TNMUG Meeting
Leveraging Mobility Data to Add Value to Planning and Model Development Projects
Kevin Johnson has 17 years of experience in the transportation planning, data, and forecasting field. He has worked primarily on big data and travel modeling projects, providing data-driven insights supporting transportation decisions. His recent work has focused on helping clients understand their data requirements, the advantages and limitations of diverse mobility data types, and how these sources can be employed to achieve their objectives in a defensible, straightforward, and cost-effective way.
Introduction

Big Data: What is it?

Smartphones and modern vehicles collect vast amounts of data, which can be processed and leveraged to offer insights into travel patterns, mobility behaviors, and individual perceptions.

However, like any data source, **passive data sources come with their own strengths and limitations** that need to be understood to maximize their utility and reduce the potential for error.
Early Case Studies
Interstate 80 & SR 65 Interchange Project

Better Data, Better Decisions
Golden 1 Center Transportation Management

Using Cell Phone Data to Develop Event Transportation Management Plan for Golden 1 Center

To plan for and evaluate the $556 million arena in the heart of downtown Sacramento, we used cell phone data to quickly estimate Arena VMT.

Value for understanding special generator travel
Highlights the importance of developing partnerships with data vendors and asking the tough questions.
Personal GPS-based data products were very new. I was tasked with evaluating the new data source and reporting back strengths and limitations.
Napa Valley Travel Behavior Study
What can we now do with GPS-based data products?
Napa Valley Travel Behavior Study

Goal: Better Understand Napa Travel Behavior

Vehicle Classification Counts
For Expanding Mobility Data

License Plate Matching
For Mobility Data Ground Truthing

Winery Regression Analysis
To Develop Winery Trip Rates

Surveys
For Mobility Data Ground Truthing

Resident Trips

Visitor Trips

Employee Trips

Student Trips

Mobility Data

Congestion:
Which Trips Cause It?
NVTA Used the Data on Short- and Long-Term Planning Projects and to Inform the Travel Model Update

Transit Improvements: New Bus Routes

Transit Possibilities: Exploring Passenger Rail

Affordable Housing: A Higher Priority

“We have a more complete Countywide Transportation Plan” – Danielle Schmitz, Planning Manager, NVTA
Napa Valley Travel Behavior Study

Question: should SR 29 be widened?

Imported Workers Main Source of Congestion on State Route 29, not Pass-Through Trips

Better Data Drives Better Forecasts to Inform Planning

Soscol Junction Project

Fresno-Madera Origin-Destination Study

Why was the study needed?

- Increased development along border of two counties
- Disagreement on best way to plan and fund mitigation
- Needed to understand and quantify transportation movements between Fresno and Madera counties

Figure 1-2: Population Growth Rate Since 1970

![Population Growth Rate Since 1970]
Fresno-Madera Origin-Destination Study

How the data was used:

• Analyzed the fiscal impact of inter-county movements
• Informed decision-making bodies regarding travel patterns and their economic impacts
• Allocated funding responsibilities equitably and stopped suing each other
• Informed new infrastructure projects and policies
Marin County Model Development Project
Help Calibrate Macro-Level Trip Patterns

Table 5-15: Origin-Destination Data AM Peak Period Intra-County Origin-Destinations

<table>
<thead>
<tr>
<th>Origin-Destination Pair</th>
<th>Low Estimate</th>
<th>High Estimate</th>
<th>TAMDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Rafael to San Rafael</td>
<td>19,800</td>
<td>26,800</td>
<td>19,968</td>
</tr>
<tr>
<td>Novato to Novato</td>
<td>13,900</td>
<td>18,900</td>
<td>17,610</td>
</tr>
<tr>
<td>San Rafael to Novato</td>
<td>2,500</td>
<td>3,400</td>
<td>4,209</td>
</tr>
<tr>
<td>Novato to San Rafael</td>
<td>5,000</td>
<td>6,700</td>
<td>5,958</td>
</tr>
<tr>
<td>San Rafael to San Anselmo</td>
<td>1,200</td>
<td>1,600</td>
<td>2,045</td>
</tr>
<tr>
<td>San Anselmo to San Rafael</td>
<td>2,400</td>
<td>3,300</td>
<td>2,715</td>
</tr>
<tr>
<td>Unincorporated to Unincorporated</td>
<td>3,700</td>
<td>5,000</td>
<td>3,743</td>
</tr>
</tbody>
</table>

Table 5-16: Origin-Destination Data AM Peak Period

<table>
<thead>
<tr>
<th>Origin-Destination Pair</th>
<th>Low Estimate</th>
<th>High Estimate</th>
<th>TAMDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonoma County to Marin County</td>
<td>7,200</td>
<td>9,800</td>
<td>8,900</td>
</tr>
<tr>
<td>Sonoma County to San Francisco</td>
<td>2,900</td>
<td>3,900</td>
<td>3,500</td>
</tr>
<tr>
<td>San Francisco to Sonoma</td>
<td>1,200</td>
<td>1,700</td>
<td>1,200</td>
</tr>
<tr>
<td>Marin County to Sonoma County</td>
<td>4,900</td>
<td>6,600</td>
<td>6,300</td>
</tr>
<tr>
<td>Marin County to San Francisco</td>
<td>11,100</td>
<td>15,100</td>
<td>13,400</td>
</tr>
<tr>
<td>San Francisco to Marin County</td>
<td>6,100</td>
<td>8,200</td>
<td>7,100</td>
</tr>
<tr>
<td>Marin County to Napa or Solano County</td>
<td>1,000</td>
<td>1,400</td>
<td>1,200</td>
</tr>
<tr>
<td>Solano or Napa County to Marin County</td>
<td>2,100</td>
<td>2,800</td>
<td>2,600</td>
</tr>
<tr>
<td>Marin County to Alameda or Contra Costa County</td>
<td>5,600</td>
<td>7,500</td>
<td>6,800</td>
</tr>
<tr>
<td>Alameda or Contra Costa County to Marin County</td>
<td>8,600</td>
<td>11,600</td>
<td>12,900</td>
</tr>
</tbody>
</table>
What we Learned
Data are Constantly Changing
How can agencies adjust and adapt?

Source: Based on graphic from StreetLight
Constellation of Data Vendors
Which data source should you use? It depends.

• RSG tried processing raw data sources
• Process was messy and required significant cleaning and assumptions be made
• RSG gained insights through this process, and now we evaluate vendors and recommend the best solutions for our clients
Considerations when Talking to Vendors

It’s imperative to understand strengths and limitations.

- Beware the oversell
- Big data has only been around for ~10 years
- Work with vendors who are open about their data
- Think about how to integrate with existing data, especially travel survey data (opposite limitations)
- Keep in mind that significant time and effort is still required to get the most out of the data
- Ask the tough questions
No Single Solution
A combination of sources is usually optimal.

- Maximize the data clients already have, leveraging what can be significant investments.
- Evaluate and recommend new sources that help clients best meet their analysis needs. Understand the strengths and limitations of each source.
- Combine data from various providers to turbocharge analyses and fill in the gaps of individual datasets, making the whole greater than the sum of its parts.
Recent Case Studies
Tampa Bay Regional Travel Survey Program
Tampa Bay Regional Travel Survey Program

- **Household Travel Survey**
  - Sample Size: 4,565 households; 9,099 people; 76,226 trips
  - Sampling Methods: address-based probability and nonprobability
  - Included robust public outreach and in-person intercepts
  - Partnered with area universities and home-owners associations

- **University Student Supplement**
  -

- **Seasonal Resident Supplement**
  -

- **Passive Data OD Tables**
  - External and internal origin-destination tables (Big Data)

- **Long-Distance Travel Survey**
  - 559 surveys collected through email re-invitations in three waves

- **Employer/Employee Survey**
  - 1,213 employer survey responses
  - 1,169 employee survey responses

- **Visitor Survey with Passive Data Add-On**
  - 1,352 surveys collected through in-person intercept
Tampa Bay Regional Travel Survey Augment

Goals:

• Establish new post-COVID baseline

• Supplement the previous travel surveys

• Focus on visitor travel

• Obtain a more spatially representative sample of travel

• Merge sources together to provide a more complete picture of Tampa Bay travel behavior
Data Sources – each with their own set of strengths and limitations

Client Already Had:

- **rMove** - invaluable source of in-depth, self-reported travel behavior data, which complements large datasets of passively collected data (like Replica and LBS sources) where travel behavior data is largely imputed by computer algorithms rather than reported by actual travelers. But low sample size and spatial representativeness.

Supplemental:

- **Replica** – large, spatially representative sample of simulated travel behavior data for trip making within the Florida, Georgia, and South Carolina megaregion.

- **LBS Traces** - large, spatially representative sample of more empirical-based home location data for visitors to the FDOT D7 region from within the United States.

[https://rsginc.shinyapps.io/Tampa-Storyboard/](https://rsginc.shinyapps.io/Tampa-Storyboard/)
Replica Visitor Travel Evaluation

1. Busch Gardens
   Visitor Home Locations

Imputed Home Locations from Location-Based Services Data

LBS to Replica Data Comparison

<table>
<thead>
<tr>
<th>Area</th>
<th>Data Source</th>
<th>LBS</th>
<th>Replica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Megaregion</td>
<td>16%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Outside D7</td>
<td>57%</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>Inside D7</td>
<td>43%</td>
<td>82%</td>
<td></td>
</tr>
<tr>
<td>Citrus County</td>
<td>1%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Hernando County</td>
<td>2%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Pasco County</td>
<td>8%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Pinellas County</td>
<td>8%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Hillsborough County</td>
<td>24%</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>Tampa</td>
<td>7%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>St. Petersburg</td>
<td>2%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>
Produced 5-County O-D Table to Inform Model Update

Select Parameters

Select Traveler Type
○ Residents ○ Visitors ○ Total

Select Base Map Type
○ Origin ○ Destination

Map map of Fall 2022 Replica trip patterns look like in Travel Model O-D format?

Trips generated from zone

Compare Fall 2022 Replica data to 2019 rMerge data

Including Trip Aggregation at Gateways
Evaluated 10 High Visitation Points of Interest
Where do employees live?

What is the household income distribution?

What is the commute mode for employees who work in person?
Replica Commercial Spending Data

Spend Type at Merchants by Week

Spending Types

Total Spend

$24,294,939,828

Total Spending
Tampa data comparison

Table 3. Trip rate by household income

<table>
<thead>
<tr>
<th>Income</th>
<th>Persons</th>
<th>Trip rate</th>
<th>Trip rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs. 25,000</td>
<td>414,757</td>
<td>1,626,299</td>
<td>3.92</td>
</tr>
<tr>
<td>25,000-50,000</td>
<td>567,705</td>
<td>2,196,740</td>
<td>3.87</td>
</tr>
<tr>
<td>50,000-75,000</td>
<td>512,532</td>
<td>1,972,651</td>
<td>3.85</td>
</tr>
<tr>
<td>75,000-100,000</td>
<td>385,037</td>
<td>1,481,128</td>
<td>3.85</td>
</tr>
<tr>
<td>100,000+</td>
<td>881,775</td>
<td>3,366,957</td>
<td>3.82</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,761,806</td>
<td>10,643,775</td>
<td>3.85</td>
</tr>
</tbody>
</table>

Table 6. Median trip distances (miles), by data source

<table>
<thead>
<tr>
<th>Mode</th>
<th>Replica Weekday</th>
<th>Replica Weekend</th>
<th>rMove Weekday</th>
<th>rMove Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto driver</td>
<td>5.46</td>
<td>4.92</td>
<td>3.81</td>
<td>3.39</td>
</tr>
<tr>
<td>Carpool</td>
<td>5.74</td>
<td>6.64</td>
<td>3.25</td>
<td>3.76</td>
</tr>
<tr>
<td>Walk</td>
<td>0.50</td>
<td>0.47</td>
<td>0.32</td>
<td>0.28</td>
</tr>
<tr>
<td>Bike</td>
<td>3.85</td>
<td>4.18</td>
<td>1.03</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Weekday auto driver trips

- Data Source
- rMove Survey
- rMove App
- Replica 2019
Napa & SANDAG Replica Evaluation

Table 5-14: Daily Vehicle Miles Traveled Information

<table>
<thead>
<tr>
<th>Trip Type</th>
<th>Spring 2018 Weekday</th>
<th>Fall 2018 Weekday</th>
<th>Summer 2018 Weekday</th>
<th>2015 MTC Travel Model One</th>
<th>2015 MTC Travel Model Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Vehicle Miles Traveled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-Napa County Trips</td>
<td>1,338,000</td>
<td>1,391,000</td>
<td>1,472,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trips into Napa County</td>
<td>1,622,000</td>
<td>1,850,000</td>
<td>1,479,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trips out of Napa County</td>
<td>1,586,000</td>
<td>1,838,000</td>
<td>1,528,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Napa County Trips</td>
<td>4,547,000</td>
<td>5,079,000</td>
<td>4,479,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of Spring 2018</td>
<td>115%</td>
<td>103%</td>
<td>129%</td>
<td>114%</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Person Trip Counts (Residents Only)

<table>
<thead>
<tr>
<th>Source</th>
<th>Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABM</td>
<td>13,782,389</td>
</tr>
<tr>
<td>Replica</td>
<td>10,092,395</td>
</tr>
<tr>
<td>2016 Calibration Target</td>
<td>13,061,373</td>
</tr>
<tr>
<td>Replica-ABM Diff (%)</td>
<td>-26.8</td>
</tr>
<tr>
<td>Replica-Target (%)</td>
<td>-22.7</td>
</tr>
</tbody>
</table>

Replica produced ~27% fewer person trips compared to ABM.

ABM resulted in longer distances. When looking at the trip distance by purpose, Replica’s distances were longer for all purposes.

Figure 15: Average trip distance by purpose (residents only)
Bow-Concord Interstate 93 Improvements Project INFRA Grant Application
February 2020
Why is the Project Needed?

Friday Late Afternoon

Sunday Early Afternoon
Utilizing INRIX Connected Vehicle Traces

Four Months
- July 2022
- October 2022
- February 2023
- May 2023

Total Unique Devices: 692,017
Total Unique Trips: 1,168,469
### I-93 Northbound Congestion Heatmaps – July 2022

<table>
<thead>
<tr>
<th>Exit 15 ➔</th>
<th>Exit 14 ➔</th>
<th>Exit 13 ➔</th>
<th>Exit 12 ➔</th>
<th>I-89 ➔</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday</strong></td>
<td><strong>Tuesday</strong></td>
<td><strong>Wednesday</strong></td>
<td><strong>Thursday</strong></td>
<td><strong>Friday</strong></td>
</tr>
<tr>
<td>July 1</td>
<td>July 2</td>
<td>July 3</td>
<td>July 4</td>
<td>July 5</td>
</tr>
<tr>
<td><strong>Saturday</strong></td>
<td><strong>Sunday</strong></td>
<td><strong>Monday</strong></td>
<td><strong>Tuesday</strong></td>
<td><strong>Wednesday</strong></td>
</tr>
<tr>
<td>July 9</td>
<td>July 10</td>
<td>July 11</td>
<td>July 12</td>
<td>July 13</td>
</tr>
<tr>
<td>July 16</td>
<td>July 17</td>
<td>July 18</td>
<td>July 19</td>
<td>July 20</td>
</tr>
<tr>
<td>July 23</td>
<td>July 24</td>
<td>July 25</td>
<td>July 26</td>
<td>July 27</td>
</tr>
<tr>
<td>July 30</td>
<td>July 31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Significant congestion every Friday from 11 AM to 6 PM
- Significant congestion every Saturday from 10 AM to 2 PM
- Light congestion some weekdays from 4 PM to 6 PM
I-93 Northbound Corridor Travel Times

<table>
<thead>
<tr>
<th>Travel Time (Minutes)</th>
<th>Day of Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>37 minutes at 5 PM</td>
<td>Monday</td>
</tr>
<tr>
<td>29 minutes at 5 PM</td>
<td>Tuesday</td>
</tr>
<tr>
<td>15 minutes of delay</td>
<td>Wednesday</td>
</tr>
<tr>
<td>23 minutes of delay</td>
<td>Thursday</td>
</tr>
<tr>
<td>29 minutes at 5 PM</td>
<td>Friday</td>
</tr>
<tr>
<td>37 minutes at 5 PM</td>
<td>Saturday</td>
</tr>
<tr>
<td>15 minutes of delay</td>
<td>Sunday</td>
</tr>
</tbody>
</table>

% of Vehicles Entering from State Line

Day of Week

Travel Time (Minutes)

% of Vehicles Entering from State Line

Day of Week

Travel Time (Minutes)

% of Vehicles Entering from State Line

Day of Week

Travel Time (Minutes)

% of Vehicles Entering from State Line

Day of Week

Travel Time (Minutes)

% of Vehicles Entering from State Line

Day of Week
I-93 Northbound Corridor Diversion Percentage

When are people making substantive changes?

- Diversion occurs primarily on Friday between 1 PM and 6 PM
- Diversion occurs primarily on Saturday between 10 AM and 3 PM
- Aligns with northbound congestion heatmaps
I-93 Northbound Corridor Diversion Routes
Traffic Forecasts Development

- Outdated regional model (2014 base)
- Utilizing July 2022 mobility data O-D patterns for updated base year
- Developed subarea assignment model from the CNHRPC Model
- Developed forecasting methodology to apply to 2022 mobility data O-D tables based on projected land use growth
Sonoma County Travel Behavior Study
Help Understand Post-COVID Travel Behavior Changes

9,000 Pre-COVID
+27% Post-COVID

2,200 Pre-COVID
+163% Post-COVID

60,000 Pre-COVID
-22% Post-COVID

16,000 Pre-COVID
-25% Post-COVID

Daily Vehicle Trips

+1.7% Post-COVID

+2.0% Post-COVID

-1.5% Post-COVID
Prior to study, agency staff believed this number was around 90% and planned infrastructure to the west, rather than to the east where it is actually needed.
Prologis Warehousing Study
Help Understand and Facilitate Labor Commutes
The Future?
Adapting to Legislative and Developer Changes Impacting Big Data
Connected Vehicle Data Considerations

- Focus shifts to autos and auto-oriented people
- How do we capture those that don’t have autos?
- Potential for safety studies
- EV planning studies
QUESTIONS
Contacts

KEVIN JOHNSON, AICP
DIRECTOR
Kevin.Johnson@rsginc.com

www.rsginc.com
Questions to Ask
Where is your data coming from and how is it processed?

- What are your data sources?
- What is the spatial resolution of your raw and processed data?
- What is your sample rate? How do you measure that?
- How do you expand your data source?
- How do you measure and account for biases in your data?
- How do you validate your data?
- Do you infer travel mode? How?
- How do you protect personal data?
Better Understand How Users Access the Freeway
## Prologis Warehousing Study

### Utilize Traffic Counts to Understand Sampling Rates

<table>
<thead>
<tr>
<th>FPID</th>
<th>Freeway Location</th>
<th>Direction</th>
<th>Daily</th>
<th>AM 4Hr</th>
<th>PM 4Hr</th>
<th>Daily</th>
<th>AM 4Hr</th>
<th>PM 4Hr</th>
<th>Daily</th>
<th>AM 4Hr</th>
<th>PM 4Hr</th>
<th>Daily</th>
<th>AM 4Hr</th>
<th>PM 4Hr</th>
<th>Ratio</th>
<th>AM 4Hr</th>
<th>PM 4Hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>303</td>
<td>I-580 South of I-205</td>
<td>EB</td>
<td>22,633</td>
<td>2,729</td>
<td>7,241</td>
<td>50,634</td>
<td>11,838</td>
<td>10,762</td>
<td>68,489</td>
<td>17,850</td>
<td>14,782</td>
<td>0.74</td>
<td>0.66</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>303</td>
<td>I-580 South of I-205</td>
<td>WB</td>
<td>28,001</td>
<td>9,109</td>
<td>3,521</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.66</td>
<td>0.63</td>
<td>0.64</td>
</tr>
<tr>
<td>301</td>
<td>Altamont Pass</td>
<td>WB</td>
<td>82,735</td>
<td>22,731</td>
<td>13,288</td>
<td>174,439</td>
<td>34,631</td>
<td>39,870</td>
<td>263,579</td>
<td>54,862</td>
<td>62,725</td>
<td>0.66</td>
<td>0.63</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>301</td>
<td>Altamont Pass</td>
<td>EB</td>
<td>91,704</td>
<td>11,899</td>
<td>26,582</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.66</td>
<td>0.63</td>
<td>0.64</td>
</tr>
<tr>
<td>306</td>
<td>I-580 east of Patterson Pass Rd</td>
<td>EB</td>
<td>26,088</td>
<td>2,962</td>
<td>9,382</td>
<td>54,578</td>
<td>12,156</td>
<td>12,988</td>
<td>71,336</td>
<td>16,367</td>
<td>17,756</td>
<td>0.77</td>
<td>0.74</td>
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<tr>
<td>306</td>
<td>I-580 east of Patterson Pass Rd</td>
<td>WB</td>
<td>28,490</td>
<td>9,195</td>
<td>3,606</td>
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<td>0.77</td>
<td>0.74</td>
<td>0.73</td>
</tr>
<tr>
<td>307</td>
<td>I-5 south of I-580</td>
<td>NB</td>
<td>22,548</td>
<td>4,402</td>
<td>4,789</td>
<td>44,834</td>
<td>7,978</td>
<td>11,081</td>
<td>65,843</td>
<td>12,258</td>
<td>17,484</td>
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<td>0.63</td>
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<tr>
<td>307</td>
<td>I-5 south of I-580</td>
<td>SB</td>
<td>22,286</td>
<td>3,577</td>
<td>6,292</td>
<td></td>
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<td></td>
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<td></td>
<td>0.68</td>
<td>0.65</td>
<td>0.63</td>
</tr>
<tr>
<td>302</td>
<td>I-205 east of I-580</td>
<td>EB</td>
<td>67,992</td>
<td>8,772</td>
<td>19,137</td>
<td>127,452</td>
<td>22,077</td>
<td>29,436</td>
<td>178,932</td>
<td>31,399</td>
<td>44,156</td>
<td>0.71</td>
<td>0.70</td>
<td>0.67</td>
<td></td>
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</tr>
<tr>
<td>302</td>
<td>I-205 east of I-580</td>
<td>WB</td>
<td>59,460</td>
<td>13,305</td>
<td>10,299</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td>0.71</td>
<td>0.70</td>
<td>0.67</td>
</tr>
<tr>
<td>304</td>
<td>I-205 at Hansen Rd</td>
<td>WB</td>
<td>71,192</td>
<td>14,104</td>
<td>13,472</td>
<td>175,856</td>
<td>35,773</td>
<td>38,063</td>
<td>201,074</td>
<td>33,892</td>
<td>51,146</td>
<td>0.87</td>
<td>1.06</td>
<td>0.74</td>
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<tr>
<td>304</td>
<td>I-205 at Hansen Rd</td>
<td>EB</td>
<td>104,664</td>
<td>21,669</td>
<td>24,591</td>
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<td></td>
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<td></td>
<td>0.87</td>
<td>1.06</td>
<td>0.74</td>
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<tr>
<td>305</td>
<td>I-205 east of Byron Rd</td>
<td>EB</td>
<td>55,282</td>
<td>8,213</td>
<td>13,975</td>
<td>105,596</td>
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<td>23,413</td>
<td>164,748</td>
<td>27,506</td>
<td>40,133</td>
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<td>0.63</td>
<td>0.58</td>
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<tr>
<td>305</td>
<td>I-205 east of Byron Rd</td>
<td>WB</td>
<td>50,314</td>
<td>9,145</td>
<td>9,437</td>
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<td></td>
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<td></td>
<td>0.64</td>
<td>0.63</td>
<td>0.58</td>
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</tbody>
</table>
El Dorado County Agritourism Study

SUSTAINABLE AGRITOURISM MOBILITY STUDY PROCESS

This study consisted of a multi-step process as illustrated below.

- Understanding Agritourism Mobility Challenges
- Collecting Additional Data & Reviewing Causes in the Field
- Identify Possible Solutions
- Implementation & Funding Strategies
El Dorado County Agritourism Study

**Why was the study needed?**

- During harvest season, rural roadways experience significant congestion
- Roadway widening is not feasible
- Wanted to better understand how people access and move around Apple Hill to inform mitigation strategies
El Dorado County Agritourism Study

How was the data used?

• Better understand where travel is occurring
• Identified underutilized off-ramps
• Identified circuitous travel patterns that could be made more efficient with improved wayfinding
• Identified five distinct hot spots to prioritize improvements
Help Understand Users of Key Facilities

Napa Valley Travel Behavior Study

**SR 29 at Napa/Solano County Line**

- **Average Trip Length**: 22 miles
- **Where are Trips into Napa County Coming From?**
  - 68% SOLANO
  - 11% SONOMA
  - 8% CONTRA COSTA
  - 5% ALAMEDA
  - 4% SAN FRANCISCO
  - 2% SAN MATEO
  - 1% MARIN
  - 0% LAKE
  - 0% SACRAMENTO
  - 0% SANTA CLARA
  - 0% YOLO

**What Types of Trips are Occurring at Napa County Gateways?**
- Total Trips: 47,000
- 16% Visiting Trip
- 8% Home-Related Trip
- 5% Park-Through Trip
- 75% Home-Derived Trip

**Average Weekday Trip Purpose**
- 25% Home-Related
- 32% Visiting
- 43% Park-Through
- 2% Home-Derived

**SR 12 at Napa/Sonoma County Line**

- **Average Trip Length**: 43 miles
- **Where are Trips into Napa County Coming From?**
  - 42% SOLANO
  - 41% SONOMA
  - 8% ALAMEDA
  - 6% MARIN
  - 2% SAN FRANCISCO
  - 0% LAKE
  - 0% SACRAMENTO
  - 0% CONTRA COSTA
  - 0% SAN MATEO
  - 0% SANTA CLARA

**What Types of Trips are Occurring at Napa County Gateways?**
- Total Trips: 31,000
- 36% Home-Related Trip
- 36% Visiting Trip
- 29% Park-Through Trip
- 1% Home-Derived Trip

**Average Weekday Trip Purpose**
- 30% Home-Related Trip
- 36% Visiting Trip
- 36% Park-Through Trip
- 2% Home-Derived Trip
Sonoma County. The Tubbs Fire destroyed roughly 7,000 structures, including 5,000 housing units, damaged roughly 500 structures, and displaced many families and individuals in Sonoma County.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Spring 2017 Daily Vehicle Trips</th>
<th>Spring 2018 Daily Vehicle Trips</th>
<th>Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>273 - City of Santa Rosa</td>
<td>23,900</td>
<td>11,500</td>
<td>-12,400</td>
<td>-52%</td>
</tr>
<tr>
<td>289 - Sonoma-Santa Rosa</td>
<td>12,300</td>
<td>11,400</td>
<td>-900</td>
<td>-7%</td>
</tr>
<tr>
<td>294 - City of Santa Rosa</td>
<td>16,700</td>
<td>10,500</td>
<td>-6,200</td>
<td>-37%</td>
</tr>
<tr>
<td>301 - Sonoma-Santa Rosa</td>
<td>7,400</td>
<td>2,800</td>
<td>-4,600</td>
<td>-62%</td>
</tr>
<tr>
<td>302 - Sonoma-Santa Rosa</td>
<td>14,100</td>
<td>9,600</td>
<td>-4,500</td>
<td>-32%</td>
</tr>
<tr>
<td>311 - City of Santa Rosa</td>
<td>42,600</td>
<td>29,600</td>
<td>-13,000</td>
<td>-31%</td>
</tr>
<tr>
<td>437 - Sonoma North</td>
<td>10,200</td>
<td>7,700</td>
<td>-2,500</td>
<td>-25%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127,200</strong></td>
<td><strong>83,100</strong></td>
<td>-44,100</td>
<td>-35%</td>
</tr>
</tbody>
</table>

Zones Adjacent to the October 2017 Tubbs Fire Burn Area

<table>
<thead>
<tr>
<th>Zone</th>
<th>Spring 2017 Daily Vehicle Trips</th>
<th>Spring 2018 Daily Vehicle Trips</th>
<th>Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>271 - City of Santa Rosa</td>
<td>20,800</td>
<td>23,000</td>
<td>2,200</td>
<td>11%</td>
</tr>
<tr>
<td>300 - City of Santa Rosa</td>
<td>9,200</td>
<td>10,200</td>
<td>1,000</td>
<td>11%</td>
</tr>
</tbody>
</table>
Napa Valley Travel Behavior Study—StreetLight LBS Data
Help Vintners and Napa Tourism District Improve Visitor Travel
Prologis Warehousing Study—Geotab Telematics Data Help Understand Supply Chain Logistics

Choose the industry leader

Geotab was ranked the #1 commercial telematics vendor worldwide by ABI Research and continues to be recognized for our innovative technology and solutions. Whether you have one vehicle or 1000, we have the solutions to suit your needs.
Behavioral research and analysis is core to RSG

- Founded by Dartmouth College Business and Engineering professors
- 35+ years in business and employee owned
- 50+ professional staff dedicated to collecting, modeling, and analyzing behavioral survey data
- 40+ major smartphone-based GPS survey projects: domestically and internationally
- 100+ energy focused stated-preference survey and modeling projects
- 50+ transportation projects using big data
Core Capabilities

**Market Research**

Custom consumer behavior surveys and market research for the public and private sectors:
- Travel behavior
- Willingness to pay
- Price/demand interactions
- Market segmentation
- Customer satisfaction
- Attribute analysis

**Demand Forecasting**

Assess consumer demand for products and services.

Evaluate the impact of policy scenarios on consumer behavior and market demand:
- Travel demand and congestion
- Mode choice
- Land use
- Pricing
- Detailed network effects through microsimulation

**Planning**

Develop a shared vision and set of goals between multiple stakeholders.

Co-develop strategic policy and launch on-the-ground implementation.

Assess system integration, energy and emissions, mode shift targets, customer satisfaction, and other evaluation measures.

Leverage insights from passively collected travel data (“Big Data”) and fuse with collected primary data.
Our work bridges public and private sectors