Updating Speed Performance Measures of Minnesota’s Interregional Corridor System

By
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GIS-T 2004
Background

- Began identifying key transportation corridors in February, 1999
- Several objectives:
  - IRC roads should be a subset of the state’s major roads (principal arterials and National Highway System roads).
  - The selection roads for IRC designation should be based on clearly defined technical criteria.
  - Investment priorities should be performance based and should define IRC performance criteria.
  - The IRC defined should enjoy broad support from local, regional, and state agencies and institutions and from residents and businesses.
IRC Study Process

- Outreach Process

- Main themes expressed by attendees
  - Need for quick and safe travel,
  - Need to address increasing delays from traffic signals,
  - Need to better control and manage access points,
  - Need to address growth in traffic congestion, and
  - Need for predictable travel times from trip to trip and for just-in-time freight movements.
IRC Study Process (con’t)

- Second set of small group meetings
- Developed principles and policies:
  - Definition of regional trade centers,
  - Identification of the IRC,
  - Development of interregional corridor principles and policies, and
  - Development of a corridor management plan guide.
Regional Trade Centers

- Based on the University of Minnesota’s 1963 report, *Trade Centers and Trade Areas of the Upper Midwest*
  - 0 = Twin Cities (only 1)
  - 1 = St. Cloud, Rochester, Duluth
  - 2 = Brainerd, Bemidji, Willmar, Marshall
  - 3 = Elk River, Little Falls, Montevideo
Defining the Interregional Corridors
Corridor Evaluation Criteria

- State highway principal arterial routes
- 6 criteria used to compare corridors
  - Average annual daily traffic
  - Heavy commercial average daily traffic
  - Seasonal peaking factor
  - Historical traffic growth rates
  - Number and level of RTCs connected by the corridor route
  - 25-yr county population growth projections
Priority Corridors

- Segments separated into 3 groups
  - High, medium, low score segments
- Segments combined into corridors connecting RTCs
- Additional factors were considered:
  1. Provide connections between Levels 0, 1, and 2;
  2. National Hwy System designation should influence whether a route is designated as part of the IRC;
  3. Consider District and metropolitan plan priorities
  4. Consider System spacing and geographic coverage
  5. Consider Regional connections to other states
Priority Corridors Results

- IRC is ~ 2,926 miles long
- ~ 56% of existing principal arterial system
- 1/3 of system – 1,007 miles, is HPI
- 2/3 of system – 1,919 miles, is MPI
- HPI and MPI account for < 2% of all roadway miles in MN
- But carry > 30% of vehicle miles traveled
Performance Measures

- Speed (surrogate for travel time)
  - methodology:
    - Posted speed limits
    - Number of signals
    - Congestion

- This established an overall speed or travel time for the corridor
Performance Targets

- Establishing target levels
  - 60 mph for HPI
  - 55 mph for MPI
  - 50 mph for high-priority Regional corridors
Evaluating Corridor Performance

- Methodology:
  1. Posted speeds from MnDOT’s TIS
  2. Base Travel Time
  3. Capacity Risk
  4. Traffic Control Devices
Evaluating Corridor Performance

- Methodology: (con’t)
  5. Capacity
  6. Adjusted Travel Time
  7. Current and future performance compliance
Adjustments

1. Base speeds were increased by 3 mph
2. Congestion Penalty
3. Signal Penalties
## Performance Target Matrix

<table>
<thead>
<tr>
<th>Performance Category</th>
<th>Interregional Corridor Priority Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High-Priority</td>
</tr>
<tr>
<td>At or Above</td>
<td>&gt;= 60 mph</td>
</tr>
<tr>
<td>Below</td>
<td>&lt; 60 mph</td>
</tr>
</tbody>
</table>
## Congestion Thresholds

<table>
<thead>
<tr>
<th></th>
<th>Volume Threshold (AADT per Lane)</th>
<th>Congestion Index Risk</th>
<th>Added Delay Penalty Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freeway</strong></td>
<td>&lt;= 15,000</td>
<td>Low</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>15,000 - 20,000</td>
<td>Moderate</td>
<td>(AADT/Lane - 15,000) / 167</td>
</tr>
<tr>
<td></td>
<td>&gt; 20,000</td>
<td>Severe</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Rural Expressway</strong></td>
<td>&lt;= 8,000</td>
<td>Low</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>8,000 - 11,000</td>
<td>Moderate</td>
<td>(AADT/Lane - 8,000) / 100</td>
</tr>
<tr>
<td></td>
<td>&gt; 11,000</td>
<td>Severe</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Urban Expressway</strong></td>
<td>&lt;= 5,000</td>
<td>Low</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>5,000 - 7,000</td>
<td>Moderate</td>
<td>(AADT/Lane - 5,000) / 67</td>
</tr>
<tr>
<td></td>
<td>&gt; 7,000</td>
<td>Severe</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Two-Lane</strong></td>
<td>&lt;= 4,500</td>
<td>Low</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>4,500 - 7,500</td>
<td>Moderate</td>
<td>(AADT/Lane - 4,500) / 100</td>
</tr>
<tr>
<td></td>
<td>&gt; 7,500</td>
<td>Severe</td>
<td>50%</td>
</tr>
</tbody>
</table>
# Signal Time Penalty

<table>
<thead>
<tr>
<th>Location</th>
<th>Low Congestion</th>
<th>Moderate Congestion</th>
<th>Severe Congestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Minnesota</td>
<td>28 seconds</td>
<td>43 seconds</td>
<td>50 seconds</td>
</tr>
<tr>
<td></td>
<td>11 seconds</td>
<td>17 seconds</td>
<td>20 seconds</td>
</tr>
<tr>
<td></td>
<td>15 seconds</td>
<td>24 seconds</td>
<td>29 seconds</td>
</tr>
<tr>
<td></td>
<td>37 seconds</td>
<td>61 seconds</td>
<td>73 seconds</td>
</tr>
</tbody>
</table>

Yellow = New Equation  
White = Original Equation
Spreadsheet Examples
Weighted Posted Speed = Posted speed * (segment length / total segment length)
Adjusted Speed = Weighted Posted speed + 3 mph
Base Travel Time = (Length / Adjusted speed) * 3600 (to get seconds)
Signal Delay = see previous slide
Stop Sign Delay = # stop signs * 14 seconds (originally used 37 secs)
Weighted AADT = AADT * (segment length / total segment length)
Weighted Lanes = Weighted AADT / # Weighted Lanes
Facility Type = Vlookup to speed_lanes03 spreadsheet

Congestion Index Risk = Formula based on Congestion Thresholds – see slide
Added Delay Penalty = Formula based on Congestion Thresholds – see slide
Added Congestion Delay = Base Travel Time * Added Delay Penalty
TOTAL Travel Time = Base Time + Signal Delay + Stop Sign Delay + Added Congestion Delay
Final Speed = (Segment Length / Total Travel Time) * 3600
PERFORMANCE = See Performance Target Slide
Future Performances

- 2014, 2023, 2030
- Updated the road segment capacity
- Original Equation vs New Equation
- Improvements vs No Improvements
  - Include current year construction
  - Include STIP 2004 – 2006
  - 10 year Work Plan (to 2013)
Future Performances (con’t)

- Analysis for High-Priority Regional Corridors
- Creating many “What-If…” scenarios
- Decision to revamp the IRC Speed Performance Spreadsheet
What’s Next

- Continue to finalize spreadsheet
- Incorporate changes into Interregional Corridor spreadsheet
- Automate
Closing

- IRCs and planning process widely accepted by local communities
- Corridor importance is recognized
- Provides an opportunity for communities and local agencies to work together
Data Sources


- Interregional Corridors – Prioritizing and Managing Critical Connections Between Minnesota’s Economic Centers, by Linda Zemotel and David Montebello
  - Transportation Research Record 1817; Paper No. 02-3252
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