Utilizing GPS Truck Data in Transportation Planning and Engineering

Mihalis M. Golias
Department of Civil Eng. and Intermodal Freight Transportation Institute

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Introduction

• Multi-Institutional Research Project
  - University of Memphis (M. Golias, J. Karafa, Z. Johnson)
  - American Transportation Research Institute (J. Short)
  - Vanderbilt University (J. Dobbins)
Goals of Analysis

• Test capabilities of data
  - Facility MOEs and turn time model
  - Determine truck stops and rest area demand
  - Validate bridge restrictions
  - Truck flow analysis
    • MOEs for LTRP and Operational Analysis
Facility Turn Time Model Development

- Analyzed four types of truck facilities in the Memphis area
  - Intermodal
  - Distribution
  - Public Warehouses
  - Private Warehouse
Turn Times

Weekly Average

<table>
<thead>
<tr>
<th>Turn Time (min)</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>15</td>
<td>15%</td>
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<tr>
<td>30</td>
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<td>300</td>
<td>300%</td>
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<tr>
<td>300+</td>
<td>300+%</td>
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</tbody>
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Legend:
- Warehouse
- Private Warehouse
- Distribution
- Intermodal
Turn Times Model

**Intermodal Facilities (R²=0.24)**

\[ Y = 20 + 275x_1 + (-390)x_2 \]

**Distribution Facilities (R²=0.18)**

\[ Y = 11 + 993x_1 + (-576)x_2 \]

**Private Warehouse Facilities (R²=0.01)**

\[ Y = 137 + 1x_1 + (-259)x_2 \]

**Public Warehouse Facilities (R²=0.06)**

\[ Y = 52 + (-155)x_1 + 1266x_2 \]

*Y = turn time*

*\( x_1 = \% \text{ daily volume per 15 min. interval} \)*

*\( x_2 = \% \text{ daily entrance volume per 15 min. interval} \)*

*Cross-validation with a 10 hold out sample was used to calculate accuracy of models*

*Data not adequate to develop turn times model*
Truck Stop and Rest Area Demand

- Procedures were developed using ATRI GPS data to analyze the truck rest areas.
- This data was compiled to determine rest area demand patterns.
Truck Stop and Rest Area Demand
Number of truck stops

By start and end times

Common pattern:
Rest starts: 8pm-11pm
Rest ends: 9am-12pm
Validation of Truck-prohibitive Geometrics: Bridges

- Analyzed 64 low clearance bridges categorized as impassable by truck TDOT (vertical clearances of less than 14ft).
- Based on truck movement the vertical clearance should be 13ft and 4 inches.
Departure Time Effects on Travel Time
Departure Time Effects on Travel Time
Destination by Zip Code

Truck Trip Destinations - September/October 2011

Number of Destinations Recorded
- 0
- 1 - 10
- 11 - 35
- 36 - 60
- 61 - 140
- 141 - 272
- 273 - 432
- 433 - 589
- 590 - 892
- 893 - 1376
- 1380 - 10000
- 10000+
Truck flows from Shelby and Davidson
Truck Routes
MOES: Average Speed

Shelby County

Davidson County
Number of trips (by direction & by time of day)

Shelby County

Davidson County
Further Research

• Establish methodology for accurate turn times with partial data
• Establish a guidebook of how the data and procedures can be incorporated into LRTP and Operations Planning
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