11-22-2013

Piloting Portland's MultiModal Arterial Performance System

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Piloting Portland’s Multi-Modal Arterial Performance System

November 22, 2013

Why Performance Measures?

➢ “What Gets Measured Gets Done”

➢ Reality-Focus rather than Prediction

➢ MAP-21 → Accountability

MAP-21

Moving Ahead for Progress in the 21st Century
Why **Not** Performance Measures?

- It costs too much
- What to collect & where to start?
- Lacking reliability, confidence, or resolution in data
- Data overload...how to make it useful?
- Software gives me answers that are “close enough”

Arterial Performance Background

- NCHRP 3-79: Measuring the Performance of Auto Traffic on Urban Streets
  - Delay & Queue Measurement
  - Running Time

Purdue Univ. – NCHRP 3-79
Data-Driven Vision for Arterial Performance

- Archive & Share Data
- Define desired outcomes & objectives
- Evaluate against outcomes & objectives
- Data Collection Plan/Program
- Validate Data & Summarize Results
- Conduct Collection
Concept for Arterial Performance Management

- Agree upon outcomes and measures
- Establish best data collection technologies & approach
- Leverage existing infrastructure and mainstream collection
- Fuse different data sources into a complete picture
- Establish institutional agreements and resources

Operations Arterial Performance Objectives

- Reduce congestion
- Minimize delay
- Minimize travel time
- Minimize queue spillback
- Reduce travel speeds
- Reduce traveler frustration
- Better inform traveler(s)

Monitor to determine/confirm problem, appropriate solutions, and on-going performance metrics
### Users of Arterial Performance Data & Information

<table>
<thead>
<tr>
<th>Role</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planners</td>
<td>want to understand future needs and how to invest wisely</td>
</tr>
<tr>
<td>Engineers/Operators</td>
<td>want to know how well this system is working</td>
</tr>
<tr>
<td>Modelers &amp; Researchers</td>
<td>want to investigate trends and ideas</td>
</tr>
<tr>
<td>Traveling Public</td>
<td>want information about their trip</td>
</tr>
</tbody>
</table>
Arterial Performance Guidance

Data Collection Guidance
- Point Based Travel Time (2 mile spacing)
- Vehicle Classification & Speed
- Vehicle Volume & Delay
- Intersection Operations
- Transit Measures
- Pedestrian Measures
- Bicycle Measures

Collector or Local Street

Arterial

Legend
- Intersection Operations & Transit Signal Priority
- Vehicle Classification
- Vehicles
- Pedestrian
- Bicycle
- Vehicle Speed
- Travel Time (Point Based)
- Volume
- Delay

TransSuite® Traffic Signal System

Detectors

Other Data Collection Devices

Other Server System(s)

PORTAL Data Warehouse

Visualizations & Reports
Criteria for Top Arterial Performance Candidates

- Street is of Regional Importance
- Frequent Transit Service
- Basic Corridor Readiness
- Signal & Comm System to Automate

Pilot Project – 82\textsuperscript{nd} Avenue Key Findings

- Successfully Leveraged Existing Infrastructure to Semi-Automate Multi-modal Data Sources
- Data interfaces are missing or incomplete
- Recognize strength & weakness of data sources
  - Ease of use, biases, etc...
- Location, Location, Location
System Detection

Length-Based Classification

Service Cabinet

To Burnside Signal
Intersection Count Data

View Volume Logs For: 10 - US26 @ 185th  24 - 185th @ Cornell

<table>
<thead>
<tr>
<th>Date</th>
<th>Start Time</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/25/11</td>
<td>16:00</td>
<td>17:00</td>
</tr>
</tbody>
</table>

### NORTHWEST SIGNAL

<table>
<thead>
<tr>
<th>Date</th>
<th>Start Time</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/23/11</td>
<td>16:00</td>
<td>17:00</td>
</tr>
</tbody>
</table>

#### Truck Priority

![Truck Priority Image]
Bicycle Count Stations

**BIKE DETECTION (NEW)**
Installed parallelogram inductive bike loop to count bike traffic.

**Performance Metrics**

<table>
<thead>
<tr>
<th>Name</th>
<th>NB/SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday PM Peak</td>
<td>13 / 7</td>
</tr>
<tr>
<td>Hour Bike Volume</td>
<td></td>
</tr>
<tr>
<td>Weekday Bike ADT</td>
<td>160 / 100</td>
</tr>
<tr>
<td>Weekend Bike ADT</td>
<td>130 / 85</td>
</tr>
</tbody>
</table>

Transit Performance Data (TriMet)

**TriMet AVL Data**
TriMet AVL data provides real-time vehicle tracking and can be aggregated to determine on-time performance for bus routes.

<table>
<thead>
<tr>
<th>Route</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB Route 72</td>
<td>64%</td>
</tr>
<tr>
<td>SB Route 72</td>
<td>78%</td>
</tr>
</tbody>
</table>

Data from TriMet, Fall 2012 (3:30 - 5:30 PM)

**Transit Signal Priority (TSP)**
Transit signal priority (TSP) operates by transmitting location and vehicle information to traffic signals which prioritizes transit vehicles at signals.

**Transit Signal Priority Performance 82nd/Woodward**

<table>
<thead>
<tr>
<th>Direction</th>
<th>NB</th>
<th>SB</th>
<th>WP</th>
<th>WW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calls Per Hour</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Avg. Extension (sec)</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>
Bluetooth™ “Probe” Permanent Locations

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Date Range</th>
<th>Speed</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>82th: Glisan - Springwater</td>
<td>3/4/12 – 3/10/12</td>
<td>454</td>
<td>+ 9.5%</td>
</tr>
<tr>
<td>82th: Springwater - Glisan</td>
<td>9/9/12 – 9/15/12</td>
<td>497</td>
<td>+ 7.1%</td>
</tr>
<tr>
<td>Powell: 8th - 42nd</td>
<td>3/4/12 – 3/10/12</td>
<td>3064</td>
<td>+ 3.1%</td>
</tr>
<tr>
<td>Powell: 42nd - 8th</td>
<td>9/9/12 – 9/15/12</td>
<td>3689</td>
<td>+ 3.5%</td>
</tr>
</tbody>
</table>

Bluetooth™ “Probe” Speed & TT

[Graph showing travel times and speed data]
**Probe Data → 24/7**

<table>
<thead>
<tr>
<th>Periods</th>
<th>Buffer IndexBefore</th>
<th>Buffer IndexAfter</th>
<th>Δ in Buffer Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weekdays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free 12:00 AM – 6:30 AM</td>
<td>46%</td>
<td>42%</td>
<td>-4%</td>
</tr>
<tr>
<td>Coord 6:30 AM - 9:00 AM</td>
<td>39%</td>
<td>43%</td>
<td>4%</td>
</tr>
<tr>
<td>Coord 9:00 AM - 3:00 PM</td>
<td>41%</td>
<td>44%</td>
<td>3%</td>
</tr>
<tr>
<td>Coord 3:00 PM - 6:30 PM</td>
<td>70%</td>
<td>55%</td>
<td>-15%</td>
</tr>
<tr>
<td>Coord 6:30 PM - 8:30 PM</td>
<td>36%</td>
<td>37%</td>
<td>1%</td>
</tr>
<tr>
<td>Free 8:30 PM – 11:59 PM</td>
<td>35%</td>
<td>31%</td>
<td>-4%</td>
</tr>
<tr>
<td><strong>24 Hour Average</strong></td>
<td>63%</td>
<td>54%</td>
<td>-9%</td>
</tr>
<tr>
<td><strong>Saturdays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free 12:00 AM - 9:00 AM</td>
<td>34%</td>
<td>38%</td>
<td>4%</td>
</tr>
<tr>
<td>Coord 9:00 AM - 7:30 PM</td>
<td>32%</td>
<td>35%</td>
<td>3%</td>
</tr>
<tr>
<td>Free 7:30 PM - 11:59 PM</td>
<td>32%</td>
<td>32%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>24 Hour Average</strong></td>
<td>37%</td>
<td>39%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Bluetooth™ Origin-Destination**

<table>
<thead>
<tr>
<th>Source</th>
<th>Destination</th>
<th>Number of Trips</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>JER</td>
<td>COSTCO</td>
<td>3000</td>
<td>40.4%</td>
</tr>
<tr>
<td>COSTCO</td>
<td>JER</td>
<td>3000</td>
<td>40.4%</td>
</tr>
</tbody>
</table>
Fleet “Probe” Data (Inrix™)

Probe Data Comparison – Pilot Evaluation

**BLUETOOTH MAC ADDRESS READER**
A Bluetooth MAC address reader is used to measure segment travel time, speed and origin-destination data.

**INRIX DATA SEGMENT**
Inrix data is used to measure travel time and average speed data for a segment. (Inrix segment highlighted below)

**Performance Metrics**
- **Travel Time SE Foster to NE Gillian (NB)**: 8:10 mins
- **Travel Time NE Foster to SE Stark (SB)**: 7:58 mins

Data collected Portal, from Feb 10 - Oct 12, 2012 (4 - 6 PM)

Data based on Inrix 2010 average weekday (4 - 6 pm)
Controller Logs = Timing Effectiveness

BEFORE

AFTER

Service Delay Log

Level Of Service: System 12 - US95 Actual M1, Local 11 - pair
Service Delay Log: Pedestrians

**PEDESTRIAN DETECTION**

With pedestrian detection, delay and call request information can be collected and logged by a 2070 traffic controller.

<table>
<thead>
<tr>
<th>AM/PM Peak Period Pedestrian Performance</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Walk Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button Calls Per Hour (100 / 100)</td>
<td>-</td>
<td>18 / 58</td>
<td>-</td>
<td>18 / 58</td>
</tr>
<tr>
<td>Delay to Serve Call (sec) (360 / 360)</td>
<td>-</td>
<td>30 / 35</td>
<td>-</td>
<td>30 / 35</td>
</tr>
</tbody>
</table>

**Pedestrian Actuations for Division & 82nd**

Date: 02/01/2012-03/01/2012, Days: Sun,Thu,Tue,Fri, Time: 06:00 - 23:59

**% Arrival on Green = Timing Effectiveness**

Source: NWS Voyage Manual

**Phase 6 AOG Before and After Retiming**

 WESTBOUND
Red Clearance Extension

Summary Arterial Performance Measures

- **Transit**
  - On-Time Performance, Ons/Offs, Travel Time, # of TSP requests

- **Pedestrian**
  - Number of ped phases served, Transit Ons/Offs, ped delay

- **Bicycle**
  - Number of bikes, bicycle delay (if own detector input)
Summary Arterial Performance Measures

▶ Freight
  ▪ # of trucks (length-based), # of truck priority requests

▶ Autos
  ▪ # of vehicles (sys det or controller log), travel time, speeds, delay, % arrival on green, max outs v. gap outs

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Next Steps – Enhanced Logging

▶ Delay by Input
▶ TSP
▶ Red Extension
Next Steps – Improved Interfaces

Next Steps – Validation & Research

- Inrix, Bluetooth, Bike Counts, Controller Logs, GUIs
Next Steps – Continued Pilot Projects

- Outreach Workshops
- Target Funded Upcoming Capital Projects
- Incorporate into Design Specs/Guidance

Successful Arterial Performance

- **Quality Data**
  - Validate!

- ** Appropriateness** for Objectives/Outcomes &
  - Know outcomes first
  - No gadgets for gadgets sake

- ** Ease of Use** are of the utmost importance
  - Time is a valuable commodity
  - Interfaces to other systems/devices
Questions / Discussion?

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