EXPANDING TRUCK GPS-BASED PASSIVE ORIGIN-DESTINATION DATA IN IOWA AND TENNESSEE

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ATRI Truck GPS Dataset

ONGOING TRUCK GPS DATA RESEARCH BEGINNING IN 2001

• Comprehensive North American Truck GPS dataset
• “Big Data”
  – Real time data feeds/ significant hardware and software
  – Currently near **100 million** data points **per day**
  – Will approach **1 billion points per week** later this year
• Fully deployed applications
  – Performance measurement/management
  – Freight flow and truck trip modeling
• Key research areas
  – Economic competitiveness and supply chains
  – Truck volume/intensity/national travel patterns
  – Weather, parking, emergency events
ATRI Truck GPS Dataset – One Day
ATRI Truck GPS Dataset

Legend
N-CAST
PM Peak Average Speeds MPH
- Less than 50.00
- 50-55,000
- Greater than 50,000

FAF AADTT
- 0 - 5000
- 5001 - 8000
- 8001 - 14000
- 14001 - 22000
- 22001 - 45000
ATRI Truck GPS Dataset
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Modeling Applications

PRIOR USAGE OF ATRI TRUCK GPS DATA

• 2012 Indiana Statewide Travel Demand Model Update
  - RMSE: 69.3% to 60.6%
  - MAPE: 74% to 42%
Iowa Dataset

DETAILS OF ATRI TRUCK GPS DATA WITHIN IOWA

• Four 2-week samples from each quarter of 2012
• Over 135,000 individual trucks
Data Processing

**ATRI PING DATASET MUST BE PROCESSED TO TRIP O-D PAIRS**

- Identifying movement for all records
- Determine trip O-Ds, travel time, VMT

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4/29/14
RSG

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Data Processing
Data Cleaning

METHODS INTRODUCED TO IMPROVE PROCESSING

• Over 50 million movement records from 135,000 trucks

• Data Filtering:
  - GPS jumps – urban canyons, mountains, spatial joins, etc.
  - Missing data – spatial joins
  - Study period edges – trips in progress
  - Duration & OD mismatch – missed stops, GPS jumps

• Applied conservative filtering methods in Iowa
• Working on more intelligent filters
GPS Blips
Circuity
Start & End Time
DATA CAPTURES ROUGHLY 10% OF TRUCKS OVER 56 DAYS

- Processed data contains:
  - 2.8 million truck trips over 56 days
  - 60,656,488 truck VMT within Iowa
  - 1,083,152 average daily truck VMT
  - 10,731,507 Iowa DOT estimated 2012 daily truck VMT
  - Sample rate of 10.1%

- Factored raw data by 0.1769 to represent daily preliminary seed OD table
Weighting & Expansion

GOAL FOR IOWA TO MOVE BEYOND SIMPLE SCALING

• Initial statewide truck modeling application of ATRI data in Indiana stopped with scaling, ultimately used ODME

• ATRI data is not a random sample – suspected some biases

• Anecdotal evidence for geographic/regional & trip-length (short-haul) biases

• Developed a weighting scheme to address these sample biases by analyzing ODME
NO EVIDENCE OF SYSTEMATIC GEOGRAPHIC BIAS

• Geographic differences of sample coverage in Iowa / Halo area
BIAS TOWARDS LONG HAUL

- Confirmed suspected bias of long-haul over short-haul truck trips
- Bias was not as strong as some may have supposed
Weighting Scheme

WEIGHTING SCHEME BASED ON TRIP LENGTH

![Bar chart showing weight vs. trip length](image-url)
Truck Assignment Tests

TRUCK ASSIGNMENTS MADE FOR TESTING PURPOSES ONLY

• ATRI data used as one component of truck model
• Assignment used to assess count consistency, weighting effectiveness, goodness-of-fit bounds

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<th>Assignment Type</th>
<th>RMSE</th>
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<td>Scaled Data</td>
<td>116%</td>
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<td>Weighted Data</td>
<td>92%</td>
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<td>ODME on Data</td>
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• Previous model used ODME to achieved 81% RMSE for trucks
Tennessee

ATRI DATA SAMPLE FOR TENNESSEE (PRELIMINARY)

- Similar four 2-week samples over 2013 quarters
- 235,000 unique trucks
- 138 million records processed to 5.8 million trips
- 84,147,030 truck VMT within TN
- Sample rate of 6.5%
Conclusions

• ATRI’s truck GPS data provides a rich and growing source of information on truck travel patterns

• It is a LARGE sample – but still a SAMPLE

• Failure to properly expand it could lead to under-representation of short-haul movements and faulty analysis or false conclusions

• Weighting offers both an understanding of ODME
  - Confirmation and measurement of long-haul bias
  - Mixed findings on geographic sample rates and an alternative to ODME
  - No ODME uncertainty or individual OD adjustments

• Better data + better analysis = better models + better planning