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
- Impact Measurement

[Diagram showing transportation methods and icons]
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

HOW
➢ Transportation Mode
  ✓ Bike/Pedestrians
  ✓ Personal Vehicles
  ✓ Commercial Vehicles
    ✓ Medium Duty
    ✓ Heavy Duty

WHEN
➢ Archival Information
  ✓ By Month
  ✓ By Day of Week
  ✓ By Time of Day

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

StreetLight InSight® closes the analysis gap
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

- GPS Trip Data
- LBS Activity Data
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.)

Fixed Annual Fee  |  Cost Savings  |  Added Value
--- | --- | ---
0  | 200000  | 600000  | 1000000
200000  | 400000  | 800000  | 1000000
400000  | 600000  | 800000  | 1200000
600000  | 800000  | 800000  | 1400000
800000  | 1000000  | 1000000  | 1200000
1000000  | 1200000  | 1200000  | 1400000

Source: Final FY 2016 SANDAG Program Budget
Variety of Uses, Multiple User Access, One Platform

- Transport Demand Modeling
- Mobility Performance Measurement
- Congestion Mitigation
- Corridor and Facility Improvement
- Air Quality and GHG Estimates
- Project Evaluation
- AADT Estimates
- Transit Planning and Accessibility
- Multi-Modal Studies
- Commercial Freight Analytics
- Internal and External Studies
- Transportation Equity
- Transit Planning and Accessibility
- Multi-Modal Studies
Using StreetLight InSight® is Quick & Easy

1. Create Zones
2. Define Project
3. Analyze Results

Using StreetLight InSight® is Quick & Easy
Visual Graphics and Data Download Options

Visualize Travel Projects

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.

Select a Type of Day:
- Average Day (M-Su)
- Average Weekday (M-Th)
- Average Weekend Day (S-Su)

Select a Time of Day:
- All Day (12am-12am)
- Early AM (5am-6am)
- Peak AM (6am-9am)
- Mid-Day (10am-3pm)
- Peak PM (3pm-7pm)
- Late PM (7pm-12am)

Data “.CSV” File
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

- Summer 2016
- Winter 2016

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

**Answer:** Regional study showed high local commuter trip volume.
ITS performance measurement in Ann Arbor

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.
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

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

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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.
**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
**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

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
- All Actual Trains
- Car
- Walk
- Bus
- Bike

StreetLight Data
- We Say Train
- Car
- Walk
- Bus
- Bike
Thank You