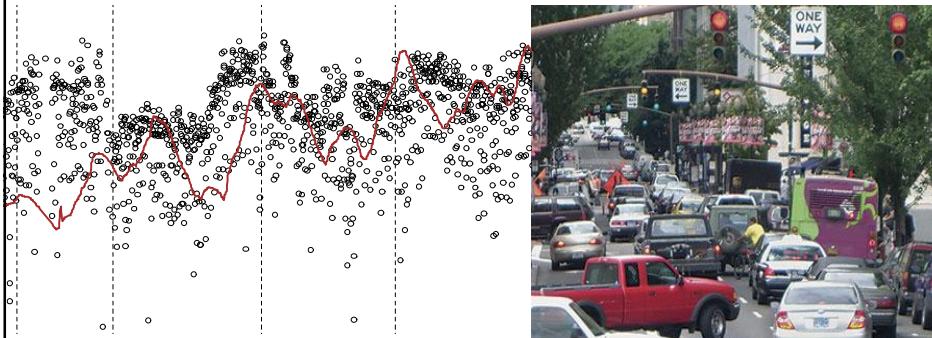


TMIP Webinar: Using Visualization Techniques to Communicate Transportation Planning Data



Christopher Monsere
Assistant Professor, Civil and Environmental Engineering
Intelligent Transportation Systems Laboratory
Maseeh College of Engineering and Computer Science
Portland State University November 13, 2008

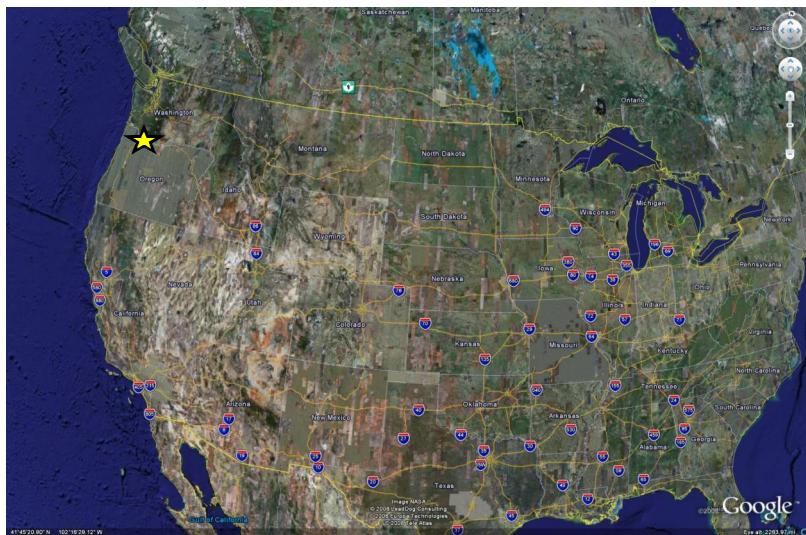


Outline

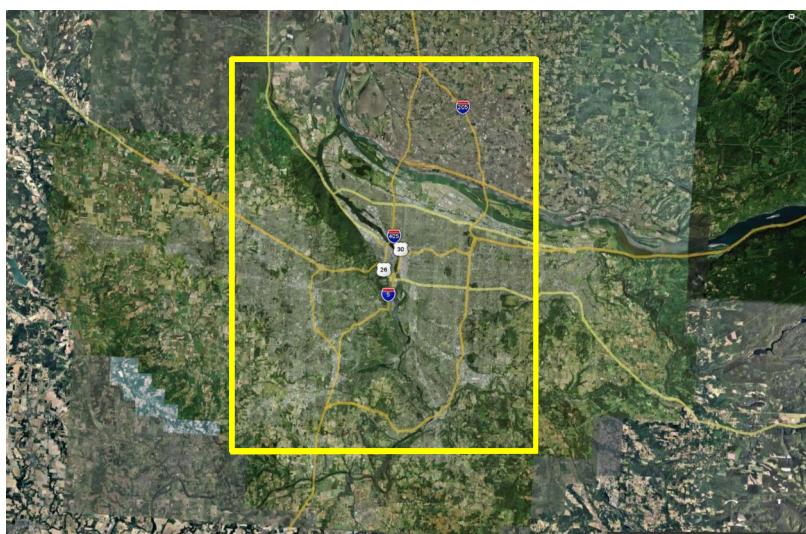
- Our data archive – PORTAL
- Data visualization examples
 - Fuel prices and travel
 - Green transportation measures
 - Freeway operations
 - Transit system performance
 - Freight system performance
- Questions



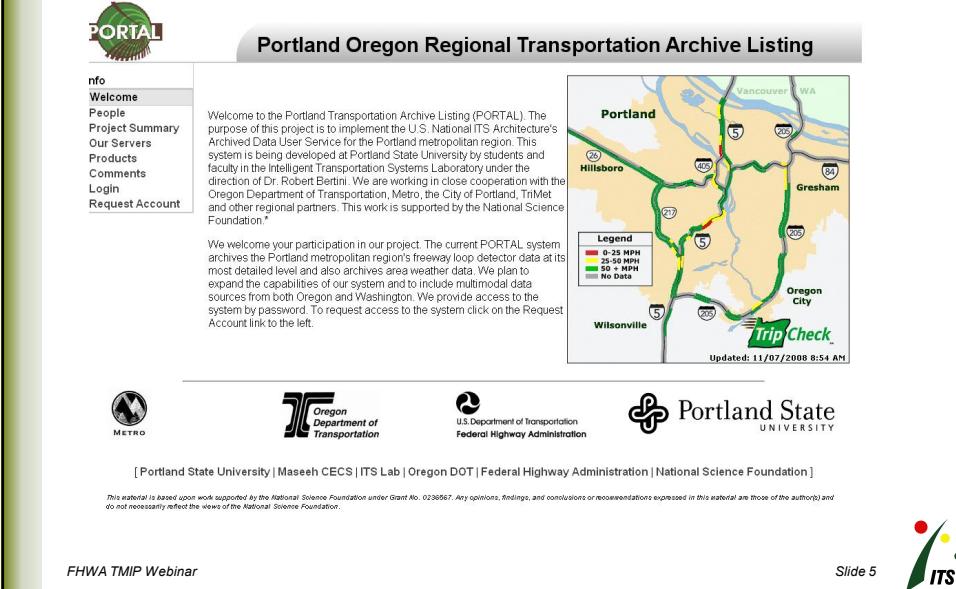
Portland, Oregon



Portland, Oregon



PORTAL -- Region's ADUS



Portland Oregon Regional Transportation Archive Listing

Welcome to the Portland Transportation Archive Listing (PORTAL). The purpose of this project is to implement the U.S. National ITS Architecture's Archived Data User Service for the Portland metropolitan region. This system is being developed at Portland State University by students and faculty in the Intelligent Transportation Systems Laboratory under the direction of Dr. Robert Bertini. We are working in close cooperation with the Oregon Department of Transportation, Metro, the City of Portland, TriMet and other regional partners. This work is supported by the National Science Foundation.*

We welcome your participation in our project. The current PORTAL system archives the Portland metropolitan region's freeway loop detector data at its most detailed level and also archives area weather data. We plan to expand the capabilities of our system and to include multimodal data sources from both Oregon and Washington. We provide access to the system by password. To request access to the system click on the Request Account link to the left.

Legend

- 0-25 MPH
- 26-50 MPH
- 50+ MPH
- No Data

Updated: 11/07/2008 8:54 AM

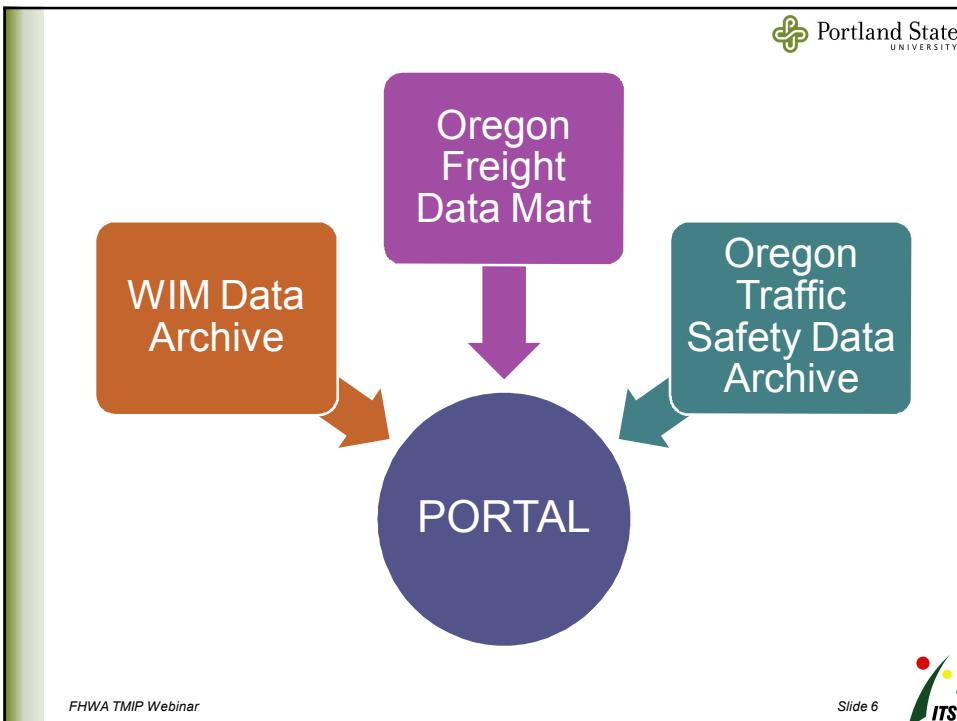
Logos

- METRO
- Oregon Department of Transportation
- U.S. Department of Transportation Federal Highway Administration
- Portland State UNIVERSITY
- National Science Foundation

[Portland State University | Maseeh CECS | ITS Lab | Oregon DOT | Federal Highway Administration | National Science Foundation]

This material is based upon work supported by the National Science Foundation under Grant No. 0238067. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

FHWA TMIP Webinar Slide 5



What's in the PORTAL Database?



Loop Detector Data
20 s count, lane occupancy,
speed from 500 detectors
(1.2 mi spacing)



Incident Data
140,000 since 1999



Bus Data
1 year stop level data
140,000,000 rows



Weather Data
Every day since 2004

001590

Days
Since July 2004
About +700 GB
6.9 Million
Detector
Intervals



VMS Data
19 VMS since 1999



WIM Data
22 stations since 2005
30,026,606 trucks



Crash Data
All state-reported crashes
since 1999 - ~580,000

FHWA TMIP Webinar

Slide 7



Performance Measures Used



- Volume
- Speed
- Occupancy
- **Vehicle Miles Traveled**
- **Vehicle Hours Traveled**
- Travel Time
- Delay

FHWA TMIP Webinar

Slide 8



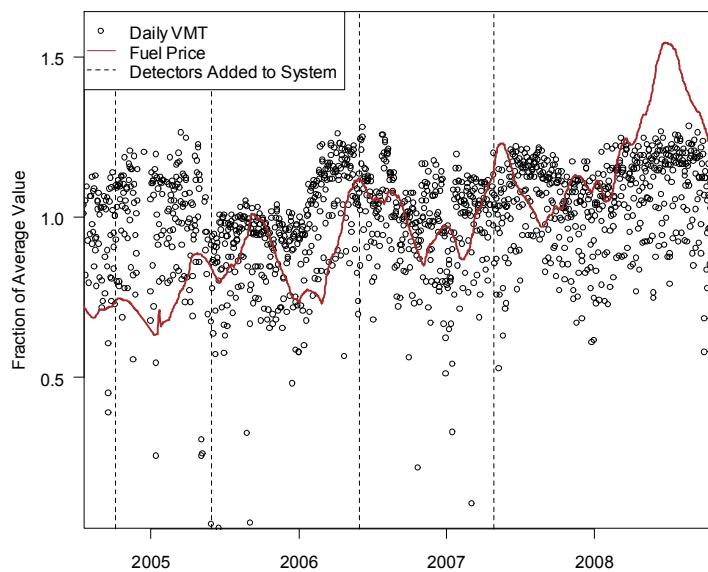
Planning-Operations Connection

- Planning for Operations
 - Regional Concept of Transportation Operations Grant
 - TSMO & ITS in RTP and TIP
 - MPO Committees
- Congestion Management
 - Non-recurring
 - Reliability
 - System management
 - Links to freight and demand management

Data Visualization Examples

- Fuel prices and travel
- Green transportation measures
- Freeway operations
- Transit system performance
- Freight system performance

Fuel Prices and Travel Measures

VMT and Gas Prices

Green Performance Measures

Factors Affecting Emissions

Travel

- Primary determinant
- VMT sometimes used as surrogate measure for emissions

Traffic

- Congestion and speed variability are important factors in urban emissions
- High speeds lead to fuel enrichment and heavy emissions
- Low speeds generate high emissions rates

Driver Behavior

- Modifying individual driving behaviors can affect emissions by 5 to 25%
- Fluidity and steadiness of speed yield the least emissions
- Aggressive accelerations and high speeds generate the most emissions

Roadway

- Steep highway grades cause increased emissions, especially at high speeds
- Surface roughness can increase emissions by increasing rolling resistance

Weather

- Affects mostly evaporative (non-exhaust) emissions
- Measure temperature, humidity, and sun exposure

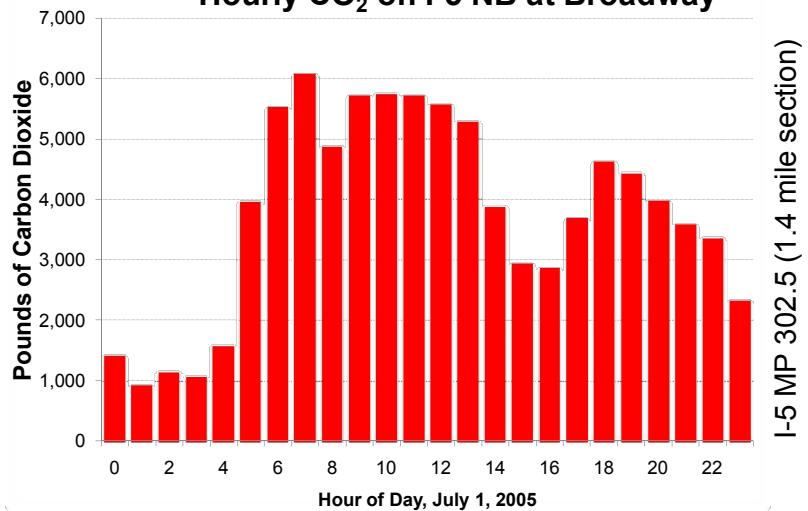
Vehicle

- Vehicles determine how above factors are translated into emissions
- Assess vehicle fleet distribution and usage over facility, vehicle class, and age

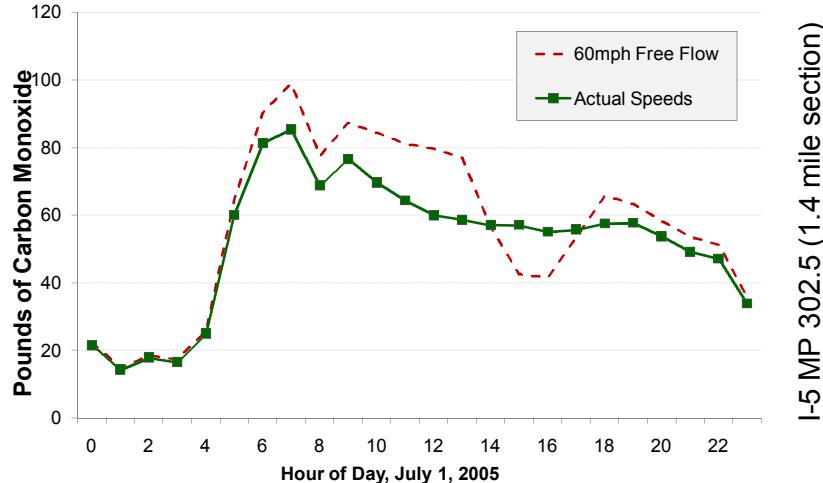
Emissions Estimation

	Regional Fuel Sales	Average Speed Models	Modal Models
Method	Carbon balance with fuel sales	Emissions rates tied to roadway average speed	Emissions based on individual vehicle modes of operation
Ideal Scope	Macro (regional, state, and national GHG inventories)	Meso to Macro	Micro (link and segment estimates)
Advantages	<ul style="list-style-type: none"> Minimal data needs 	<ul style="list-style-type: none"> Only needs speed and travel data Can be improved with other inputs (speed distribution) 	<ul style="list-style-type: none"> Captures more influences (Roadway and driver)

Hourly CO₂ on I-5 NB at Broadway

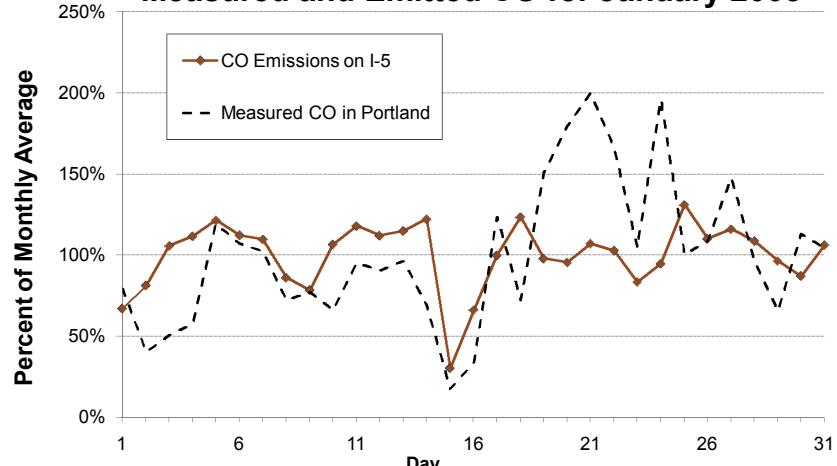


Hourly CO Emissions and Congestion



I-5 MP 302.5 (1.4 mile section)

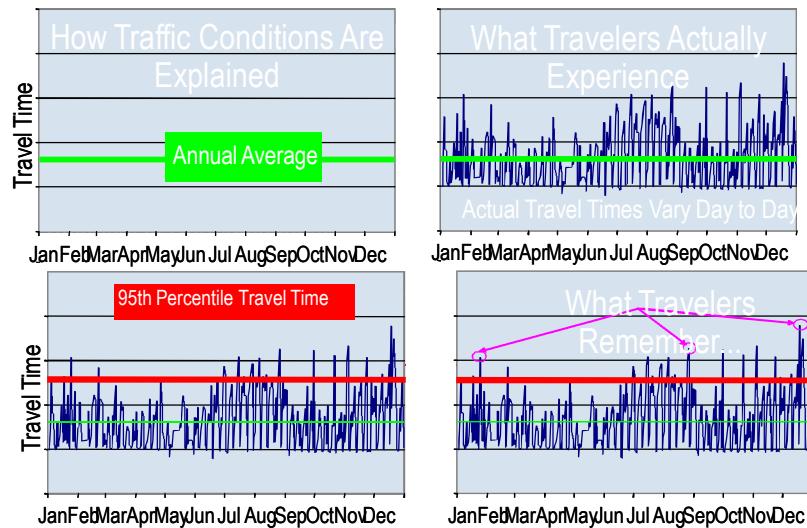
Measured and Emitted CO for January 2005



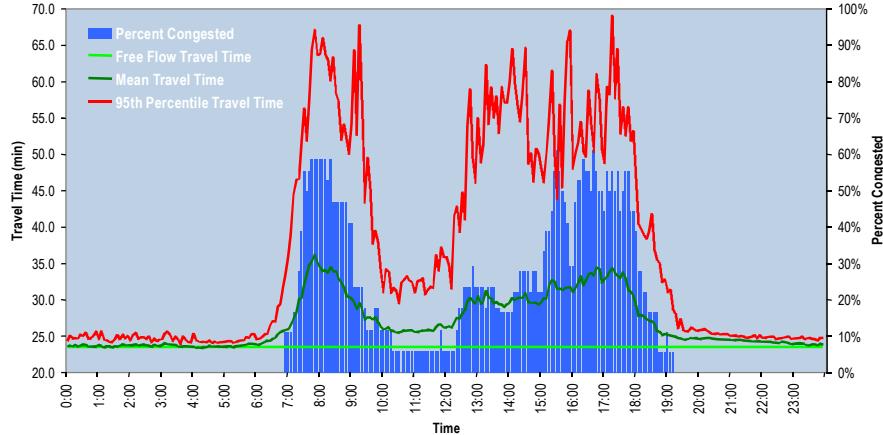
Note: There are many other factors (temperature) and sources (non-mobile) for CO in Portland. This was simply a sample visual comparison, not a correlation analysis.

Freeway System Performance

How Travelers View Reliability



Estimated Monthly Travel Time I-5 North September 2006

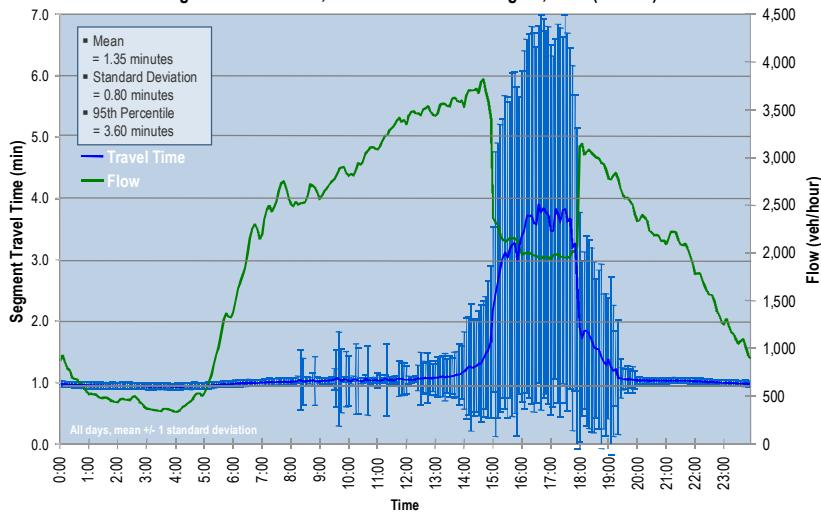


Lyman and Bertini, 2007



Reliability at the Segment Level

Segment Travel Time, Northbound I-5 at Going St., 2005 (0.75 mi)



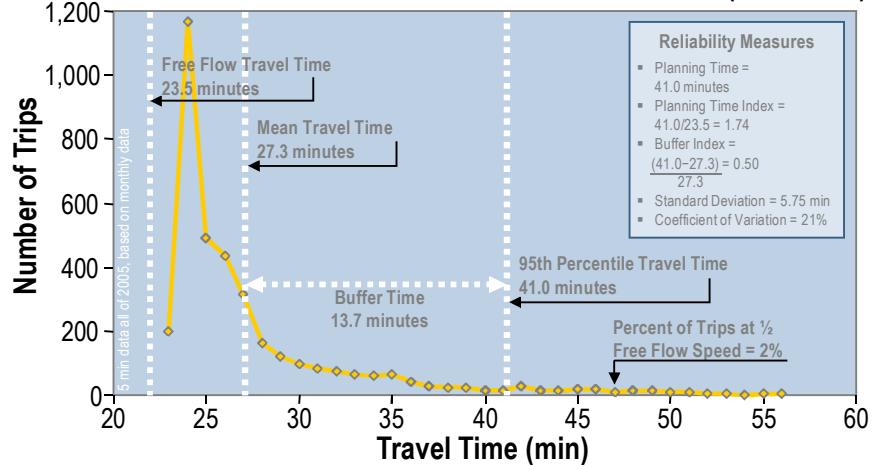
Lyman and Bertini, 2007

FHWA TMIP Webinar

Slide 22



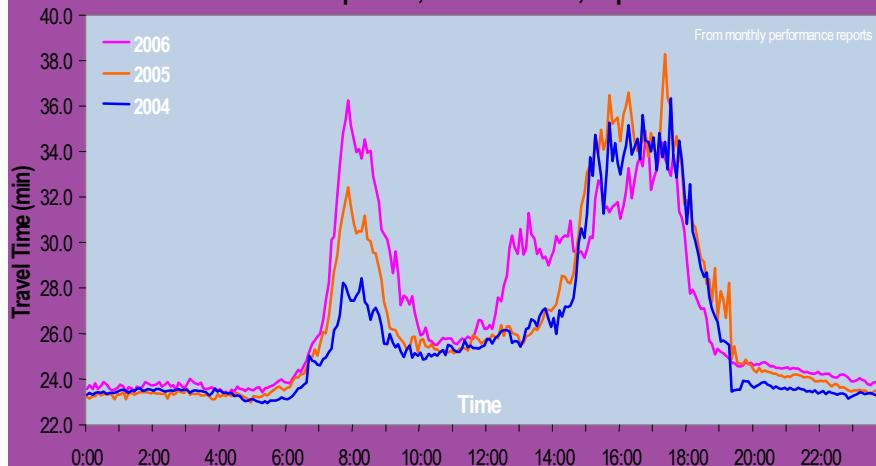
Distribution of Travel Times, Northbound I-5, 2005 (23.5 miles)



Lyman and Bertini, 2007



Travel Time Comparison, Northbound I-5, September 2004-2006



Lyman and Bertini, 2007



Mapping – Speed By Month



Average Evening Peak Speed (5-6 pm)

Metropolitan Congestion Over Time

Winter

Spring

Summer

Fall

2004



2005

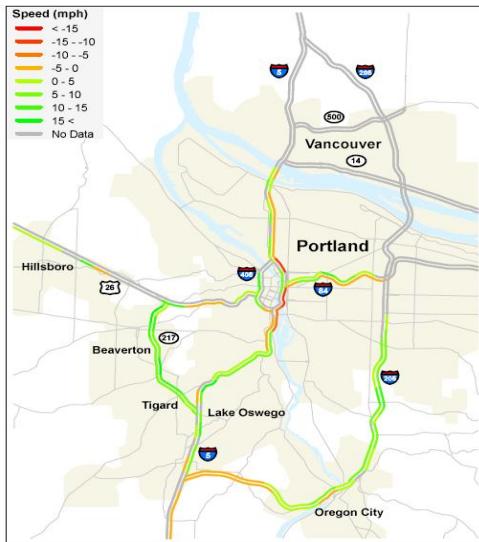


2006



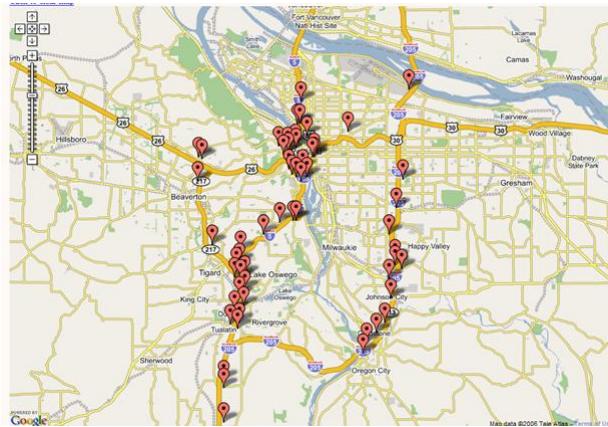
Mapping – Speed Subtraction

Difference
July-December 2005



Average
Evening Peak
Speed (5-6 pm)

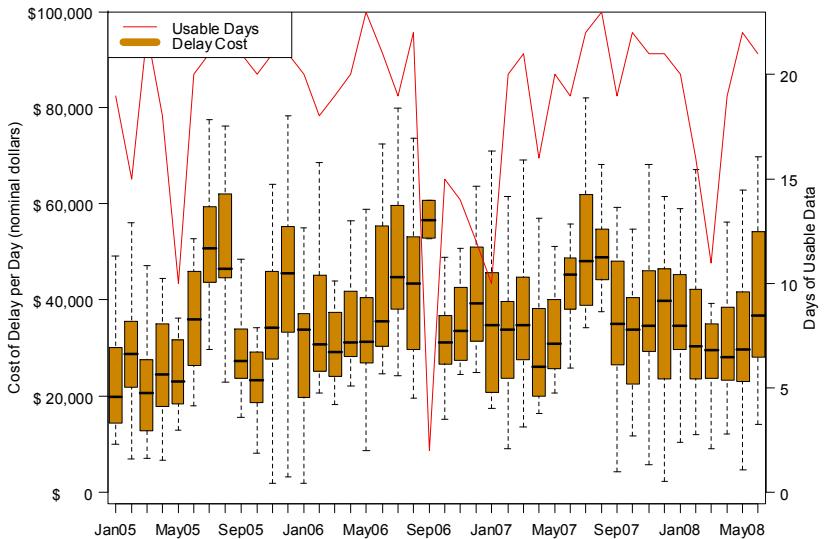
Data Quality Reports



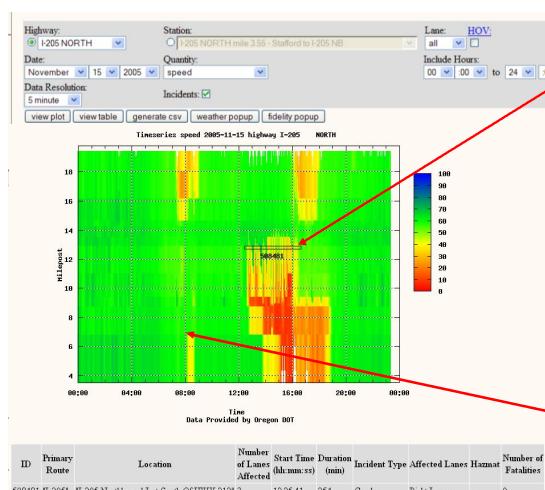
Stations Reporting (June 2006 weekdays):

- No Traffic (all lanes) > 20% of Samples
- Communications Failure > 15% of Samples

Daily Cost of Delay, I-5 NB (MP301 to MP308)



Incident Reports

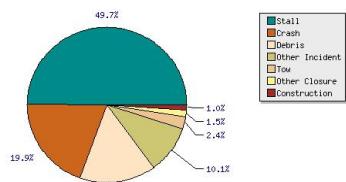


Incident on NB I-205, log truck rear-ended a nursery truck, two cars also involved, duration over 4 hours.

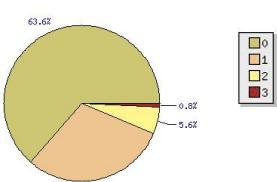
Incident on SB I-205, NB effects visible

Monthly Incident Reports

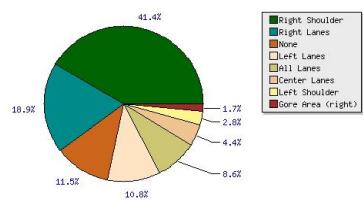
Incident Types



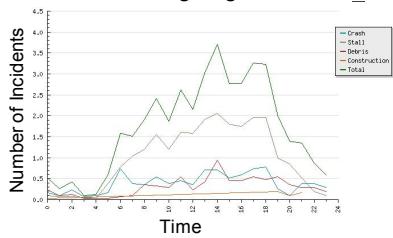
Number of Lanes Affected



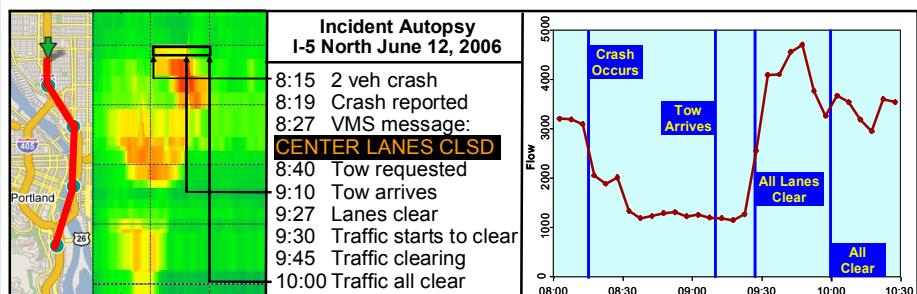
Incident Locations



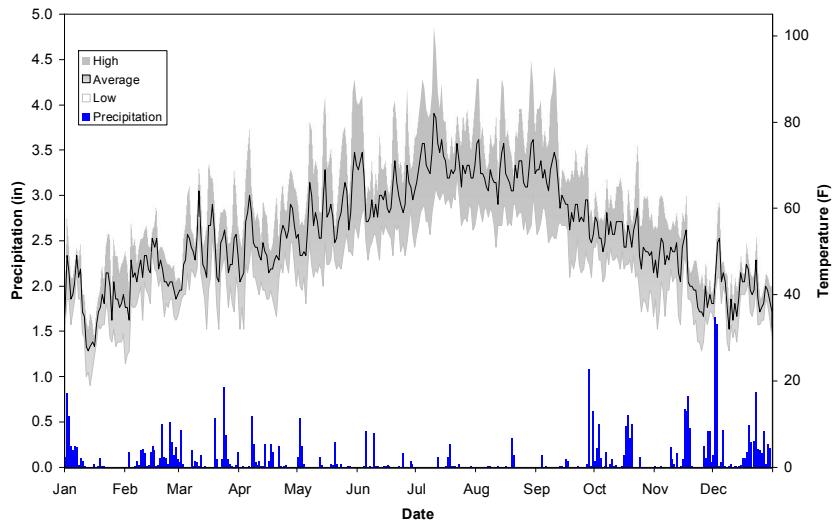
Number of Ongoing Incidents



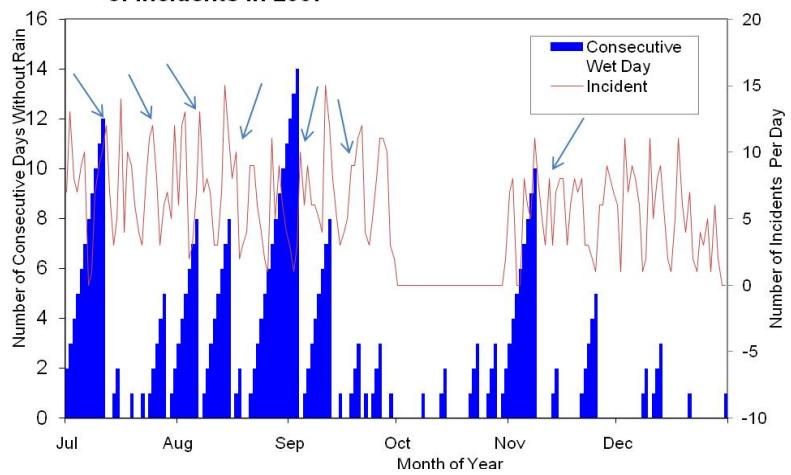
Incident Autopsy



Portland Temperature and Precipitation 2007

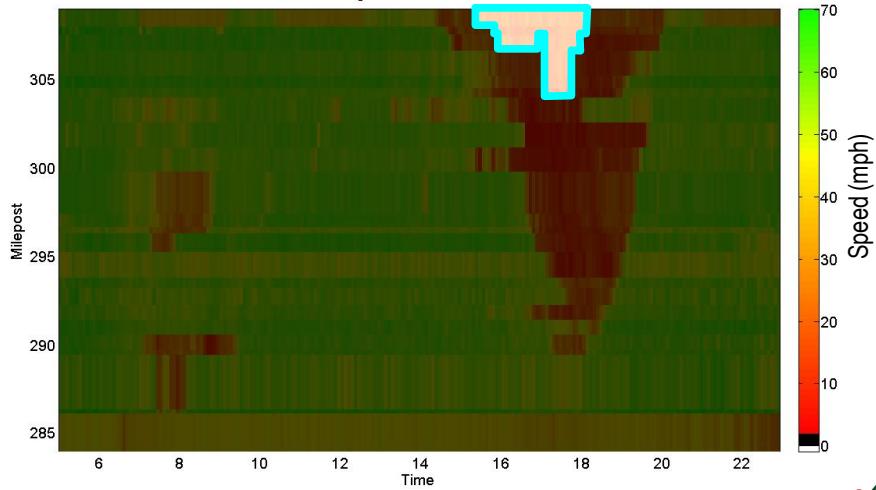


Number of Consecutive Days Without Rain vs Number of Incidents in 2007



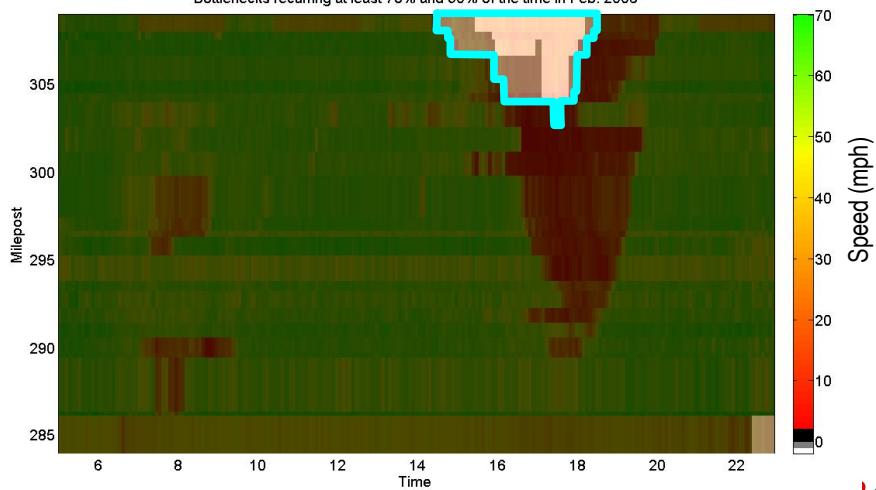
Systematically Identifying Bottlenecks

Bottlenecks recurring at least 90% of the time in Feb. 2008

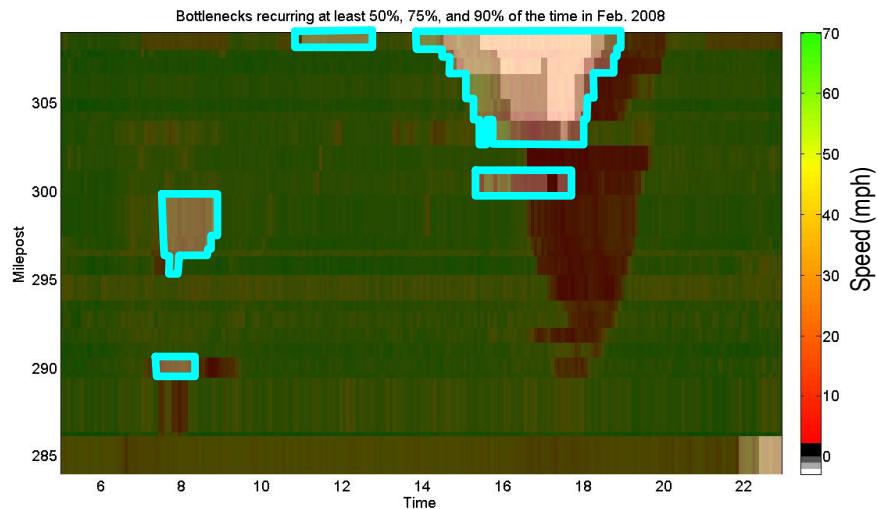


Systematically Identifying Bottlenecks

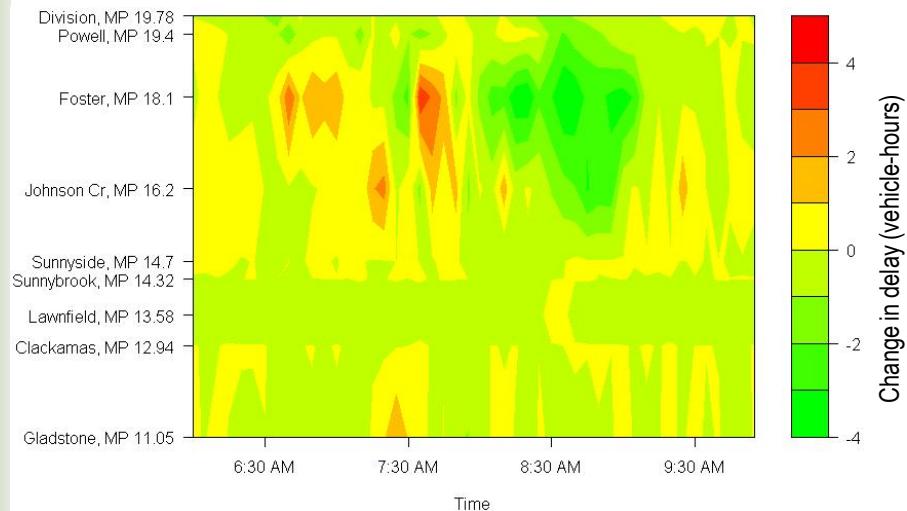
Bottlenecks recurring at least 75% and 90% of the time in Feb. 2008



Systematically Identifying Bottlenecks



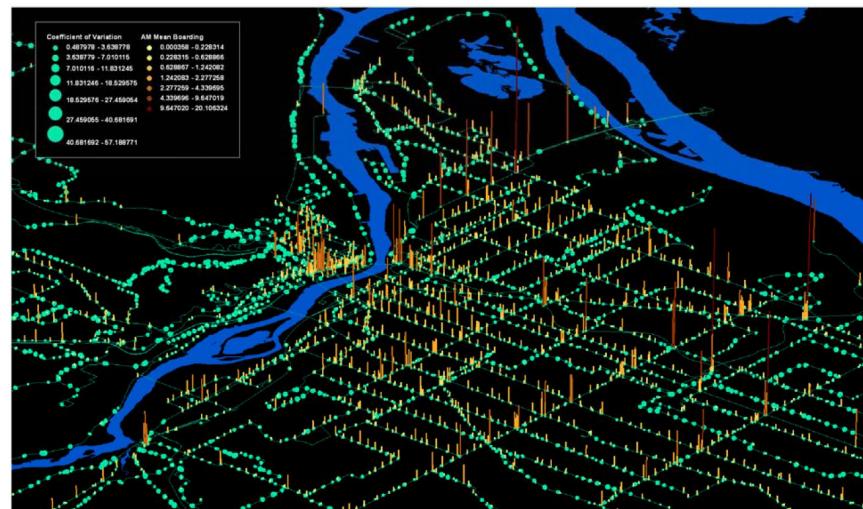
Ramp Meter Performance



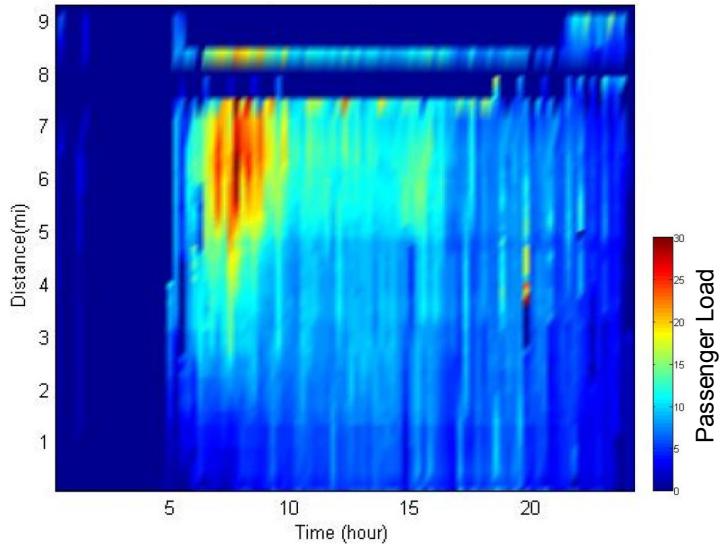
Transit System Performance

Passenger Boarding

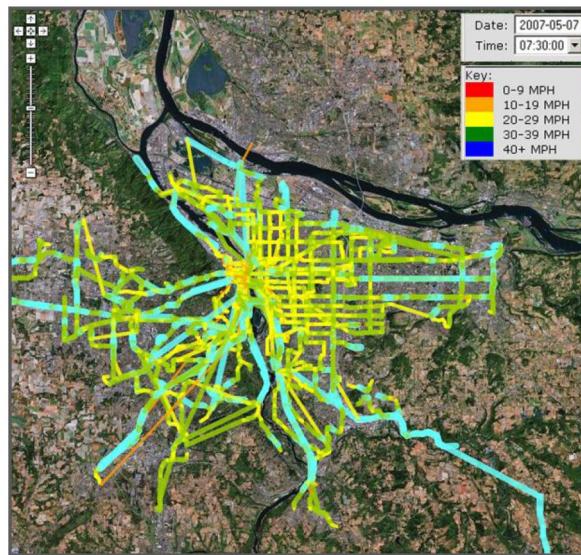
Coefficient of Variation	AM Mean Boarding
0.487978 - 3.636778	0.003056 - 0.228314
3.638778 - 7.010115	0.228315 - 0.828656
7.010116 - 11.831245	0.228316 - 1.028292
11.831246 - 18.529575	0.228317 - 2.277258
18.529576 - 27.456054	0.228318 - 4.339695
27.456055 - 40.581691	0.339696 - 9.647019
40.581692 - 57.188771	0.647020 - 20.106224



Passenger Boarding



Speeds as Reported By Bus



Freight System Performance Measures

Oregon Freight Data Mart

Oregon Freight Data Mart Prototype

A map-based interface to freight related data with data from Port of Portland PORTAL and ODOT.

Oregon Freight Data Mart Project Description

Data Layers

 Bottlenecks

 AM

 PM

 Truck Incidents

Incident Level: Min [0] Max [4]

Date Range

From: 1999-01-01 To: 2008-10-31

Num Incidents to Display: 25

 Truck Volumes

 Truck Generators

 Weigh-in-motion Stations

Google Traffic

Google Street View

Highway Speed and Reliability

1-10 AM Peak (7-9 AM)

1-10 PM Peak (4-9 PM)

1-5 AM All Peak (7-9 AM)

1-5 PM All Peak (4-9 PM)

Land Use Maps

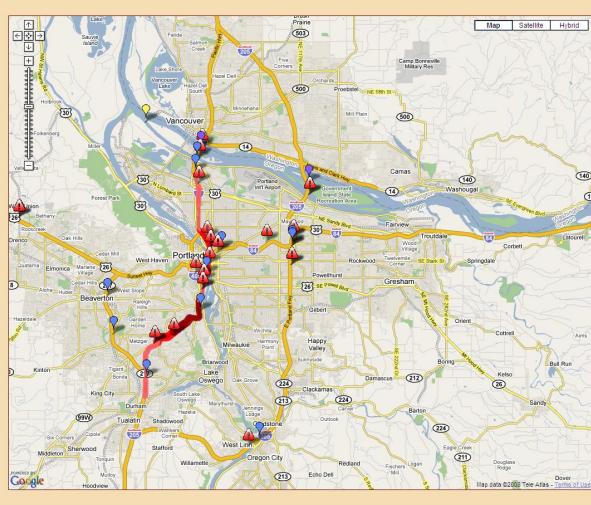
Freight Volume Maps

Data Sources

Links

Publications and Presentations

This project is funded by the Oregon Research and Education Consortium (OREC)



Truck Incident Display

Oregon Freight Data Mart Prototype

A map-based interface to freight-related data with data from Port of Portland PORTAL and ODOT.

Oregon Freight Data Mart Project Description

Data Layers

Bottlenecks

All AM PM

Truck Incidents

Incident Level: Min 0 Max 4

Date Range:

From: 2001-08-01 To: 2001-08-31

Num Incidents to Display: 25

Truck Volumes

Truck Generators

Weigh-in-Motion Stations

Google Traffic

Google Street View

Highway Speed and Reliability

- I-5 NB All Peak (7-9 AM)
- I-5 NB PM Peak (4-6 PM)
- I-5 SB All Peak (7-9 AM)
- I-5 SB PM Peak (4-6 PM)

Land Use Maps

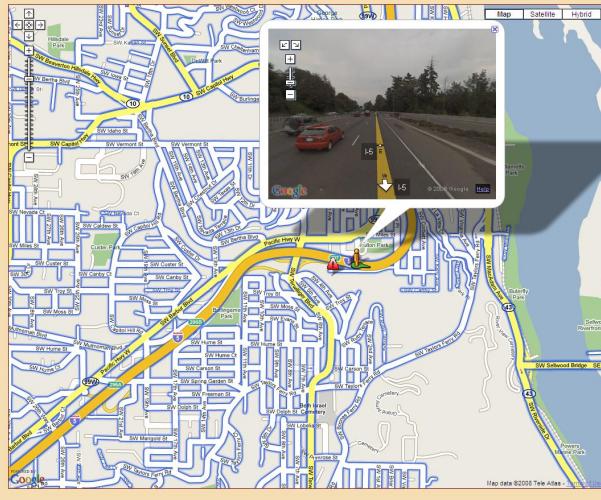
Freight Volume Maps

Data Sources

Links

Publications and Presentations

This project is funded by the Oregon Research and Education Consortium (OREC).



Slide 45



FHWA TMIP Webinar

Travel Speed and Reliability

Oregon Freight Data Mart Prototype

A map-based interface to freight-related data with data from Port of Portland PORTAL and ODOT.

Oregon Freight Data Mart Project Description

Data Layers

Bottlenecks

All AM PM

Truck Incidents

Incident Level: Min 0 Max 4

Date Range:

From: 2001-08-01 To: 2001-08-31

Num Incidents to Display: 25

Truck Volumes

Truck Generators

Weigh-in-Motion Stations

Google Traffic

Google Street View

Highway Speed and Reliability

- I-5 NB All Peak (7-9 AM)
- I-5 NB PM Peak (4-6 PM)
- I-5 SB All Peak (7-9 AM)
- I-5 SB PM Peak (4-6 PM)

Land Use Maps

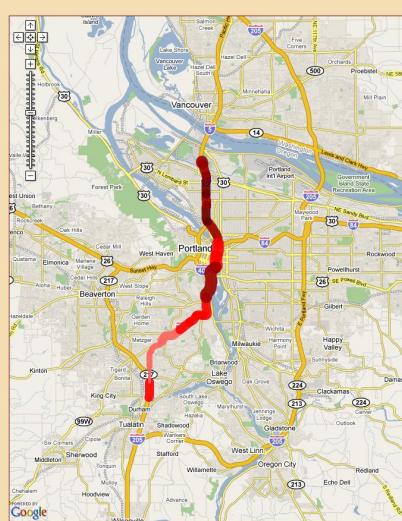
Freight Volume Maps

Data Sources

Links

Publications and Presentations

This project is funded by the Oregon Research and Education Consortium (OREC).



Slide 46



FHWA TMIP Webinar

Acknowledgments

- R.L. Bertini, Kristin Tufte, M.A. Figliozi, PORTAL Team
- National Science Foundation
- Oregon Department of Transportation
- Federal Highway Administration
- TransPort ITS Coordinating Committee
- City of Portland, Office of Transportation
- TriMet
- Oregon Engineering and Technology Industry Council
- PORTAL Team

Visit PORTAL Online:
<http://portal.its.pdx.edu>

FHWA TMIP Webinar

Slide 47

