11-22-2013

# Piloting Portland's MultiModal Arterial Performance System

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*Kittleson & Associates, Inc.*

# Piloting Portland's Multi-Modal Arterial Performance System

November 22, 2013

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## 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

Hococonnect.blogspot.com

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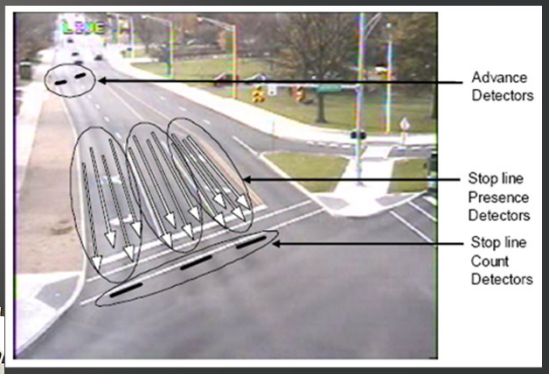
## Why Not Performance Measures?

- 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”

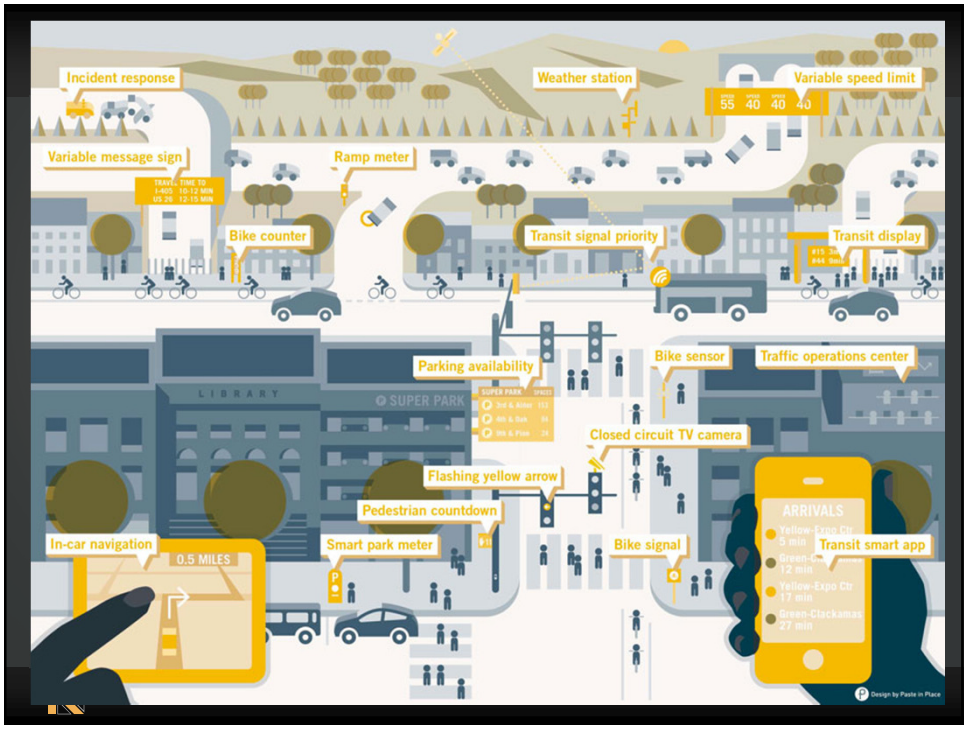



## Arterial Performance Background

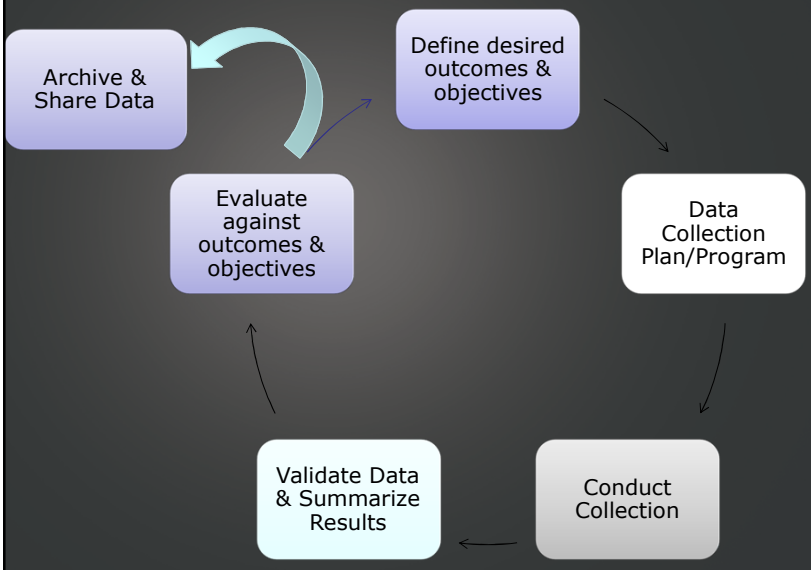
- NCHRP 3-79: Measuring the Performance of Auto Traffic on Urban Streets
  - Delay & Queue Measurement
  - Running Time




Purdue Univ. – NCHRP 3-79




## Data-Driven Vision for Arterial Performance

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## 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

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## 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*

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## Users of Arterial Performance Data & Information

### Planners
- want to understand future needs and how to invest wisely

### Engineers/Operators
- want to know how well this system is working

### Modelers & Researchers
- want to investigate trends and ideas

### Traveling Public
- want information about their trip

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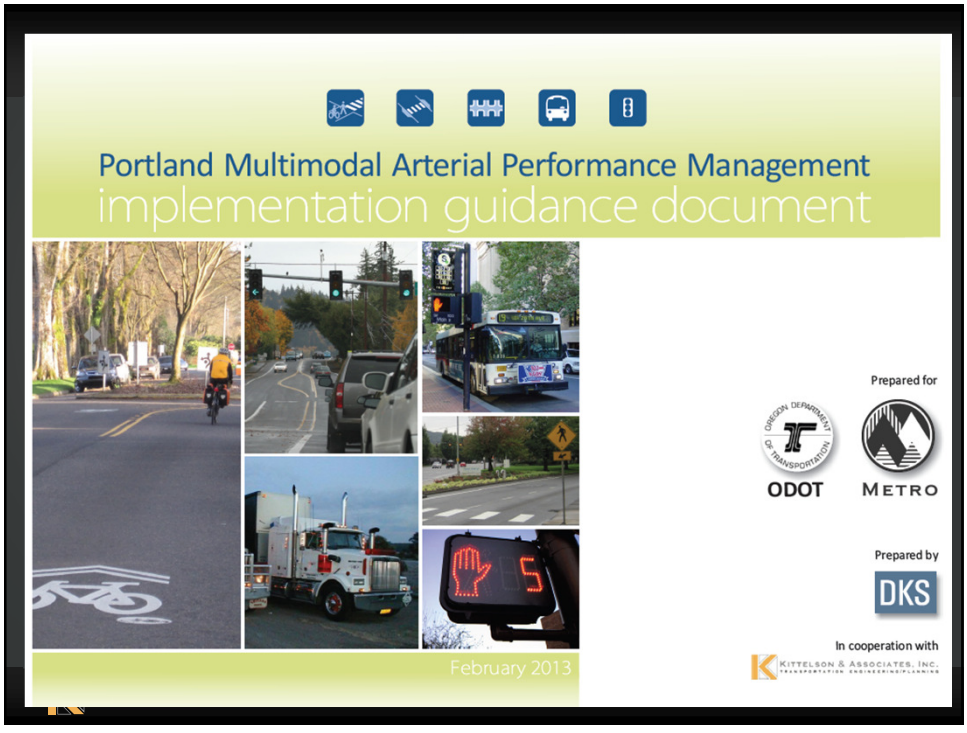
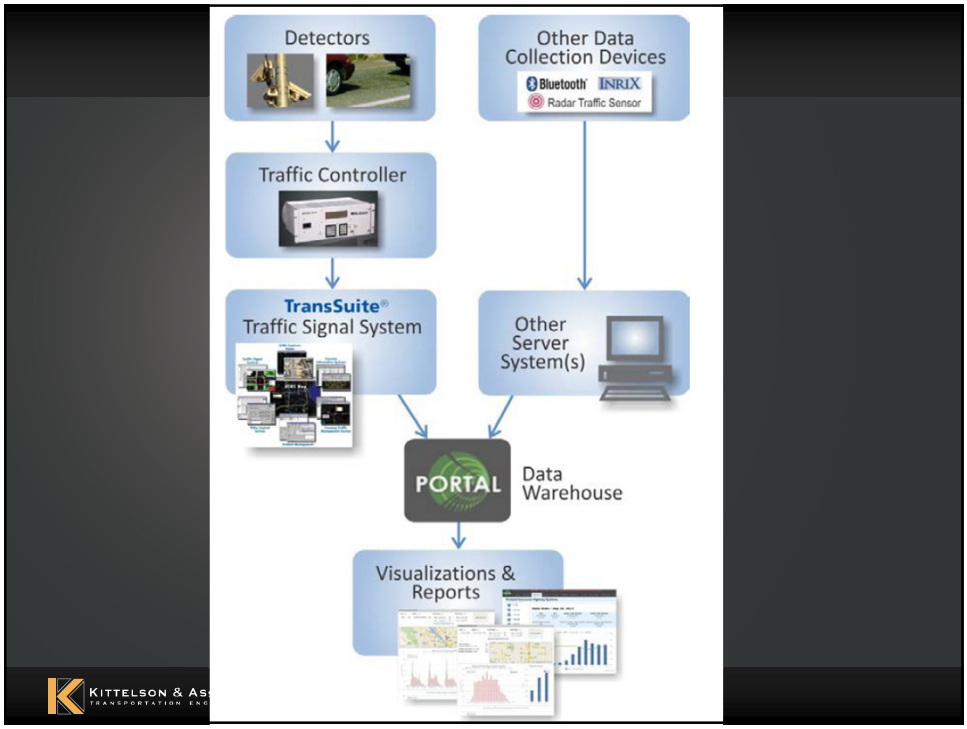
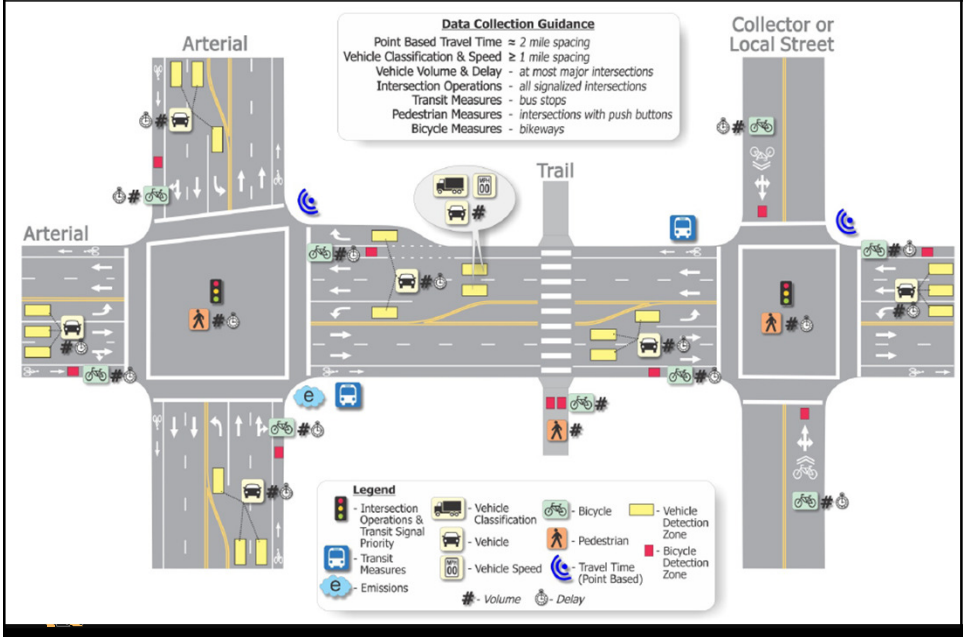





## Arterial Performance Guidance



## Criteria for Top Arterial Performance Candidates

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

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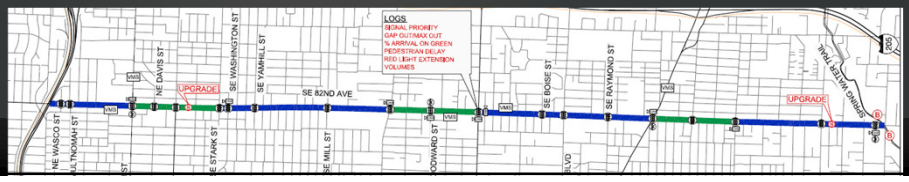
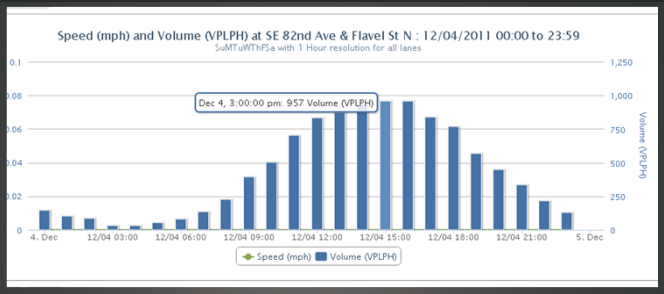
## Pilot Project – 82nd Avenue Key Findings

- 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




Rob Klug, Clark Co

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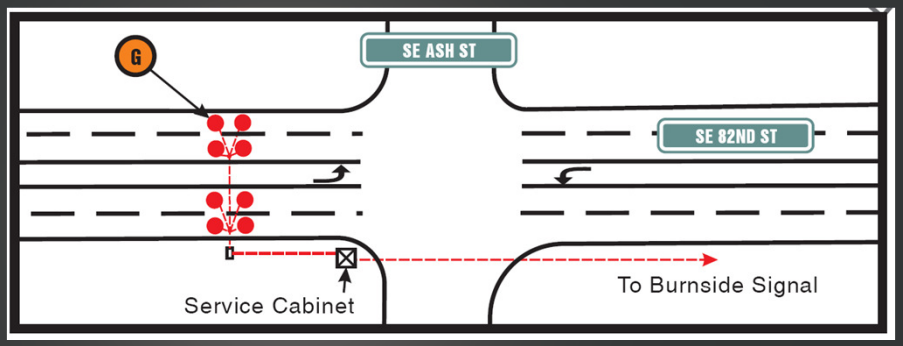
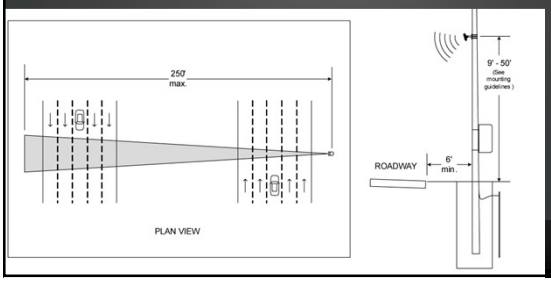
## Length-Based Classification




# Intersection Count Data


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

Print Volumes | Display Graph

Enter Date: 10/25/2011
Enter Start Time: 16:00
Enter End Time: 17:00

NORTHWEST SIGNAL

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

Tuesday, September 24, 2013 12:27

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of Records | 4 | | | | Sample Period (min.) | | | 15 |
| Date | Tuesday, October 25, 2011 | | | | Search Time | | | 16:00 - 17:00 |
| Detector | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Volume | 114 | 122 | 132 | 205 | 190 | 205 | 190 | 270 |
| Detector | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Volume | 407 | 989 | 747 | 0 | 0 | 385 | 537 | 656 |
| Detector | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Volume | 0 | 198 | 522 | 954 | 4 | 274 | 235 | 315 |
| Detector | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| Volume | 80 | 455 | 533 | 1 | 0 | 0 | 0 | 0 |

Dates of Stored Volume Logs

10/27/11
10/26/11
10/25/11
10/24/11
10/23/11
10/22/11
10/21/11
10/20/11
06/01/11
05/31/11
05/30/11
05/29/11
05/28/11
05/27/11

# Truck Priority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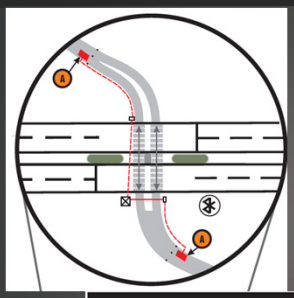
## Bicycle Count Stations



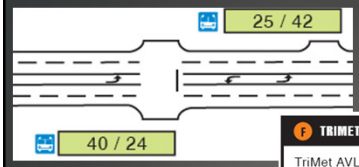
**A BIKE DETECTION (NEW)**

Installed parallelogram inductive bike loop to count bike traffic.

**Performance Metrics**

| Name | NB/SB |
|---|---|
| Weekday PM Peak Hour Bike Volume | 13 / 7 |
| Weekday Bike ADT | 160 / 100 |
| Weekend Bike ADT | 130 / 85 |

## Transit Performance Data (TriMet)




**F TRIMET CAD/AVL DATA**

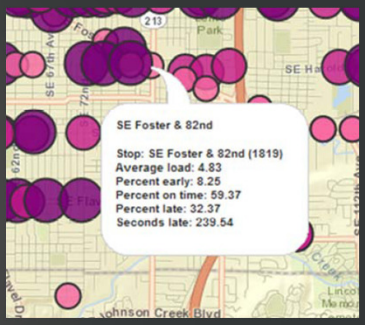
TriMet AVL data provides real time vehicle tracking and can be aggregated to determine on-time performance for bus routes.

**Bus On-time Performance**

**PM Peak hour**

| | |
|---|---|
| NB Route 72 | 84% |
| SB Route 72 | 78% |

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




**I TRANSIT SIGNAL PRIORITY (TSP)**

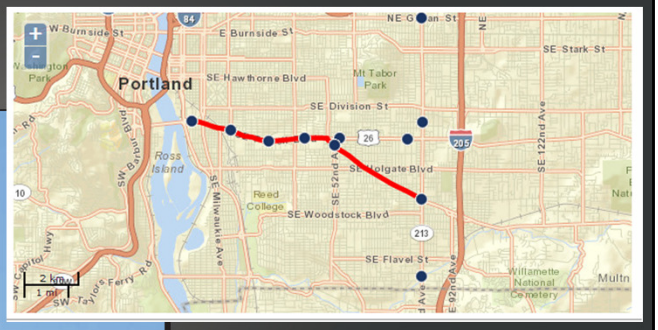
Transit signal priority (TSP) operates by transmitting location and vehicle information to traffic signals which prioritize transit vehicles at signals

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

| Direction | NB | EB | SB | WB |
|---|---|---|---|---|
| Calls Per Hour | 0 | - | 8.8 | - |
| Avg. Extension (sec) | 0 | - | 11 | - |

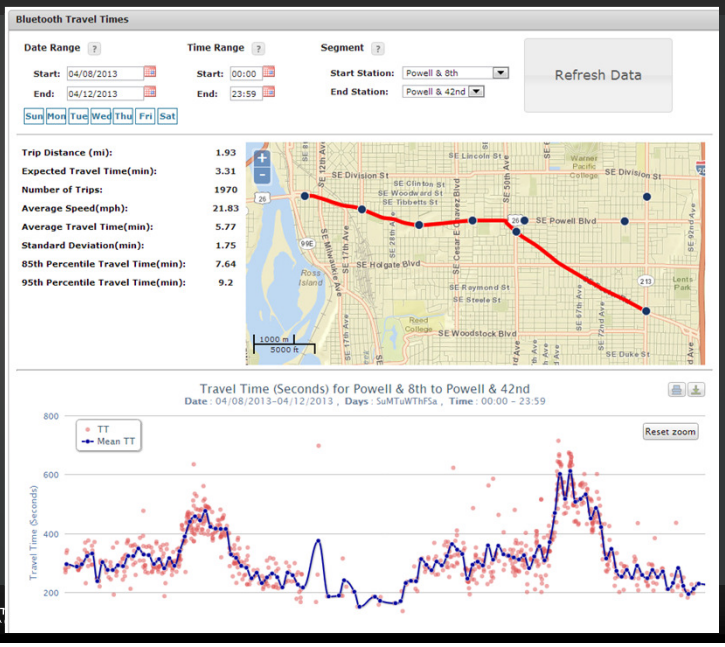
Data collected from TransSuite; Oct 15 - 19, 2012

# Bluetooth™ "Probe" Permanent Locations




| | 3/4/12 – 3/10/12 | 9/9/12 – 9/15/12 | Delta |
|---|---|---|---|
| 82nd: Glisan - Springwater | 454 | 497 | + 9.5% |
| 82nd: Springwater - Glisan | 421 | 451 | + 7.1% |
| Powell: 8th - 42nd | 3064 | 3159 | + 3.1% |
| Powell: 42nd – 8th | 3566 | 3689 | + 3.5% |

# Bluetooth™ "Probe" Speed & TT



## Probe Data → 24/7

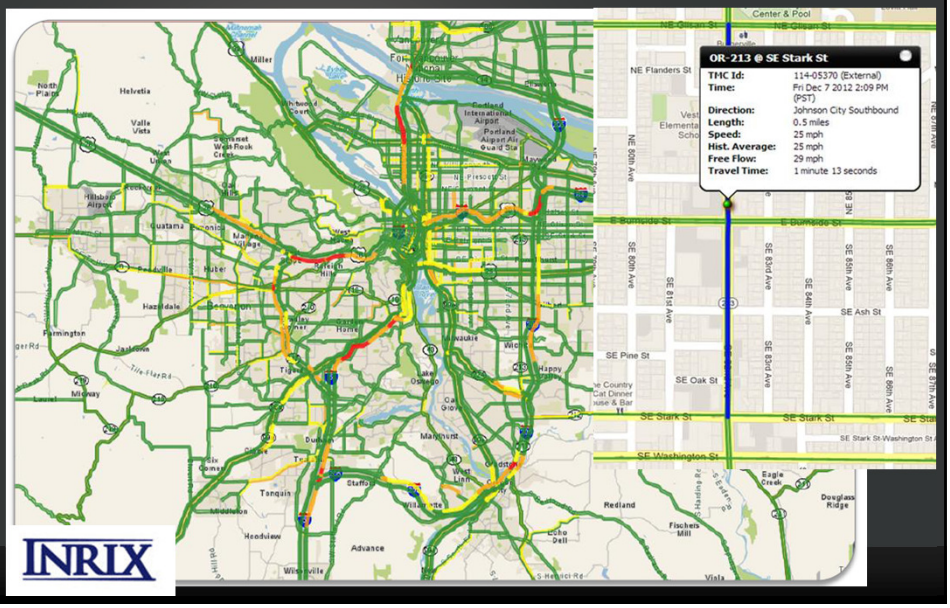
| Pre-SCATS Plan | Periods | Eastbound Buffer IndexBefore[1] | Eastbound Buffer IndexAfter[1] | Eastbound Δ in Buffer Index |
|---|---|---|---|---|
| | | | | **Weekdays** |
| Free | 12:00 AM – 6:30 AM | 46% | 42% | -4% |
| Coord | 6:30 AM - 9:00 AM | 39% | 43% | 4% |
| Coord | 9:00 AM - 3:00 PM | 41% | 44% | 3% |
| Coord | 3:00 PM - 6:30 PM | 70% | 55% | -15% |
| Coord | 6:30 PM - 8:30 PM | 36% | 37% | 1% |
| Free | 8:30 PM – 11:59 PM | 35% | 31% | -4% |
| 24 Hour Average | | 63% | 54% | -9% |
| | | | | **Saturdays** |
| Free | 12:00 AM - 9:00 AM | 34% | 38% | 4% |
| Coord | 9:00 AM - 7:30 PM | 32% | 35% | 3% |
| Free | 7:30 PM - 11:59 PM | 32% | 32% | 0% |
| 24 Hour Average | | 37% | 39% | 2% |

## Bluetooth™ Origin-Destination

Butler Street as Origin


| Loc | Destination | Number of Trips | Percentage |
|---|---|---|---|
| | 48th Ave | 2628 | 61.6% |

## Fleet "Probe" Data (Inrix™)




## Probe Data Comparison – Pilot Evaluation

**D BLUETOOTH MAC ADDRESS READER**

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

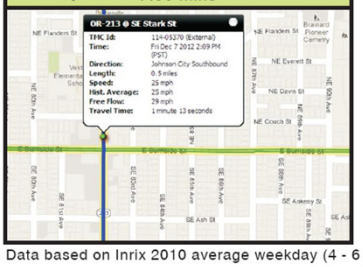
| Performance Metrics |
|---|
| Travel Time From Foster Road (NB) |
| → 10:40 mins |
| Travel Time To Foster Road (SB) |
| ← 10:41 mins |

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

**E 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 Glisan (NB) |
| → 8:10 mins |
| Travel Time NE Foster to SE Stark (SB) |
| ← 7:58 mins |




Data based on Inrix 2010 average weekday (4 - 6 pm)

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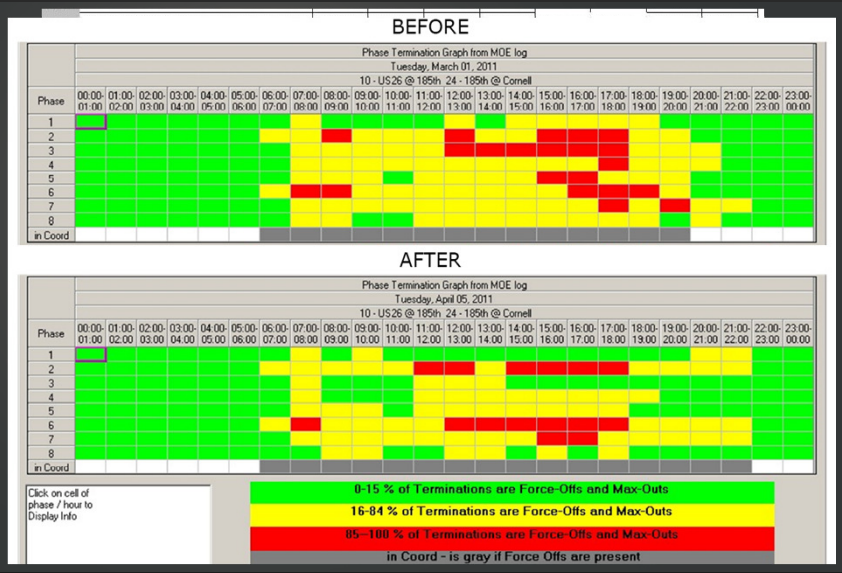
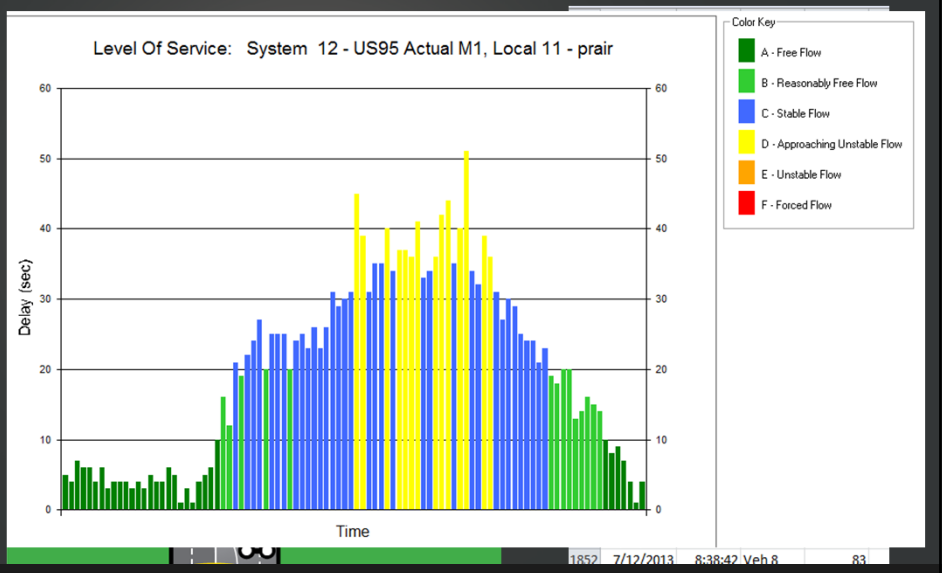
## Controller Logs = Timing Effectiveness






## Service Delay Log

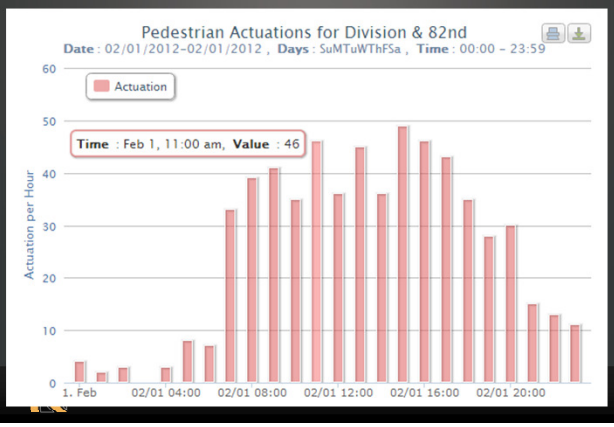


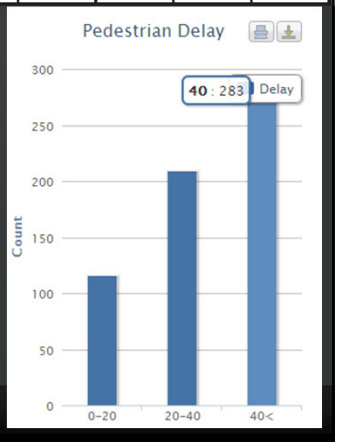
# Service Delay Log: Pedestrians

**B PEDESTRIAN DETECTION**

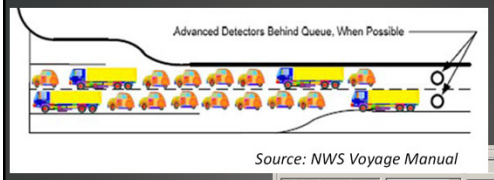
With pedestrian detection, delay and call request information can be collected and logged by a 2070 traffic controller

| AM/PM Peak Period Pedestrian Performance | | | | |
|---|---|---|---|---|
| Cross Walk Phase | 2 | 4 | 6 | 8 |
| Button Calls Per Hour | - | 16 / 58 | - | 16 / 58 |
| Delay to Serve Call (sec) | - | 30 / 35 | - | 30 / 35 |



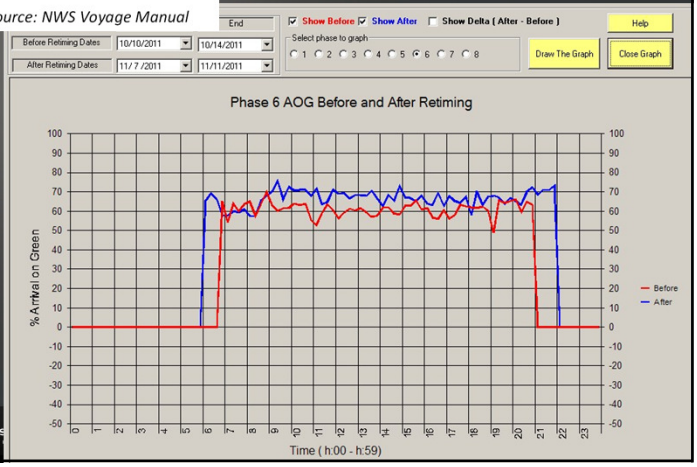




# % Arrival on Green = Timing Effectiveness




*Source: NWS Voyage Manual*

WESTBOUND

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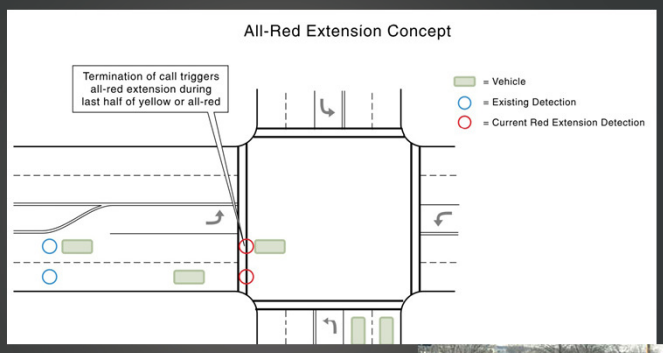
## Red Clearance Extension




## Summary Arterial Performance Measures

- Transit
  - On-Time Performance, Ons/Offs, Travel Time, # of TSP requests
- Pedestian
  - Number of ped phases served, Transit Ons/Offs, ped delay
- Bicycle
  - Number of bikes, bicycle delay (if own detector input)

Photo: Greg Raisman

## 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

"4 - TP Max'd Out, NO Conflict"
"5 - Priority Override"
"6 - Override Timeout Fault"
"7 - TP Input Failed"
"8 - Inhibit (Various)"
"9 - TP Input Returned to Normal"
"10 - Min Re-service Refusal"
"11 - Inhibit Transit Priority Applied"
"12 - Force Off Termination"
"13 - TP Input Went Inactive In TP Green"
"14 - TP Clear Input Active In TP Green"
"15 - TP Went Away During Bus Extend"
"16 – Truck Caused TP"
"17 – Truck Arrived Late, no TP"
"18 - TP Remains Active After Extension"
"19 – Preempt Override"
"20 - TP Max'd Out, With Conflict"

| | Time | Type | Detect. | Delay Time | Mode | Max Plan | Service Plan | Intersection Level of | Phase Level of Service | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 60 | 14:45:00 | LOS | | | | | | 25 (C) | 86 | 3 | 57 | 54 | 35 | 15 | 37 | 62 |
| 61 | 15:00:00 | LOS | | | | | | 28 (C) | 93 | 3 | 70 | 100 | 26 | 11 | 47 | 74 |
| 62 | 15:15:00 | LOS | | | | | | 20 (B) | 61 | 1 | 39 | 70 | 28 | 10 | 53 | 58 |
| 63 | 15:30:00 | LOS | | | | | | 28 (C) | 86 | 4 | 59 | 88 | 31 | 11 | 47 | 54 |
| 64 | 15:45:00 | LOS | | | | | | 26 (C) | 57 | 2 | 34 | 91 | 32 | 11 | 51 | 61 |
| 65 | 16:00:00 | LOS | | | | | | 25 (C) | 104 | 4 | 54 | 70 | 37 | 8 | 41 | 49 |

## Next Steps – Improved Interfaces

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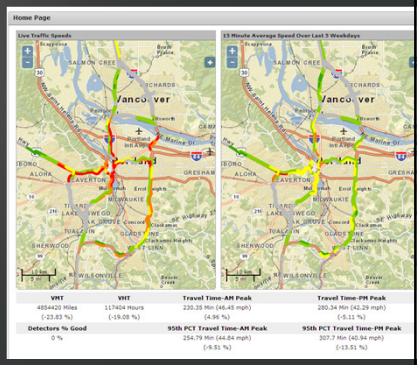
PORTAL

| Service Plan | Intersection Level of | Phase Level of Service | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | 25 (C) | 86 | 3 | 57 | 54 | 35 | 15 | 37 | 62 |
| | 28 (C) | 93 | 3 | 70 | 100 | 26 | 11 | 47 | 74 |
| | 20 (B) | 61 | 1 | 39 | 70 | 28 | 10 | 53 | 58 |
| | 28 (C) | 86 | 4 | 59 | 88 | 31 | 11 | 47 | 54 |
| | 26 (C) | 57 | 2 | 34 | 91 | 32 | 11 | 51 | 61 |
| | 25 (C) | 104 | 4 | 54 | 70 | 37 | 8 | 41 | 49 |

TransSuite




| Date/Time | Count | Gap | Date/Time | Count | Gap |
|---|---|---|---|---|---|
| 12/01/2012 09:00:00 | 4 | 0 | 12/02/2012 05:05:00 | 2 | 0 |
| 12/01/2012 10:00:00 | 15 | 0 | 12/02/2012 06:05:00 | 1 | 0 |
| 12/01/2012 11:00:00 | 19 | 0 | 12/02/2012 07:05:00 | 2 | 0 |
| 12/01/2012 12:00:00 | 29 | 0 | 12/02/2012 08:05:00 | 4 | 0 |
| 12/01/2012 13:00:00 | 36 | 0 | 12/02/2012 09:05:00 | 9 | 0 |
| 12/01/2012 14:00:00 | 31 | 0 | 12/02/2012 10:05:00 | 10 | 0 |
| 12/01/2012 15:00:00 | 14 | 0 | 12/02/2012 11:05:00 | 14 | 0 |
| 12/01/2012 16:00:00 | 16 | 0 | 12/02/2012 12:05:00 | 29 | 0 |

## Next Steps – Validation & Research

- Inrix, Bluetooth, Bike Counts, Controller Logs, GUIs

OTREC
OREGON TRANSPORTATION RESEARCH AND EDUCATION CONSORTIUM

Portland State UNIVERSITY

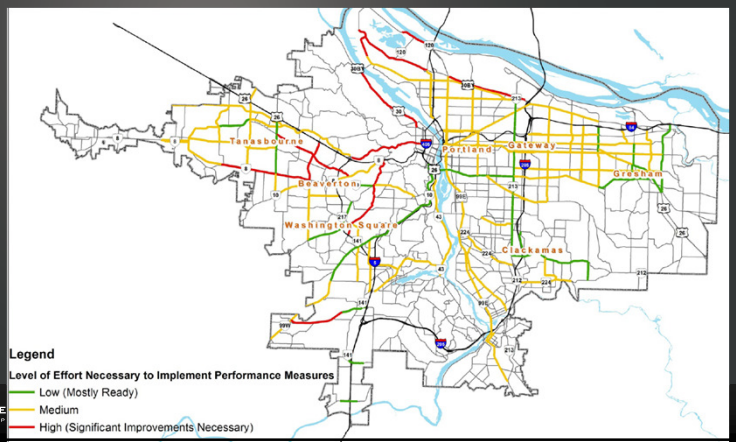
OSU Oregon State UNIVERSITY

UNIVERSITY OF OREGON

Oregon Institute of Technology

## 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

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## Questions / Discussion?

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