Development of the Utah Statewide Travel Demand Model: Phase I

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Today’s Presentation

- Acknowledgements
- Overview of Phase I
- Model Architecture
- Model Inputs (network, TAZs, SE data, other) - Key Attributes
- Using the USTM – Key features
- Next Steps
Phase I Overview

- **UDOT needs (why have a statewide model?)**
  - Consistent method of forecasting
  - Rural and emerging areas
  - Auto and truck travel forecasting model to assess statewide mobility and system performance. Not to replace MPO models, not for intersections.
  - 3 step model

- **Phase I**
  - Data development & Model Architecture
  - Network and TAZ development
  - Model sequence development
  - No adjustments to match traffic counts yet. That’s Phase II.
Focus of the Utah STM

Rural and Small City (Red) Areas of Utah
Phase I Overview (cont.)

- **Architecture Task Completed**
  - Workshop for end-users in November, 2007
  - Utah model supplemented by a national model
  - Finalized in March, 2008

- **Data and Networks Task Completed**
  - UDOT completed review of networks and data
  - Presented to Technical Steering Team on July 10 & July 30, 2008
  - Final Q/C and updates completed in August

- **Model sequence completed - working prototype available.**
  - Presented to both UDOT senior management and TST in July, 2008

- **Phase II – Start in September, 2008**
The Utah DOT wanted a Statewide Travel Demand Model that is:

• Practical
• Useful
• Robust
• Developed and implemented quickly
• Relatively easy to learn and maintain
UDOT Statewide Model Needs (cont)

- The Utah DOT wanted a Statewide Travel Demand Model that is:
  - Cost-effective to develop and use
  - Geared to your needs
  - Provides value-added results
  - Provides a consistent method (reproducible).
USTM Model Architecture: Key Concepts

- Review & Adapt NCHRP Best Practices
- Design a Simple but Complete Framework
- Adhere to Key Concepts
- Understand Utah – Mobility Issues
- Work Closely with MPOs - they produce 2/3 of statewide trips
- Conflation of MPO models
USTM Model Architecture: Key Concepts

- 2005 base
- 2030 future year (consistent with MPOs)
- Simple and sensitive to Utah conditions
- Daily traffic validated with AADTs
- Truck submodel
- Cube (Citilabs) software
- Master highway network
Architecture: Framework

Utah Statewide Model
Concept Level Framework

- National Transportation Network
- National Traffic Analysis Zones
- Utah Internal Travel Model
- Trip Tables by Purpose and Networks from MPOs
- Interstate & County-to-County Truck Flow Trip Tables
- Long Distance Interstate Passenger Vehicle Trip Table
- Utah Rural (non-MPO) Transportation Network
- Utah Rural (non-MPO) Traffic Analysis Zones
- Utah Rural (non-MPO) Trip Generation
- Utah Rural (non-MPO) Trip Distribution

Comprehensive Auto and Truck Assignment
USTM Model Inputs

- National Flows
- Traffic Analysis Zones
- Socioeconomic Data
- Model Network
- Trip Generation
- Trip Distribution
- Traffic Assignment
USTM Model Inputs

- National Flows Into and Through Utah
  - Passenger Flows: National Trip Table from NHTS
  - Truck Flows: Freight Analysis Framework (FAF2)
Distribution of National Truck Traffic Through Utah
Traffic Analysis Zones

• The model zonal system is the division of the model area into geographic boundaries which load trips onto/off of roadways from centers of housing, employment and other activities.

• USTM has 3228 internal zones and 27 external zones.
Traffic Analysis Zones Boundaries

- Outside the MPO Boundaries
  - Zones were constructed using Census Block boundaries.
  - Zones are no larger than Census Block Groups.
  - Consistency with Census Geography is important for applying data available at Block and Block Group levels of detail.
Traffic Analysis Zones
Boundaries

• Inside MPO Boundaries
  – MPO TAZ Structures used in USTM.
  – Advantage: method allows for a one to one consistency between USTM and MPO models.
Socioeconomic Variables

- Trips are generated and attracted to zones based on a function of the number of households and employment in the zone.
- Zonal attributes used in the USTM:
  - Population
  - Households
  - Employment (Total, Retail, Industrial, Other, Agricultural, Mining and Construction)
Socioeconomic Allocation

Population

Total Employment
Highway Network

• The model road network is the model’s representation of state highways and principal local roads in the state, including their geometric characteristics.

• Network developed from several sources including:
  – UDOT Routes06 Roadway Inventory Database
  – MPO Networks (were used directly in the USTM network)
True Shape Examples

Removal of Pseudo Nodes

Network Conflation Example
Highway Network Attributes

• Input Attributes
  – Functional Class
  – Posted Speed
  – Distance
  – Roadway Name
  – Traffic Counts
  – Direction of Travel
  – Number of Lanes

• Calculated Attributes
  – Free Flow Speed
  – Capacity
  – Area Type
USTM Network

- USTM Network is designed as multi-year network
  - Base year and future year projects stored in one database.
  - Required links selected as part of model run.
Base Year vs. Forecast Network

• Base Year Network: Representation of the network for model base year
  – Existing lanes
  – Existing functional class (current operations)

• Future Year Networks: Representation of the forecast networks
  – Future lane increases
  – Closed roads
  – New projects

• Projects Included in the Future Networks based on UDOT’s Long Range Plan and High Profile, High Priority Projects
Base Year vs. Forecast Network

- Projects Included in the Future Networks based on UDOT’s Long Range Plan and High Profile, High Priority Projects
Overview of Using the USTM

Key Features of the USTM

- CUBE Voyager Application that takes advantage of Scenario Management
- Ability for analyst to see all input, parameter and output files
- User interface that allows analyst to select desired files for the scenario in question
- Toolbox to be developed that will allow for comparison of outputs to baseline model (base year and future year)
USTM Output Files

- Outputs created from USTM
  - Average Annual Daily Traffic (AADT) on all links in the USTM Network
  - AADT disaggregated into the following vehicle types:
    - Passenger Vehicles
    - Commercial Vehicles (4 tire)
    - Single Unit Trucks (> 4 tire)
    - Multi Unit Trucks
  - Demand

- Calculated Outputs
  - Summary Statistics
    - Vehicle Miles of Travel
    - Vehicle Hours of Travel
    - Level of Service by Lane Mile
    - Delay
  - Can be summarized by county, AOG, district, statewide, etc.
  - Demand between different summary regions
How USTM Supports Project Prioritization for UDOT Planning

- Identifies facilities in emerging areas where future traffic will be most severe
- Illustrates and quantifies volume to capacity relationships
- Identifies key point to point connections and travel times
- Supports performance measures, indexes and GIS tools.
Next Steps…

• Phase II Activities 2008-2009:
  – Model Validation
  – Documentation and Training
  – Performance Measures and Congestion Index
  – Pilot Study for Emerging Area Analyses
  – GIS Tool Coordination