Introduction and Updates to StreetLight Data

SCAG Modeling Task Force Meeting
10/23/19

Matt Pettit, Solution Engineer
Matt.Pettit@StreetLightData.com
Agenda

1. Who we are
2. Our data sources
3. How StreetLight InSight® changes transportation planning
4. StreetLight Data Modeling Applications
5. Q&A
A sea change is coming to transportation and cities.
StreetLight InSight® is the only interactive transportation data platform.

- It’s NOT a model, a report or a static heatmap.
- It’s your self-serve desktop software with on-demand access to accurate mobility metrics.
How we get there: Big Data and proprietary Route Science®

- Every month, we process over 100 billion anonymized location records from **smart phones** and **GPS navigation devices** in cars and trucks.

- **Route Science®** transforms them into **contextualized**, normalized and aggregated travel patterns.

**MOBILE DEVICE DATA**
from ~28% of U.S. and Canadian adults

Example, San Bernardino, CA
Oct 8, 2017 24-hr snapshot

**CONTEXT**

- Parcel Data
- Digital Road Network Data
- U.S. Census
At your fingertips:
Analytics for every road, bike lane and Census Block

**MÖDES:**
- Trucks
- Cars*
- Cyclists
- Pedestrians

* Ride hailing and delivery mode also available

**FUNDAMENTAL ANALYTICS:**
- Origin Destination
- Routing
- Select Link
- AADT, MADT, hourly traffic

**TRIP ATTRIBUTES:**
- Trip speed, duration, length
- Travel time
- Trip circuity

**TRAVELER ATTRIBUTES:**
- Inferred trip purpose
- Demographics
Faster, better answers to your biggest problems

Industry Use Cases:

**TRANSPORTATION PLANNING:**
- Active Transportation
- Before & After Studies
- Congestion Studies
- Event & Tourism Studies
- Freight Studies
- First & Last Mile Studies
- Transit Studies
- Travel Demand Management

**TRAFFIC ENGINEERING & OPERATIONS:**
- Congestion Studies
- Corridor Studies
- Travel Time
- Turning Movements
- Safety
- Circuity

**SMART CITIES & NEW MOBILITY:**
- Before & After Studies
- EV Infrastructure Planning
- Greenhouse Gas Emissions & VMT
- Ride Hailing & Delivery Studies
- Social Equity
- Travel Demand Management
A journey of innovation marked by transportation industry-firsts

2015
World’s first mobility SaaS platform
StreetLight InSight® software gives mobility professionals on-demand access to actionable analytics.

2016
Industry first with LBS data
Boost in accuracy and data coverage by tapping into location-based services (LBS) data sources.

2017
Industry first with on-demand AADT
Average daily traffic counts for 5 million miles of roadway, validated with more than 11,000 permanent counts.

2019
Industry-first Bike and Ped metrics
Volume, trip and traveler attributes and other core metrics for bicycle and pedestrian traffic.
1.4 billion usable trips analyzed in Jan 2019
Increase of 4x vs. Jan 2018, with better accuracy

- More confidence in your sample, your recommendations, and their future success
- Increased coverage of smaller roads and rural areas
- More sample for granular zones, e.g. city blocks, parcels, gas stations and other destinations
- More sample for less frequent behaviors like biking.
- More sample for special events, e.g. games and festivals
StreetLight's Mission

Measure all modes and how they INTERACT.
Step 1: Pick the Right Data

- Cellular
- LBS
- Ad-derived Data
- Active Mode App
- GPS-Survey

- Counters
- Traditional Surveys
Step 2: Machine Learning to Recognize Modes at the Ping Level

Training a Random Forest Classifier – Data Sets by Source

<table>
<thead>
<tr>
<th>Source</th>
<th>Tagged Points</th>
<th>Harvested Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caltrans Travel Survey (NREL”)</td>
<td>26M</td>
<td>~500K</td>
</tr>
<tr>
<td>Atlanta Regional Travel Survey (NREL)</td>
<td>2.4M</td>
<td>~75K</td>
</tr>
<tr>
<td>Mid-Region Travel Survey – Albuquerque (NREL)</td>
<td>3M</td>
<td>~92K</td>
</tr>
<tr>
<td>Southern Nevada Household Travel Survey (NREL)</td>
<td>4.2M</td>
<td>~133K</td>
</tr>
<tr>
<td>Capital Bikeshare</td>
<td>334K</td>
<td>~48K</td>
</tr>
<tr>
<td>Beijing Pedestrian (Microsoft)</td>
<td>5.5M</td>
<td>~27K</td>
</tr>
<tr>
<td>Total Number of Points in Training Data Set</td>
<td></td>
<td>~900K</td>
</tr>
</tbody>
</table>
3 METHODOLOGY + VALIDATION

- Build ML Algorithm
- Train ML Algorithm
- Modify ML Algorithm
- Evaluate training results
- LEARN
- MODE CLASSIFIER
- RAW Data
- Tagged Data
- Launch
- ITERATE
Step 3: Group “Pings” into Mode-Assigned Trips

- Apply intelligence from machine learning process to infer probability of mode choice for each ping
- Stationary is a “mode”
Step 4: “Lock” to Allowable Networks

• No geometry subtracted from car Open Street Map (OSM), only added

• Implications for Pedestrians
  – Complexities with pedestrians: jaywalking can be missed
  – Very large and spread out buildings, like conferences centers, can be confusing
Validation – Compare to NHTS/CHTS Surveys (Bike Only)

StreetLight’s nationwide sample (May 2017) is 86 times larger than NHTS!

Average Trip Length from Different Sources

<table>
<thead>
<tr>
<th>Mode</th>
<th>NHTS (miles)</th>
<th>SL – Nat’l (miles)</th>
<th>CHTS (miles)</th>
<th>SL – CA (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle (all)</td>
<td>2.38</td>
<td>1.09</td>
<td>1.50</td>
<td>1.11</td>
</tr>
<tr>
<td>Bicycle (&gt;300m)</td>
<td>1.30</td>
<td></td>
<td>1.30</td>
<td></td>
</tr>
</tbody>
</table>
LBS Mobile Applications reveal a much higher share of short trips

Histogram of Bike Trip Distance Comparison

- NHTS
- STL National
Mobility Analytics as Real-World Counts by Hour, Month, or Year.

3. The output is unbiased, population-representative mobility analytics — accessible through StreetLight InSight®.

- Traffic counts
  - Annual (AADT)
  - Monthly (MADT)
  - Hourly (AAHT)

- Origin, destination, and routes
- Trip speed, duration, length, and more
Result: A Validated Big Data MADT at Your Fingertips

- In our validation, StreetLight MADT was found to be closely aligned with a known permanent counter on I-77.

- Get MADT to calculate vehicle miles traveled (VMT) for all roads in the region, not just highways.

- Accurately measure seasonal traffic conditions to support better forecasts, future traffic capacity, and congestion.

- Understand the growth and impact of traffic seasonality to better support policy planning.
Result: On-Demand Turning Movement Counts, Validated and Proven as Accurate as Real-World Counts

- We compared our results to counts gathered using a traditional data collection method.
- We saw a high correlation, $R^2$ of 0.947.
- StreetLight Volume reliably captures turning movement counts **without the hassle** of installing sensors, or any manual post-processing.
- Transportation experts can easily get tens, if not **hundreds**, of turning movement counts **within minutes**.
Agenda

1. Who we are
2. Our data sources
3. How StreetLight InSight® changes transportation planning
4. StreetLight Data metrics
5. Q&A
Pass-Through Congestion Study

Challenge

Napa residents felt that growing numbers of tourists and pass-through tech workers were causing growing congestion. Planners wanted to know for sure.

Big Data-Driven Solution

The analysis revealed that commuters working in Napa were the top cause of traffic. Tourists and pass-through trips from neighboring counties were less significant.

Data visualization showing that congestion trips originate within Napa county and neighboring counties

“StreetLight helped us answer questions that are too costly and time consuming to analyze with traditional methods.”

KEVIN JOHNSON
Fehr & Peers
719 vehicles traveled from A to B of 4,078 vehicles on NB PCH

Via MacArthur
Avg 180 of 719 (25%)
Avg 12.7 min trip time

Via Newport Coast Dr
Avg 537 of 719 (75%)
Avg 9.9 min trip time

Via Jamboree
Avg 2 vehicles of 719 (0.3%)
Avg 23.5 min trip time

Northbound PCH to Northbound 73
Weekday, AM Peak (7-9 AM)

Pricing + Stakeholder Outreach
Freight Studies for Long-Haul Traffic

Challenge

To study potential congestion mitigation tactics, planners needed to know what percentage of Florida highway traffic was long-haul trucks.

Big Data-Driven Solution

Big Data told FDOT that 15-20% of vehicles in the corridor are freight trucks, and a significant portion are long-haul, and worth analyzing for possible shift options.

“StreetLight Data is the most efficient way for us to differentiate if the truck traffic was long-haul or short-haul”

CHUN-YU LU
AECOM Florida
Understanding External Trips in Whatcom County, Washington

1 WHY IT MATTERS

External trip activities are an important piece of the puzzle for Whatcom County. Many of the cross-border trips pass through Whatcom County. Many of the cross-border trips pass north (e.g. Vancouver, B.C.) or south (e.g. Seattle).

Increased congestion along Interstate 5 through Whatcom County poses safety of pass-through trips. In addition to trips passing through the region originate at a location outside of Whatcom but have destinations elsewhere.
Understanding External Trips in Whatcom County, Washington

2 THE DATA COLLECTION CHALLENGE

The current methodology for pass-through trips is time consuming, costly, and logistically difficult:

- **SENSORS**
  Captures increased traffic flow, but not the origin and destination (O-D) of those vehicles.

- **LICENSE PLATE STUDIES**
  Can be costly for a smaller jurisdiction like Whatcom County.

- **MODE SPLITTING**
  Difficult to distinguish or capture different modes.
Understanding External Trips in Whatcom County, Washington

3 NEXT STEPS

UPDATE THE TRAVEL DEMAND MODEL
With the updated travel behavior information, Whatcom Region (COG) can now use the updated travel demand model in preparation for the upcoming regional transportation plan process: Whatcom Mobility 2040.

IMPROVING MOBILITY
Whatcom 2040 will assess local and regional projects to improve mobility for the next 20 years.

<table>
<thead>
<tr>
<th>EXTERNAL STATION</th>
<th>2013</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-5 Southern External</td>
<td>5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>I-5 Northern External</td>
<td>19%</td>
<td>24.5%</td>
</tr>
<tr>
<td>SR-543 Northern External</td>
<td>21%</td>
<td>19%</td>
</tr>
<tr>
<td>SR-539 Northern External</td>
<td>7%</td>
<td>0.3%</td>
</tr>
<tr>
<td>SR-9 Northern External</td>
<td>7%</td>
<td>14.5%</td>
</tr>
<tr>
<td>SR-11 Southern External</td>
<td>0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>SR-9 Southern External</td>
<td>0%</td>
<td>2.8%</td>
</tr>
<tr>
<td>SR-542 Eastern External</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Understanding Incident Impacts on the I-5 Corridor and Roadway Conditions
Top Origins and Destinations of Trips on I-5 Northbound

- **Origins AM Peak Period (6AM-10AM)**
  - I-5 Northbound Gate
  - Downtown Seattle: 23%
  - South Lake Union: 6%
  - University District: 7%

- **Destinations AM Peak Period (6AM-10AM)**
  - I-5 Northbound Gate
  - Seattle: 12%
  - South Seattle: 10%
  - University District: 7%
  - South Lake Union: 6%
Top Truck Destinations AM Peak & Midday Periods

Destinations AM Peak Period (6AM-10AM)

- Boeing & Amazon Distribution Center
- I-5 Northbound Gate

Destinations Midday (10AM-4PM)

- I-5 Northbound Gate
Northbound Streets are Congested at Peak AM Hour (8-9am)

• Some alternative corridors are already congested in the AM Peak Period including the 99 corridor and 1st street
• But other corridors like 4th Street, 15th Street and Martin Luther King have capacity
Changes in Route Choices NB Travelers After Incident

Before Incident

During Incident
Focus on I-5 Route Choice at West Seattle Bridge

Origin

Impact Segments:
- 32%
- 17%
- 20%
- 24%
Route Choice Changes for Southbound Trips from Downtown Seattle

Before the Incident (6AM-10AM)

During the Incident (11AM-4PM)
Local Roadways Experience Severe Drop in Speeds, particularly airport Way and 4th Street Northbound
Modeling Applications in SCAG Region
Measuring External and Internal Trips
Measuring External and Internal Trips – All Trips

Basic Project Metrics

Heatmap of O-D Traffic
Colors indicate the O-D Traffic to each destination Zone during the selected time.

O-D Traffic %
Percent of O-D Traffic for Select...

0.0% 50.0% 100.0%

Total O-D Traffic Volume

Streetslight Data
Proprietary and Confidential
Measuring External and Internal Trips – Commercial Trips

Basic Project Metrics

Commercial Travel
- Weekday (M-Th)
- Peak AM (6am-16am)
- Zone Type: Origin
- Origin Zone: I-15 North

Excluding Origin = Destination
- O-D Traffic

View as %
- O-D Traffic

Heatmap of O-D Traffic
Colors Indicate the O-D Traffic to each destination Zone during the selected time period.

O-D Traffic %

<table>
<thead>
<tr>
<th>Destination Zone</th>
<th>O-D Traffic Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riverside</td>
<td>0%</td>
</tr>
<tr>
<td>CA-91 West</td>
<td>14.8%</td>
</tr>
<tr>
<td>I-15 South</td>
<td>11.6%</td>
</tr>
<tr>
<td>Ontario Ranch Rd West</td>
<td>4.6%</td>
</tr>
<tr>
<td>I-10 North</td>
<td>1.3%</td>
</tr>
<tr>
<td>CA-71 West</td>
<td>0.8%</td>
</tr>
<tr>
<td>I-215 North</td>
<td>0.8%</td>
</tr>
<tr>
<td>Etiwanda Ave North</td>
<td>0.8%</td>
</tr>
<tr>
<td>Archibald Ave West</td>
<td>0.5%</td>
</tr>
<tr>
<td>Hammer Ave West</td>
<td>0.5%</td>
</tr>
<tr>
<td>Riverside Dr West</td>
<td>0.4%</td>
</tr>
<tr>
<td>I-10 East</td>
<td>0.3%</td>
</tr>
<tr>
<td>Schleisman Rd West</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

To get more information on how to interpret your analysis traffic Output Type: https://streetlight.com/help/24082/25525982

Total O-D Traffic (GTL Index)

Percent of O-D Traffic for Select...
More Detailed Sub Area Modeling and Corridor Simulations
Origin Destination Scanning

Basic Project Metrics

- Origin: Long Beach Pwy NB On-Ramp

To get more information on how to interpret your analysis traffic output: https://support.streetlightdata.com/hc/en-us/articles/360029042992
Pedestrian – Sample Trip Tables

### Basic Project Metrics - ZA

#### Personal - Pedestrian Travel

- **Weekday (M-Th):**
- **Peak AM (6am-10am):**
- **Intersection: Trips that End Only:**
- **15 Zones:**
- **Zone Traffic:**
- **View as StreetLight Index:**

#### Heatmap of Zone Traffic

Colors indicate the Zone Traffic to each Zone during the selected time period.

#### Zone Traffic Volume

<table>
<thead>
<tr>
<th>Zone</th>
<th>Total Zone Traffic (ctl Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>6,572</td>
</tr>
<tr>
<td>Zone 11</td>
<td>3,798</td>
</tr>
<tr>
<td>Zone 14</td>
<td>3,768</td>
</tr>
<tr>
<td>Zone 13</td>
<td>3,040</td>
</tr>
<tr>
<td>Zone 7</td>
<td>2,624</td>
</tr>
<tr>
<td>Zone 19</td>
<td>2,624</td>
</tr>
<tr>
<td>Zone 3</td>
<td>2,395</td>
</tr>
<tr>
<td>Zone 8</td>
<td>2,602</td>
</tr>
<tr>
<td>Zone 12</td>
<td>2,169</td>
</tr>
<tr>
<td>Zone 4</td>
<td>1,108</td>
</tr>
<tr>
<td>Zone 5</td>
<td>1,080</td>
</tr>
<tr>
<td>Zone 9</td>
<td>958</td>
</tr>
<tr>
<td>Zone 8</td>
<td>715</td>
</tr>
<tr>
<td>Zone 10</td>
<td>484</td>
</tr>
<tr>
<td>Zone 7</td>
<td>264</td>
</tr>
</tbody>
</table>

To get more information on how to interpret your analysis traffic output type: [https://support.streetlightdata.com/hc/en-us/articles/269059642982](https://support.streetlightdata.com/hc/en-us/articles/269059642982)
Route Choice and Select Link Analysis

Top Routes

Routes between Origin-Destination Segments containing less than 2% of visualization.

Route distribution by segment for selected O-D pair(s). Segments are mutually exclusive of each other.
Transportation Behavior Today is Changing Rapidly

To keep up with fast-changing travel behavior, we need data that:

1. Describes current behavior
2. Measures change over time
3. Is diagnostic & predictive