



# Use of Dynamic Traffic Assignment in FSUTMS in Support of Transportation Planning in Florida

*Requirement Workshop*

December 2, 2010

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## Need for Assignment

- Estimating link flows
- Estimating zone to zone travel cost for use in other modeling steps
- Estimating performance measures
- Estimate routes between each O-D pairs
- Estimate diversion with and without ATIS
- Analyzing which O-D pairs use a particular link
- Obtaining turning movements at intersections
- Obtaining flows between ramps

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## Types of Assignment

- **Static:** Link flows and link travel times remain constant over the modeling horizon.
- **Dynamic:** link flows and link travel times are time-variants.
  - DTA provides a more realistic representation of traveler behaviors and traffic conditions
  - However, the implementation requirements of DTA is much higher.

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## FHWA DTA Survey (85 respondents)

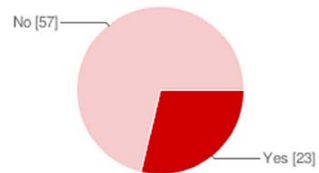


- **Observations**
  - Congested corridors are the drivers
  - Both operations and planning issues are emphasized
  - Emerging policy issues (e.g. pricing)



## FHWA DTA Survey (85 respondents)

Do you consider yourself an experienced DTA model user?



Yes	23	29%
No	57	71%

- Observations:
  - Less 30% considered themselves an experienced DTA user
  - These include those who actually have false understanding of DTA, examined through other questions in the survey aimed at testing their knowledge about DTA

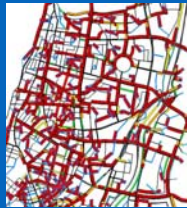
## 2009 Nationwide Survey

- Five concerns
  - DTA requires more data than those are available or accessible (47%)
  - Setting up a DTA model takes too much resource (44%)
  - Cost/benefit is unclear (45%)
  - DTA tools take too long to run (35%)
  - Modeling approaches are unclear (35%)

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## DTA Components

- Time-dependent shortest paths
- Path choice
  - Problem formulation
  - Solution
- Traffic flow model (network loading)
- Convergence criteria



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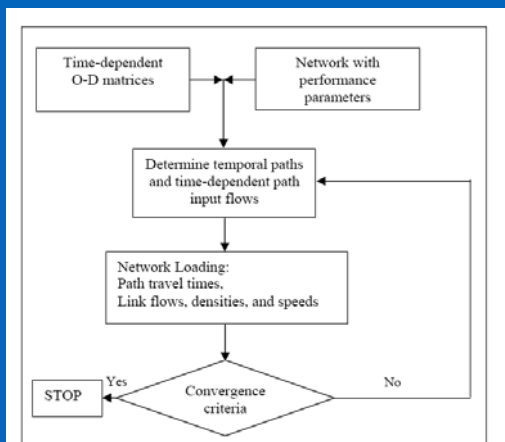


FIGURE 1 Structure of the solution algorithm for the DTA model

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## Time-dependent shortest paths

- Important particularly from computational performance perspective
- Not only the algorithm but how it is implemented in software



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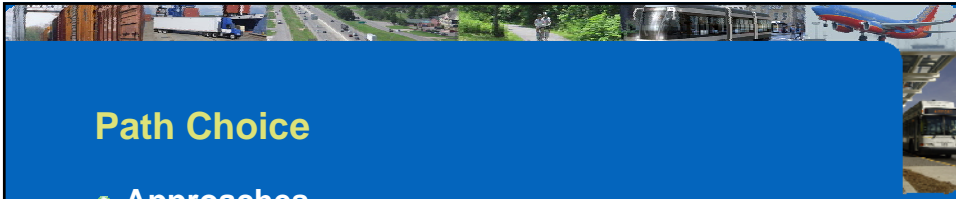


## Path Choice

- Problem formulation
  - Many tools only allow the disutility to be based on travel time and cost with a specification of value of time
    - Should be based on other factors?
  - Should the value of time be allowed to be different for different vehicle types/trip purposes
  - Should the toll value be specified by link for different vehicle types
  - What else?

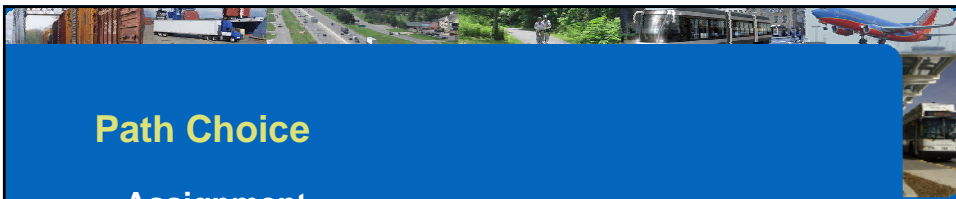


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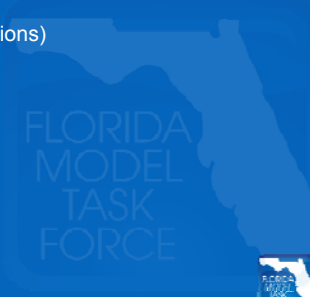
## Path Choice

- Approaches
  - One-shot assignment
  - Dynamic user equilibrium
    - Instantaneous travel time
    - Experienced travel time
  - System user equilibrium
- With DTA, the static user equilibrium is extended to assume equilibrium for each departure time interval.
- Method affects convergence



## Path Choice

- Assignment
  - Pre-trip route choice (at the origin)
  - En-route
    - People switch route due to on-board equipment
      - ♦ Market penetration and compliance (variable function of conditions)
    - People switch route due to DMS
      - ♦ Compliance (variable function of conditions)



## Network Loading

- Performance assesment
  - Analytical
  - Simulation
- Utilized simulation types vary in their fidelity
  - Macro
  - Meso
  - Low fidelity Micro
  - High fidelity micro



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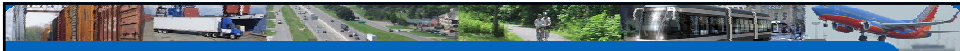
## Traffic Flow Models

- Should be able to accurately simulate recurrent congestion
- Should be able to simulate incidents and special events?
- Should be able to simulate ITS/signal control?



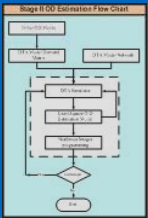
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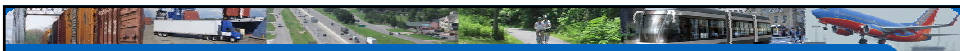
## O-D Estimation

- **Dynamic O-D Matrix Estimation Method**
  - Optimize based on traffic counts
  - Many studies available in the literature
  - No off-the-shelf tool
  - Start with TOD model factors but still need a tool




Origin	Dest	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
1	2	100	100	100	100	100	100	100	100
1	3	200	200	200	200	200	200	200	200
1	4	300	300	300	300	300	300	300	300
1	5	400	400	400	400	400	400	400	400
1	6	500	500	500	500	500	500	500	500
2	3	150	150	150	150	150	150	150	150
2	4	250	250	250	250	250	250	250	250
2	5	350	350	350	350	350	350	350	350
2	6	450	450	450	450	450	450	450	450
3	4	100	100	100	100	100	100	100	100
3	5	200	200	200	200	200	200	200	200
3	6	300	300	300	300	300	300	300	300
4	5	150	150	150	150	150	150	150	150
4	6	250	250	250	250	250	250	250	250
5	6	100	100	100	100	100	100	100	100



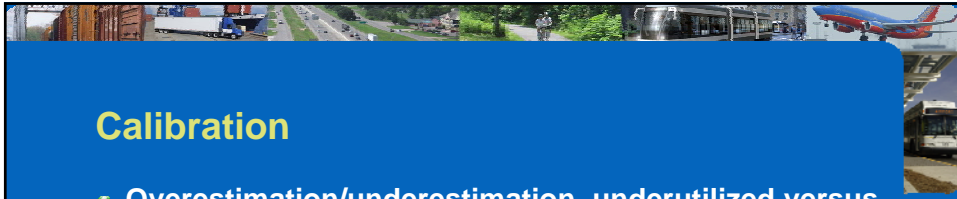


## Calibration

- **Very important aspect of DTA**
- **Use of all available data**
  - ITS data
  - Statistics office data
  - Others?



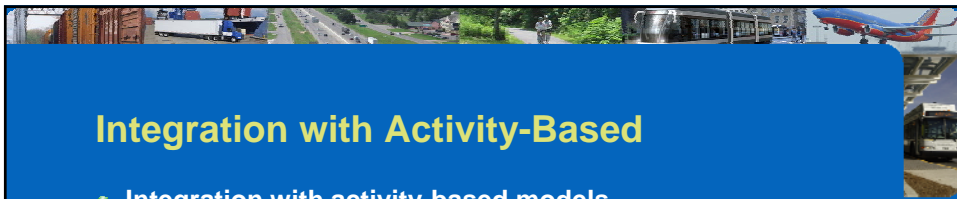





## Calibration

- Overestimation/underestimation, underutilized versus over-utilized paths between O-D pairs, time-of-departure, zone connectors
- The challenge is to calibrate and fine-tune the O-D matrix, assignment process, and traffic flow models


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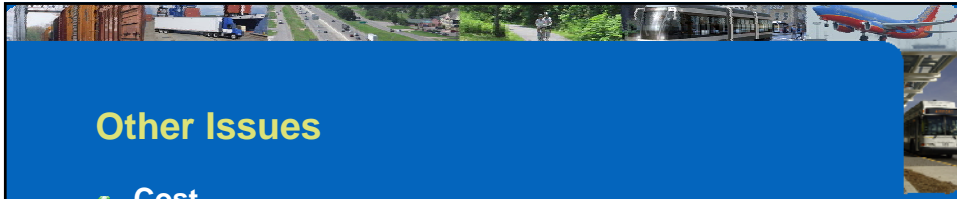


## Integration with Activity-Based

- Integration with activity-based models
- Trips can be aggregated to O-D matrices based on TAZ for each aggregation interval
- One option is trips output by activity-based model like DaySim are kept and used
  - Trips can be aggregated to activity locations rather than TAZs
  - Trips can be kept to individual minutes rather than aggregated to 15-30 minute periods
  - Does not lose the logical continuity of trips
- Feedback of DTA model output to ABM to re-estimate the activities

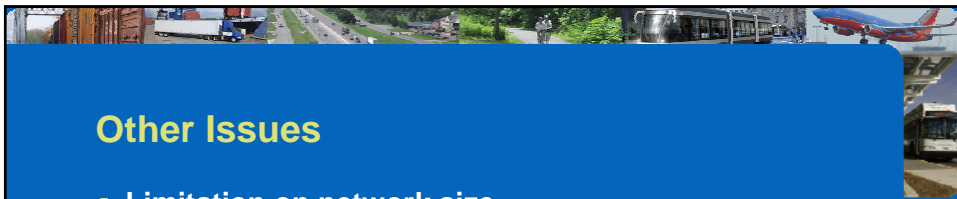

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## Other Issues

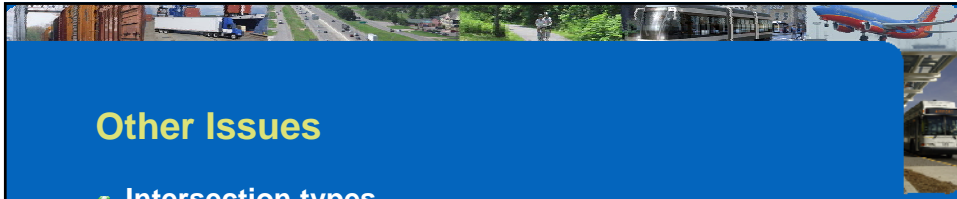
- Cost
- Open source/accessibility
- How widely the software has been used
- Customer support – level and cost
- Ability to be integrated with Cube
- Number of facility types
- O-D matrix versus trip lists



## Other Issues

- Limitation on network size
  - Zones
  - Nodes
  - Links
- Maximum number of matrices
  - Flexibility in types

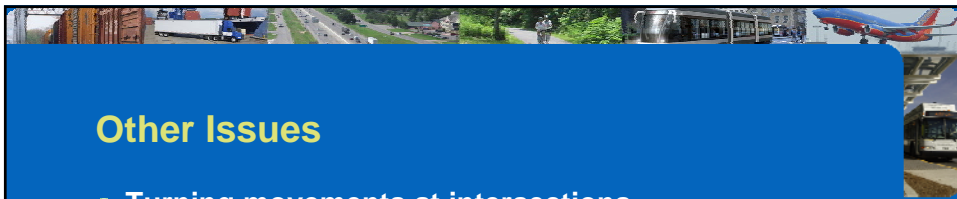





## Other Issues

- Intersection types
  - Stop/yield control
  - Signal control
    - Pre-timed and actuated
    - Calculated versus input signal control
- Ramp metering, DMS, in-vehicle navigation
- Merge, diverge, and weaving


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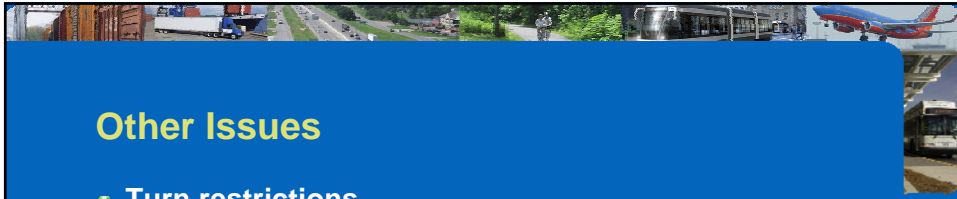


## Other Issues

- Turning movements at intersections
- Ramp metering, DMS, in-vehicle navigation
- Detailed intersection geometry including turning bays
- Effect of trucks on performance
- Time-variant capacity reduction (work zones, incidents, etc.)

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## Other Issues

- Turn restrictions
- Turn penalty?
- Vehicles with fixed paths can be input as a fraction of the total vehicles
- Fixing the paths to assign traffic to
- Computational time and storage requirement
- Departure time choice and mode choice

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