ITS in Minnesota

Minnesota Guidestar Program and Project Updates

September 13, 2005
Intelligent Transportation Systems (ITS) in Minnesota

• ITS and the Minnesota Guidestar Program
• Truck Priority at Signalized Intersections
• Condition Acquisition and Reporting System and 511
• Mayday Project
What is ITS?

• Application of technology to improve the safety and efficiency of the transportation system.
What is ITS?

- **Traffic Management**
  - Signal Systems
  - Ramp Meters
- **Emergency Response**
  - Mobile Data Terminals
  - 911 Dispatch
  - RF Data Networks
- **Public Transportation**
  - Paratransit Dispatch
  - Automatic Vehicle Location
  - Signal Priority
- **Commercial Vehicles**
  - Electronic Clearance
  - Electronic Permits
- **Traveler Information**
  - Message Signs
  - 511, Web Sites/E-mail
- **Infrastructure**
  - Cell Providers
  - Telecom/Data Services
  - Wide Area Networks
  - Fiber Optic Facilities
  - GIS Databases
- **Intelligent Vehicles**
  - Driver Assistance Technologies
  - Collision Prevention
- **Research**
IT\'S in the Twin Cities

INCIDENT

CONGESTION

- About 50\% of all congestion is incident related
- About 15\% of the freeway crashes are secondary crashes
Regional Transportation Management Center (RTMC)

- Co-location of:
  - Freeway Operations
  - Maintenance Dispatch
  - State Patrol Dispatch
  - Signal Operations
CCTV Cameras
(285 Cameras)

Loop Detectors
(4000 Loops)
Variable Message Signs
(70 VMS on Metro Freeways)

Ramp Meters
(419 Meters)
ITS in Greater Minnesota

- Road Weather Conditions
- Road Construction
- Special Event Traffic Management
ITS in Greater Minnesota: Transportation Operations and Communications Centers

- Mn/DOT Maintenance Dispatch
- State Patrol Dispatch
- Transportation Operations
- Traveler Information
R/WIS

Cameras

SLOW DOWN
ACCIDENT
AHEAD

Roadside VMS

LEFT LANE CLOSED

Portable VMS
Automated Gates

Bridge De-icing

Smart Work Zones

Transit Priority
Minnesota Guidestar Program

Research, Operational Tests, Operations

Minnesota Guidestar Program (Formed in 1991)

- Minnesota Guidestar Board of Directors
  - Role: - MN ITS Policy Direction
    - Strategic Plan
    - Action Plan

- Mn/DOT Office of TSO
  - Role: - Administer ITS $
    - Support Guidestar Board
    - Direct Statewide Conformance
      (Arch., Stds., Consistency)

- ITS Minnesota
  - Role: - Foster Particip/Partnerships
    - ITS Awareness/Acceptance
    - Professional Capacity Bldg.
    - Help Grow Markets, Research

Minnesota Guidestar
www.dot.state.mn.us/guidestar
3 Project Updates

- Truck Priority at Signalized Intersections
- Condition Acquisition and Reporting System (CARS) and 511
- Mayday Project
Truck Priority at Signalized Intersections: The Problem

- Trucks suffer more stopping and starting penalty than cars
- Cars following trucks are penalized
- Pavement wear and noise are greater for stopping trucks
- Safety issues with stopping and starting trucks
Truck Priority at Signalized Intersections: The Possibilities

• Optimize Signal Timing
• Hold the green light for a truck
• Notify truck of speed to get a green light ("speed funnel")
Truck Priority at Signalized Intersections: Hwy 169 at Laredo Street, Belle Plaine
Truck Priority at Signalized Intersections: Optimize Signal Timing

- Increase the main road minimum green
- Increase gap between vehicles on main road before ending green
- Favors main road vehicles
Truck Priority at Signalized Intersections: Detecting Trucks

New Truck Loops

Existing Loops

30’ 150’ 550’
Truck Priority at Signalized Intersections: Speed Funnel

- Would require making portions of the signal green time to be “pre-timed”
- Incompatible with preemption
- Sign Display would change quickly
- Conclusion: Do not implement speed funnel
Truck Priority at Signalized Intersections:
Results for Percent Stopping

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Percent Stops - Mainline Trucks</th>
<th>Percent Stops - Cross Street</th>
<th>Percent Stops - Mainline NB</th>
<th>Percent Stops - Mainline SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Before</td>
<td>Modified Timing</td>
<td>Truck Priority</td>
<td>Before</td>
</tr>
<tr>
<td>MID</td>
<td>64.0%</td>
<td>82.0%</td>
<td>30.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>PM</td>
<td>66.0%</td>
<td>76.0%</td>
<td>32.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>AM</td>
<td>Modified Timing</td>
<td>Truck Priority</td>
<td>Before</td>
<td>30.0%</td>
</tr>
<tr>
<td>MID</td>
<td>68.0%</td>
<td>74.0%</td>
<td>Modified Timing</td>
<td>25.0%</td>
</tr>
<tr>
<td>PM</td>
<td>70.0%</td>
<td>72.0%</td>
<td>Truck Priority</td>
<td>20.0%</td>
</tr>
</tbody>
</table>

The graphs show the percentage of stops for mainline trucks, cross street, and mainline directions (NB and SB) before and after modified timing and truck priority.
Truck Priority at Signalized Intersections: Results for Cycle Length

![Bar Chart: Truck at Front of Queue in Right Lane]

- **AM**
  - Before: 0.0%
  - Modified Timing: 16.0%
  - Truck Priority: 14.0%
- **MID**
  - Before: 2.0%
  - Modified Timing: 14.0%
  - Truck Priority: 10.0%
- **PM**
  - Before: 0.0%
  - Modified Timing: 8.0%
  - Truck Priority: 6.0%
Truck Priority at Signalized Intersections: Results for Delay/Vehicle

- **Delay/Vehicle - Mainline Trucks (sec)**
  - AM: Before, Modified Timing, Truck Priority
  - MID: Before, Modified Timing, Truck Priority
  - PM: Before, Modified Timing, Truck Priority

- **Delay/Vehicle - Cross Street (sec)**
  - AM: Before, Modified Timing, Truck Priority
  - MID: Before, Modified Timing, Truck Priority
  - PM: Before, Modified Timing, Truck Priority

- **Delay/Vehicle - Mainline NB (sec)**
  - AM: Before, Modified Timing, Truck Priority
  - MID: Before, Modified Timing, Truck Priority
  - PM: Before, Modified Timing, Truck Priority

- **Delay/Vehicle - Mainline SB (sec)**
  - AM: Before, Modified Timing, Truck Priority
  - MID: Before, Modified Timing, Truck Priority
  - PM: Before, Modified Timing, Truck Priority
Truck Priority at Signalized Intersections: Results for Delay/Stopped Vehicle

- **Delay/Stop - Mainline Trucks (sec)**
  - AM, MID, PM
  - Before, Modified Timing, Truck Priority

- **Delay/Stop - Cross Street (sec)**
  - AM, MID, PM
  - Before, Modified Timing, Truck Priority

- **Delay/Stop - Mainline NB (sec)**
  - AM, MID, PM
  - Before, Modified Timing, Truck Priority

- **Delay/Stop - Mainline SB (sec)**
  - Time Period: 1, 2, 3
  - Before, Modified Timing, Truck Priority
Truck Priority at Signalized Intersections: Results for Cycle Length

Average Cycle Length (sec)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Average Cycle Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>80</td>
</tr>
<tr>
<td>MID</td>
<td>90</td>
</tr>
<tr>
<td>PM</td>
<td>100</td>
</tr>
</tbody>
</table>

- **Before**
- **Modified Timing**
- **Truck Priority**
Truck Priority at Signalized Intersections: Conclusions

- Truck priority is low cost
- Truck detection is reasonably accurate
- Truck priority reduces the number of trucks that must stop
- Truck priority increases the cycle length, which cancels the benefits in delay
- Try a 2-lane site next
Condition Acquisition and Reporting System (CARS) and 511

- **CARS**: A standards based system for assembling, managing, and distributing real time road and weather related information
- **511**: A nationwide reserved phone number for traveler information
- In Minnesota CARS provides the data for 511
Condition Acquisition and Reporting System (CARS) and 511

- Automated entry of Road Weather Information System data
- Automated entry of traffic congestion levels
Condition Acquisition and Reporting System (CARS) and 511

Manual entry of construction events, incidents, and Amber Alerts
Condition Acquisition and Reporting System (CARS) and 511

Current and Future Connections to:

• Other states’ systems (Northwest Passage)
• On-Star
• MnPass
• Travel Time
• State Patrol computer aided dispatch
Condition Acquisition and Reporting System (CARS) and 511
Condition Acquisition and Reporting System (CARS) and 511

Traveler Information Distribution:
• 511
• 511mn.org web page
Condition Acquisition and Reporting System (CARS) and 511

511 in 2004

• 544,138 calls
Condition Acquisition and Reporting System (CARS) and 511

511mn.org in 2004
- 344,120 visitors
- 16,762,902 page views
- 35,915,277 hits
Conclusion:
• CARS is the focal point for real time traveler information in Minnesota
• CARS access multiple sources of data
• Main CARS output is to 511 and 511mn.org
Mayday Project

- A project to integrate emergency voice and data communications between:
  - Telematics Call Centers (OnStar)
  - 911 Call Center Dispatchers
  - Emergency Responders
Mayday Project

Data:

• Vehicle to OnStar
  – Location
  – Airbag deployed
  – Change in velocity, direction of force, multiple impacts
  – Rollover
  – Other
Mayday Project

Centrally Available Standardized Server

Data Portion Operational In 2004

Other Users

CARS

Emergency Responder

www.dot.state.mn.us/guidestar
Mayday Project

Voice:

• Vehicle to OnStar
  – Cellular connection to OnStar operator
• OnStar to Public Safety Answering Point
  – OnStar determines appropriate PSAP
  – Wired line call to PSAP
  – Administrative line
Mayday Project
Mayday Project

- 22 PSAPS will participate in test
- 3 Selective Routers
  - IES - Hutchinson
  - Qwest - Minneapolis/St.Paul and Rochester
- Looking for feedback from PSAPs
- Currently Performing Testing
Mayday Project
Conclusions

• Data from a vehicle can be provided to emergency service providers through a central standardized database

• Voice call from a vehicle can be routed from the telematics call center to the appropriate PSAP using standard telephone equipment
Summary

• ITS and the Guidestar Program
• Truck Priority at Signalized Intersections
• CARS/511
• Mayday Project
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