

- **Data downloads**: All data is available via data download through the Replica web interface, for easy analysis in other applications, including GIS, without any necessary post-processing.
- **Replica web interface:** Replica can be consumed and queried through the Replica web interface, which enables individual users to view standard visualizations or build their own. Specifically, in the Replica Places' Explorer interface, the model's disaggregate data can be filtered by characteristics of individual trips (such as mode, purpose, or start time) and individual trip takers (such as household size, car ownership, demographics, or household income). The data can then be viewed at a number of standard or custom geographic levels including census tracts and block groups, zip codes, cities, and counties. This information is displayed in the form of maps, charts, and tables, including network link (powered by Open Street Map) and transit route-level information.
  In the Trends interface, mobility and spend data can be aggregated weekly or monthly, displayed year over year, compared in absolute or relative terms, and shown across multiple geographies. The resulting outputs of these queries can be exported and used for any and all purposes.
- **Replica reports and dashboards:** Summary data is also available in a series of pre-packaged reports, also available through the Replica web interface. Examples of these reports include Seasonal Comparisons, Year over Year Comparisons, Resident Reports by Income or Car Ownership, and Transit Reports by Income or Race & Ethnicity.
- **Direct database access:** Replica can provide direct database access to facilitate custom analyses or integrated with third-party tools.