Region-wide Microsimulation-based DTA:
Context, Approach, and Implementation for NFTPO

presented by
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Context: Motivation

- Technical
  - Many transportation planning problems require dynamic models
- Practical
  - Effective transportation planning solutions require consensus/buy-in

Context: Technical Motivation

- Dynamic Traffic Assignments are needed for analyzing pricing strategies, capacity improvements, and ITS
- Congested travel times form the basis for crucial planning model estimation and application
- Static assignments produce biased travel times and biased models and forecasts
- These compromises are no longer necessary or justifiable
- …

Context: Technical Motivation (cont.)

- …
- Operational fidelity needed for traffic engineering work
- Many projects and traffic management measures have impacts that cannot be estimated with planning models
- These require detailed microsimulation in which lane level behavior is captured

Context: Practical Motivation

- Effective deployment hinges on usability, robustness
- DTAs lend themselves better to dynamic visualization and animation
- A more compelling tool for engaging stakeholders and the public

Context: Background

- Early experiments with macro DTA
- TRANSIMS & MITSIM
- Meso models-Integration, Dynasmart, & DYNAMIT
- Microsimulation thought to be impossible at the regional scale
- The TransModeler hybrid approach: Macro, Meso, and Micro in any combination on the same network
- 4-D lane level GIS for efficiency in simulation development

Context: Microscopic DTA Successes

- Eureka, CA
- Burlington, VT
- Phoenix, AZ
- Practical, calibrated, validated, and deployed Microscopic DTA models
- Hybrid models neither needed nor warranted for any reason

Approach: Key DTA Elements

- Dynamic shortest paths based upon departure times
- Realistic route choice
- Queue build-up and dissipation
- Short time intervals for travel time measurement
- Dynamic User Equilibrium condition- Temporal extension of Wardrop's principle that all used paths between each OD pair, have the same minimum cost for a given departure time interval and that there are no lower cost routes
- Iterative computation to achieve convergence

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Direct tie-in with activity-based models (ABM)

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While rooted in familiar trip-based model theory

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Key advantages

Approach: Microscopic DTA

- Microscopic in level of detail
  - Referenced to ground truth with accurate geometry
  - Lane level and intersection area representation
  - Temporal dynamics (as low as 0.1-sec)
  - 2-d and 3-d dynamic visualization

- Microscopic in modeling accuracy
  - Microscopic (car following, lane changing)
  - Employs realistic route choice models
  - Handles complex network infrastructure (Signals, variable message signs, sensors, etc.)
  - Simulates multiple modes, user classes, vehicle types

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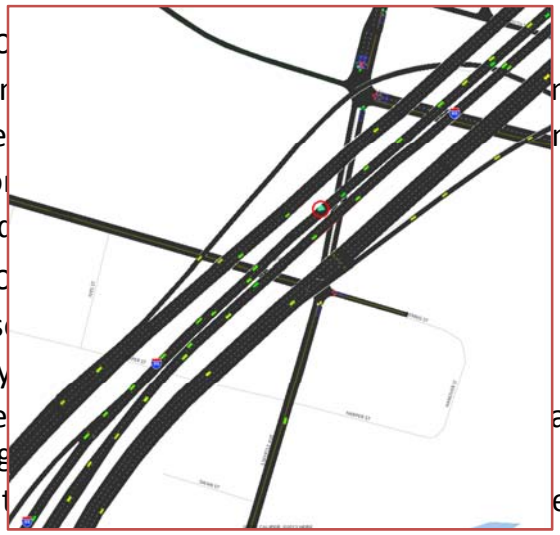
Approach: Microscopic DTA



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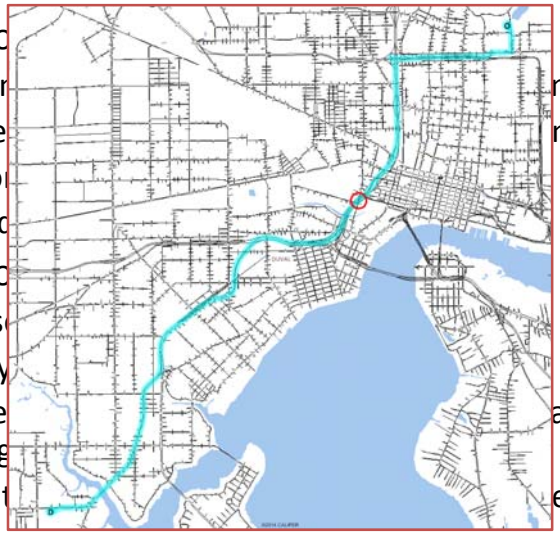
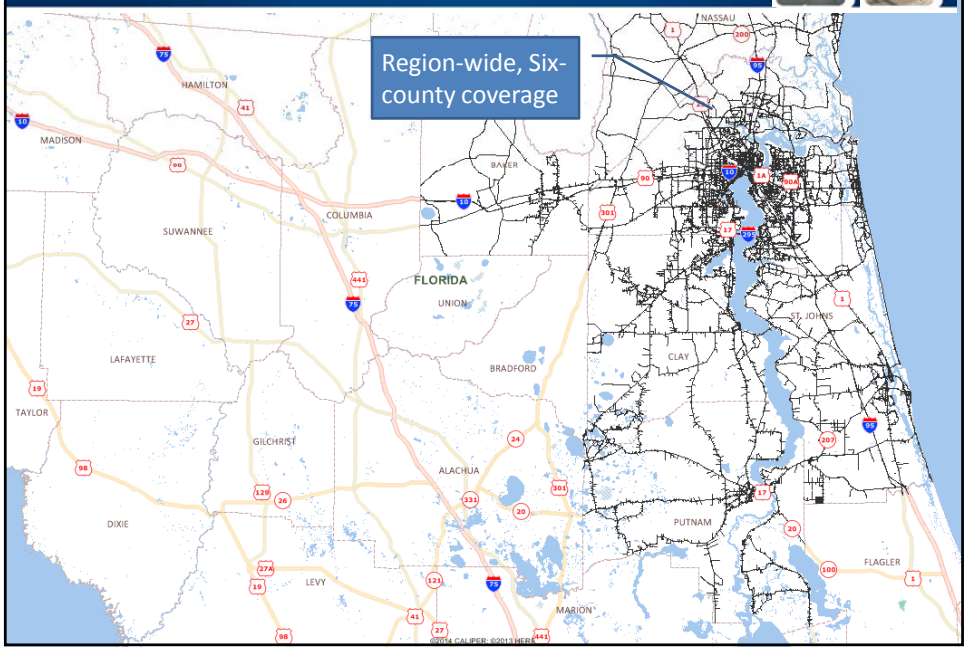


Implementation: North Florida TPO



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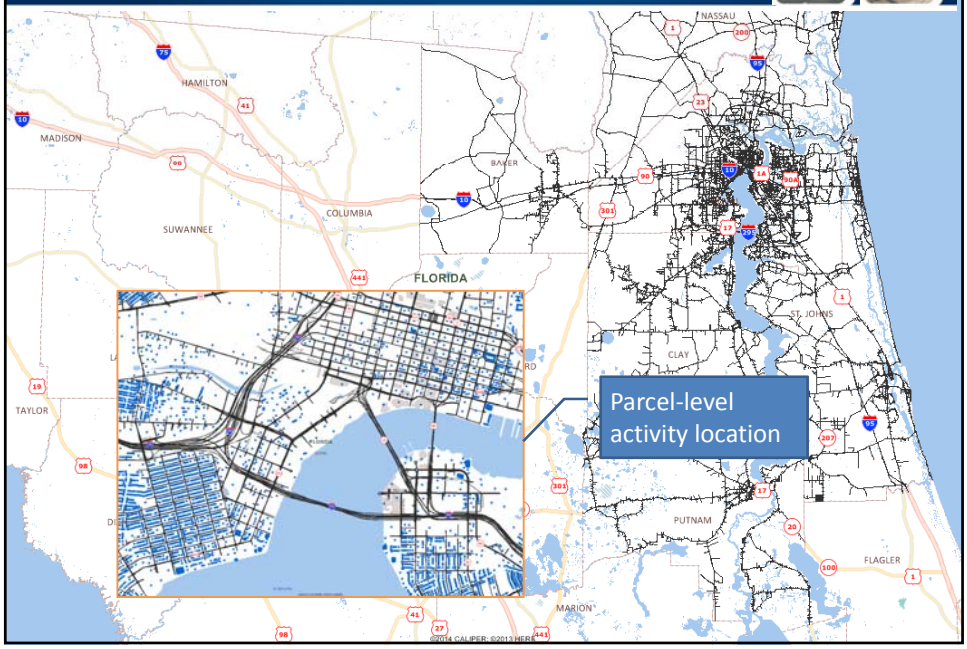

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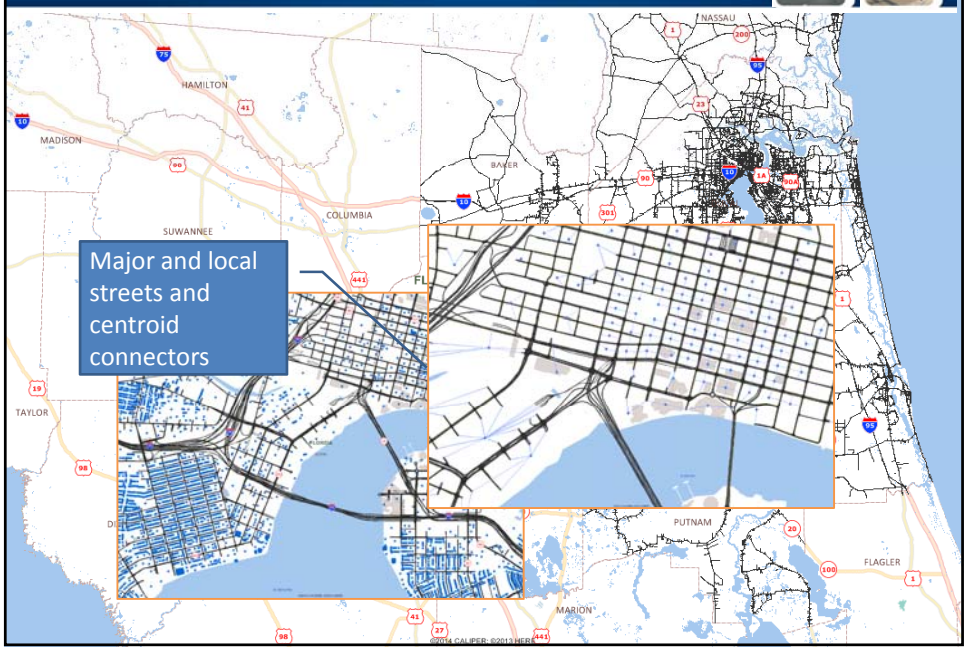

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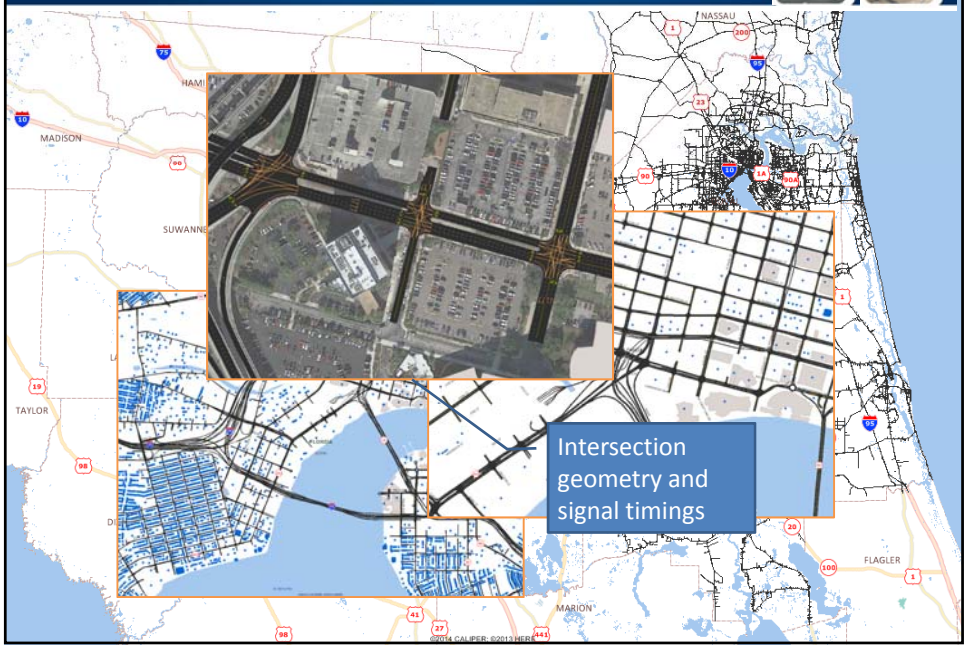

Implementation: Framework

- Parcel-level origins and destinations
  - 492,684 parcels
  - Point-to-point route choice
  - Trips produced by DAYSIM
- Zonal truck and external traffic
  - 2,578 TAZs
  - Zone-to-zone route choice
  - Matrices produced by CUBE
- Integration/Linkage
  - DAYSIM
  - CUBE

Implementation: Challenges

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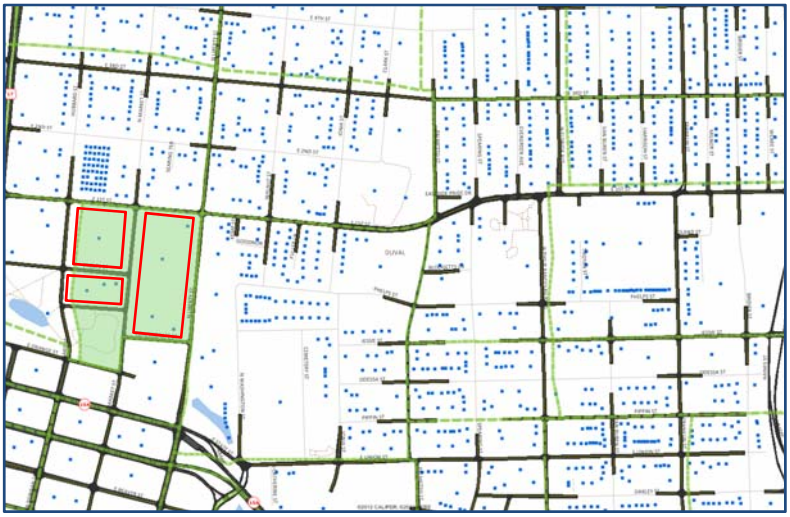

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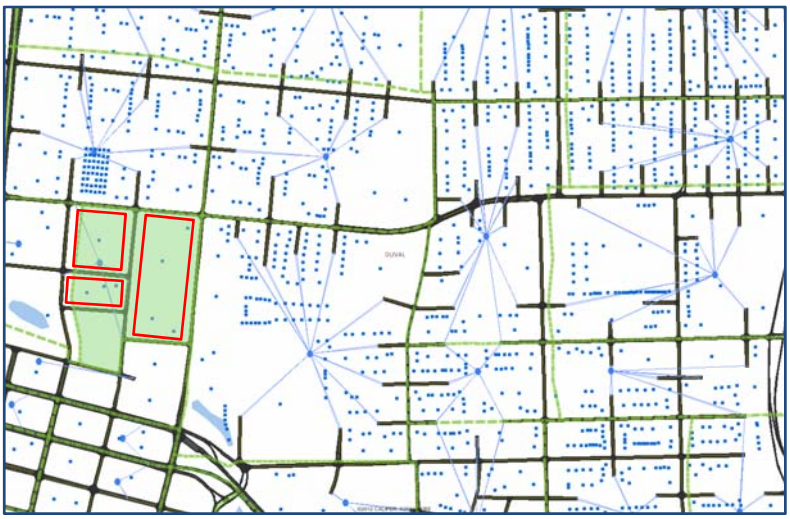
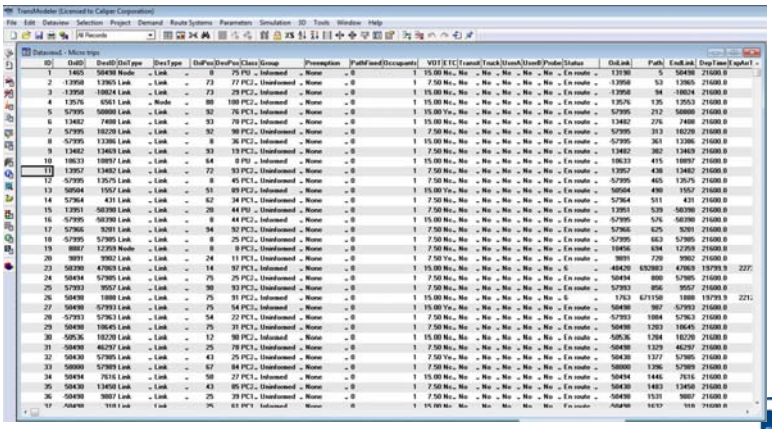


Implementation: Features

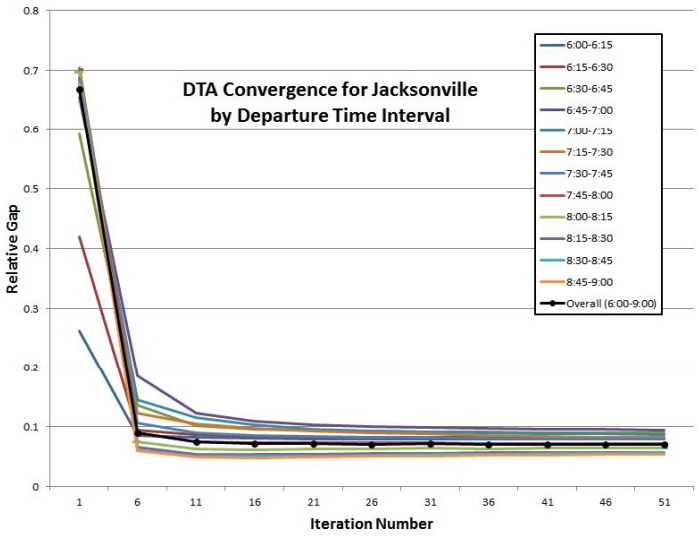
- Read DAYSIM trips without temporal aggregation
- Handle parcel locations without spatial aggregation
- Use dense street network
  - Realistic accessibility, connectivity
- Simulate multiple travel modes
- Possess practical running times

Implementation: Input

- Demand: Disaggregate trip tables
  - Detailed demographic and trip information
  - Approximately 650K trips in 3-hour AM peak [6:00-9:00]

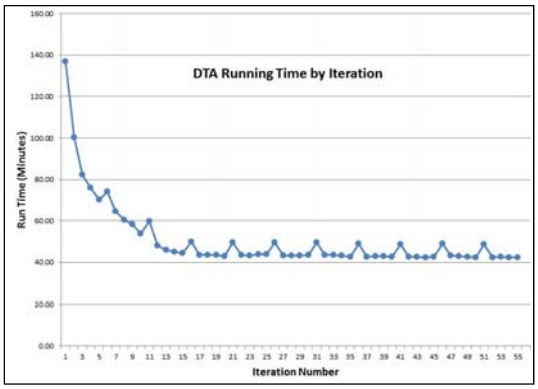


Implementation: Convergence



Implementation: Running Time

- DTA running time per iteration
  - Approx. 50 minutes overall
  - 3.1 GHz Intel Xeon Dual-Core 64-Bit CPU, 64 GB RAM



Implementation: Next Steps

- Model Development Review
  - Testing
  - Signal timings validation
  - Running time performance evaluation
- Model Calibration
  - Compare DTA volumes with counts
- Software integration/linkage
  - Refine
  - Deliver
  - Support