Data Quality Monitoring in PORTAL 2.0

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Portland OR metro region

1,400,000 urban area residents living
65,600 businesses
33,229 acres of parks and natural areas
3,210 miles of roadway
2,686 signalized intersections
830 miles of rivers and streams
66 miles of light rail track
25 cities
3 counties
1 region
Regional Data Archive

Why Now?
- Building a performance-based long-range transportation plan
- Increased focus on better management of transportation system
- Beyond level-of-service decision making

Key benefits
- Transportation data is more accessible
- Sharing data in a central location saves money
- Provides critical data to support transportation planning, operations and investment decisions
PORTAL Background

- Official ADUS for Portland–Vancouver Metro Region
- Established 2004; Now (2010) – working on PORTAL 2.0
- Wide-variety of Users
  - Local transportation professionals
  - Regional Transportation Plan
  - Local news media
  - Research projects
- Funding
  - TransPort MTIP (OR), RTC (WA), OTREC, NSF, FHWA
PORTAL Database and Web Site

OR & WA Loop Detector Data

Incident & Crash Data

Arterial Data – Transit, Probe, Signal

WIM Data

Performance Metrics; Map-Based; Graphical Data Visualization

Intelligent Transportation Systems: Saving Lives, Time and Money
Reduced volumes in 2009 improved speeds during the PM peak period.
PORTAL measures reliability

I-5 SB at Marine Drive (2006)

I-84 EB at 60th (2006)

The longer the vertical bar the more variability in travel speed.
PORTAL compares design performance

Interchange spacing = 0.15 miles

Interchange spacing = 2 miles

Speed/Volume Relationship
ORE 217 at Denney Road

Max flow = 2000

Speed Volume Relationship
I-205 NB Stafford Road

Max flow = 2250

Intelligent Transportation Systems: Saving Lives, Time and Money
PORTAL measures traffic incident impacts

No incident (total delay cost $7,000)

With Incident (total delay and incident cost $58,000)
Data Quality

- **Goal:** Efficient use of maintenance resources
  - Prioritize detectors to be visited

- **Field Visits**
  - Correlate anomalies observed in the data with issues in the field

- **Web site**
  - Detectors producing suspicious data
    - Detectors not producing data
    - Detectors with data failing pre-set criteria (i.e. 20-sec vol > 17, speed > 100 mph, etc.) at a high rate
  - Offline detectors (construction, damage, etc.)
Field Visits – Low Occupancy

Amplifier Card Update, AM April 14, 2009

Intelligent Transportation Systems: Saving Lives, Time and Money
Field Visits – High Speed

Controller Update, April 15, 2009

Intelligent Transportation Systems: Saving Lives, Time and Money
Field Visits – Variability

I-5 NB at Stafford
Lane 2 – Speed – April 10, 2009
Before Controller Card Update

I-5 NB at Stafford
Lane 2 – Speed – April 17, 2009
After Controller Card Update
Data Quality – Offline Detectors

Detector Data Quality Control

The following tables were constructed by processing loop detector data on 2010_06_22. For monthly or weekly reports, the data used to generate the report will include one month or week of data prior to the selected day. For a day report, the data of the selected day is used to generate the report.

### Offline Detectors

<table>
<thead>
<tr>
<th>detectorId</th>
<th>stationId</th>
<th>highwayId</th>
<th>rampId</th>
<th>locationDescription</th>
<th>milepost</th>
<th>count</th>
<th>description</th>
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<tbody>
<tr>
<td>1009</td>
<td>1002</td>
<td>1</td>
<td>1002</td>
<td>Stafford Rd WB to NB</td>
<td>286.3</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1010</td>
<td>1002</td>
<td>1</td>
<td>1002</td>
<td>Stafford Rd WB to NB</td>
<td>286.3</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1011</td>
<td>1002</td>
<td>1</td>
<td>1002</td>
<td>Stafford Rd WB to NB</td>
<td>286.3</td>
<td>4319</td>
<td>construction-related</td>
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<tr>
<td>1017</td>
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<td>1</td>
<td>1003</td>
<td>Nyberg EB to NB</td>
<td>289.4</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1018</td>
<td>1003</td>
<td>1</td>
<td>1003</td>
<td>Nyberg EB to NB</td>
<td>289.4</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1019</td>
<td>1003</td>
<td>1</td>
<td>1003</td>
<td>Nyberg EB to NB</td>
<td>289.4</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1022</td>
<td>5003</td>
<td>1</td>
<td>1003</td>
<td>Nyberg EB to NB</td>
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<tr>
<td>1025</td>
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<td>1</td>
<td>1004</td>
<td>Nyberg WB to NB</td>
<td>289.63</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1026</td>
<td>1004</td>
<td>1</td>
<td>1004</td>
<td>Nyberg WB to NB</td>
<td>289.63</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1027</td>
<td>1004</td>
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<td>1004</td>
<td>Nyberg WB to NB</td>
<td>289.63</td>
<td>4319</td>
<td>construction-related</td>
</tr>
<tr>
<td>1080</td>
<td>1040</td>
<td>2</td>
<td>1040</td>
<td>Nyberg EB</td>
<td>289.28</td>
<td>1318</td>
<td>construction-related</td>
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</table>

Intelligent Transportation Systems: Saving Lives, Time and Money
# Data Quality – Damaged Detectors

## Damaged Detectors

<table>
<thead>
<tr>
<th>detectorid</th>
<th>stationid</th>
<th>highwayname</th>
<th>locationtext</th>
<th>ATMS lane number</th>
<th>field lane number</th>
<th>startdate</th>
<th>enddate</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1671</td>
<td>1089</td>
<td>US 26 EAST</td>
<td>Parkway EB</td>
<td>1</td>
<td>3</td>
<td>2009-10-22</td>
<td></td>
<td>construction interruption</td>
</tr>
<tr>
<td>1253</td>
<td>1028</td>
<td>I-5 SOUTH</td>
<td>Columbia Blvd SB</td>
<td>2</td>
<td>2</td>
<td>2009-05-11</td>
<td></td>
<td>construction interruption</td>
</tr>
<tr>
<td>1256</td>
<td>5028</td>
<td>I-5 SOUTH</td>
<td>Columbia Blvd SB</td>
<td>1</td>
<td>3</td>
<td>2009-05-11</td>
<td></td>
<td>construction interruption</td>
</tr>
<tr>
<td>1675</td>
<td>5089</td>
<td>US 26 EAST</td>
<td>Parkway EB</td>
<td>1</td>
<td>3</td>
<td>2009-10-22</td>
<td></td>
<td>construction interruption</td>
</tr>
<tr>
<td>1022</td>
<td>5003</td>
<td>I-5 NORTH</td>
<td>Nyberg EB to NB</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>Temporary off until repaired by E.C(was damaged by an auto accident)</td>
</tr>
<tr>
<td>1026</td>
<td>1004</td>
<td>I-5 NORTH</td>
<td>Nyberg WB to NB</td>
<td>2</td>
<td>2</td>
<td>2009-10-13</td>
<td></td>
<td>construction-related</td>
</tr>
<tr>
<td>1033</td>
<td>1040</td>
<td>I-5 SOUTH</td>
<td>Nyberg SB</td>
<td>1</td>
<td>3</td>
<td>2009-10-15</td>
<td></td>
<td>construction-related</td>
</tr>
<tr>
<td>1303</td>
<td>5034</td>
<td>I-5 SOUTH</td>
<td>Greeley Ave SB</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>Micro loops bad</td>
</tr>
<tr>
<td>1615</td>
<td>1081</td>
<td>US 26 EAST</td>
<td>Helvetia EB</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>Loops out again due to construction until the project can fix them</td>
</tr>
<tr>
<td>1766</td>
<td>1110</td>
<td>I-205 NORTH</td>
<td>ORE 43 NB-NB</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>Video detection problems</td>
</tr>
<tr>
<td>1672</td>
<td>1089</td>
<td>US 26 EAST</td>
<td>Parkway EB</td>
<td>2</td>
<td>2</td>
<td>2009-10-22</td>
<td></td>
<td>construction interruption</td>
</tr>
<tr>
<td>1017</td>
<td>1003</td>
<td>I-5 NORTH</td>
<td>Nyberg EB to NB</td>
<td>1</td>
<td>3</td>
<td>2009-10-14</td>
<td></td>
<td>construction-related</td>
</tr>
<tr>
<td>1236</td>
<td>1026</td>
<td>I-5 SOUTH</td>
<td>Jantzen Beach SB</td>
<td>1</td>
<td>3</td>
<td>2009-06-25</td>
<td></td>
<td>The loops were either ground out or paved over due to repairs to the road surface from winter damage. The contractor will be installing new loops.</td>
</tr>
<tr>
<td>1002</td>
<td>1001</td>
<td>I-5 NORTH</td>
<td>Stafford Rd</td>
<td>2</td>
<td>2</td>
<td>2009-10-18</td>
<td></td>
<td>construction-related</td>
</tr>
</tbody>
</table>
**Suspicious Data Criteria**

- 20-second Volume > 17
- Occupancy > 95%
- Speed > 100 MPH
- Speed < 5 MPH (?)
- Low maximum occupancy
- Low average occupancy during peaks
## Detector Data Quality Control

The following tables were constructed by processing loop detector data on 2010-01-08. For monthly or weekly reports, the data used to generate the report will include one month or week of data prior to the selected day. For a day report, the data of the selected date is used to generate the report.

### Configuration Errors

<table>
<thead>
<tr>
<th>detectorid</th>
<th>stationid</th>
<th>highwayname</th>
<th>locationtext</th>
<th>ATMS lane number</th>
<th>field lane number</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1291</td>
<td>1033</td>
<td>I-5 NORTH</td>
<td>Jantzen Beach NB</td>
<td>1</td>
<td>3</td>
<td>3.92</td>
</tr>
<tr>
<td>1228</td>
<td>1025</td>
<td>I-5 SOUTH</td>
<td></td>
<td>1</td>
<td>3</td>
<td>1.50</td>
</tr>
<tr>
<td>1466</td>
<td>1060</td>
<td>I-84 WEST</td>
<td>58th WB</td>
<td>3</td>
<td>1</td>
<td>1.06</td>
</tr>
<tr>
<td>1803</td>
<td>1115</td>
<td>I-205 SOUTH</td>
<td>10th Street to I-205 SB</td>
<td>1</td>
<td>2</td>
<td>0.26</td>
</tr>
<tr>
<td>1835</td>
<td>1122</td>
<td>US 26 WEST</td>
<td>US26 WB @ I-405 Count Station</td>
<td>1</td>
<td>1</td>
<td>0.23</td>
</tr>
<tr>
<td>1551</td>
<td>1080</td>
<td>OR 217 SOUTH</td>
<td>Walker Rd SB</td>
<td>1</td>
<td>3</td>
<td>0.23</td>
</tr>
<tr>
<td>1717</td>
<td>1095</td>
<td>US 26 WEST</td>
<td>Murray Rd WB</td>
<td>3</td>
<td>1</td>
<td>0.21</td>
</tr>
<tr>
<td>1432</td>
<td>1056</td>
<td>I-84 EAST</td>
<td>16th EB</td>
<td>1</td>
<td>3</td>
<td>0.14</td>
</tr>
<tr>
<td>1830</td>
<td>1121</td>
<td>I-405 SOUTH</td>
<td>Montgomery to I-405 SB</td>
<td>2</td>
<td>2</td>
<td>0.14</td>
</tr>
<tr>
<td>1765</td>
<td>1104</td>
<td>I-205 SOUTH</td>
<td>ORE 43 SB</td>
<td>1</td>
<td>2</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Detectors that have the largest percentage of volume readings over 17

### Occupancy > 95 — Detector Always Occupied

<table>
<thead>
<tr>
<th>detectorid</th>
<th>stationid</th>
<th>highwayname</th>
<th>locationtext</th>
<th>ATMS lane number</th>
<th>field lane number</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1474</td>
<td>1061</td>
<td>I-84 WEST</td>
<td>Sandy WB</td>
<td>3</td>
<td>1</td>
<td>99.95</td>
</tr>
</tbody>
</table>
System-Wide Data Quality Metric

- **Uses**
  - Performance measure for maintenance group
  - Determine to which detectors to direct maintenance visits

- **Metric**
  - Percent of offline data readings
  - Percent of suspicious data readings
  - System-level, highway-level and station-level
  - Separate damaged detectors from those that can be improved with a maintenance visit
Arterial Data Quality

- System detectors can be count stations
- Validate data collection
- Establish feedback loop and web site for arterial signal detectors

**Volume vs. Time**

- Manual Count
- Smoothed Detector Count
- Raw Detector Count

**Graph 1:**
- SE Sunnyside Rd & SE 86th Ave (rightmost 3 lanes)
- Speed vs. Time
  - Time: 7:00 PM to 7:45 PM
  - Speed: 0 to 80

**Graph 2:**
- Vehicle Count vs. Time
  - Time: 7:15 PM to 7:40 PM
  - Vehicle Count: 0 to 100
Thank you!

http://portal.its.pdx.edu
Acknowledgments

- R.L. Bertini – ITS Lab and PORTAL founder
- Colleagues –
  - Chris Monsere, Miguel Figliozzi, Kelly Clifton, Ashley Haire, Portland State University
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- Sponsors –
  - Transport ITS Coordinating Committee
  - RTC (Southwest Washington Regional Transportation Council)
  - OTREC
  - City of Portland, Office of Transportation
  - Oregon Department of Transportation
  - TriMet
  - Federal Highway Administration
  - National Science Foundation
  - Oregon Engineering and Technology Industry Council