Replica

ARE YOU EXPERIENCED?
A-Side: Audition
The Players

**Replica**
Checked almost every box

**Streetlight**
Lacked multimodal and demographic information

**INRIX**
Already use and are the source information for most options
What is Replica?

**Places**
Interactive map with filters and summaries of trips and people for a modeled season

**Trends**
Weekly updates of O-Ds, VMT, and spending

**Traffic Data**
AADT, turning movements, volume and speed profiles
Can it be Trusted?

Replica utilizes most of the same data sources we are already using to create our regional travel demand model. “Big Data” observations are used to enhance the model.

- American Community Survey (ACS)
- Public Use Microdata Sample (PUMS)
- Longitudinal Employer-Household Dynamics Data (LEHD)
- Census Transportation Planning Product (CTPP)
- National Center for Education Statistics (NCES)
- OpenStreetMap (OSM)
- General Transit Feed Specification (GTFS)
- Counts (INRIX or supplied locally)
- Parcel and Building Footprints

Plus

- Location-Based Services (LBS)
- Various Transaction Data
Replica Places

A seasonal activity based model for megaregions. It is available for the entire United States with models back to 2019. Each model provides multimodal output for typical weekday and weekend day.

- Interactive map
- Filterable trips, persons, and geographies
- Summary information
- Loaded network for all modes
- Complete trip and person tables
<table>
<thead>
<tr>
<th>ID</th>
<th>Household ID</th>
<th>Age</th>
<th>Sex</th>
<th>Race and Ethnicity</th>
<th>Employment Status</th>
<th>Work From Home</th>
<th>Individual Income</th>
<th>Commute Mode</th>
<th>Household Size</th>
<th>Household Income</th>
<th>Private Auto Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1564243921904357158349</td>
<td>628850025024902963</td>
<td>13</td>
<td>Male</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>Unemployed</td>
<td>Other travel mode</td>
<td>3</td>
<td>61961</td>
<td>Zero</td>
</tr>
<tr>
<td>15794629058482353299</td>
<td>625910025024902964</td>
<td>64</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Employed</td>
<td>In person</td>
<td>23727</td>
<td>Private auto</td>
<td>0</td>
<td>811961</td>
<td>Zero</td>
</tr>
<tr>
<td>17362301952536951012</td>
<td>12489998283703183939</td>
<td>82</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>Unemployed</td>
<td>Other travel mode</td>
<td>1</td>
<td>11958</td>
<td>Zero</td>
</tr>
<tr>
<td>00835507062425299055</td>
<td>57262270220151971522</td>
<td>12</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>Unemployed</td>
<td>Other travel mode</td>
<td>5</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>15631031887539457166</td>
<td>57262270220151971522</td>
<td>5</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>Unemployed</td>
<td>Other travel mode</td>
<td>5</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>41310861414908483959</td>
<td>57262270220151971522</td>
<td>32</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Employed</td>
<td>In person</td>
<td>8744</td>
<td>Private auto</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>18037642056200985827</td>
<td>57262270220151971522</td>
<td>55</td>
<td>Male</td>
<td>White, not Hispanic or Latino</td>
<td>Employed</td>
<td>In person</td>
<td>210</td>
<td>Private auto</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>38973251149050257460</td>
<td>57262270220151971522</td>
<td>55</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Employed</td>
<td>Work</td>
<td>3765</td>
<td>Private auto</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>17447138304415595007</td>
<td>836887650772185645</td>
<td>55</td>
<td>Male</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>In person</td>
<td>45509</td>
<td>Private auto</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>13816133668791215181</td>
<td>9886591806292312961</td>
<td>60</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>6638</td>
<td>Other travel mode</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>01529999283992019281</td>
<td>3521708294900502928</td>
<td>70</td>
<td>Male</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>40465</td>
<td>Other travel mode</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
<tr>
<td>38962752032235685911</td>
<td>7331025158844496297</td>
<td>70</td>
<td>Female</td>
<td>White, not Hispanic or Latino</td>
<td>Unemployed</td>
<td>Under 16</td>
<td>40465</td>
<td>Other travel mode</td>
<td>0</td>
<td>46120</td>
<td>Zero</td>
</tr>
</tbody>
</table>
Replica Trends

A weekly model for monitoring. It is available for the entire United States with models back to 2019. Each model provides output for typical weekday and weekend day.

- Origins-Destinations
- Mode Share
- Trip Start Time
- Residential Vehicle Miles Traveled (VMT)
- Spend by Merchant and Home Location
- Spend by Online and Brick and Mortar
### Trips by Origin

<table>
<thead>
<tr>
<th>Week Starting</th>
<th>Trip Count</th>
<th>Origin Geo Id</th>
<th>Origin Geo Name</th>
<th>Origin Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023-09-30</td>
<td>805515</td>
<td>47187</td>
<td>Williamson County, TN</td>
<td>225329</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>327804</td>
<td>47119</td>
<td>Maury County, TN</td>
<td>91958</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>2810177</td>
<td>47037</td>
<td>Davidson County, TN</td>
<td>687257</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>458339</td>
<td>47189</td>
<td>Wilson County, TN</td>
<td>136614</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>1166704</td>
<td>47149</td>
<td>Rutherford County, TN</td>
<td>315740</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>229168</td>
<td>47147</td>
<td>Robertson County, TN</td>
<td>70246</td>
</tr>
<tr>
<td>2023-09-30</td>
<td>603573</td>
<td>47105</td>
<td>Sumner County, TN</td>
<td>183397</td>
</tr>
</tbody>
</table>

### Spend by Merchant Location

<table>
<thead>
<tr>
<th>Week Starting</th>
<th>Geo Id</th>
<th>Geo Name</th>
<th>Population</th>
<th>Airline Hospitality Car Rental Spend</th>
<th>Entertainment Recreation Spend</th>
<th>Gas Stations Parking Taxis Tolls Spend</th>
<th>Grocery Stores Spend</th>
<th>Restaurants Bars Spend</th>
<th>Retail Spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023-10-07</td>
<td>47165</td>
<td>Sumner County, TN</td>
<td>183397</td>
<td>982965.32</td>
<td>930269.62</td>
<td>713916.77</td>
<td>5065408.65</td>
<td>7101315.21</td>
<td>24443694.81</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47189</td>
<td>Wilson County, TN</td>
<td>136614</td>
<td>1469775.2</td>
<td>340687.95</td>
<td>7076730.31</td>
<td>4514712.77</td>
<td>5415424.67</td>
<td>27743338.42</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47037</td>
<td>Davidson County, TN</td>
<td>687257</td>
<td>16368317.76</td>
<td>5294082.18</td>
<td>25605354.52</td>
<td>26314053.65</td>
<td>35781422.34</td>
<td>126994921.76</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47147</td>
<td>Robertson County, TN</td>
<td>70246</td>
<td>215248.14</td>
<td>241035.93</td>
<td>4088360.73</td>
<td>3511730.35</td>
<td>2594724.21</td>
<td>13453050.16</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47149</td>
<td>Rutherford County, TN</td>
<td>315740</td>
<td>2264416.01</td>
<td>2096473.54</td>
<td>13432175.52</td>
<td>9721913.03</td>
<td>11351770.31</td>
<td>5372870.73</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47119</td>
<td>Maury County, TN</td>
<td>91958</td>
<td>675203.18</td>
<td>413798.24</td>
<td>6109084.11</td>
<td>3836052.67</td>
<td>3361380.41</td>
<td>17910416.89</td>
</tr>
<tr>
<td>2023-10-07</td>
<td>47187</td>
<td>Williamson County, TN</td>
<td>225329</td>
<td>2624248.24</td>
<td>2027487.45</td>
<td>740684.28</td>
<td>6854831.15</td>
<td>9196798.59</td>
<td>3728504.25</td>
</tr>
</tbody>
</table>
Replica Traffic Data

Annual model for monitoring and reference. It is available for the entire United States with models back to 2019. Aside from AADT, each model provides output for typical weekday and weekend day.

- Annual Average Daily Traffic (AADT)
- Free Flow Speeds
- Hourly Auto Volume Profile
- Quarter Hourly Speeds Profile
- Turning Movement Counts
B-Side: Samples
Fans (60+ users)

**GNRC Staff**
Travel demand and land use models, monitoring congestion, comprehensive plans, economic development, aging and disability, local and media inquiries

**Transit Agencies**
System analysis, identification of potential expansion, better understanding of roadway conditions

**Local Governments and Consultants**
Safety analysis, active transportation demand, impact analysis, monitoring of congestion, better understanding of mobility needs
How Have We Been Using Replica?

**Updating Travel Demand Model**
Reference data as model input and modeled data in calibration

**Locating Potential Transit Riders**
Finding transit dependent populations

**Profiling a Corridor**
How should a roadway be designed based on its users
How Else Can Replica be Used?

Replica provides detailed outputs that can be used beyond traditional regional transportation planning.

- Peer Analysis
- Market Characteristics
- Land Use and Built Environment
- Safety
- Freight
- Parking
- Economic Impact
- Traffic Impact
- Workforce
- Electric Vehicle
- Transportation Network Company (TNCs)
- Housing
- Equity
- Transit Demand
Updating TDM

GNRC is using Replica to update assumptions in travel behaviors to supplement an outdated household travel survey. Also provides significant time savings on data collection and processing.

- Origins-Destinations
- Mode Share
- Trip/tour Purposes
- Trip Length and Time
- Time of Day Distribution
- Freight Movements
- Telecommuting
Locating Potential Transit Riders

Transit agencies are using Replica to identify new markets for potential service expansion. By understanding where transit dependent populations live and work, services can be tailored for efficiency.

- Income
- Auto Ownership
- Trip Purpose
- Time of Commute
- Existing Ridership
- Travel Times
Profiling a Corridor

Local agencies are using Replica to understand the users of a corridor of interest. By having a clear picture of who is using a roadway segment, it can be designed to best serve its users.

- Demographics
- Mode
- Trip Purpose
- Origins and Destinations
- Loaded Network with Local Streets
- Time of Day
Liner Notes
Is Replica a One Hit Wonder?

**Provides Speed, Volumes, and Turning Movements**
Similar to INRIX through RITIS platform currently using for system monitoring. Multimodal volumes and turning movements previously unavailable will improve prioritization tools and studies.

**Demographic, Spend and Trip Data**
Understanding of users and how they traverse the transportation system without effort and time involved to update regional TDM.

**Always Adding Features**
Replica is ever evolving to create new features and functions.
Performance

Overall, the performance of Replica has been acceptable. Urban areas seem to be underestimated and rural areas tend to be overestimated. We also noted several locations where counts appeared significantly different.

- Compared TDOT AADT to Replica 2022 AADT
- $\text{AADT R}^2 = 0.952$
- Replica count incorrectly tagged bidirectional
- Historic TDOT counts indicate that many counts are possible
- DVMT undercount by 4.5M or -7.6%

![Graph showing DVMT trend over years](image)
Performance

Resources and documentation of results:

- **Seasonal Quality Reports**

- **GNRC AADT Validation – Segments**

- **GNRC AADT Validation – Ramps**
  (https://public.tableau.com/app/profile/gnrc/viz/ReplicaValidationRamp/Dashboard1)
Can Quality Improve?

**Improve Local Data**
Every seasonal model can improve by submitting local data. This could be counts, turning movements, transit feeds, speed profiles, editing OSM.

**Export Data**
Mapping and summaries can be limiting. Exporting data to display and analyze is sometimes necessary.

**Brainstorm with Replica**
If an issue is identified or you would find a feature helpful, the Replica team is willing to discuss anything to improve their product.
Are you experienced?
Have you ever been experienced?

Well, I have

Jimi Hendrix