Leveraging Archived Freeway Sensor Data for Regional Transportation Performance Measurement

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Portland Oregon Regional Transportation Archive Listing

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Portland State University

ABSTRACT

The performance of our transportation infrastructure critically affects our nation's economy, security, environment, and quality of life. Intelligent transportation systems (ITS) are one means for improving the efficiency, safety and sustainability of our transportation system. With an increasing focus on the use of performance measures for managing our transportation infrastructure, it is becoming increasingly possible to use real-time sensor data to create robust, user-friendly decision support systems. In partnership with the Oregon Department of Transportation (ODOT), the City of Portland, Metro, TriMet and other regional partners, Portland State University has developed the Portland Oregon Regional Transportation Archive Listing (PORTAL). With nearly 200 registered users, PORTAL archives data every 20 seconds from 500 freeway sensors, as well as incident data and weather report data for the Portland metropolitan region. PORTAL users have access to more than 132 GB of data, and can generate automated plots, tables and performance reports that address measures such as speed, flow, travel time, delay, vehicle miles traveled and vehicle hours traveled along the freeway network. Recent activities have focused on integrating incident data so that non-recurrent congestion can be tracked in addition to recurrent congestion. Further efforts to incorporate data from other sources has included the creation of a regional resource for archiving traffic count and classification data from multiple users in order to coordinate the availability of historical traffic data. Further development of graphical map displays of key performance measures allows users to "see" the changes in traffic conditions over time. Efforts have also included implementation of a data quality initiative, working with ODOT to improve and stabilize sensor data fidelity. In conformance with regional and Federal Highway Administration congestion reporting needs, a dashboard feature has been established, allowing reports to be generated automatically, including reports of the well-known travel time index, buffer index, and percent congested travel. Ongoing work includes the incorporation of transit probe data, testing and improvement of travel time algorithms and development of freight data sources.

What's in PORTAL Database?

Loop Detector Data
20-s count, occupancy, speed from 500 detectors (~2 mi spacing)

Incident Data
140,000 since 1999

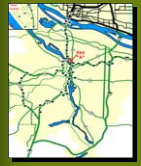
Weather Data

VMS Data
19 VMS since 1999

Web Interface
220 Registered Users

Data Archive

Days Since July 2004
About 300 GB
4.2 Million Intervals



Performance Measures
- Volume
- Speed
- Occupancy
- Delay
- VMT
- VHT
- Travel Time
- Reliability

What's Behind the Scenes?

Database Server
PostgreSQL, ROMS

Development Server
CentOS Linux distribution

Storage
2 Terabyte RAID

Overview

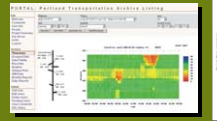
Welcome to PORTAL— the Portland Oregon Regional Transportation Archive Listing (http://portal.its.pdx.edu). This system is being developed at Portland State University by students and faculty in the Intelligent Transportation Systems (ITS) Lab under the direction of Dr. Robert L. Bertini. Sponsored by the National Science Foundation, we are working in close cooperation with the Oregon Department of Transportation (ODOT), Metro, the City of Portland, TriMet and other regional partners. The purpose of this project is to implement the archived data user service (ADUS) under the guidance of the National ITS Architecture for the Portland metropolitan region. Since July 2004, PORTAL has been archiving 20-second data from the 485 inductive detectors comprising the Portland region's Advanced Traffic Management System (ATMS). We also archive area weather data and plan to expand the capabilities of our system and to include multimodal data sources from both Oregon and Washington. We welcome your participation in our project.

Regional Infrastructure

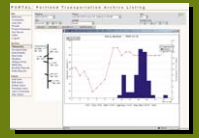
- 98 CCTV Cameras
- 138 Ramp Meters
- TriMet Automatic Vehicle Location and Bus Dispatch System
- Extensive fiber optics network
- Bi-state region
- Regional ITS
- Committee: TransPort
- Data sharing philosophy
- Gigabit ethernet/private ITS network
- PSU official data archive entity

Querying the Archive

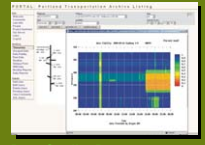
The web interface allows users to perform queries on 5-min aggregated data to extract volume, speed, occupancy, vehicle miles traveled, vehicle hours traveled, travel time, and delay. The user can specify a point on the freeway or a full highway segment, the time period and specific travel lanes. Users can display summaries of data from multiple days. The data can be grouped by hour of day, day of week, or week of year. The user can also determine the statistics they wish to see, including, mean, minimum value, maximum value, and standard deviation. The user can also generate congestion-related performance measures for the entire region.



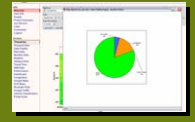
Contour Plots - Speed



Weather Popup



Data Quality Popup



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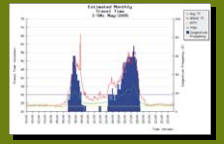
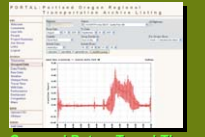
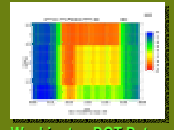


Performance Report

Monthly Report



Grouped Data – Travel Time



Washington DOT Data

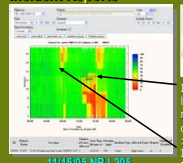
Time Series - Volume

Daily Dashboard

Bus Probe Arterial Speed Map

Travel Time Reliability

Incident Reports

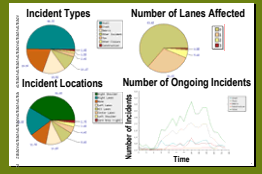


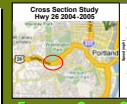
11/15/05 NB I-205

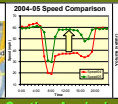
- 20,000 reported incidents/year
- 92 Database fields
- 4 Entries per incident

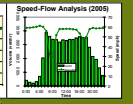
Incident on NB I-205, log truck rear-ended nursery truck, two cars involved, duration >4 hrs
Incident on SB I-205, NB effects visible

Monthly Incident Reports









Freeway Cross Section Analysis

Archiving ITS Data

Data archiving for ITS refers to the systematic retention and re-use of operational ITS data. Though the original and primary purpose of generating these data is often for real-time management of transportation systems, archiving these otherwise-discarded data offers a rich source of information to various entities and agencies with a heightening need to evaluate system performance and characteristics on a continuing basis. Once retained, the vast amount of ITS-generated data can be used in transportation planning, administration and research by key stakeholders including metropolitan planning organizations (MPOs), state transportation planners, traffic management operators, transit operators and transportation researchers.

Mapping:
Speed Subtraction

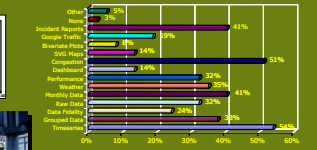
Request an Account

Let Us Hear From You!

Future Work

The Intelligent Transportation Systems Lab (www.its.pdx.edu) has been designated as the regional archiving site for ITS data from Portland and adjacent areas of southwestern Washington. The design and implementation of this archive are being carried out in accordance with the functional requirements for ADUS set forth in the National ITS Architecture. By openly sharing algorithms and experiences, all regions can benefit from past experiences. In Portland, we are emphasizing the development of a multimodal resource that is benefiting all transportation agencies via a unique collaborative environment established by the TransPort committee.

User Survey: What Are People Using?



Expanding Functionality

- Data from:
  - 1995-2004 (15 min)
  - TriMet bus probe locations
  - Washington State DOT
  - City of Portland arterials
  - ODOT WIM Data
- Additional processing tools and performance measures
- Web interface expanding use of archived data
- Increasing awareness of value of these systems
- Decision support for transportation officials in the region

ITS

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