Multimodal ITS Data Integration and Performance Measurement in Portland, Oregon

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Portland State University
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San Diego, California ▪ June 30, 2004
Outline

- Regional Vision
- Regional ITS Partners and Data Integration
- Working with Metropolitan Planning Organization
  - Empirical data for travel demand model
  - Performance measures for annual report
- ITS Data Integration
  - Video Imaging Processing and Loop Detector Data to Provide Vehicle Classification
  - Freeway Incident Management Performance Assessment
  - Using Bus AVL Systems and Loop Detector Data to Characterize Corridor Performance
  - Using Bus AVL Data To Characterize Arterial Performance (Session 21)
ITS Data Integration
Regional Vision

- Warehouse ITS data at their most raw level.
- Include user interface for extracting relevant performance measures in real time and historically.
- Through regional cooperation, Portland State University is the regional center for collecting, coordinating and disseminating variable sources of transportation data and derived performance measures.
- Data can be mined for operations, planning, management and research purposes for the transportation system
Regional ITS Partnerships
Data Integration

- TransPort Technical Advisory Committee
  - Oregon Department of Transportation
  - City of Portland
  - TriMet
  - Metro (OR)
  - Regional Transportation Commission (WA)
  - Washington State Department of Transportation
  - Cities (bi-state)
  - Counties (bi-state)
  - C-Tran
  - Port of Portland
  - Portland State University

- Monthly coordination meetings
- Voluntary project funding integration
- Subcommittee Structure
  - Data
  - ITS Architecture
  - Communications
Traffic Management System
Portland Region

- 75 CCTV cameras
- 18 variable message signs
- 118 ramp meters
- 436 inductive loop detectors
- 24 hour/day incident response with 11 vehicles
- Digital archives of incident logs
- AVL Archives of COMET movements
- Extensive fiber optic communications system
Traveler Information
Portland Region

Variable Message Signs

Traffic Reports

Traffic Cameras

www.tripcheck.com
Integrating ITS Data Into Corridor Planning
Metro Highway 217 Corridor Study

- Available archived loop detector data along key travel corridor.
- Possible to incorporate updated speed/travel time information into trip distribution step of Metro’s travel demand model.

Background
- Metro developing corridor study for Highway 217 corridor improvements.
- EMME/2 travel demand model.
- Trip Distribution step relies on “theoretical” and “default” values.

Opportunity for linking ITS data to regional transportation planning efforts.
Supplement theoretical and default values in the trip distribution step with empirical data.

Improve Bureau of Public Roads (BPR) volume/travel time functions.

BPR does not take into account regional variations and dynamic changes for a particular facility.

Facility characteristics and driver behavior have changed significantly over the 40 years since BPR functions were created.

Recent developments in the transportation system such as ramp metering and other ITS technologies may have altered highway performance.
Integrating ITS Data Into Corridor Planning
Metro Highway 217 Corridor Study

Study Area
- Ramp metering
- 39 detectors at 9 locations
- Estimated segment capacity from loop detector data
  - Count
  - Occupancy
  - Queue discharge
- Created function relating V/C ratio to travel time
Integrating ITS Data Into Corridor Planning
Metro Highway 217 Corridor Study

Oblique Plot of Flow at Detector 1524

- Minimum Flow
- Maximum Flow 2170 vph

Time
Integrating ITS Data Into Corridor Planning
Metro Highway 217 Corridor Study

Highway 217 Volume/Delay Curve
Regional Performance Measures
Metro Performance Report 2004

- Metro Performance Report – reports on progress of region including transportation system.

- PSU ITS Lab generated performance measures as indicator of possible future ITS based reporting.

- Sample performance data prepared in 2004:
  - Average Speed Map for the regional highway system
  - Congestion frequency charts for key corridors
Regional Performance Measures
Average Speed Map

Average Speed 4:30-5:30 PM Peak January 2001

Average Speed (MPH)
- 0 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- 61 - 70

Freeways
Arterials
Rivers
Regional Performance Measures
Congestion Frequency

Percent of Reported Speeds < 30mph (2001)
WB I-84 Between I-205 and I-5

Time

Percent

06:00 06:30 07:00 07:30 08:00 08:30 09:00 09:30 10:00 10:30 11:00 11:30 12:00 12:30 13:00 13:30 14:00 14:30 15:00 15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30
Video Imaging Processing
Vehicle Classification

- Regional need for truck count data on an ongoing basis.
- Live feed from 75 CCTV cameras into ITS Lab.
- Using Autoscope to extract vehicle classification data.
- Developing statistical sampling plan:
  - Spatial
  - Temporal
- Challenge is to properly re-orient cameras.
- Collaborating with University of Washington.
Video Imaging Processing
Vehicle Classification

- Testing loop only algorithm to extract truck count estimates.
- 5 minute intervals.
- Uncongested conditions.
- Wang-Nihan algorithm.
- Developing sampling plan.
- Collaborating with University of Washington.
Freeway Incident Data Integration
Incident Management Program Assessment
Freeway Incident Data Integration
Incident Management Program Assessment

Year 2001 Incident Inventory

N=18920

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<th>Stall</th>
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<td>December</td>
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Mean 1576
Freeway Incident Data Integration
Incident Management Program Assessment

Impact of Weather on Incident Frequency

1152 Crashes on Wet Days
1712 Crashes on Dry Days
113 Wet days

Month

Number of Crashes

January 150
February 158
March 157
April 144
May 125
June 101
July 133
August 150
September 199
October 174
November 181
December 194

Number of Wet Days

150
200
250

0
5
10
15
20
25

Portland State University
Freeway Incident Data Integration
Incident Management Program Assessment

Year 2001 Average Ongoing Incidents

- Sunday
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- IR Vehicles Weekday
- IR Vehicles Weekend

Number of Incidents/IR Vehicles

Time

1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Using Bus AVL Systems and Loop Detector Data to Characterize Corridor Performance

- TriMet Express Bus Routes on Interstate 5
- Route 95X morning peak service between Sherwood and Downtown Portland
- Route 96X provides morning and evening peak only service between Sherwood and Downtown Portland
- Three week I-5 experiment
  - Loop detector data
  - Express bus AVL data (pseudo stops on freeway)
- Geo-coded data from Tri-Met’s automatic vehicle location (AVL) system was used to build trip trajectories.
- Trajectories were overlaid onto contour plots of speed data from ODOT’s inductive loop detectors on Northbound I-5 Corridor
- Merging of two data sources to effectively achieve travel time estimation and validation.
I-5 Freeway Corridor Performance
Bus AVL and Loop Detector Data
I-5 Freeway Corridor Performance
Loop Detector Data

I-5 Northbound, November 7, 2002
I-5 Freeway Corridor Performance
Bus AVL Data
I-5 Freeway Corridor Performance
Bus AVL and Loop Detector Data

I-5 Northbound, November 7, 2002
# I-5 Freeway Corridor Performance

Bus AVL and Loop Detector Data

## Northbound Corridor Travel Times (min)

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<td>0.4</td>
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Acknowledgments

- Andrew Byrd, B.S., Computer Science
- Thareth Yin, M.S., Civil & Environmental Engineering
- Michael Rose, Master of Urban & Regional Planning
- National Science Foundation
- Oregon Department of Transportation
- City of Portland
- TriMet
- Portland State University
- Oregon Engineering and Technology Industry Council
For More Information
Comments and Feedback Welcome

http://www.its.pdx.edu

Thank You!