

Using Big Data for Transportation Planning & Modeling

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TOPICS

- ❖ New techniques in Big Data analytics
- ❖ What problems does it solve?
- ❖ How does it benefit you?
- ❖ Features and options
- ❖ Case Studies, Q & A



Data Driven Approach to Transportation Planning

Investment Decisions



Alternative Strategies



and



Impact Measurement

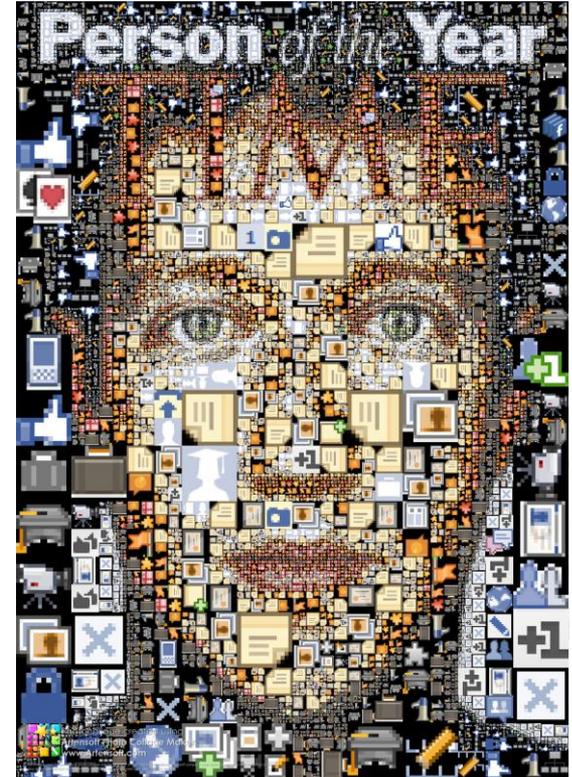
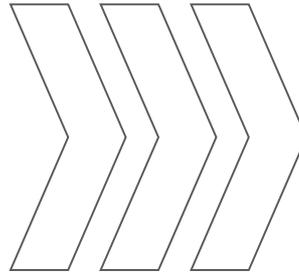


Conventional Data Tools are Insufficient



- ➔ Expensive
- ➔ Infrequent
- ➔ Time Consuming
- ➔ Small Sample Size
- ➔ H/W Install & Maintenance
- ➔ Provide Incomplete Picture

- ✓ What?
- ✓ When?
- ✓ Where?
- ✓ Why?
- ✓ How?



Exploring Complete Anatomy of People Movement

WHAT

➤ Trip Information

- ☑ Speed
- ☑ Volume
- ☑ Distance
- ☑ Duration
- ☑ AADT

WHERE

➤ O-D Information

- ☑ By TAZs
- ☑ By Zip Codes
- ☑ Via Select Links
- ☑ By Census Blocks

WHEN

➤ Archival Information

- ☑ By Month
- ☑ By Day of Week
- ☑ By Time of Day

HOW

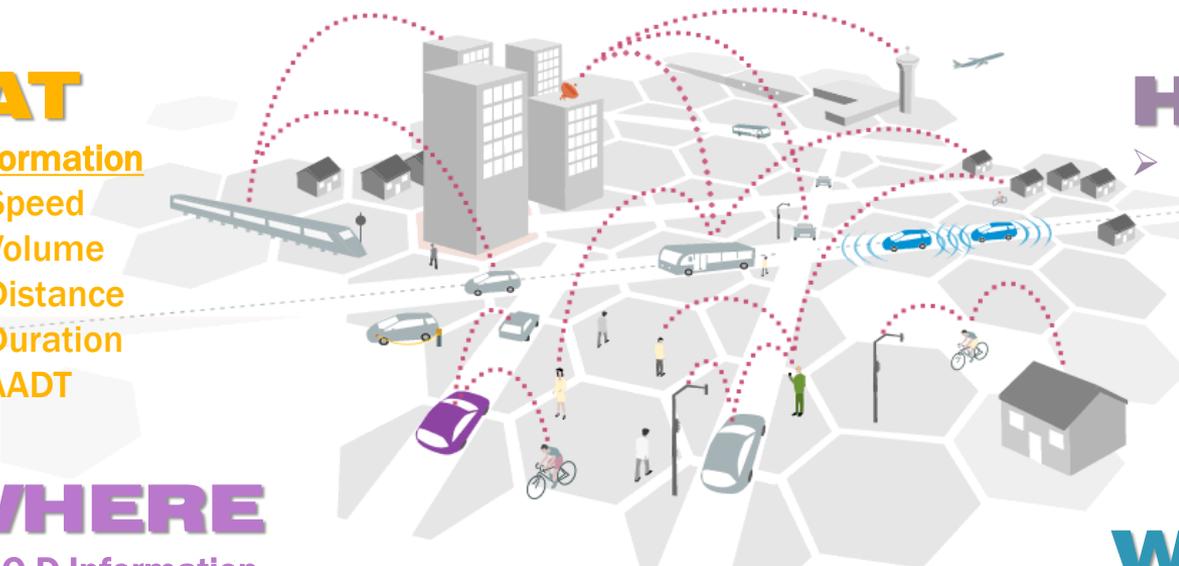
➤ Transportation Mode

- ☑ Bike/Pedestrians
- ☑ Personal Vehicles
- ☑ Commercial Vehicles
 - ☑ Medium Duty
 - ☑ Heavy Duty

WHY

➤ Traveler Information

- ☑ Trip Purpose
 - ☑ Home/Work
- ☑ Demographics



Available via a cloud-based

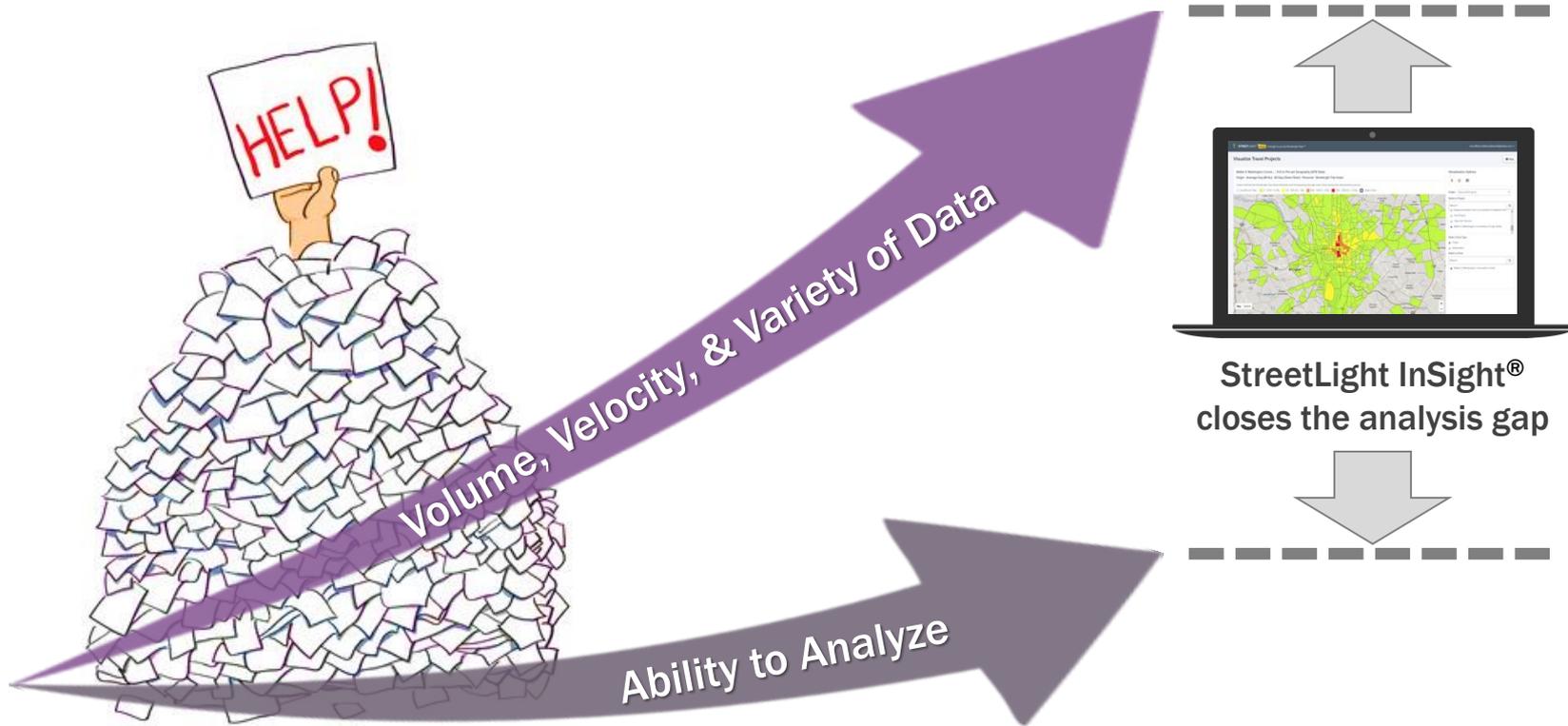
Transportation Analytics Platform



- ✓ On-Demand Access
- ✓ Archival Data (2014+)
- ✓ Interactive U/I
- ✓ Easy to Use
- ✓ Cost Effective
- ✓ Fast Data Delivery
- ✓ Covers US & Canada



Converting Big Data into Useful Metrics



Combining Data Sources for a Holistic View

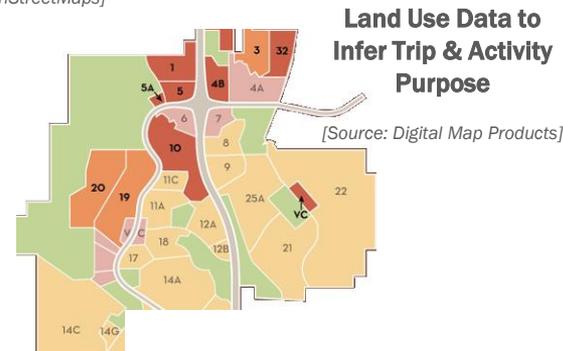
LBS Data from Smart Phone Apps
32B+ Data Points per month
Best for Understanding Activities
[Source: Cuebiq]



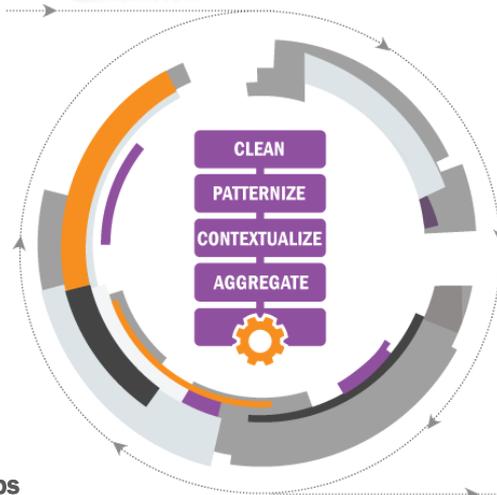
GPS Data from Vehicle & Navigation Apps
28B+ Data Points per month. Best for Understanding Trips
[Source: Inrix]



Road Network Maps to Lock Trips to Routes
[Source: OpenStreetMaps]

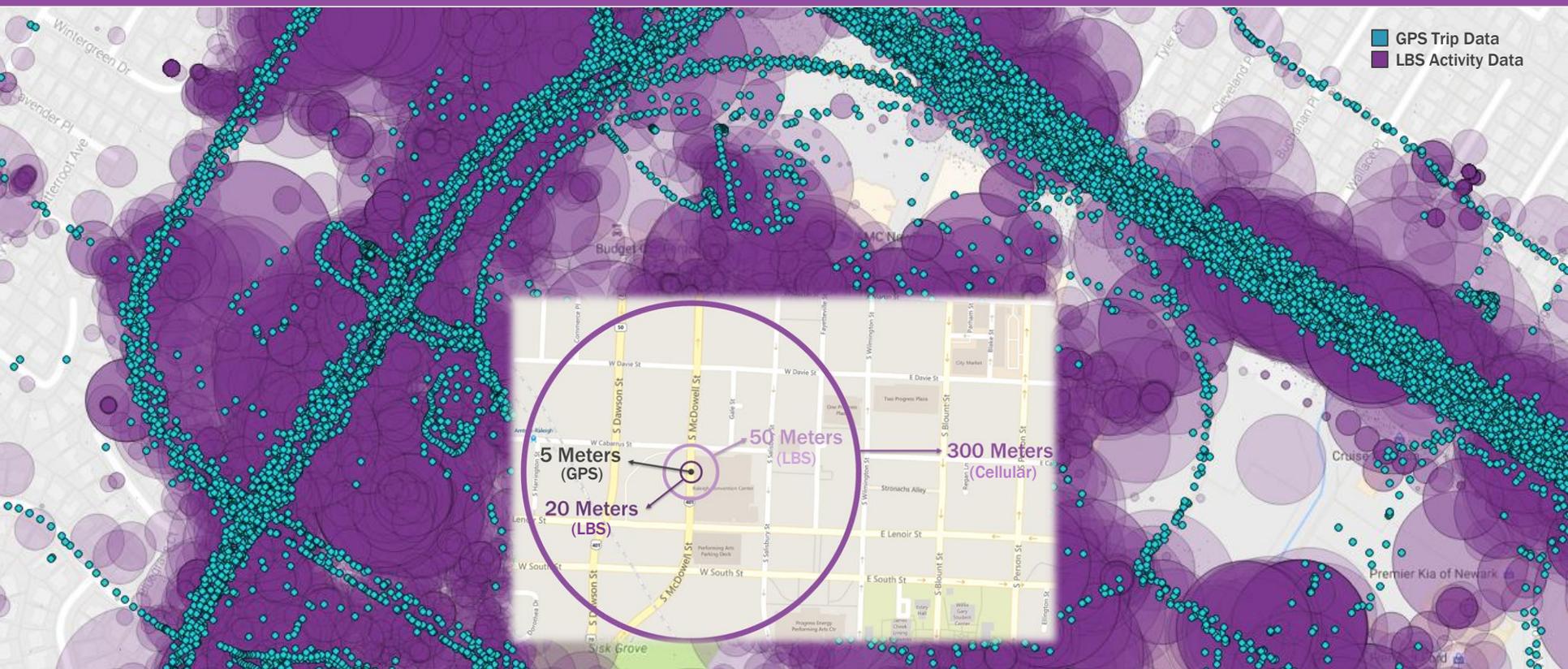


Land Use Data to Infer Trip & Activity Purpose
[Source: Digital Map Products]



Census and ACS Data
for Understanding Demographics
[Source: ACS 2010]

Achieving both Spatial and Temporal Precision



Reducing Direct Data Costs by Nearly 50%

Annual StreetLight InSight Subscription Fee vs. Annual Data Spending for a Mid-Size MPO

StreetLight InSight Regional Subscription
Multi-Domain Licenses; Premium Metrics for Population of 3.2M

Household Survey

(Last survey cost \$1.5M. Assume data was 2/3 of costs, and costs were amortized over 5 years.)

Transportation Studies for Modeling

(MPO budgeted \$1.3M. Assume 1/4 can be displaced.)

Understanding Regional Trucking Flows

(MPO budgeted ~\$200k for GPS data biennially.)

TDM for Employer Support

(MPO budgeted \$1M. Assume 10% is for data.)

Regional Mobility Hub Implementation

(MPO budgeted \$413k. Assume 20% for equity-focused data collection.)

Special Studies: Commutes, Corridors, etc.

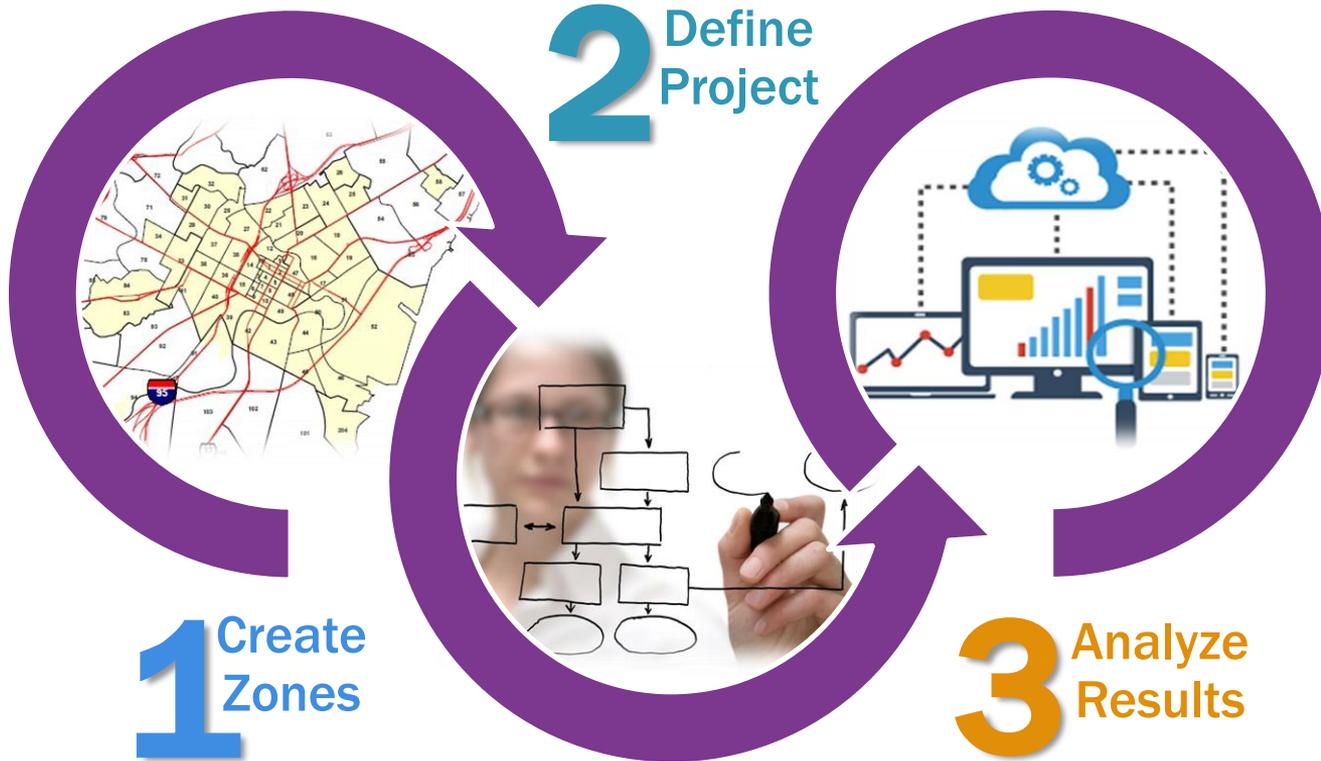
(Data budget estimated based on prior special studies.)



Variety of Uses, Multiple User Access, One Platform



Using StreetLight InSight[®] is Quick & Easy



Visual Graphics and Data Download Options

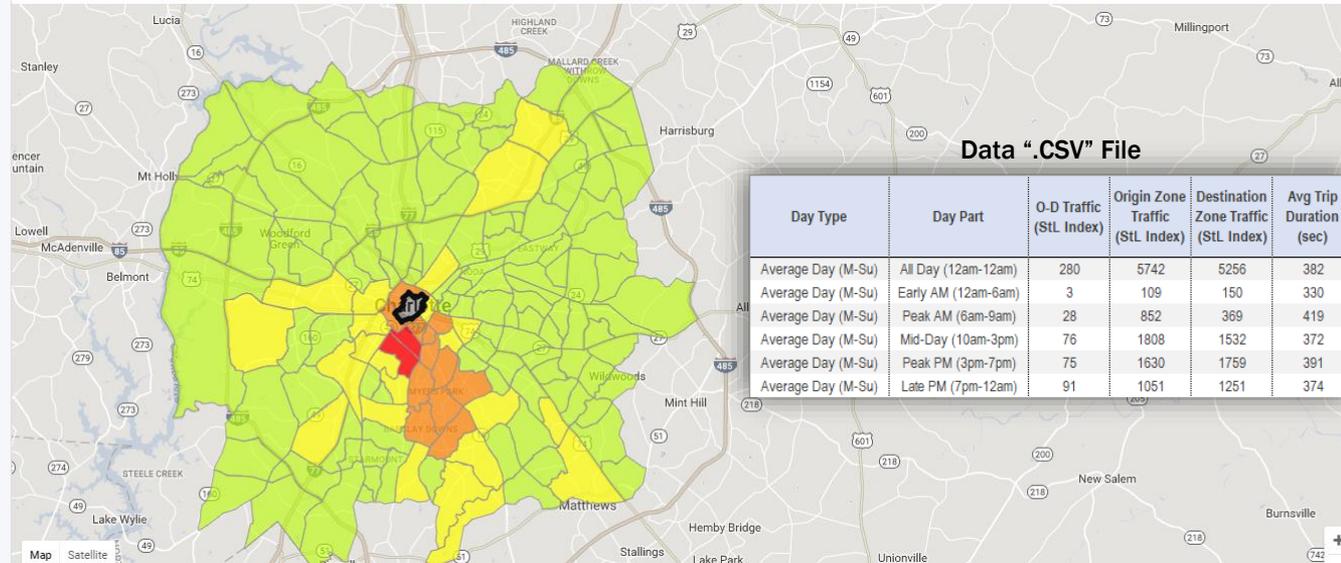
Visualize Travel Projects

Help

Charlotte Tracts OD | O-D Analysis (GPS Data)
 Origin | Average Day (M-Su) | All Day (12am-12am) | Personal | StreetLight Trip Index

Colors Indicate the StreetLight Trip Index to each destination Zone during the selected time period.

Insufficient Trips
 23 - 850 (0 - 0.7%)
 851 - 2,382 (0.7 - 1.9%)
 2,383 - 4,771 (1.9 - 3.8%)
 4,772 - 6,877 (3.8 - 5.5%)
 Origin Zone



Data ".CSV" File

Day Type	Day Part	O-D Traffic (StL Index)	Origin Zone Traffic (StL Index)	Destination Zone Traffic (StL Index)	Avg Trip Duration (sec)
Average Day (M-Su)	All Day (12am-12am)	280	5742	5256	382
Average Day (M-Su)	Early AM (12am-6am)	3	109	150	330
Average Day (M-Su)	Peak AM (6am-9am)	28	852	369	419
Average Day (M-Su)	Mid-Day (10am-3pm)	76	1808	1532	372
Average Day (M-Su)	Peak PM (3pm-7pm)	75	1630	1759	391
Average Day (M-Su)	Late PM (7pm-12am)	91	1051	1251	374

Visualization Options



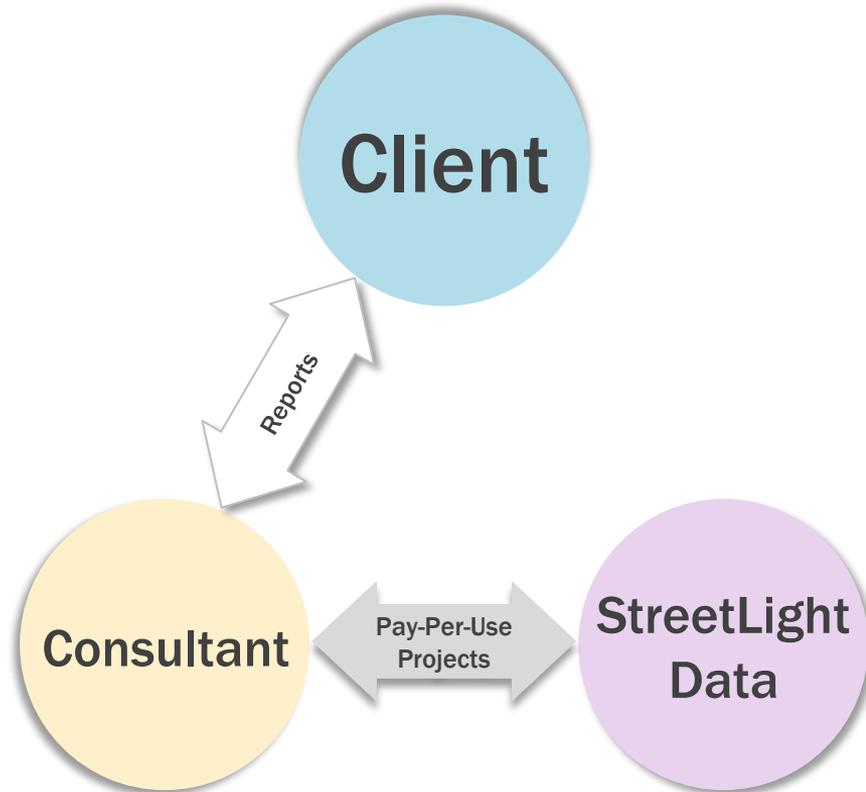
Select a Type of Day

- Average Day (M-Su)
- Average Weekday (M-Th)
- Average Weekend Day (Sa-Su)

Select a Time of Day

- All Day (12am-12am)
- Early AM (12am-6am)
- Peak AM (6am-10am)
- Mid-Day (10am-3pm)
- Peak PM (3pm-7pm)
- Late PM (7pm-12am)

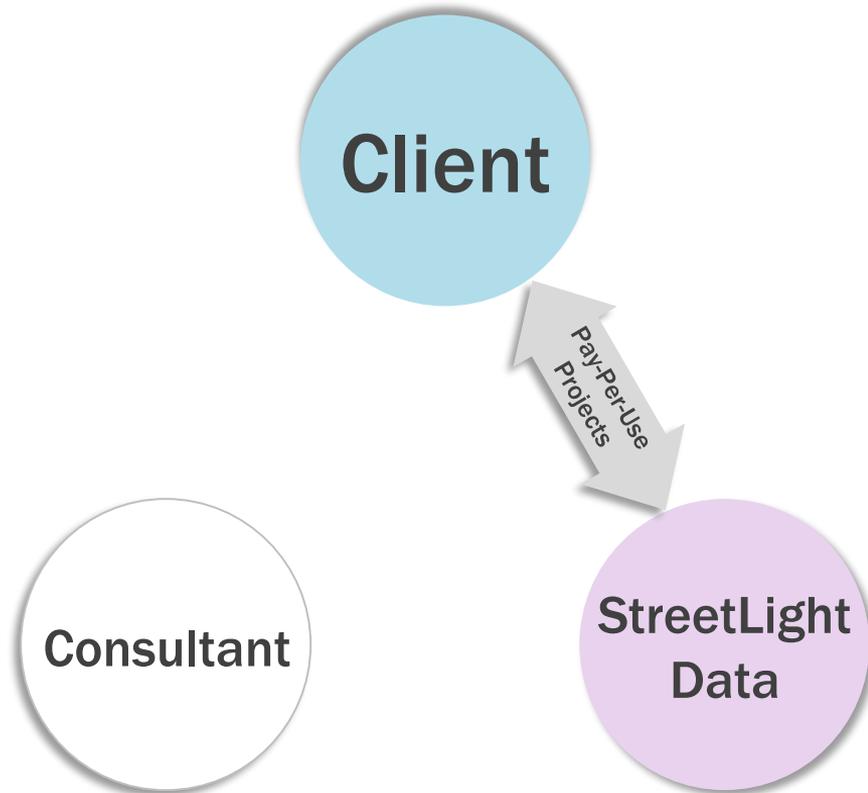
Platform Access Option A



Pay-Per-Use (Consultant):

- **Price:**
 - Per project, per analysis period.
 - Based on total analysis zones in the project and metrics type.
- **Access:**
 - Consultant only.
 - Limited to project and metrics purchased.

Platform Access Option B



Pay-Per-Use (Client):

- **Price:**
 - Per project, per analysis period.
 - Based on total analysis zones in the project and metrics type.
- **Access:**
 - Client only.
 - Limited to project and metrics purchased.

Platform Access Option C



Regional Subscription:

- **Price:**
 - Annual subscription.
 - Based on area population and metrics type.
- **Access:**
 - Client and key consultant(s).
 - Unlimited usage within a specific geographical region for metrics purchased.
 - May extend to other agencies under a multi-domain license.

Self-Service Platform Features and Options

BASIC METRICS

- Origin-Destination
 - Relative volume
 - Avg. travel time
- O-D w/Middle Filter
 - Select link analysis
- Zone Analysis
 - All above metrics for each zone analyzed

PREMIUM METRICS

- Trip Attributes
 - Speed, Duration Length, Circuity
 - Commercial vehicle class (heavy/med)
 - O-D by geography
- Traveler Attributes
 - Simple trip purpose
 - Home/Work/Visitors
 - Demographics
- Volume
 - AADT Counts

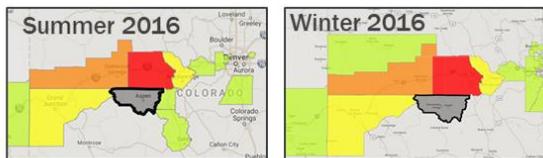
STANDARD OPTIONS

- Data Period
 - Months of year
- Day Type
 - Days of week
- Day Parts
 - Times of day
- Trip Type
 - Personal
 - Commercial
- Route Type
 - Locked/Unlocked

Some Popular Uses of StreetLight InSight®

Travel Demand Modeling

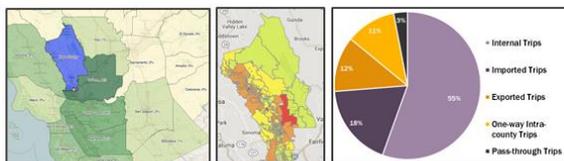
Calibrate with Empirical, Comprehensive O-D Matrices



Colorado DOT used StreetLight InSight To Understand Seasonal & Weekday/Weekend Trends

Long-Term Planning

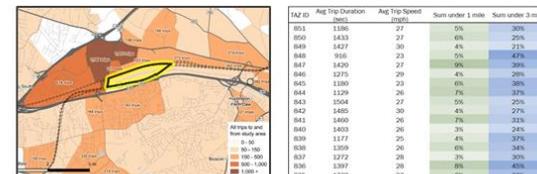
Study Regional Patterns & Engage With the Public



Fehr & Peers and Napa Valley Transport. Authority Used StreetLight InSight to Study Regional Trends

Travel Demand Management

Scan for High-Potential Project Opportunities



Virginia DOT, Michael Baker, and SSTI Scanned for “Displaceable Vehicle Trips” with StreetLight InSight

Performance Measurement

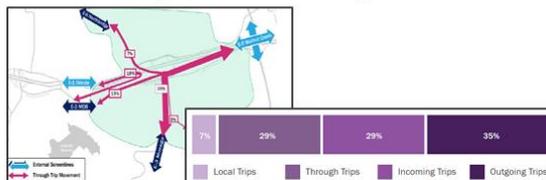
Evaluate AADT, Travel Time Reliability, & More



Siemens Used StreetLight InSight to Study the Impact of its ITS Traffic Signals on Travel Time Reliability

Congestion Studies

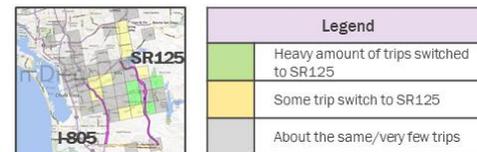
Identify the Cause of Congestion



The City of Lafayette, CA and Arup used StreetLight InSight to Analyze Downtown Congestion

Project Evaluations

Easily Conduct “Before & After” Studies



Fehr & Peers and SANDAG used StreetLight InSight to Determine the Impact of a Toll on Behavior

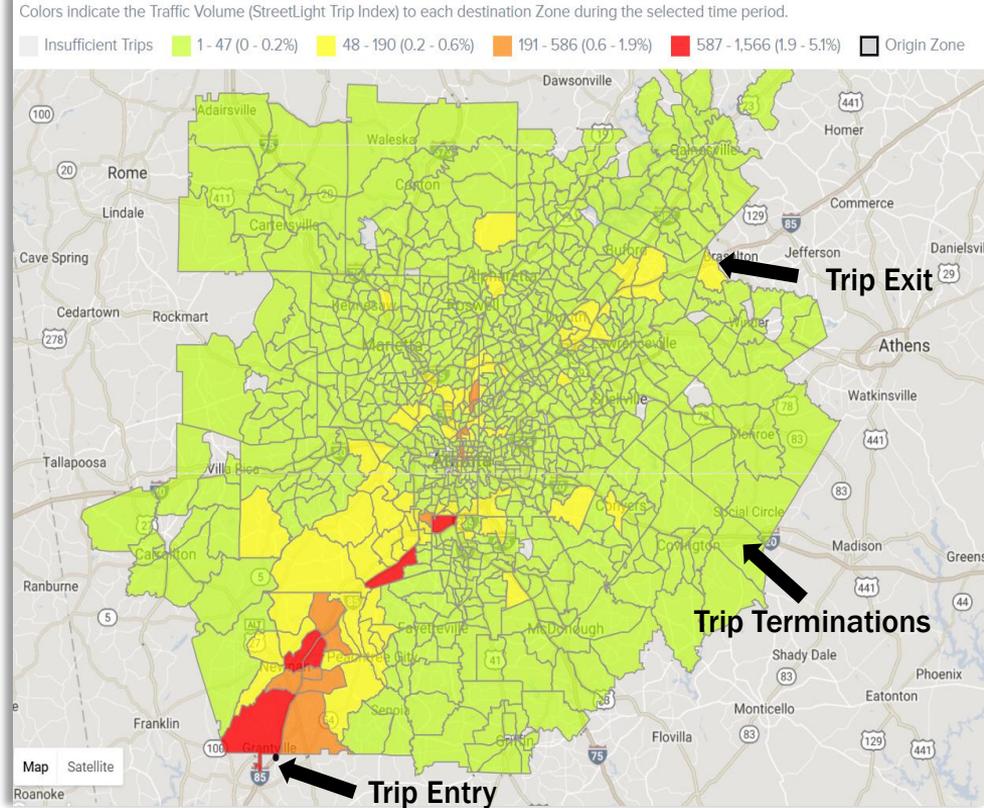
Case Studies



Pass thru trips on I-85 in Atlanta Metro area

Question: How many trip traveling to Atlanta metro area on I-85 NB, a major traffic corridor, are pass thru trips?

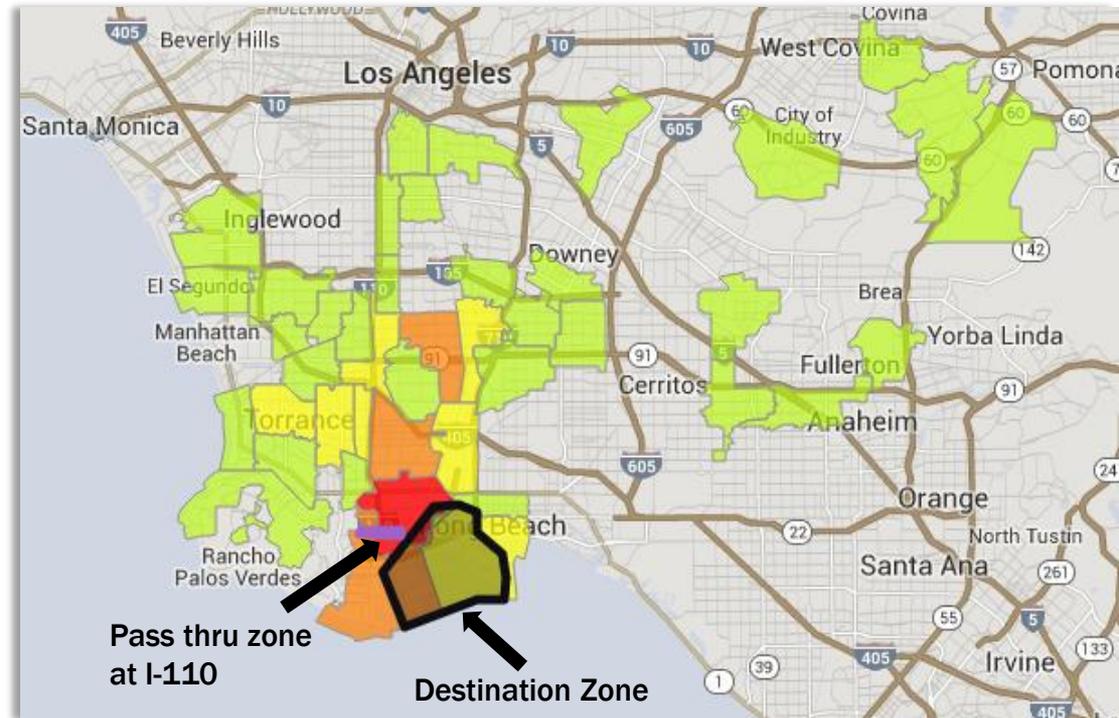
Answer: The heat map shows the destinations (and relative distribution) of the trips that enter thru the zone marked “trip entry” on I-85 NB. About 3.2% of those trips continue thru the zone marked “trip exit” on I-85 NB.



Reducing congestion near Port of Long Beach

Question: How should LA Metro re-route commercial trucks to reduce commuter congestion on I-110 near Port of Long Beach?

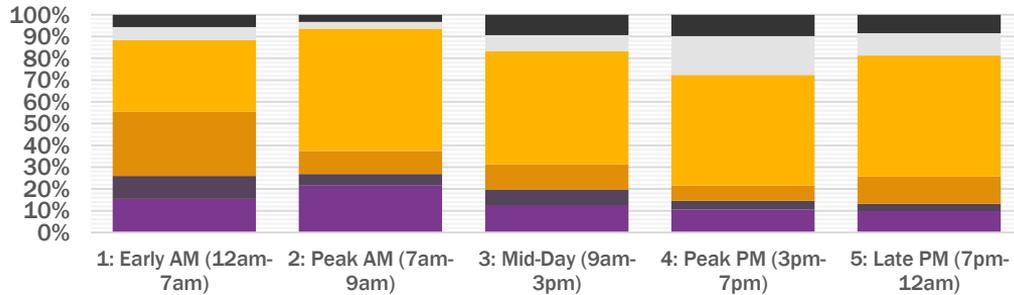
Answer: The heat map shows the origins (and relative distribution) of all commercial trips during average weekday, peak PM hours, that use I-110 to access POLB.



Construction planning at an interchange in Baltimore

Share of Personal Vehicles on E. Lombard that go to each Destination Link by Day Part

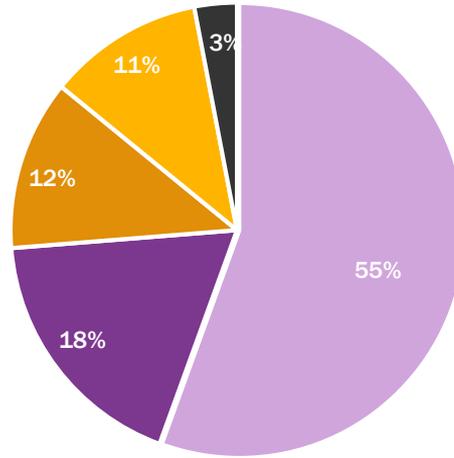
■ Bayview Blvd SB ■ E Lombard Continuing ■ Ponca SB ■ Ramp to 895 NB ■ Ramp to 895 SB ■ Other



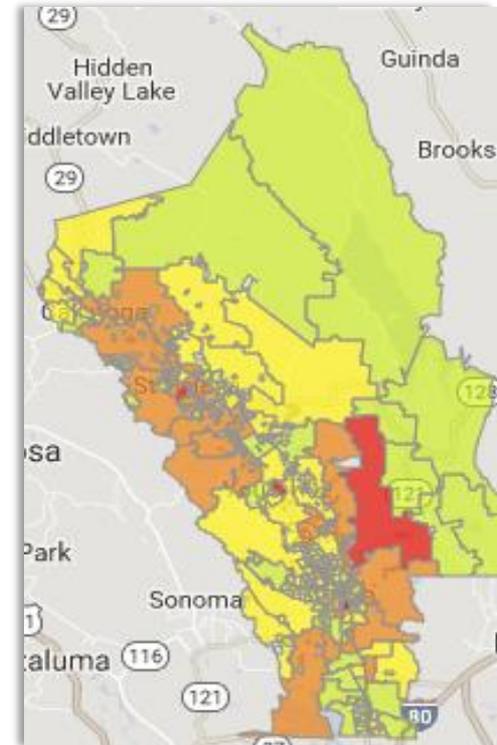
Transit routes planning in Napa county

Question: Where are the transit options most needed in Napa county?

Answer: Regional study showed high local commuter trip volume.

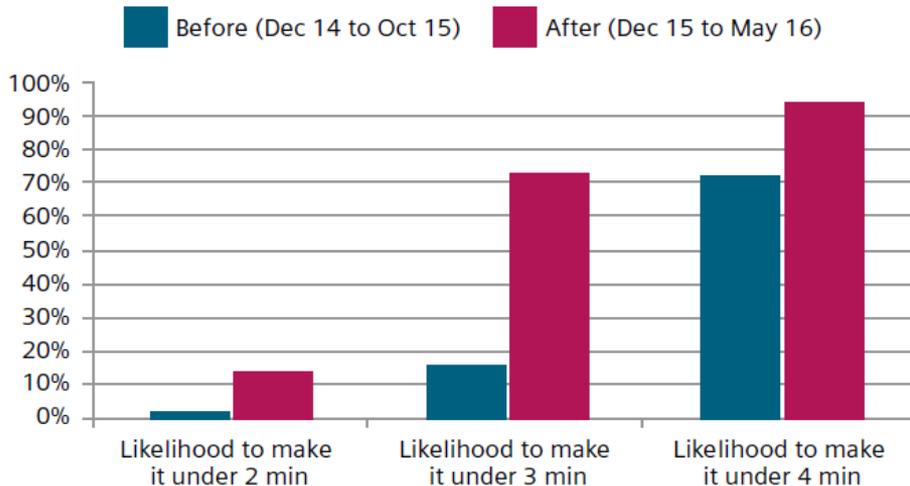


- Internal Trips
- Imported Trips
- Exported Trips
- One-way Intra-county Trips
- Pass-through Trips

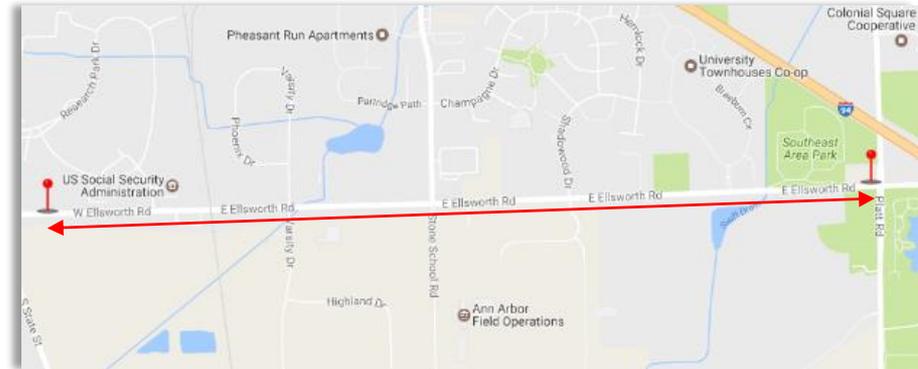


ITS performance measurement in Ann Arbor

Weekdays - Increase in Likelihood to Complete Corridor in Target Time



Siemens wanted empirical data to prove that its SCOOT adaptive signal technology reduced travel times. Siemens used StreetLight's analytics to evaluate the impact. It showed SCOOT improved travel times and reliability significantly.

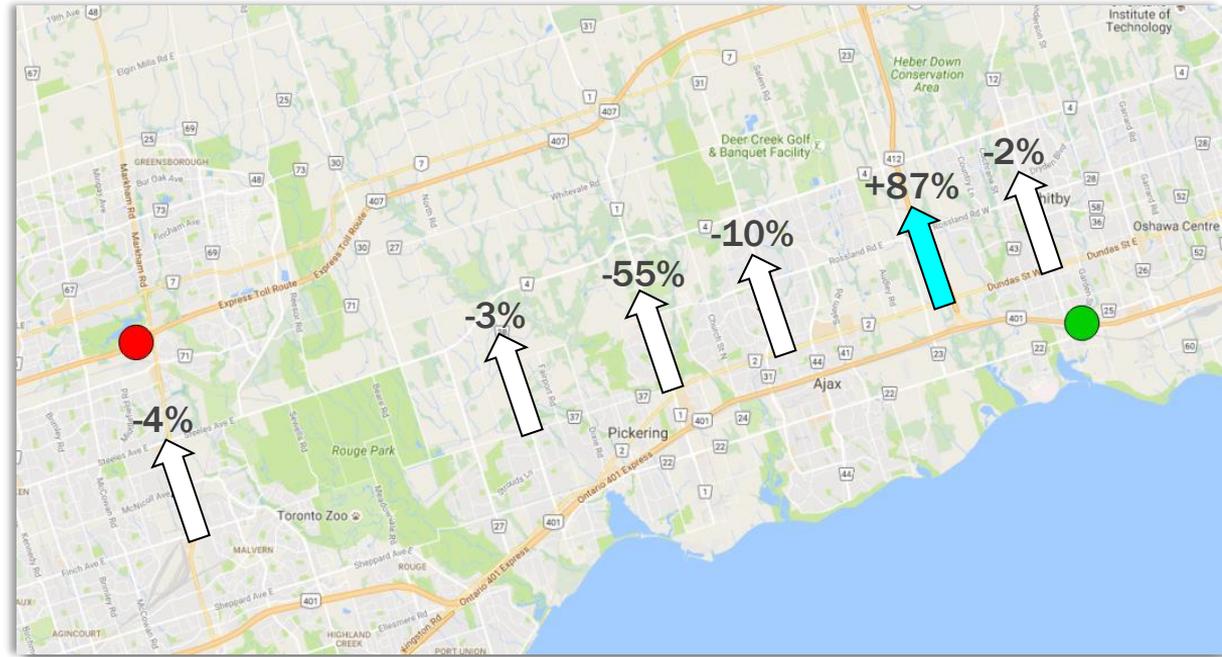


Ellsworth Corridor where SCOOT was installed

Corridor improvements impact in Toronto

Question: Did the construction of a new highway divert traffic from local roads?

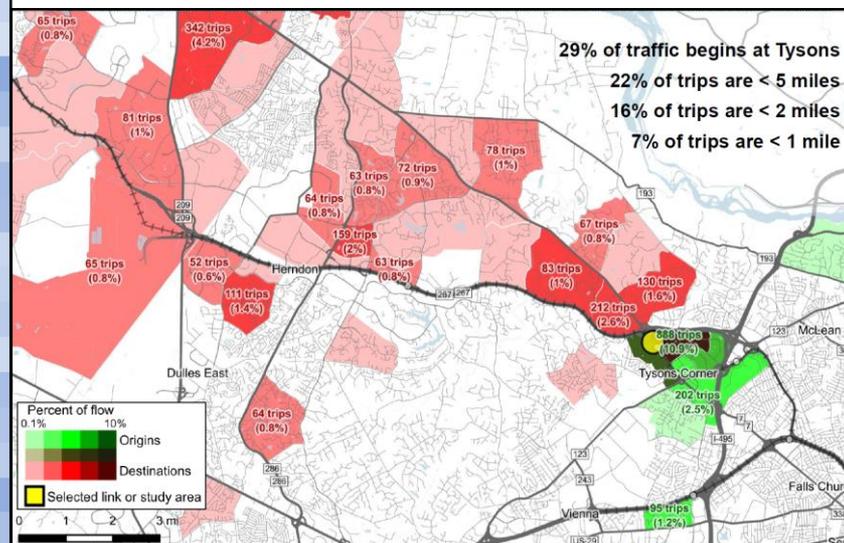
Answer: A before/after study showed significant reduction of trips from neighborhood roads after the corridor improvement.



Transportation Demand Management in Virginia

TAZ ID	Avg Trip Duration (sec)	Avg Trip Speed (mph)	Sum under 1 mile	Sum under 3 mile
851	1186	27	5%	30%
850	1433	27	6%	25%
849	1427	30	4%	21%
848	916	23	5%	47%
847	1420	27	9%	39%
846	1275	29	4%	28%
845	1180	23	6%	38%
844	1129	26	7%	37%
843	1504	27	5%	25%
842	1485	30	4%	27%
841	1460	26	7%	31%
840	1403	26	3%	24%
839	1177	25	4%	37%
838	1359	26	6%	34%
837	1272	28	3%	30%
836	1397	28	8%	45%
835	1732	33	6%	36%

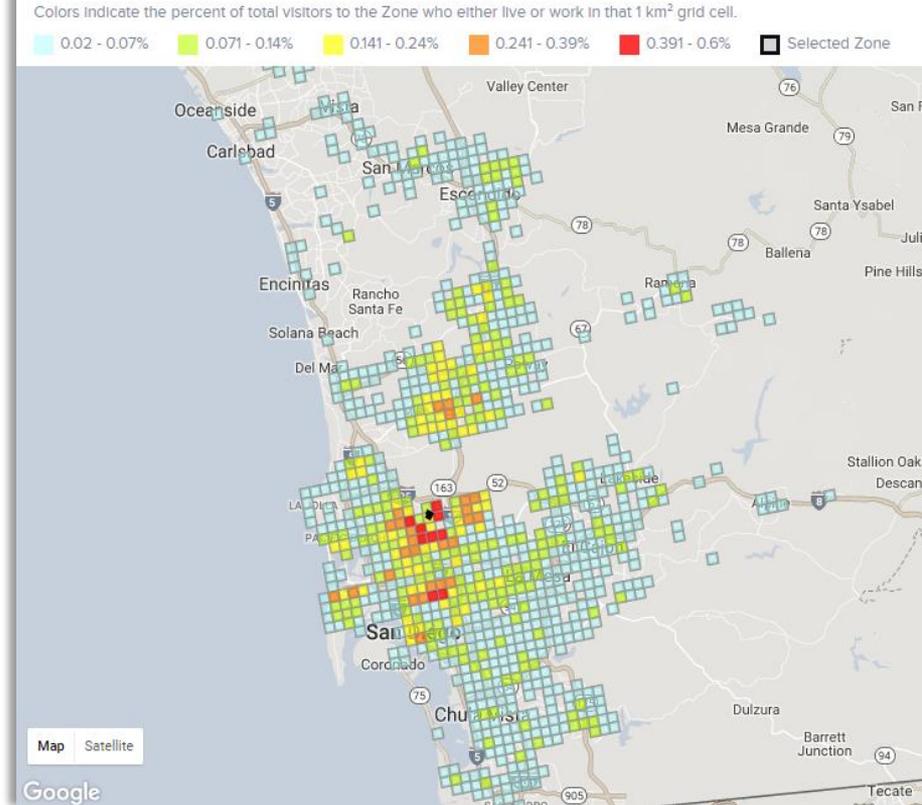
Large Volume of Short Vehicle Trips WB on Route 7 during Peak PM hours



Measuring a large employer's impact on commutes

Question: How can an MPO determine impact of large employers on regional commutes?

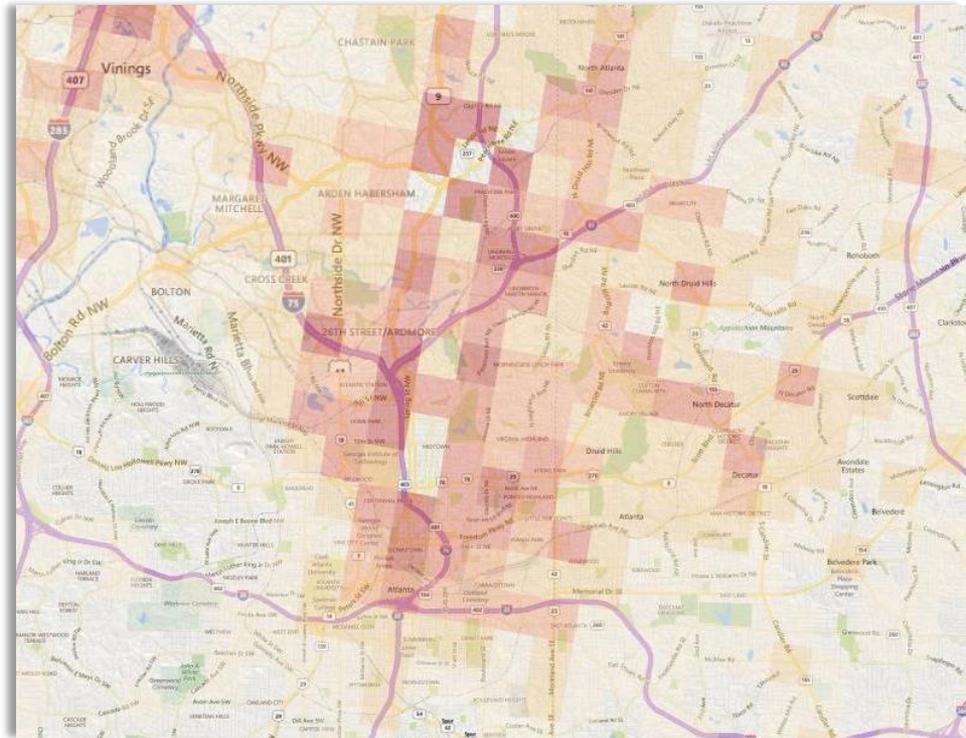
Answer: A scan of greater San Diego region with 1 km² grids shows distribution of homes for employees of a major San Diego area employer.



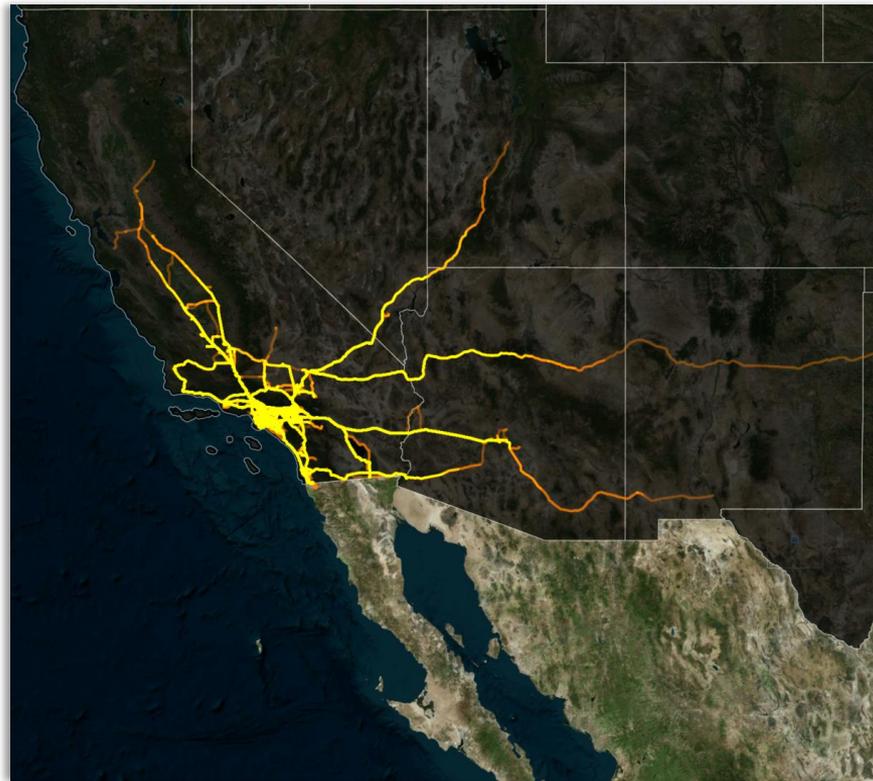
Where to add new bike facilities in Atlanta?

Question: Can Big Data help planners understand where new bike facilities should be located?

Answer: A scan of Atlanta region with 1 km² grids “lit up” areas with highest volume of short trips under 2 miles.



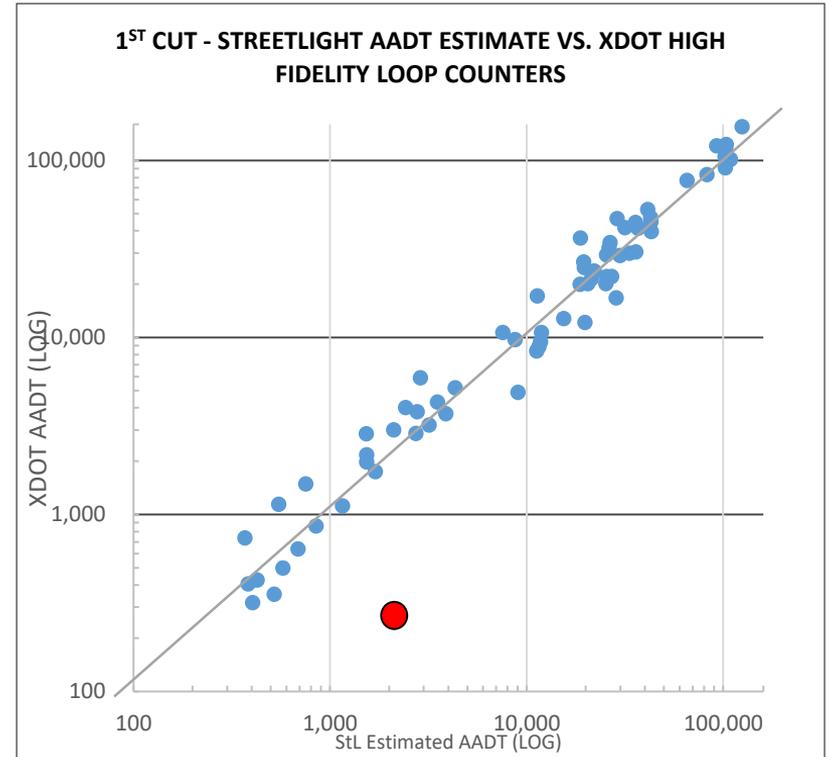
Identifying popular truck routes out of POLA/POLB



Validating Rural AADT Counts

Question: Are the DOTs old rural AADT counts accurate?

Answer: StreetLight's AADT counts returned with one outlier. Further analysis and field inspection revealed that one of the DOT's sensor was mislocated in a much lower traffic segment of the road.



A Look Ahead: Multi-modal Trip Analysis

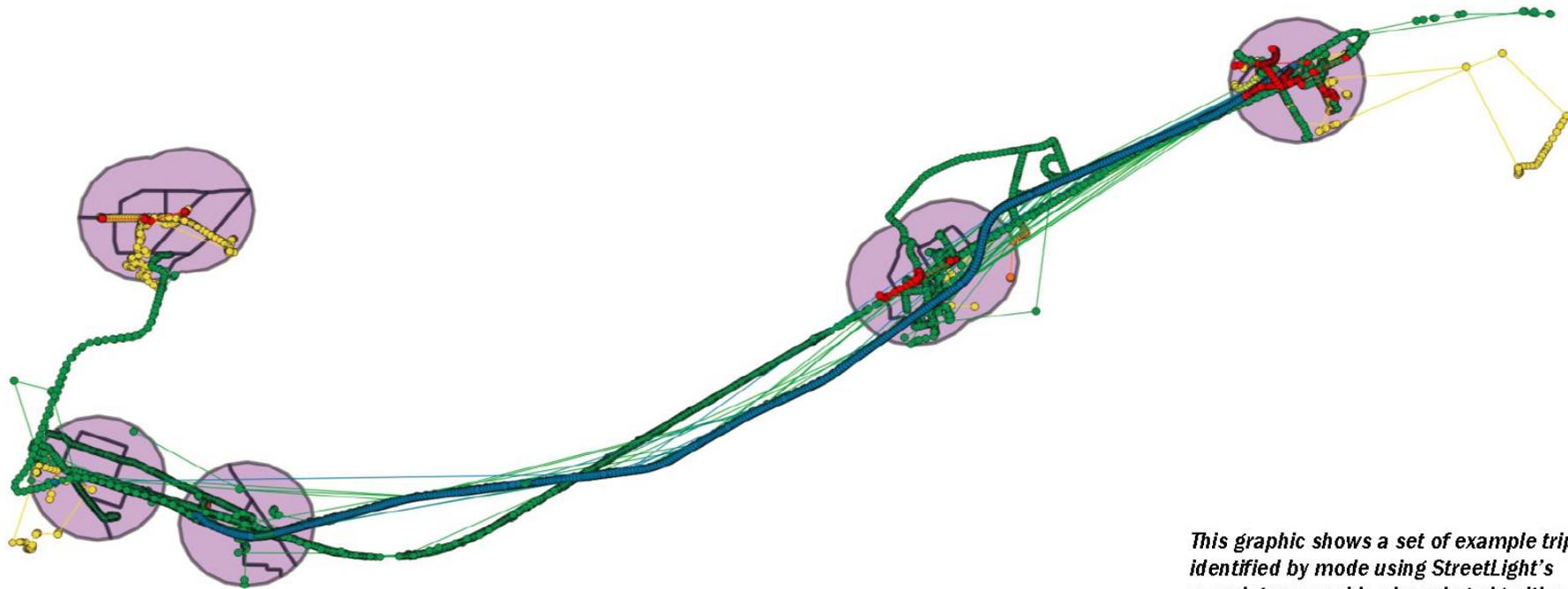
PED

BIKE

BUS

CAR

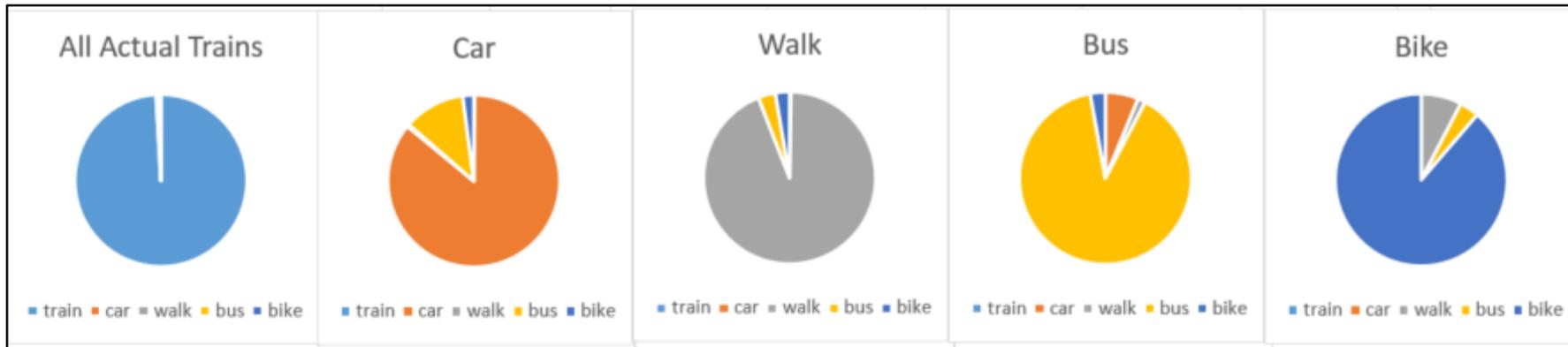
TRAIN



This graphic shows a set of example trip identified by mode using StreetLight's proprietary machine learning algorithms

Machine Learning Approach to non-Mode IDed Data

Control Data



StreetLight Data



Thank You