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

Define desired outcomes & objectives

Archive & Share Data

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
<table>
<thead>
<tr>
<th>Users of Arterial Performance Data &amp; Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planners</strong></td>
</tr>
<tr>
<td>• want to understand future needs and how to invest wisely</td>
</tr>
<tr>
<td><strong>Engineers/Operators</strong></td>
</tr>
<tr>
<td>• want to know how well this system is working</td>
</tr>
<tr>
<td><strong>Modelers &amp; Researchers</strong></td>
</tr>
<tr>
<td>• want to investigate trends and ideas</td>
</tr>
<tr>
<td><strong>Traveling Public</strong></td>
</tr>
<tr>
<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: ≤ 1-mile spacing
- Vehicle Volume & Delay
- Intersection Operations
- Transit Measures
- Pedestrian Measures
- Bicycle Measures

Collector or Local Street

Legend
- Intersection Operations & Transit Signal Priority
- Transit Measures
- Emissions
- Vehicle Classification
- Vehicle Speed
- Travel Time (Point Based)
- Volume
- Delay
- Bicycle
- Pedestrian
- Arterial Detection Zone
- Arterial
Criteria for Top Arterial Performance Candidates

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

Pilot Project – 82nd 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
Intersection Count Data

View Volume Logs For: 10 - US526 @ 185th - 24 & 185th @ Cornell

NORTHWEST SIGNAL

Volume Logs For: 10 - US526 @ 185th - 24 & 185th @ Cornell

| Date       | Start Time | End Time | Volumes | Volume
|------------|------------|----------|---------|-------
| 10/27/11   | 10/26/11   | 10/26/11 | 114     | 160   |
| 10/24/11   | 10/24/11   | 10/24/11 | 114     | 160   |
| 10/21/11   | 10/21/11   | 10/21/11 | 114     | 160   |
| 10/18/11   | 10/18/11   | 10/18/11 | 114     | 160   |
| 10/15/11   | 10/15/11   | 10/15/11 | 114     | 160   |
| 10/12/11   | 10/12/11   | 10/12/11 | 114     | 160   |
| 10/09/11   | 10/09/11   | 10/09/11 | 114     | 160   |
| 10/06/11   | 10/06/11   | 10/06/11 | 114     | 160   |

Truck Priority

Kittelson & Associates, Inc.
Bicycle Count Stations

**BIKE DETECTION (NEW)**

Installed parallelogram inductive bike loop to count bike traffic.

<table>
<thead>
<tr>
<th>Performance Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Weekday PM Peak Hour Bike Volume</td>
</tr>
<tr>
<td>Weekday Bike ADT</td>
</tr>
<tr>
<td>Weekend Bike ADT</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>Performance</th>
<th>NB Route 22</th>
<th>SB Route 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Time (%)</td>
<td>84%</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.
Bluetooth™ “Probe” Permanent Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>3/4/12 – 3/10/12</th>
<th>9/9/12 – 9/15/12</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>82nd: Glisan - Springwater</td>
<td>454</td>
<td>497</td>
<td>+ 9.5%</td>
</tr>
<tr>
<td>82nd: Springwater - Glisan</td>
<td>421</td>
<td>451</td>
<td>+ 7.1%</td>
</tr>
<tr>
<td>Powell: 8th - 42nd</td>
<td>3064</td>
<td>3159</td>
<td>+ 3.1%</td>
</tr>
<tr>
<td>Powell: 42nd – 8th</td>
<td>3566</td>
<td>3689</td>
<td>+ 3.5%</td>
</tr>
</tbody>
</table>

Bluetooth™ “Probe” Speed & TT

[Map and Graph Showing Travel Times and Data Analysis]
### Probe Data \( \rightarrow \) 24/7

<table>
<thead>
<tr>
<th>Periods</th>
<th>Buffer IndexBefore(^1)</th>
<th>Buffer IndexAfter(^2)</th>
<th>Delta in Buffer Index (^3)</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

#### Butler Street as Origin

<table>
<thead>
<tr>
<th>Source (Next)</th>
<th>Destination (Previous)</th>
<th>Number of Trips</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCM Avon</td>
<td>34 E. Avon</td>
<td>2508</td>
<td>45.1%</td>
</tr>
<tr>
<td>Premier Plaza</td>
<td>34 E. Avon</td>
<td>2601</td>
<td>45.4%</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**

<table>
<thead>
<tr>
<th>Route</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time SE Foster to NE Gilsan (NB)</td>
<td>8:10 mins</td>
</tr>
<tr>
<td>Travel Time NE Foster to SE Stark (SB)</td>
<td>7:58 mins</td>
</tr>
</tbody>
</table>

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

Color Key:

A: Free Flow
B: Reasonably Free Flow
C: Stable Flow
D: Approaching Unstable Flow
E: Unstable Flow
F: Forced Flow
Service Delay Log: Pedestrians

**PEDESTRIAN DETECTION**

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

**AM/PM Peak Period Pedestrian Performance**

<table>
<thead>
<tr>
<th>Cross Walk Phase</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button Calls Per Hour</td>
<td>16 / 58</td>
<td>16 / 58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay to Serve Call (sec)</td>
<td>30 / 35</td>
<td>30 / 35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Arrival on Green = Timing Effectiveness

Source: NWS Voyage Manual

% Arrival on Green Before and After Retiming
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

Next Steps – Enhanced Logging

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

Inrix, Bluetooth, Bike Counts, Controller Logs, GUIs

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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