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.
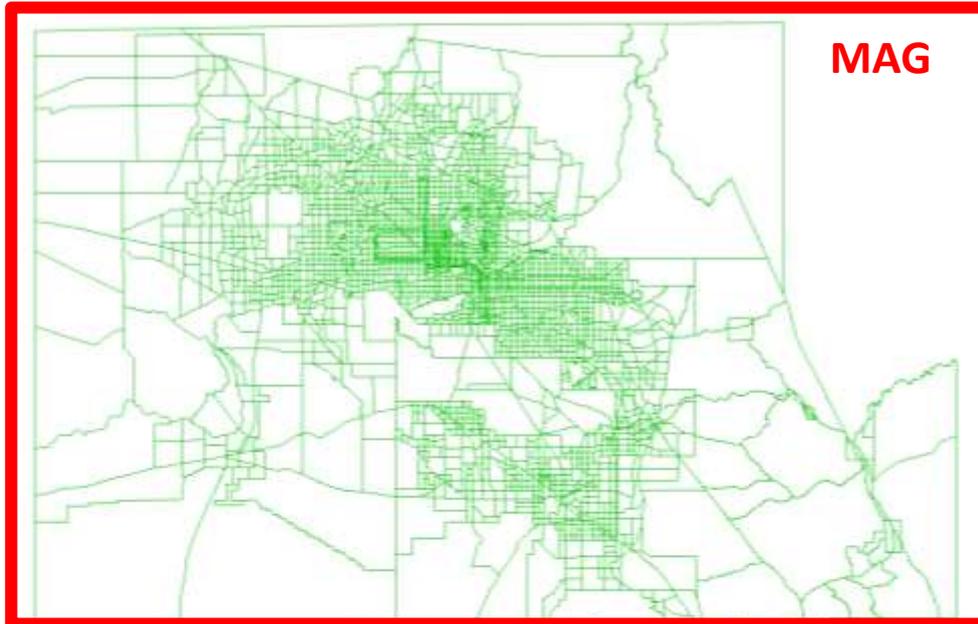
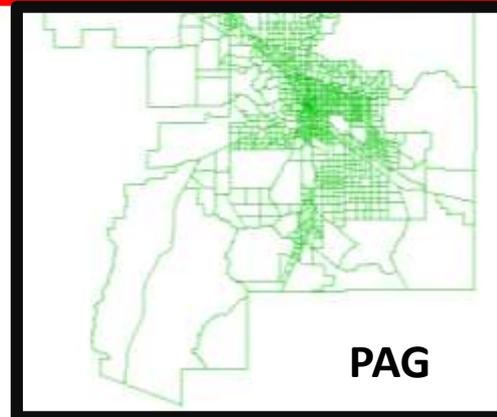# WHERE DOES FREIGHT MODEL FIT IN THE MODERN MODELING PARADIGM?
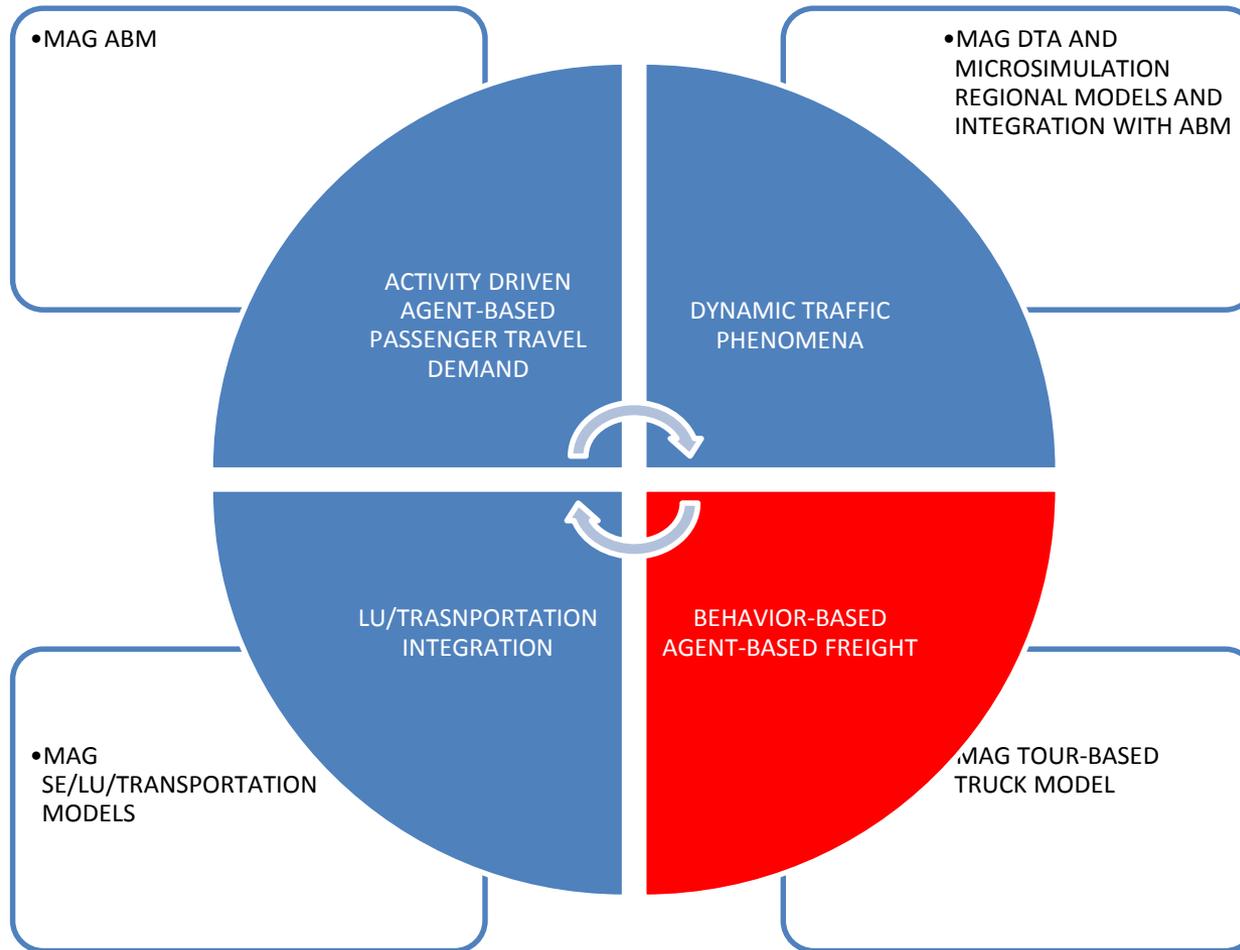
MAG Project Background

- 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

MAG

3,040 TAZs

1,104 TAZs

PAG

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MAG+PAG MAZ

MAG
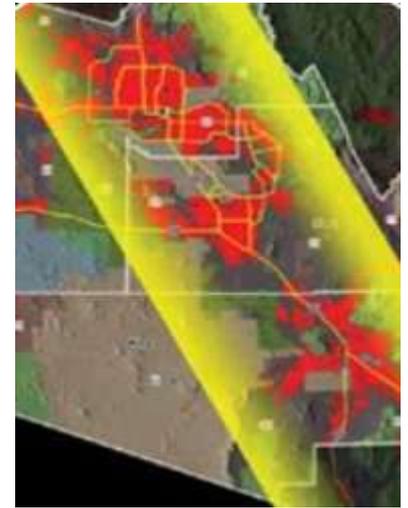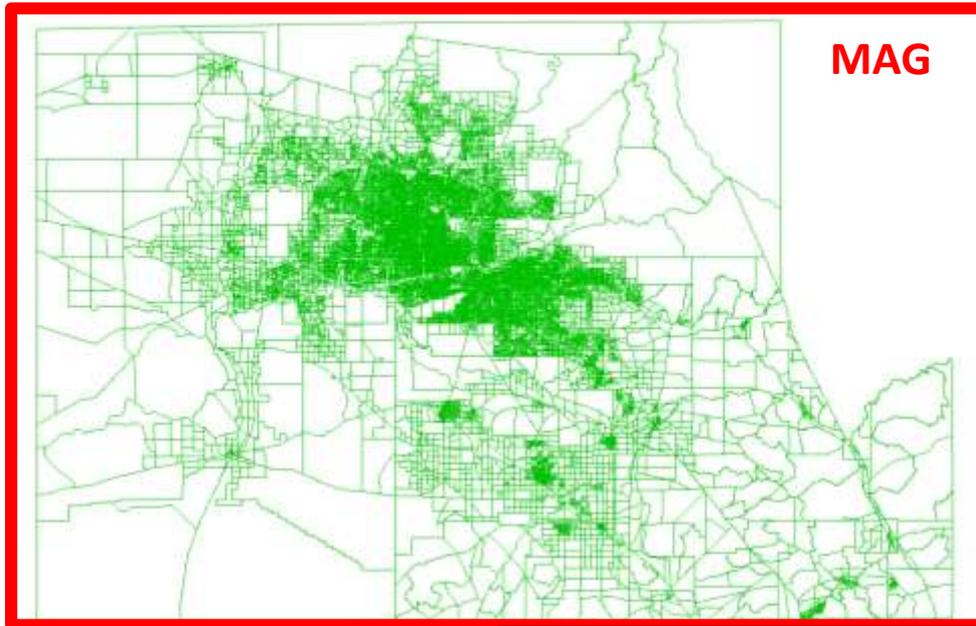
26,268 MAZs

7,392 MAZs

PAG
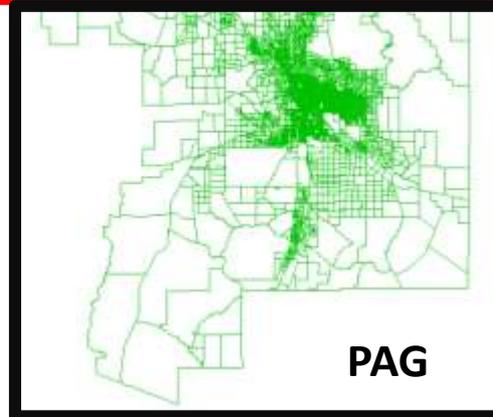
Main Methodological Principles

- 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 GPS, Truck Survey	• Truck Trip Generation • Heavy, Medium, Light
Truck Trips Generation	• Truck Trip Distribution
Multiclass Truck Demand	• Multiclass Assignment

MAG Behavior-based Freight Model

NETS. Employment, establishment databases	• Firm Synthesis
TRANSEARCH, FAF, BEA, CFS, surveys	• Supplier Selection Models
FAF, TRANSEARCH, surveys	• Transport Choice Models
Truck GPS	• Truck Tour Models
Freight Demand	• Multiclass Multimode Assignment

ON-CALL CONTRACT NO. 639-E

MAG Project No. 0600-0631-15-E001-0639-0E.000B01

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

MARICOPA ASSOCIATION of GOVERNMENTS

Prepared By

CDM Smith

Date

April 15, 2015

TMIP◆FMIP
Better Methods. Better Outcomes.

MARICOPA ASSOCIATION of GOVERNMENTS

Presentation 3
Review of Freight Data Sources for the Development of a Behavior-Based Freight Model

Sreevatsa Nippani, MAG

Krishnan Viswanathan, CDM Smith

4/24/2015 — MPO Transportation Data Collection and Analysis MAG Experience — 34

Data Source	Data Type										Spatial (Smallest Geography)	Temporal
	Trade Statistics	National Account Data	Transportation Statistics	Shipper surveys	Stated preference surveys	Consignment Bills and RFID data	Traffic Count data	Weight Data	Network data with cost functions	Terminal data		
Bureau of Economic Analysis (BEA) Input/Output Tables		✓									National	Annual
County Business Patterns (CBP)	✓										County	Annual
National Establishment Time-Series (NETS)	✓										County	Annual
Longitudinal Business Dynamics (LBD)	✓										State	Annual
Annual Survey of Manufacturers (ASM)	✓										State	Annual
Business Dynamics Statistics	✓										MSA	Annual
Business Employment Dynamics	✓										County	Quarterly
Commodity Flow Survey (CFS)			✓	✓							CSA or MSA	Every 5 years
Freight Analysis Framework (FAF)			✓								CSA or MSA	Every 5 years
Transearch			✓								County/TAZ available on demand	Annual
Surface Transportation Board (STB) Carload Waybill Sample			✓		Project Specific						BEA	Annual
Air Carrier Statistics			✓								Airport	Monthly
North American Transborder Freight Database			✓								State and Port of Entry/Exit	Monthly
PIERS			✓			✓				✓	Port	Annual
National Highway Planning Network (NHPN)							✓		✓		State	Unknown
National Performance Management Research Dataset (NPMRDS)							✓		✓		Traffic Message Channel	Every 5 minutes
ATRI							✓		✓		Truck Lat/Long	Second
MAG Roadway Network							✓		✓		Unknown	Unknown
Vehicle Inventory and Use Survey (VIUS)								✓			State	Every 5 years
ORNL Rail Network									✓		Unknown	Unknown
VTRIS								✓			Weight Station	Unknown
Establishment Surveys			✓	✓							Establishment	Varies by Sponsor

✓ - Applies

Applications

- Regional and Megaregional Transportation Forecast
- Scenario Testing and Planning
- TIP/RTP
- AQ Conformity Analysis
- Regional Freight Transportation Plan

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MAG FREIGHT TRANSPORTATION PLAN

Guiding the Region's 21st Century Freight Network

Acknowledgement: Tim Strow, MAG

September 2015

SCHEDULE

TASKS BY MONTH	2015			2016												2017	
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

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

| PROJECT PHASE | ONE | TWO | THREE | |

Summary of Past Findings and Recommendations

Define infrastructure for freight movements to be inclusive

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

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

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

Transportation, Distribution, & Manufacturing Employers

DRAFT

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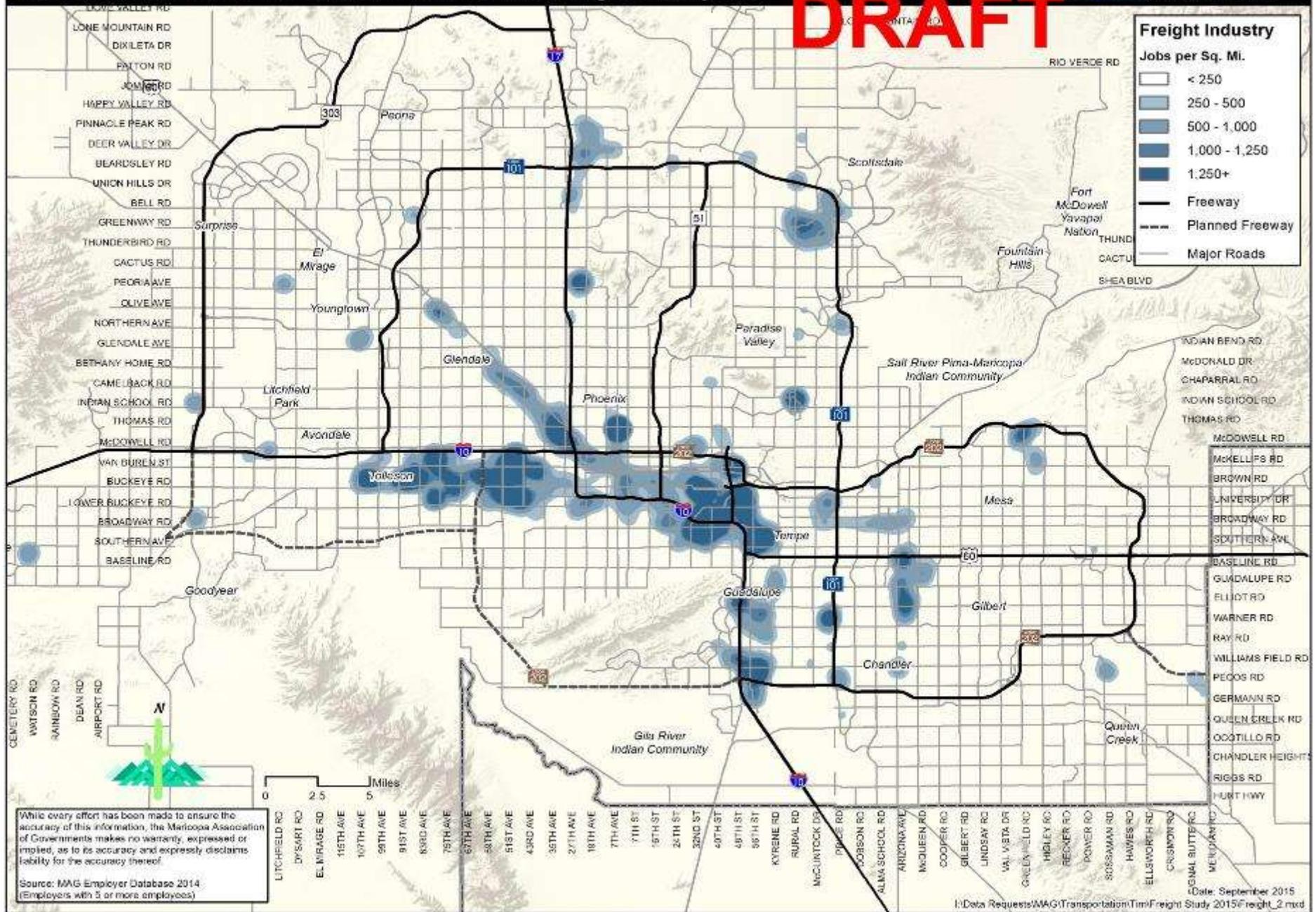
Freight Industry
Jobs per Sq. Mi.

- < 250
- 250 - 500
- 500 - 1,000
- 1,000 - 1,250
- 1,250+

— Freeway
--- Planned Freeway
— Major Roads

While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

Source: MAG Employer Database 2014
(Employers with 5 or more employees)

Date: September 2015
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0   2.5   5   Miles

Transportation, Distribution, & Manufacturing Employers

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Freight Industry Employers
Cluster
- Construction
- Consumer Goods Manufacturing
- High Tech Manufacturing & Development
- Metal Inputs & Transportation-Related Manufacturing
- Non-Metallic Manufacturing
- Retail
- Transportation & Distribution
- Maricopa County

Freight Industry Size Legend
Employees
- < 50
- 50 - 100
- 100 - 500
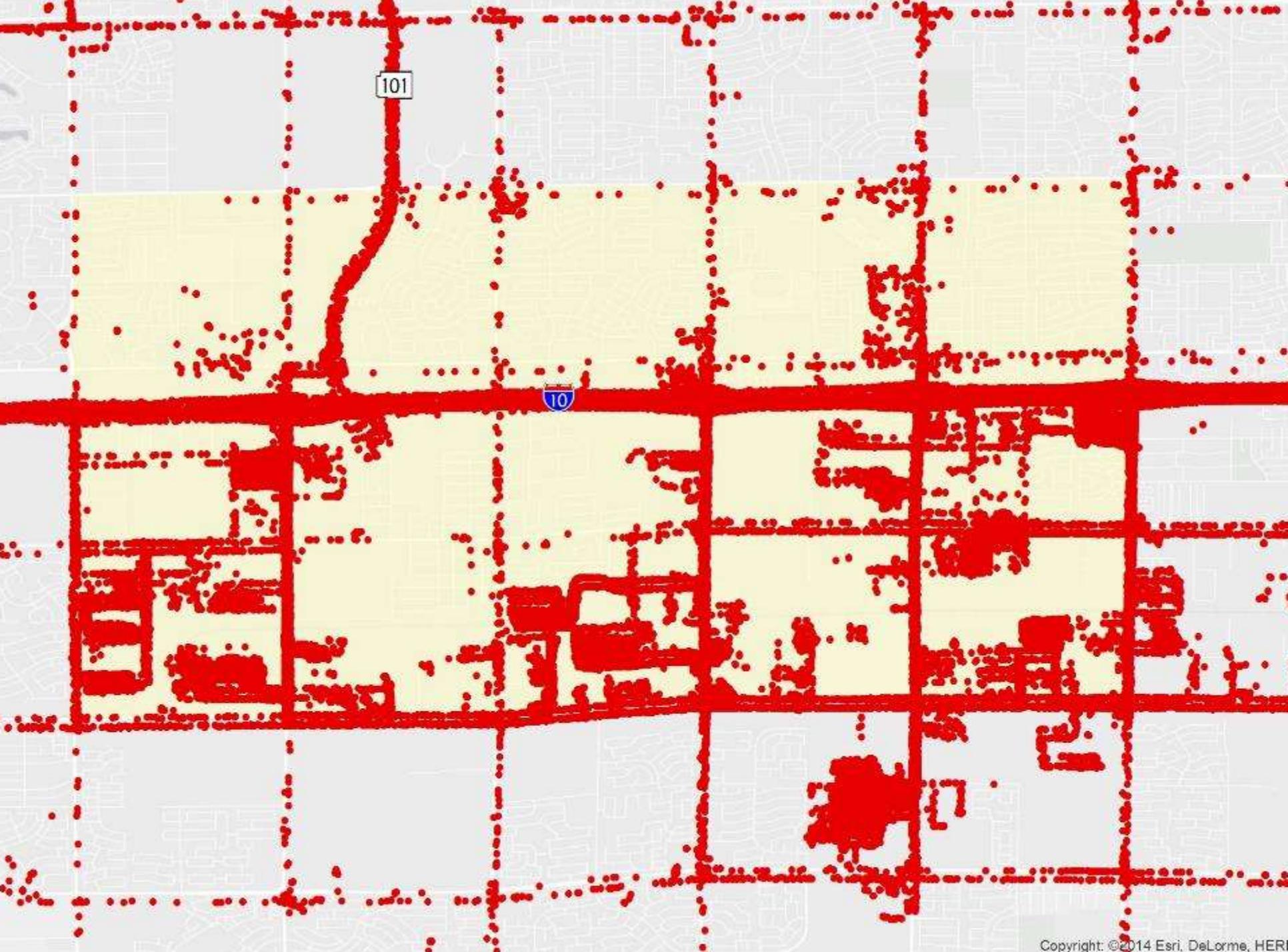- 500 - 1,000
- 1,000+
- Freeway
- Planned Freeway
- Major Roads

DRAFT

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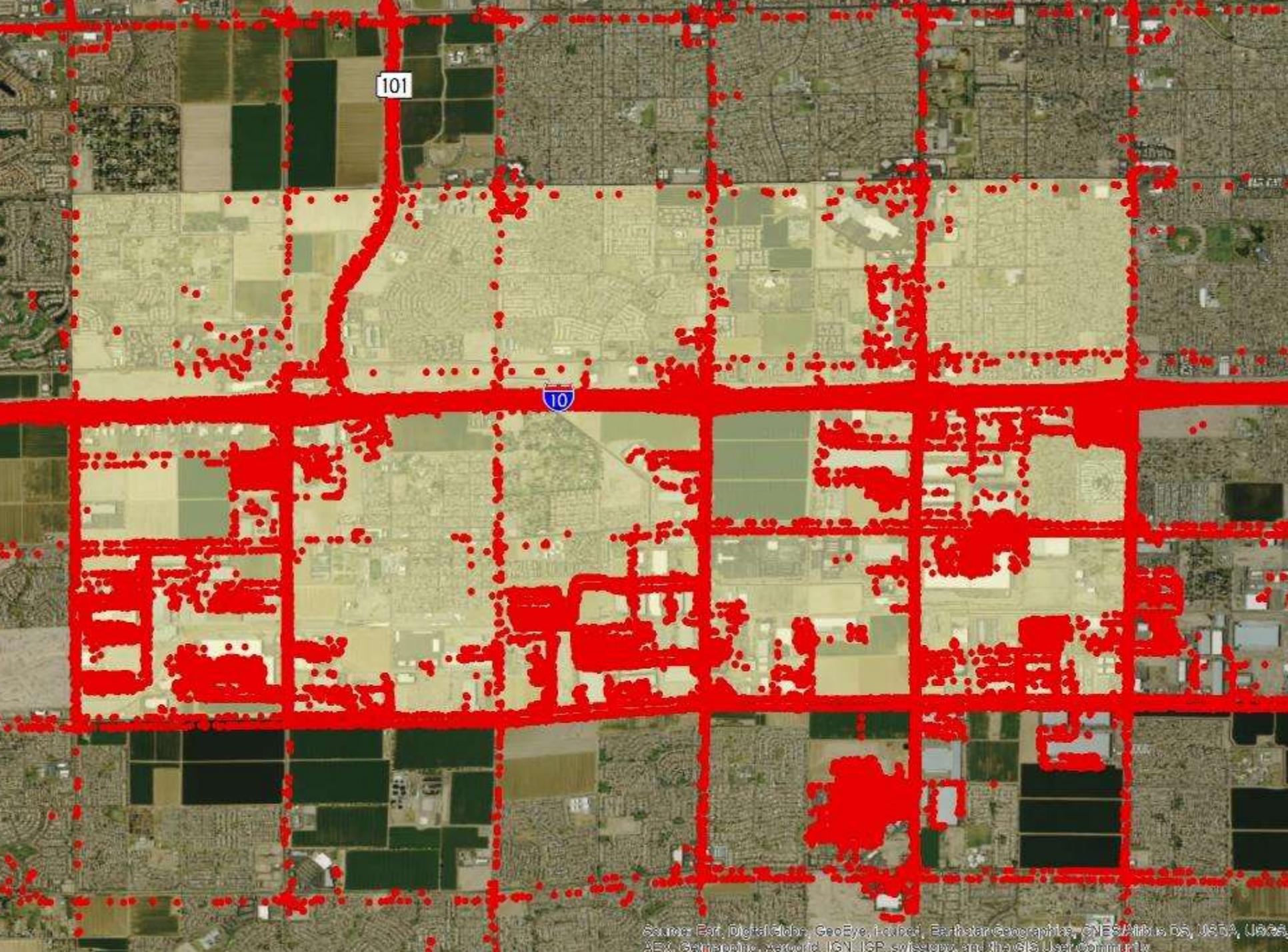(Employers with 5 or more employees)

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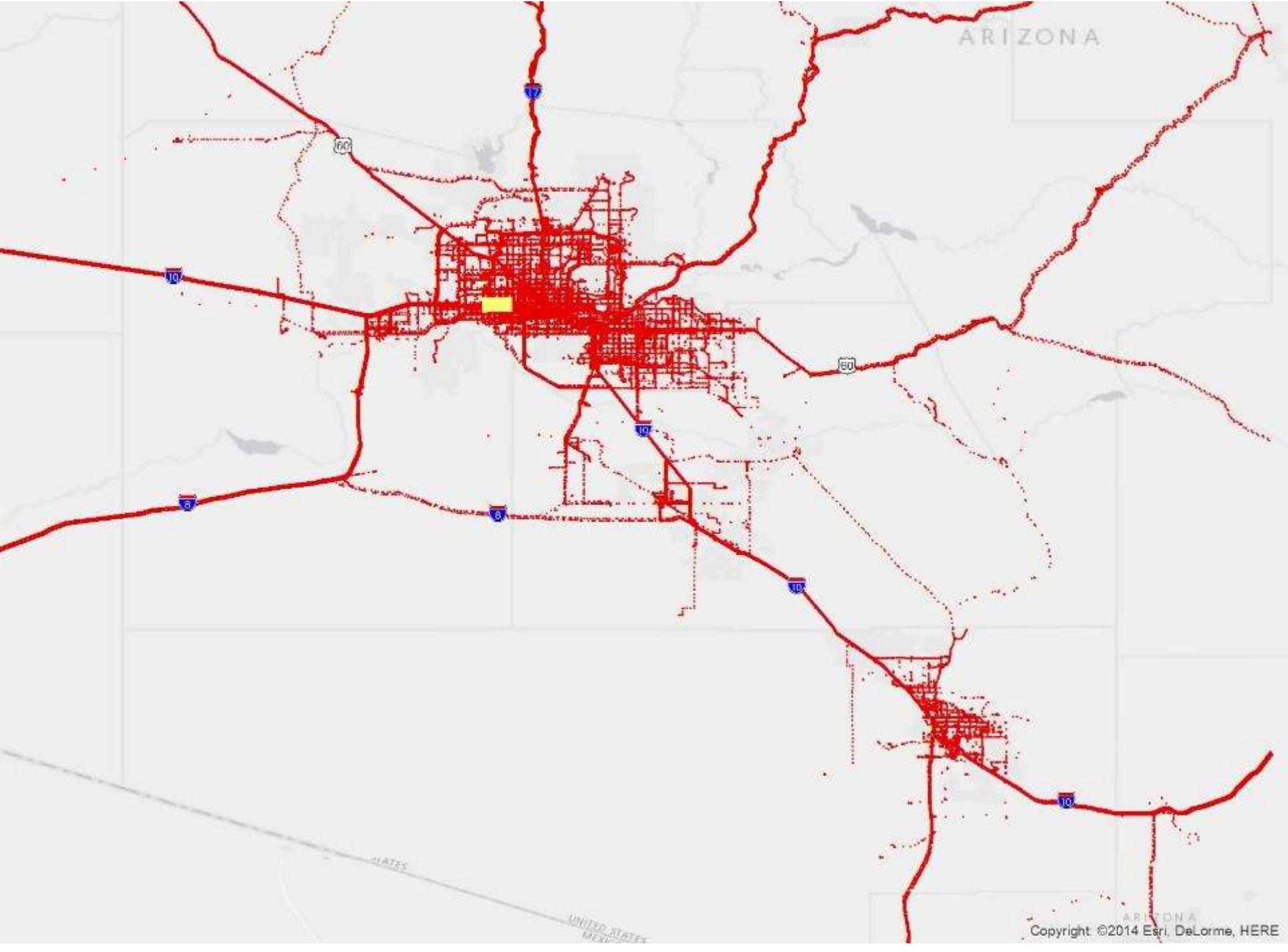
NEXT STEPS AND CONCLUSIONS

•MAG ABM

•MAG REGIONAL DYNAMIC TRAFFIC MODELS

ACTIVITY DRIVEN AGENT-BASED PASSENGER TRAVEL DEMAND MAZ LEVEL

DYNAMIC TRAFFIC PHENOMENA, FINE GRAIN NETWROKS

LU/TRASNPORTATION INTEGRATION

BEHAVIOR-BASED AGENT-BASED FREIGHT

•MAG INTEGRATED SE/LU/TRANSPORTATION MODELS

•MAG SHRP2 C20 IAP FREIGHT MODEL

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