Macroscopic Modeling – Real World Project Applications in Michigan beyond Long Range Transportation Plan Development

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Outline of Presentation

• What is a Travel Demand Forecast Model?
• What the Model Can and Cannot Do
• Real World Project Applications
  – Impacts to Changes in Road Networks
  – Work Zone Safety & Mobility Analysis
  – Select Link Analysis
  – Corridor Studies
• Resources for Modelers
What is a Travel Demand Forecasting Model?

• A series of mathematical equations which are used to simulate and estimate observed traffic conditions

• **Forecasting**
  – Validated/calibrated model
  – Predict travel into the future
  – Growth factors
  – Data projections
Purposes of Model

• **Forecasts**
  – How changes in Socio-Economic data (SE-data) effect traffic flows
  – Predict future traffic congestion
  – Test solutions

• **System wide analysis**
  – How changes in the network affect traffic flows
Purposes of Model

• Test alternative methods for alleviating congestion
  – Not just widening roads
  – Parallel corridor
  – Connectivity improvements

• Congestion management
  – Use a volume-to-capacity (V/C) ratio to identify deficiencies or levels of congestion
  – Hierarchy of congestion
Macroscopic Model Capabilities – What the Model Can and Cannot Do

• Travel demand models are designed for system wide analysis
• Provide patterns and changes, not specific numbers
• Provide estimates of change based on alterations to the road network (e.g., increased or reduced travel lanes, new roads, etc.)
What the Model Can Do

• Provide system wide responses to changes in road network
  – Increased travel lanes (due to road widening)
  – Reduced travel lanes (due to construction or road diets)
  – New roads
  – Impacts to surrounding roads as a result of changes on a corridor
What the Model Can Do cont.

• Provide estimated percentage changes on all roads in model area
• Provide regional impacts to construction projects
• Provide impacts to roads as a result of a change in land use (e.g., new shopping mall).
• Scenario or Alternative Analysis on Corridor Studies
What the Model Cannot Do

• Not considered: Traffic Signals, Access Management, Geometrics and Human Behavior/Preferences
• Intersection Level Analysis
  – Impacts to Signals or improvement of Signal Timing
  – Impacts to turning lanes at intersections
  – Changes to design of ramps at interchanges
• Specific Volume changes
  – Percent Change, but not actual numbers
• Block Analysis
  – Models are broken into Traffic Analysis Zones, so those are the smallest unit of measurement
Applications of Model – Project Impact Analysis

• Impacts to Changes in Road Networks
• Work Zone Safety & Mobility Analysis – Construction Projects
• Detour Analysis
• Select Link/Zone Analysis
• Corridor Studies
Changes in Road Networks

• New Roads
• New interchanges
  – Ex: I-96/Latson Road interchange – currently being constructed
• Lane widenings or reductions
• Closure of roads, or removal of ramps
I-96/Latson Road Interchange – Howell

• Situation
  – Development on east side of Howell along Grand River (I-96 BL) near Latson Road has caused high increases in traffic volumes since late 1990s
  – From east side of Howell, no good way to get to I-96 west towards Lansing
    – Forced to use downtown D-19 exit or M-59 several miles west
    – EB travelers can use the Lake Chemung exit

• Task
  – Add new road over freeway and ramps to and from I-96 to new road
  – Run model to determine shifts in travel behavior as a result of new interchange
  – Create diversion map
Work Zone Safety and Mobility Analysis

- MDOT policy established, in accordance with federal regulation, to improve safety and mobility in work zones by reducing congestion and traffic incidents
- Construction and Maintenance Projects
- Develop Diversion Maps showing impacts to proposed Construction Projects
- Maps are used by Regional Engineers in their analysis when programming the job
  - Establish detour routes
  - Understand impacts to different construction scenarios
  - Determine preferred alternative
Work Zone Safety and Mobility Analysis cont.

• Use of Travel Demand Model
  – Determine diversion rate
    • Run model for construction year
    • Add construction project to model
    • Create percent change in model volumes by link
  – Potential adjustments for diversion analysis
    • Speed reduction
    • Lane width reductions
    • Side restrictions
Work Zone Safety and Mobility Analysis cont.

• **Modeling Capabilities**
  – Types of construction projects
    • Lane closures
    • Flagging
    • Prohibiting turns
  – Time of construction
    • 24 hour
    • Evening work
Work Zone Safety and Mobility Analysis cont.

• Examples of Work Zone Analysis

1. I-75 in Genesee County
   • Off-peak (evening work)

2. M-59 (Highland Road) in Oakland County
I-75 in Genesee County

• Location: I-75 from Oakland County line to I-475 (north of Flint)
  – Situation
    • Proposed lane closures to 1 travel lane in each direction during night-time hours
  – Task
    • Create new network using GCMPC model with only one lane allowed on I-75 NB and I-75 SB during off-peak period
    • Assign trips to new network
    • Create diversion map showing impacts
I-75 in Genesee County cont.
M-59 (Highland Road) in Oakland County

• **Location**
  – M-59 from Milford to Williams Lake Rd in western Oakland County

• **Situation**
  – Proposed lane reduction from 2 to 1 lane in each direction

• **Task**
  – Create new network using SEMCOG model with only one lane allowed in each direction.
  – Assign trips to new network
  – Create diversion map showing impacts.
M-59 (Highland Road) in Oakland County cont.
Detour Analysis
Zilwaukee Bridge Closure

• **Situation**
  – What happens if we close the Zilwaukee Bridge?

• **Task**
  – Create new network without bridge
  – Assign trips to the new network

• **Results**
  – Maps with directional percent change
  – Color and size theme
  – Remember model assumptions
Detour Analysis

Zilwaukee Bridge Closure cont.
Select Link/Zone Analysis

• Select Link Analysis
  – Studies all the trips that pass through a road segment
  – Displays flows to and from a specific link across entire model network
  – Can support a work zone explaining who will be impacted as a result of changes to a given corridor or road segment

• Select Zone Analysis
  – Studies all the trips that go to and from a given traffic analysis zone
  – Shows flows to and from a specific zone
  – Ex: Hospital, Shopping Mall or Employment Center (where are people coming from to go to these facilities?)
Select Link on M-46
Thomas Township Question

• Situation
  – Select Link on M-46
  – How many trips that use this link begin or end in Thomas Township?

• Task
  – Select Link Assignment
  – Selection set of connectors in Thomas Township
Select Link on M-46

Thomas Township Question cont.
Select Link on M-46
Thomas Township Question cont.

• Results - Summary

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<th>Link</th>
<th>Total Volume</th>
<th>Thomas Twp</th>
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<tr>
<td>East bound</td>
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<tr>
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Corridor Studies

- Traffic Studies performed to explore options for mitigating congestion along specific corridors
- Travel Demand Model will test alternative scenarios
  - Often a **sub-area analysis** is performed to study more localized impacts to changes in a corridor
- Develop a preferred alternative based on impacts to study area
M-153 (Ford Road) west of I-275 in Canton Township

**Situation:**
- Ford Road is home to IKEA and many commercial and retail shopping centers.
- Haggerty Road runs immediately parallel to I-275 and the Ford/Haggerty Road intersection creates bottlenecks during peak periods back towards and onto I-275.

**Task:**
- Determine cost effective strategies to reduce congestion and improve mobility along Ford Road and neighboring corridors.
- Six Alternatives were studied using SEMCOG Model
- Subarea Model of SEMCOG model used as a basis to develop Synchro Model
- Establish preferred alternative to proceed
M-153 (Ford Road) west of I-275 in Canton Township cont.
Summary

• What is a Model and What it Can and Cannot Do
• Models are used in many capacities to:
  – Assist in project analysis
  – Study impacts to changes in road network (new roads/interchanges)
  – Study impacts to proposed construction projects (work zone)
  – Study potential detour routes
  – Study who is affected by changes in roads or zones (select link, select zone)
  – Determine preferred alternatives in a corridor study
Questions and Contact Info

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