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

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Goal and Objectives

- The goal is to develop processes and associated tools for a successful implementation of DTA in Florida
- The specific objectives are:
  - Review state-of-the-art in DTA modeling
  - Identify the needs of the Florida demand modeling
  - Develop processes to allow DTA Tool assessment
  - Develop tools to support effective and efficient use
  - Document the project effort, results, conclusions, and recommendations

Review of State of DTA Development

- Overview of DTA Concepts
- Assignment Types
- Time-Dependent Shortest Path
- Path Choice
  - Generalized Cost Function Formulation
  - Assignment Solutions
- Convergence
- Traffic Flow Models
- Overview of Existing DTA Tools
  - Existing tools reviewed are Dynasmart, DynusT, TRANSIMS, Cube Avenue, TransModeler, Dynameq, VISTA

Identification of DTA Issues

- Modeling community survey
- Modeling community workshop
- Interviews with DTA users

Assessment Criteria

- General hardware and software criteria
- Shortest path and path choice modeling
- Traffic flow modeling (TFM)
- Network geometry
- Network demand
- Transit modeling
- Calibration support

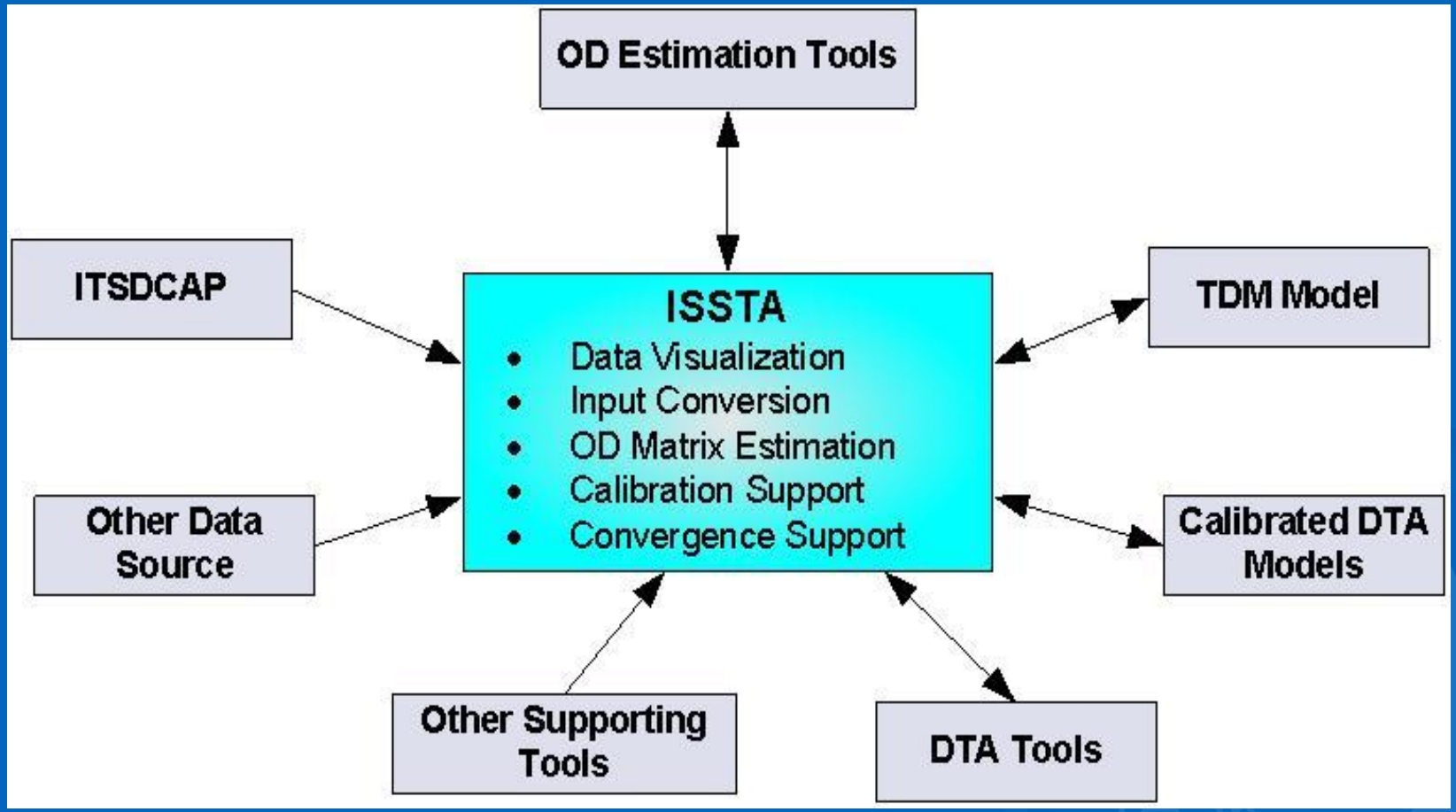
Purpose of Criteria

- Assessment criteria list provides basis for testing/assessments
- Allow understanding of DTA and differences between tools
- Can be customized for different purposes/regions

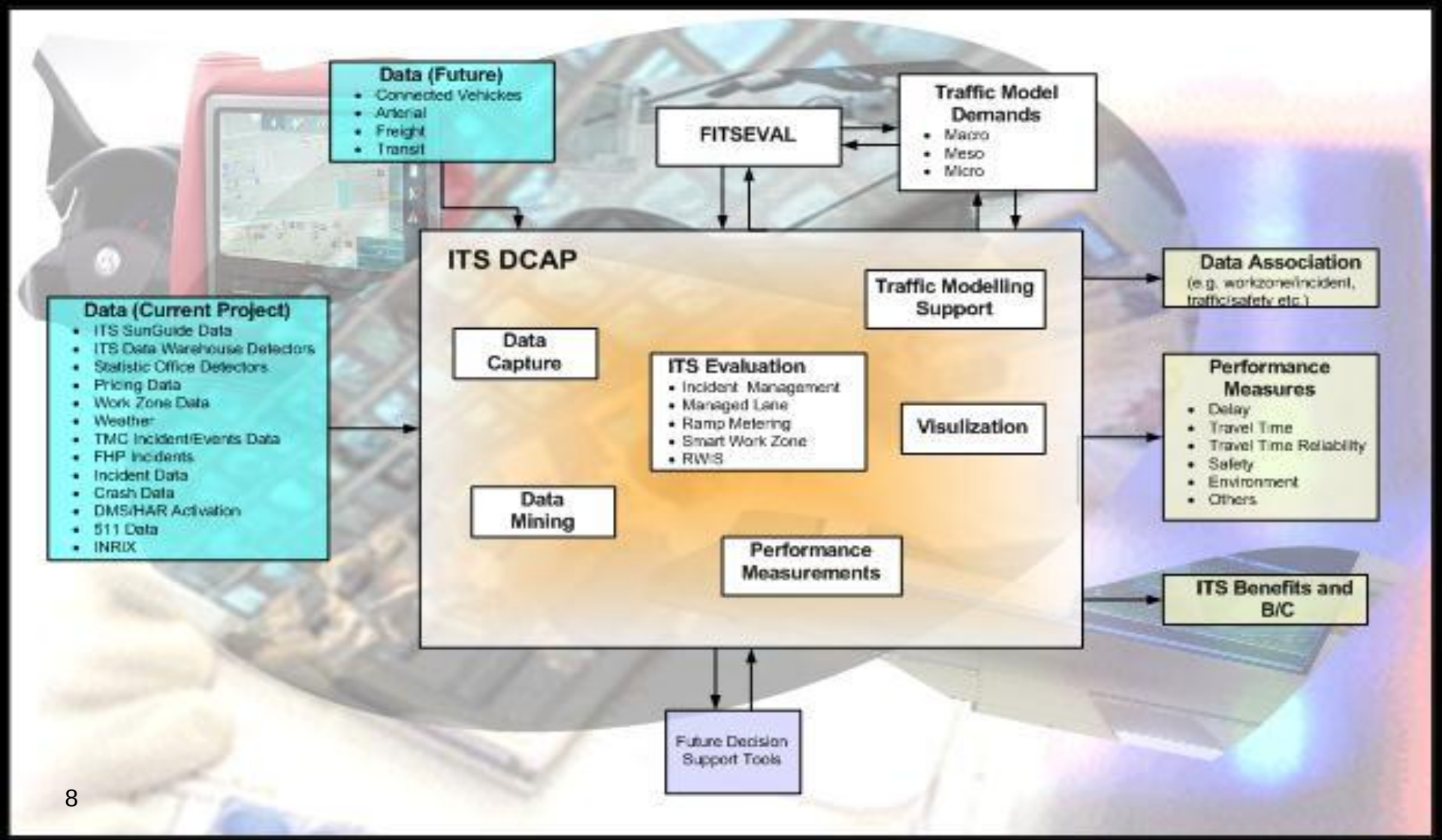
Testing based on Criteria

- A demonstration of how assessments can be made based on the developed criteria
- An assessment is made of the ability of the static Cube assignment, DynusT, TRANSIMS, andCube Avenue to meet criteria
- The assessments were conducted utilizing a number of simple hypothetical networks and three real-world networks

ISSTA


OD Estimation Tools
ITSDCAP
ISSTA
Data Visualization
Input Conversion
OD Matrix Estimation
Calibration Support
Convergence Support
TDM Model
Other Data Source
Calibrated DTA Models
Other Supporting Tools
DTA Tools

ITSDCAP


Data (Future)
Connected Vehicles
Arterial
Freight
Transit
FITSEVAL
Traffic Model Demands
Macro
Meso
Micro
ITS DCAP
Traffic Modelling Support
Data Association
(e.g. workzone/incident, traffic/safety etc.)
Data Capture
ITS Evaluation
Incident Management
Managed Lane
Ramp Metering
Smart Work Zone
RWIS
Visulization
Performance Measures
Delay
Travel Time
Travel Time Reliability
Safety
Environment
Others
Data (Current Project)
ITS SunGuide Data
ITS Data Warehouse Detectors
Statistic Office Detectors
Pricing Data
Work Zone Data
Weather
TMC Incident/Events Data
FHP Incidents
Incident Data
Crash Data
DMS/HAR Activation
511 Data
INRIX
Data Mining
Performance Measurements
ITS Benefits and B/C
Future Decision Support Tools

ITSDCAP

Data Capture | Performance Measures | Data Mining | ITS Evaluation | Model Support | Visualization

Mobility | Travel Time Reliability | Safety | Energy and Emission

Data Source: CDW Data
District: D6
Start Location: MP8.895 (NORTH OF NW 1
Start Date: Tuesday , May 17, 2011
End Date: Tuesday , May 17, 2011
Start Time: Hour 16 : Minute 0
End Time: Hour 20 : Minute 0
Day Type: M T W R F S U
Time Interval: 5 Minutes

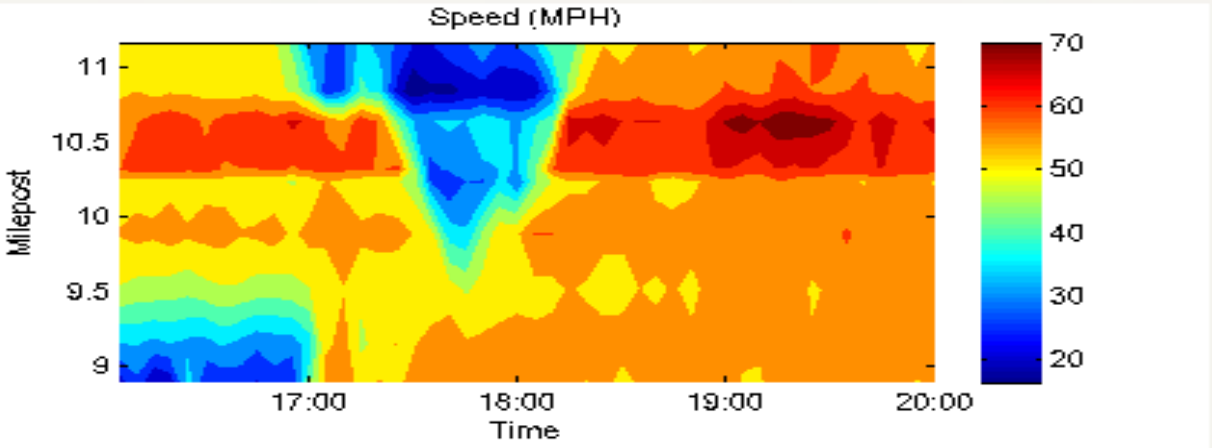
Group Name:
Roadway: I-95 NB
End Location: MP11.16 (NORTH OF OPA_
Estimation Method: On-Line Mid-Point Method

Performance Measures
- [ ] VMT
- [ ] Delay
- [ ] Queue Length
- [ ] VHT
- [x] Speed
- [ ] Travel Time
- [ ] Density
- [ ] Average for Selected Days

Estimate Performance

Result Display
Display Format: Graph
Performance: Speed
Date: 05172011
- [ ] HOT

Display | Save Image



Close

Conclusions

- DTA is maturing and can play a major rule in demand and performance forecasting
- For successful implementations of DTA, a number of issues have to be addressed, as confirmed by the user survey and workshop conducted in this study

Identified Issues based on MTF Surveys

- Lack of data (36% of responses)
- Lack of experience (24%)
- Calibration and validation (22%)
- Excessive computational time (21%)
- Lack guidance on parameter assumptions for future years (21%)
- Complexity of the process (18%)
- Need for training (15%)
- Cost of software (11%)

State of DTA Applications

- Significant interests by agencies in DTA
- Real-world applications of simulation-based DTA for large scale networks, is still limited
- It is anticipated that in the next two to three years, results from selected large scale and regional applications of DTA will become available
- Interviews with DTA users confirmed the benefits and issues with DTA

Benefits of DTA

- Network Performance –Compared to Static Assignment
- Easier to identify trouble spots in network
- Better peak spreading
- Time-variant queues and delays
- More network detail
- Much improved network performance
- No-recurrent events
- Advanced strategies

DTA Tools

- Existing DTA tools vary in their capabilities and in the underlying models and procedures used in these tools
- DTA tools are rapidly evolving with improvements affecting efficiency, accuracy, and capability
- Important differences are stability and flexibility, flexibility and openness, user support, capabilities, and effeciency
- Only a subset of existing DTA tools currently allows ABM and DTA combinations

DTA Components

- The TDSP component impacts computational efficiency. Some newer implementations of TDSP utilize more efficient algorithms, data handling capabilities and parallel processing
- There has been an increasing interest in the inclusion of reliability as part of the generalized cost in the assignment
- In the past few years, a number of studies have questioned the convergence properties and computational efficiency of MSA – Newer methods and enhancements are implemented

DTA Components

- Simulation models have been categorized into macroscopic models , mesoscopic models, low-fidelity microscopic models, and high fidelity microscopic models. Some tools used analytical models
  - Affects the expected computational efficiency and level of details of the analysis
- Some regions have used multi-resolution analyses, in which combinations of DTA and simulation models at different levels are implemented

Recommendations

- **Background**
  - **Travel forecasting rapidly evolving**
    - **Time specific (DTA) on networks**
    - **Activity based demand**
  - **Needed to support**
    - **Methods improvement**
    - **Software development**
    - **Training**
    - **User community**
- **Move toward advanced modeling**
  - **Slow, deliberate steps**

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Agency Recommendations

- In the near future, the focus of DTA in Florida should be on small regional networks, subarea networks, and corridor studies
- Utilization of analytical-based DTA may also be considered for larger regional networks. The benefits of replacing static assignment with analytical-based DTA for a large network may be investigated

Agency Recommendations (2)

- For the next several years, it is recommended that DTA be used in conjunction with, rather than a replacement of static assignment
- The use of static assignment for long range planning is expected to remain in use for a longer period of time, although analytical-based DTA may also be considered
- As DTA tools and applications evolve and staff becomes more familiar with DTA methods, agencies is expected to replace static methods with simulation-based DTA in increasing numbers of applications and for larger size networks

Agency Recommendations (3)

- **Support case study applications that demonstrate the benefits of DTA in**
  - **Modeling congestion**
  - **Modeling non-recurrent events such as evacuation, incidents, and construction impacts**
  - **Providing time-variant measures not available from static demand models (such as queues, delays, and bottleneck locations)**
  - **Modeling of advanced management strategies such as pricing, reversible lanes, freight management, traffic management, managed lanes, and other advanced applications**

FDOT Recommendation

- DTA Library - Reviews and documents applications of DTA within Florida, identifying the types of application, the results obtained, and user experience
- Capacity Building/Training - Provide training on DTA and the benefits of using DTA in place of static assignment. The training should focus on DTA applications and be as independent as possible of specific software packages
- DTA experts may be invited to present to the modeling community in persons or through the web
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Recommendation to Users

- When deciding on DTA, the analysts should consider the nature of the questions that need to be answered and the benefits of DTA
  - The assessment criteria presented in this document should be used as a starting point
- Start incorporating reliability in modeling based on SHRP2 program products
- Start utilizing the wealth of data produced from emerging detection systems in DTA calibration and validation including using the ISSTA and ITSDCAP tools

Recommendations to Users (2)

- Most DTA packages have default methods for estimating green times at intersections. While these may be appropriate for many intersections in a network, it is recommended that analysts carefully review results and obtain actual green times where appropriate.
- Users should ensure convergence of DTA, which can be a challenging tasks particularly for congested networks and when combined with other choice models

Research Issues

- Continue examining the trip matrix estimation procedures developed in this study and from vendors to determine the quality of the resulting trip matrices and the impacts of various factors
- Best approaches and guidelines should be identified for multi-resolution modeling of transportation networks (analytical macroscopic, mesoscopic, and microscopic)
- DTA convergence and calibration/validation will continue to be important issues of research

Other Recommendations

- Continue monitoring the on-going tool enhancements, lessons learned, experiences with these tools, and application to large networks
- Vendors and developers should always be encouraged to improve the efficiency, accuracy, stability, usability, capabilities, flexibility, openness, visualization quality, and documentation of their software

Long Term Recommendations

- **Continue analysis of the SHRPII models developed in Jacksonville**
- **Document further results illustrating strengths of DTAs and activity based models large area analyses**