AN INTEGRATED TRANSPORTATION PLANNING AND OPERATIONS MODEL FOR MEMPHIS, TENNESSEE

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Transportation Planning Model
Trip generation, Trip Distribution, Modal Split, Traffic Assignment

Dynamic Traffic Assignment

DTA
• Road geometry, Traffic Control, GIS, Transit
• Dynamic OD Estimation, Traffic Data

Traffic Control, Road, Safety, Bicycle, Pedestrian Transit, Freight...... Improvements

Improvements Costs

Selected Project Implementation

Environmental Impacts

Funding

Existing/Proposed Land Use
TRAFFIC MONITORING
- Traffic Counts
- Travel time/speed data
- GPS Veh. Trajectories
- TRANSMIT Veh. Trajectories

REAL-TIME ORIGIN-DESTINATION ESTIMATION

OD DATA
- MPO OD Matrix Estimate
- OD Surveys

CALIBRATED UTM MODEL

TRAFFIC FORECASTING
- Link/Path travel time/speed
- Movement travel time
- Traffic flow rate

VEHICLE ROUTING
- CARS, TRUCKS
- Shortest Path
- Vehicle Tour

AIR QUALITY

BUS TRAIN
- Routing
- Scheduling

DTA Models
- Traffic Simulators
- Time-Dependent Shortest Path Models

Dynamic OD Estimation Models

UNIVERSAL TRANSPORTATION MODEL
MEMPHIS, TN
UNIVERSAL TRANSPORTATION DATA WAREHOUSE MODEL

INFRATESTRUCTURE DATA
GIS, roadway geometry, location of signs, pavement, bridges, tunnels

TRAFFIC CONTROL DATA
Signal timing, roadway signs, lane designation, ramp metering, speed limits

ORIGIN-DESTINATION DATA
Auto, bus, train, truck

TRAFFIC COUNT DATA
Auto, bus, train, truck

TRAVEL TIME DATA
Link, path

CRASH DATA
Auto, bus, train, truck, pedestrian related, bicycle related

CONSTRUCTION DATA
Schedule, geometry, roadway signs, monitoring

ALGORITHMS/STUDIES
- OD matrices estimation/prediction
- Dynamic traffic assignment (all modes)
- Estimated/predicted link/path travel times (all modes)
- Incident delays (estimation/prediction)
- Bus/train station arrival prediction
- Transit schedule optimization
- Transportation network optimization
- Infrastructure improvement
- Traffic control improvements
- Construction schedule optimization
- Work zone analysis
- Signal optimization
- Signal warrant analysis
- Crash prediction models
- Bicycle studies
- Pavement studies
- Asset management studies
- Evaluation studies
- Other

Transportation Degrees, Short Courses, Certificates on Transportation Data Warehousing
- Data integrity and accuracy
- Accessibility under different security levels
- Large quantity of quality data in efficient/low cost manner
- Unifying data and ensuring consistency for transportation planning and operations

State of the art simulator
- Safety/security emulation and response models
- Scenario training/evaluation

Homeland Security, Police, EMS, Fire Dept, FEMA, HAZMAT
Highway/Transit Authorities
Municipalities/Counties
Consultants
Universities
MPO’s, DOT’s
Other
Typical 4-step planning process

1. Trip Generation
2. Trip Distribution
3. Mode Split
4. Traffic Assignment
5. Link Flows and Turning Movements
Then what?

- Simulation based software
- Require more detailed (e.g. 15min) path/link flows/travel times and turning movements
- Current state of the arts: DTA
- A number of MPOs/DOTs are heading to that directions (Florida, New York, San Francisco etc)
Why DTA?

- Simulation-based DTA innovation in traffic simulation
- Depart from the traditional static/analytical models
- Simulation used to replicate the complex traffic flow dynamics especially for signalized systems
Why Integrated

- Common place for all data: Multiple benefits
- A comprehensive tool to model various infrastructure and operations alternatives and select the best ones for implementation
- A comprehensive research tool for both training, classroom, research
Integrated Approach

Static Model

Dynamic Traffic Assignment

Path/Link Flows and Turning Movements

Microscopic simulation, Traffic controls, traffic safety analysis (SSAM), emissions (MOVES)
Research objectives

TransCAD

VISTA

Path/Link Flows and Turning Movements

Paramics, Synchro
SSAM, MOVES
Teaching Objectives

• Theory
  - Transportation planning
  - Travel demand modeling
  - Roadway capacity modeling
  - Signal optimization
  - Traffic flow theory
  - Integrated transportation planning

• Practice
  - Software: TransCAD, VISTA, Paramics, Synchro
  - Case studies and data
  - Real world problems, issues, solutions
  - Transportation engineers with experience
Source: Memphis and Shelby County, Metropolitan Planning Organization (MPO), Travel Demand Model. Training Presentation
Regional Model

Inputs from the planning model
- Network geometry & properties
- Location of Traffic Signals
- Total OD Demand

Data processing
- Data formatting
- Geometry adjustments
- Signal timing plans (based on DTA flows)
- Demand profile

AM Peak (6AM-9AM)
- 26,000 Links
- 12,000 Nodes
- 744 Signals
- 2,500 Zones
- 504,000 Trips
- 7,000 Truck Trips
Subnetwork Extraction

Procedure

Goal
- Refine calibration
- Conduct scenario analysis
- Produce refined inputs for micro simulation models

Select Links
Generate OD matrix using trajectories
Subnetwork Model

1,286 Links
516 Nodes
27 Signals
101 Zones
66,000 Trips
Developing an Operational ITPM

Step 1. Establish a federation of the main stakeholders
Step 2. Implement an ITPM Operational model
Step 3. Implement an Operational VISTA DTA model
Step 4. Establish a Base ITPOM
Step 5. Continuously Updated ITPOM
Step 6. ITPOM Research
TIA

• Existing condition
• Future conditions without the proposed action
• Future conditions with the proposed action
• Traffic analysis for potential impact determination
• Proposed mitigation/mitigation measures
• Recommendations
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CUNY Institute for Transportation Systems Universal Transportation Model Simulation Center
VISTA Transport Group (VTG) Inc.

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