Estimating Nationwide Truck Flows From the Freight Analysis Framework (FAF) 2017 Data

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FHWA Project Objectives

- Improved and transparent methodology for estimating freight trucks on national highway systems
- Develop a replicable means of deriving county level Origin-Destination Flow data from FAF
- Create a software tool to allocate the Freight Analysis Framework (FAF) data to a national road network.
Background

• The Commodity Flow Survey 2017 Data and the Freight Analysis Framework 5 (FAF5) have been published
• More detailed flow estimates are desired between smaller spatial units such as counties and for major roads
• Disaggregation of FAF5 and network assignment are possible through modeling
Project Elements

• Disaggregation of FAF5 flows by commodity group from 132 FAF zones to counties, sub-county areas, ports, airports, and border crossings
• Conversion of commodity tonnage flows to truck trips using payload factors
• Creation of a new national model network suitable for flowing long haul truck trips in 2017
• A new traffic assignment approach for these trips
• Application software for disaggregation of flows, network assignment, data queries, and visualization
Commodity Flow Disaggregation

- Preserves FAF 5 published totals by commodity and FAF to FAF zone
- Creates estimates for 3,599 zones representing county centroids, sub-county centroids for large counties, ports, airports, and border crossings
- Production and attraction regression equations as a function of industry employment, population, and other variables
- Tri-proportional gravity model used to preserve known totals and mean flow length distributions
Commodity Flows Converted to Truck Trips

<table>
<thead>
<tr>
<th>Commodity/Name</th>
<th>TonsPerSUTruck</th>
<th>TonsPerCUTruck</th>
<th>SUTruckShare</th>
<th>CUTruckShare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live animals/fish</td>
<td>2.910</td>
<td>15.4700</td>
<td>5.60</td>
<td>94.40</td>
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<tr>
<td>Cereal grains</td>
<td>9.240</td>
<td>22.2500</td>
<td>8.40</td>
<td>91.60</td>
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<tr>
<td>Other ag prods</td>
<td>4.490</td>
<td>20.0100</td>
<td>7.40</td>
<td>92.60</td>
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<tr>
<td>Animal feed</td>
<td>6.870</td>
<td>9.3700</td>
<td>9.20</td>
<td>90.70</td>
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<tr>
<td>Meat/seafood</td>
<td>3.430</td>
<td>18.8500</td>
<td>3.60</td>
<td>96.40</td>
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<tr>
<td>Milled grain prods</td>
<td>1.800</td>
<td>17.3000</td>
<td>4.40</td>
<td>95.50</td>
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<tr>
<td>Other foodstuffs</td>
<td>4.190</td>
<td>14.8600</td>
<td>5.80</td>
<td>94.20</td>
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<tr>
<td>Alcoholic beverages</td>
<td>5.590</td>
<td>17.7700</td>
<td>6.00</td>
<td>94.00</td>
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<tr>
<td>Tobacco prods</td>
<td>5.840</td>
<td>18.0900</td>
<td>6.80</td>
<td>93.20</td>
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<tr>
<td>Building stone</td>
<td>8.880</td>
<td>19.0700</td>
<td>23.50</td>
<td>76.10</td>
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<td>Natural sands</td>
<td>12.380</td>
<td>22.1400</td>
<td>30.40</td>
<td>69.60</td>
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<tr>
<td>Gravel</td>
<td>14.110</td>
<td>22.2600</td>
<td>43.60</td>
<td>56.40</td>
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<tr>
<td>Nonmetallic minerals</td>
<td>12.570</td>
<td>22.4700</td>
<td>31.40</td>
<td>68.60</td>
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<tr>
<td>Metallic ores</td>
<td>13.320</td>
<td>19.2400</td>
<td>21.30</td>
<td>78.70</td>
</tr>
</tbody>
</table>
New National Model Network for Road Freight-2017

• Accurate geography and topology including ramps
• 480,000 links, 342,000 nodes
• Attributes conflated from HPMS data from each state
• Congested speeds from NPMRDS where applicable
• Truck tolls compiled for 2017
Truck Trip Assignment

- Intercity truck flows do not follow equilibrium principles, only overall traffic does
- Truck flows are based on congested travel times
- Path choices are influenced by tolls and travel time
- Meaningful alternative routes are enumerated
- Routes can be viewed, edited, deleted, & added
- Discrete choice model is used to model the route shares
- Path-size logit is used to correct for overlapping routes
- Validation with ATRI data
Empirical Data are Available on Truck Routes That Can be Used for Calibration and Validation

• Quite apart from conceptual reasons, it is attractive to use a method that can benefit from empirical data

• Best source for intercity truck route data is GPS data collected from truck fleets such as that available from ATRI-the American Transportation Research Institute

• Through an arrangement between ATRI and U.S. DOT, we were able to obtain the routes utilized and the share of traffic on each for some key O-D pairs
Alternative Routes Between Lubbock and Houston
Truck Route Choice Example
Comparison of FAF Routes with ATRI Data
National FAF Trucks Flow Map
Application Software

• The FAF5 Network Analysis Tool is a software application built upon TransCAD Version 9
• Performs a computationally intensive set of calculations
• Flowchart User Interface
• The methodology and software are modular and flexible so that methods can be updated and improved.
• The tool includes facilities for network management, querying data, and visualization
Routes and Route Choice Parameters

• Routes can be edited, added, or deleted
• Route choice parameters (coefficients and scale) can be edited
• Values of time can be adjusted
• Calibration to known targets is possible
Query Flows by O-D, Commodities, and Route Segments
Route Diversion-I-40 Bridge Closure Impact
Future Work

• Further calibration and validation-flows are expected to be lower than counts due to lack of coverage of all commodities and all truck trips
• Publication of the Data
• Project Final Report
• For more information contact Birat.Pandey@dot.gov or Howard@caliper.com