Nashville Freight Model

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July 17, 2008
Tennessee MUG
Overview of Presentation

- **Nashville Area**
- **Study Background**
- **Truck Model**
Nashville Area

- Nashville Area MPO
  - 7 County area surrounding Nashville
  - Population (1.43 Million+)
  - 25 Member Jurisdictions
Freight Conditions

Nashville Area MPO

- 3 Interstates (I-65, I-40, I-24)
- Cumberland River
- CSX, Radnor Yard, 2 short line
- Nashville International Airport (BNA)
- Automotive (Nissan & Saturn), Pharmaceuticals, Publishing, Electronics
Study Area
Nashville as Crossroads

Issues

- 80% of freight traffic is thru
- Interstates function as arterials
- Noise & air pollution
- Limited rail capacity
  (freight vs. commuter)
- Manufacturing & warehousing in downtown area
- Sprawling Growth (nationally ranked)

Thru movements lead to congestion at bottlenecks

Expect to be non-attainment under new EPA requirements
Nashville as Crossroads

Priorities

- Influence the overhead flow
- Effective system of bypass routes
- “Think globally and act locally”
- Preserve existing communities’ character & resources

The Flatrock Community decorated the CSX bridge piers

The Nashville area is beginning to understand the notion of regionalism
Influence Overhead Flow

Solutions

• Smarter land use planning
  (Locations of manufacturing & warehousing)

• Improving interchanges & intersections on major thoroughfares

• Promoting rail diversion
  (rail bypass)

Both of Nashville’s rail yards are located in town

Interchanges are closely spaced and reduce capacity
“Effective” Bypass

Solutions

• Quality Growth

Growth → Bypass → Sprawl

• Need for Land Use Management

• Briley Parkway

• Old Hickory Blvd. SR-840
Positive Impacts

Investments in the transportation system start a chain reaction of events that benefits more than trucking companies and road users.
Negative Impacts

- **Economic**
  - Stress on infrastructure
  - Wal-Mart effect

- **Environmental**
  - Air Quality
  - Noise
  - Loss of open space
  - Change of communities identity

- **Efficiency**
  - Vehicle mix (tractor vs. tractor)
  - Design shortfalls

- **Safety**
  - Vehicle mix (truck vs. car)
  - Design shortfalls
Study Background
Why Study Freight?

• Federal surface transportation legislation, beginning with the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, which first emphasized freight as a factor to consider in the transportation planning process. The importance of incorporating freight issues within the metropolitan and statewide planning efforts was further emphasized in the Transportation Equity Act of the 21st Century (TEA-21) and again more recently with the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFTEY_LU).

• Recognition by business and community leaders that efficient freight transportation is a key factor in statewide and metropolitan economic competitiveness and vitality and an important consideration in business attraction and retention decisions.
Why Study Freight?

- **Continued globalization** and an increasing reliance on international trade, which has heightened the importance of a safe, reliable, and secure transportation system and placed increased pressure on already strained infrastructure.

- **Acknowledgement from private industry** that public investments will be considered – and in many cases required – to meet increasing freight demands.

Source: NCHRP 8-53 – Integrating Freight into Transportation Planning and Project-Selection Processes
Incorporating Freight Within the Transportation Planning Process

**Needs Identification**
- **Description**: Need for transportation improvement projects identified by studies, committees, the private sector, and the general public.

**Key Freight Issues**
- Lack of understanding of freight operations makes it difficult to identify needs and deficiencies.
- Freight issues not addressed within existing transportation policy and planning activities.
- Limited private sector and public involvement in the needs identification process.
- Limited data and tools.

**Plan Development**
- **Description**: Initial strategies developed to meet transportation needs; long-term goals, visions, and strategies laid out in long-range transportation plan.

**Key Freight Issues**
- No link to the existing transportation planning and programming process.
- Few advocates for freight planning activities.

**Project Programming**
- **Description**: Potential projects evaluated and ranked in priority order.

**Key Freight Issues**
- Limited data and criteria that can properly evaluate freight projects.
- Limited funding and financing tools for freight improvement projects.

**Project Development and Implementation**
- **Description**: Detailed project scoping and design; project evaluated for conformity with Federal, state, and local environmental requirements via EIS; all necessary approvals and permits are acquired.

**Key Freight Issues**
- Difficulty in developing and sustaining public-private partnerships.
- Difficulty assessing environmental and community impacts of freight projects.

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Source: NCHRP Report 594, pg 6
Types of Freight Models

- **Direct Facility Flow Factoring Method**
  - Generates link flows based on the specific facility or generator. Better suited to project level, short term forecasts.

- **Origin-Destination Factoring Method**
  - Based on existing OD table that is factored to local data.

- **Truck Model**
  - Generation and distribution of truck flows and do not require a mode choice step.

- **Four Step Commodity Model**
  - Generation and distribution of commodity flows. Mode choice step required prior to assignment.

- **Economic Activity Models**
  - Generation and distribution of freight forecasts as a function of the economic activity in the region.
Current Nashville Model

- MPO is in the process of updating the regional travel demand model as part of the plan update to be completed in 2009.
- The existing model currently models passenger movements and estimates truck movements with a simplistic approach.
- Trucks estimated based on a function of households and total employment in each zone.
- Truck movements include estimates of external – internal and external through movements.
Future Nashville Model

- As part of this project, WSA is developing a four step commodity model.
- Features:
  - Model will include trucks, as well rail and water freight movements.
  - Will have the ability to forecast commodity movements based on local employment changes in the region and external economic growth to the region.
  - Sensitive to major infrastructure improvements in the road and rail networks.
  - Commodity Model will be fully integrated into the regional travel demand model.
- Model will be calibrated using the 2006 Transearch Commodity data being purchased by TnDOT.
Integration with Travel Demand Model

- Travel times used in trip distribution will incorporate congestion from passenger flows.
- Assignment process will include both passenger movements and truck movements simultaneously.
Progress

- Freight Model (Commodity based) will be begin development late summer of 2008 once Transearch data is received from TnDOT.
- Model will be completed and integrated in regional model by October of 2008 to allow MPO to begin alternative testing for plan development.
- To assist MPO in current model validation efforts, WSA has developed a truck model to estimate flows in the region. Truck model estimates flows by truck type: multi unit, single unit (greater than four tire) and commercial trucks.
Truck Model Development

- Purpose of the interim truck model is to provide a place holder volume to the MPO of Commercial, Single Unit and Multi Unit Trucks. MPO is currently validating passenger flows.
- Result is a static ODME based matrix that is assigned to the network as a preload to the passenger volumes.
- Truck flows will be replaced with output from freight model in final application.
Model Development - Data

- Assignment of Truck Counts to Network
  - 434 Classification counts identified in region from TRIMS.
  - Used only actual classification stations.
  - Commercial volume estimated based on data from the Truck Inventory and Use Survey (1992).
- Assignment of External Station Truck Volumes
  - A classification station was applied to each external station. In some cases percentages from upstream or downstream stations were selected.
- Extraction of Statewide Model Flows (Through, Inbound and Outbound)
  - Subarea extraction was done from the Tennessee Statewide Model to generate the EE, Inbound, and Outbound distribution at each external station.
  - Internal end of trip was allocated based on employment and statewide zone.
- Distribution of Non-Retail Employment based on INFO-USA Geocoded Data to QRFM categories.
Vehicle Classification Data
## Nashville Network Attributes

| NAME          | ID    | Length | Dia  | [BD:1] | log  | LINK_ID | FUNC_CLASS | HNV_FLAG | DIVIDED | LANE  | PAVEMENT_W| CTL_FLAG | CONT_NUM | CONTACT | [TOD_STA]  |
|---------------|-------|--------|------|--------|------|---------|------------|----------|---------|-------|--------|---------|----------|----------|----------|------------|
| 5 NT JUJET RO| 1891285| 0.17   | 0    | 1891285| 11.68| 1205    | 16         |          |         |       | 24     | 0       | 17       | 0        | 189000017 |
| TOT_STA      |       |        |      |        |      |         |            |          |         |       |        |         |          |          | 16419     |

- **[2002_AD1]**
  - [Add / Remove] 1
  - [FTYPE] 1
  - [SPED] 60.0
  - [SPED1] 20.0
  - [Capacity] 780.0
  - [Alpha] 0.84
  - [Beta] 5.5
  - [Time] 0.23
  - [Len] 0.28
  - [CapAM_AB] 9120.0
  - [CapAM_RA] 9120.0
  - [CapOP_AB] 9120.0
  - [CapOP_RA] 9120.0
  - [CapPM_AB] 9120.0
  - [CapPM_RA] 9120.0
  - [Type] 0
  - [PROHIBITION] AMFlow_AB 1400
  - AMFlow_BA 2573
  - OFlow_AB 3695
  - OFlow_BA 3420
  - PMFlow_AB 3109
  - PMFlow_BA 1999
  - AMFlow_tot 3900
  - PMFlow_tot 5130
  - OFlow_tot 7124
  - PMFlow_tot 7124
  - AMSpeed_AB 43.52
  - AMSpeed_BA 33.73
  - OSpeed_AB 42.02
  - OSpeed_BA 42.67
  - PMSpeed_AB 42.17
  - PMSpeed_BA 27.42
  - AM_VMT 602
  - OP_VMT 1220
  - PM_VMT 0
  - DAILY_FLOW 14070
  - DAILY_VMT 2794
  - AB_COMM 2249.88
  - BA_COMM 2321.07
  - TOT_COMM 4571.98
  - AB_SULDY 812.45
  - BA_SULDY 829.2
  - TOT_SULDY 1641.65
  - AB_HVOSLY 569.36
  - BA_HVOSLY 591.14
  - TOT_HVOSLY 1160.50
Model Development Process

1. SE Data
2. Calculate P’s and A’s by Vehicle Type using QRFM Rates
3. Distribute P’s and A’s
4. FF by Vehicle Type and AT
5. Network (FF Spd and OP Cap)
6. Assign Trip Table (UE)
7. Validation Comparison of Volumes to Class Counts
8. Adjust Trip Generation Rates
9. Compare Regional VMT
10. Apply ODME and Assign ODME Matrix to Network
Model Validation

- Validation by Vehicle Type
  - VMT by Facility Type, Area Type and Overall
  - % RMSE by Volume Group
- Validation Criteria Applied to Trucks
  - % RMSE by Volume Group based on Volume of Trucks, Not ADT.
  - VMT Criteria is relaxed from Passenger Validation
Validation Results

- Overall VMT by Vehicle Type
- VMT Error by Functional Class
- VMT Error by Area Type
- Percent RMSE by Volume Group
Commercial and Single Unit Truck Flows
Multi Unit Truck Flows
• Questions/Comments
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