Developing behavior-based freight model and related data sets:
*MAG SHRP2 C20 IAP Implementation*

Vladimir Livshits, Sreevatsa Nippani, Krishnan Viswanathan, Monisha Khurana

2015 AMPO Annual Conference. October 21, 2015. Las Vegas, NV
Release of project findings and specific products and technical details will be coordinated by FHWA upon completion of the project. This presentation only provides general outline and information about the ongoing effort and input data sets.
MOTIVATION

- Aggregated model – does not account for detailed land use, infrastructure, community planning scenario analysis. Insensitive to agent-based economic scenarios, does not account for evolutionary developments of economic agents in the forecast, insensitive to fine-grained network changes.

- Does not include supply chain models and is not suitable for development of economic scenarios on mega-regional scale. Insensitive to mega-regional supply chain scenarios and technological shifts.

- Static model - does not provide for integration with dynamic traffic simulations, detailed safety analysis, and agent-based passenger travel demand models with continuous timeline.

- Trip-based – is not consistent with operational behavior of carriers and as a result insensitive to operational scenarios or relevant network improvements.

- Does not account for multi-modal aspect of supply chains, does not forecast multimodal freight flows and is not sensitive to multimodal freight issues.
WHERE DOES FREIGHT MODEL FIT IN THE MODERN MODELING PARADIGM?
MAG Project Background

- On February 13, 2014 MAG, ADOT and PAG submitted a joint application for implementation and technical assistance funds in Round 3 of FHWA SHRP2 IAP, MAG was the lead agency in the Freight Demand Modeling portion of the proposal.
- On March 28, 2014, FHWA and AASHTO announced that MAG was one of the organizations selected in Round 3 of SHRP2 implementation assistance for freight demand modeling.
- On May 19, 2014 MAG RC EC approved to accept $350,000 of SHRP2 IAP Funding in the Draft FY 2015 MAG UPWP and Annual Budget and to add the funding to the corresponding on-call consultant project.
MAG+PAG TAZ

3,040 TAZs

1,104 TAZs
MAG+PAG MAZ

26,268 MAZs

7,392 MAZs
Main Methodological Principles

• Agent-based micro-simulation model
• Multi-modal freight model
• Mega-Regional Model (MAG, PAG)
• Behavioral model, including economic behavior of establishments, shippers, carriers in travel generation and tour formation
• Integration with activity-based passenger model
• Industry-specific model
Main Tasks

• Data Sources Review and Analysis
• GPS Data Purchase, Review, Analysis and Development of Truck Tour Models
• Transearch Data Purchase and Analysis
• National Establishment Time-Series (NETS) Data Purchase and Analysis
• Freight Networks and Analysis Zones Development
• Development of a Firm Synthesizer
• Supplier Selection and Evaluation of Commodity Flows
• Transport, Mode and Path Choice Models
• Overall model integration and validation
Moving to a new modeling framework

MAG Trip-based Truck Model
- Truck Trip Generation
- Heavy, Medium, Light
- Truck Trip Distribution
- Multiclass Assignment

MAG Behavior-based Freight Model
- Firm Synthesis
- Supplier Selection Models
- Transport Choice Models
- Truck Tour Models
- Multiclass Multimode Assignment

Truck GPS, Truck Survey
Truck Trips Generation
Multiclass Truck Demand

NETS, Employment, establishment databases
TRANSEARCH, FAF, BEA, CFI, surveys
FAF, TRANSEARCH, surveys
Truck GPS
Freight Demand
Maricopa Association of Governments (MAG) System Analysis Program

2015 Behavior Based Freight Model Development

Review of Freight Data Sources for the Development of a Behavior-Based Freight Model

Prepared For

Prepared By

Date
April 15, 2015
<table>
<thead>
<tr>
<th>Data Source</th>
<th>National Account Data</th>
<th>Trade Statistics</th>
<th>Transportation Statistics</th>
<th>Shipment Surveys</th>
<th>Stated Preference Surveys</th>
<th>Congestion Skills and MPDP data</th>
<th>Traffic Count Data</th>
<th>Weight Data</th>
<th>Network data with cost functions</th>
<th>Terminal data</th>
<th>Spatial (Smallest Geography)</th>
<th>Temporal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureau of Economic Analysis (BEA)</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>National</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>County Business Patterns (CBP)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>County</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>National Establishment Time-Series (NETS)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>State</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Business Dynamics (LBD)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>State</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>Annual Survey of Manufacturers (ASMI)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MSA</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>Business Dynamics Statistics</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>County</td>
<td>Quarterly</td>
<td></td>
</tr>
<tr>
<td>Business Employment Dynamics</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodity Flow Survey (CFS)</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight Analysis Framework (FAF)</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transsearch</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation Board (STB) Carload Waybill Sample</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Carrier Statistics</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North American Transborder Freight Database</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIES</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Highway Planning Network (NHPN)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Performance Management Research Dataset (NPMRD)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATRI</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAG Roadway Network</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle Inventory and Use Survey (VIUS)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORNL Rail Network</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VTRI</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Applies
Applications

• Regional and Megaregional Transportation Forecast
• Scenario Testing and Planning
• TIP/RTP
• AQ Conformity Analysis
• Regional Freight Transportation Plan
MAG FREIGHT TRANSPORTATION PLAN

Guiding the Region’s 21st Century Freight Network

Acknowledgement: Tim Strow, MAG

September 2015
### Freight Transportation Framework Phase Two

#### Schedule

<table>
<thead>
<tr>
<th>Tasks by Month</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Project and Stakeholder Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2. Guiding Document for 21st Century Freight Network</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Potential Regional Freight Network &amp; Logistic and Manufacturing Clusters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Regional Freight Network Stakeholder Coordination</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Regional Freight Network Performance Testing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6. Logistics, Manufacturing, and Freight Development Zones</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7. Strategic Transportation Investments</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>8. Prepare Final Report and Documentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
</tr>
</thead>
</table>

1. Project and Stakeholder Management
2. Guiding Document for 21st Century Freight Network
3. Potential Regional Freight Network & Logistic and Manufacturing Clusters
4. Regional Freight Network Stakeholder Coordination
5. Regional Freight Network Performance Testing
6. Logistics, Manufacturing, and Freight Development Zones
7. Strategic Transportation Investments
8. Prepare Final Report and Documentation
Summary of Past Findings and Recommendations

Coordinate freight transportation, land use, economic development and marketing to implement the regional freight framework.

Define infrastructure for freight movements to be inclusive.

Guide the most appropriate and advantageous areas for freight and manufacturing areas.

Implement strategic transportation improvements to support efficient freight distribution.
OVERVIEW

• Summary of past findings and recommendations
• Project and stakeholder Engagement
• PHASE ONE
  – Guiding Document for 21st Century Freight Network
  – Potential Regional Freight Network
• PHASE TWO
  – Network Performance Testing and Evaluation
  – Sub-regional Workshops
• PHASE THREE
  – Logistics, Manufacturing, and Freight Development Zones
  – Strategic Transportation Investments
• Next Steps
NEXT STEPS AND CONCLUSIONS