Big Data for Transportation Planning

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Agenda

• Defining Big Data
  – The Questions it Can Answer
  – Technical Characteristics

• Case Studies and Use Cases

• Q&A
Big Data is Just A Buzzword...

Will Big Data Cure Cancer?
*Fortune* - Nov 2, 2016

While there's a lot of breathless talk about the potential of big data, Commons now holds the raw genomic data, from the Cancer Genome Atlas and the National Cancer Institute, and shares them.

Big Data: Key to Customer Understanding and Service Delivery

Transit agencies invest millions to transport people in the most seamless, efficient, safe and reliable manner. Whether public or private, mass...

This Startup Is Using Big Data And Smart Tech To Save The Oil...
*Forbes* - Oct 29, 2016

While experiencing an influx of funding and increased cash flow from oil, the failure to adopt a smarter business model driven by big data and...

Why Cultural Change Is Necessary For Big Data Adoption
*Forbes* - Nov 8, 2016

Love it or hate it, big data is here to stay. As data volumes and sources of data proliferate at ever increasing rates, leading companies will be...

Big Data Unleashes Business Opportunity
*Forbes* - Nov 1, 2016

Businesses have gone data crazy. You can't blame them. Streaming, real-time data analysis promises to bring the type of predictability that cuts...

Mitigating the Security Risks of Big Data
*CIO* - Nov 1, 2016


Defining Big Data in a Transportation Context
(A Subset of LBS and Navigation-GPS data from Sept 2016 in Fremont, CA)

Key Benefits:

- **Accurate**: Empirically Measures Travel Behavior
- **Precise**: Spatial and Temporal Precision
- **Comprehensive**: Large Sample of Complete Trips and Activities

Location-Based Services Data Location
Circle radii vary: they accurately reflect the spatial precision of each unique data point

Navigation-GPS Data Location
Circle enlarged for visibility

Note: This image shows a filtered subset of data to improve visibility
Big Data Must Be Processed to Be Useful

Source for chart: Kay, David and Mark van Harmelen. Delivering benefits from the data deluge, Dec 2012. jisc.ac.uk
Data Processing Engines Can Turn this Messy Data into Useful Metrics for Travel Demand Modeling

Input: **Big Data**
- Anonymous and accurate Locational Big Data
- Road network, land use, parcel, census and more Contextual Data

Processing: **RouteScience®**
- Clean
- Patternize
- Contextualize
- Aggregate

Output: **StreetLight InSight Metrics**
- Basic Metrics: Origin-Destination, Select Link, Zone Activity
- Premium Metrics: AADT, Trip Purpose, Demographics, Commercial Tours, Home/Work Analysis
- Customization: Day Parts, Day Types, Data Period
What Questions Can Big Data Analytics Answer for Planners? A Few Examples....

- What types of trips cause congestion on a particular roadway?
- What are the origins and destinations of travelers on a particular roadway?
- How do travel patterns vary during different types and times of day?
- What are the demographic characteristics of travelers? How long are their trips?
- Where do commuters live, and where do residents work?
Case Studies and Use Cases
When Does it Make Sense to Use Big Data?

1. Going “Back in Time”

2. Large Study Areas

3. Need Large Sample

4. Complex Project Set-Up

5. Need Complete Trips

6. For Truck Trips & Demographics
OD Data - Downtown Syracuse: Distribution of Trip Destinations

**Need:** Accurate O-D information to understand distribution of trips to calibrate study with travel demand model

**Question:** Where do trips from downtown Syracuse travel to?

**Challenge:** Very low response rate to surveys, and inaccurate assessments of behavior based on incomplete participant replies

**Metrics:** O-D to Pre-Set Geography by Census Block Group – (could have used US TAZs as well)
Looking at Home/Work Locations in Downtown Syracuse

**Origin-Destination for Syracuse MPO**

**Need:** Accurate Home/Work locations as contextual input for calibration of transportation demand model with demographics

**Question:** Where do workers in central Syracuse live?

**Challenge:** Very low response rate to employer surveys – lack of good data

**Metrics:** Visitor Home-Work Analysis
Pinpointing the Cause of Congestion in Lafayette, CA

**Need:** Evaluate and prioritize solutions to congestion in downtown corridor

**Question:** Understand what which type of trip causes congestion: School drop-offs, commuters to downtown via freeway, “first/last mile” commuters to transit stop, or trips to downtown businesses

**Challenge:** The city had counts, but they didn’t show origins and destinations, and surveys were inconclusive.

**Metrics:** Origin-Destination with Middle Filter
Travel Demand Management in Virginia

Need: Evaluate and prioritize solutions to traffic when highway expansion is not an option

Question: Where are the highest volume of trips that could be converted to other modes?

Challenge: Northern Virginia had to scan hundreds of miles of roads to identify and prioritize the best TDM opportunities, which was not possible to do cost-effectively with conventional data sources

Metrics: Zone Activity, O-D with Trip Attributes, O-D with Middle Filter
Evaluating the Impact of a New Road in Canada

**Need:** Determine if a new road successfully shifted traffic from neighboring roads

**Question to Answer:** By what percentage did the volume of trips on each route change before and after construction of the new road?

**Challenge:** Data was not collected for “Before” time period

**Metrics:** O-D with Middle Filter
Understanding Heavy-Duty Truck Tours Originating in the Port of New Jersey/New York

**Commercial Tours for Port Authority**

**Need:** Understand Behavior of Commercial Tours to Build Freight Modeling

**Zones:** 1 (Port of New Jersey/New York)

**Metric:** Commercial Tours

**Months:** All of 2016
Putting it All Together: When To Use Big Data

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Thank You
Q&A

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