Bluetooth Traveler Information and Integration

I-5/Joint Base Lewis-McChord (JBLM) Corridor

TONY LEINGANG
FREEWAY OPERATIONS MANAGER – WSDOT OLYMPIC REGION

National Rural ITS Conference – Chattanooga, TN
October 3, 2016
Presentation Overview

• Project History/Goals
• Project Planning/Technology Selection
• Project Coordination/Installation
• How it Works
• BlueTOAD Site
• Project Implementation
• Project Issues/Challenges
• Public Outreach/Measuring Success
• Summary: Lessons Learned, Overall Experience
• Questions?
TIGER III Grant – I-5 ITS Congestion Relief Project

- $15M Congestion Relief project through the I-5/JBLM corridor – primarily by adding ITS solutions including ramp meters, traffic cameras, DMS, travel time signs, data stations, fiber network

- Grant required using a portion of funds to address JBLM and surrounding community’s traveler information needs/gate status with the addition of ramp meters
Project History/Goals

Attempted efforts to satisfy local community support requirement:

- 100 yds to JBLM EOC with fiber from WSDOT
- Provide devices on the installation for gate wait times
- Unsuccessful in eliminating Red Tape with DOD IT/Security and Purchasing
- Preliminary efforts with INRIX

Two Primary Goals:

☑ Provide Traveler Information to benefit local community
- Give travelers awareness of options that will encourage spreading traffic out, reducing short and/or unnecessary trips, and relieving congestion
Previous study/Proven Technologies Assessed
(2013 Presented at the WTI TTI Forum)

Error Assessment for Emerging Traffic Data Collection Devices

Ted Bailey, WSDOT
Ron Vessev, WSDOT
Bahar Namaki, Aalborg Univ.
Yegor Malinovskiy, UW
Yinhai Wang, UW
Existing state contract available for TrafficCast & Blip Systems

- Solicited five bids
- Blip was less expensive but hadn’t yet successfully proven their solar solution (as TrafficCast had)

### I-5 JBLM Traveler Information Options

All Pricing based on the purchase (NOT Lease) of 30 units and 2 yrs of support. Taxes were NOT included in the Quote. Pricing does NOT include installation.

<table>
<thead>
<tr>
<th>Line Item</th>
<th>*** TrafficCast BlueTOAD (Advanced)</th>
<th>*Blip Systems - BlipTrak (Coral Sales Quote)</th>
<th>Acyclica - (Western Systems Quote)</th>
<th>**Acyclica - (INRIX Quote)</th>
<th>Iteris - Velocity (Western Systems Quote)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment (w/solar power and cellular communication) - 30 units</td>
<td>$126,000</td>
<td>$117,090</td>
<td>$187,555</td>
<td>$136,800</td>
<td>$210,000</td>
</tr>
<tr>
<td>2 yr - SUPPORT (Data Service, Web Service, Data Analytics, API, XML for WSDOT Flow Map)</td>
<td>$39,600</td>
<td>$17,760 (Pricing was included in the Equipment Line Item)</td>
<td></td>
<td>$15,000</td>
<td>$25,409</td>
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<tr>
<td>2 yr - cellular communication</td>
<td>$21,600</td>
<td>$28,260</td>
<td>$22,500</td>
<td>$21,600</td>
<td>$36,000</td>
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<tr>
<td>2 yr - INRIX Fixed Route Travel Times</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$24,000</td>
<td>$0</td>
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<tr>
<td><strong>SubTotal</strong></td>
<td>$187,200</td>
<td>$163,110</td>
<td>$210,055</td>
<td>$197,400</td>
<td>$271,409</td>
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<tr>
<td>Sales Tax (8.8%)</td>
<td>$16,474</td>
<td>$14,354</td>
<td>$18,485</td>
<td>$17,371</td>
<td>$23,884</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td>$203,674</td>
<td>$177,464</td>
<td>$228,540</td>
<td>$214,771</td>
<td>$295,293</td>
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<tr>
<td>Variance from BlueTOAD</td>
<td>$0</td>
<td>($26,210)</td>
<td>$24,866</td>
<td>$11,098</td>
<td>$91,619</td>
</tr>
</tbody>
</table>

* Solar Power Solution would be custom for this installation (not tested)
** INRIX Equipment bid is unclear if solar power is included. INRIX bid also includes INRIX Fixed Route Travel Times
*** Cellular communication billing is covered directly by TrafficCast as part of their turn key solution
Cost Considerations

Equipment purchase was included in funding from project grant

Not included:

- Ongoing operations costs (past first six mo)
- WSDOT staff installation costs
- WSDOT staff maintenance costs/impacts
- IT development and maintenance costs

Acceptance of this selection required with all stakeholders (WSDOT Management, JBLM, Pierce County, local agencies, etc.) on project approach, important routes, pilot project status
Project Coordination/Installation

Steps towards Success

• Assembling the WSDOT team:
  • Region Traffic Operations office
  • ITS & Signals groups
  • HQ IT and Traffic Operations groups
  • Communications office

• Partnership with JBLM representatives to identify key routes for equipment location (prescribed by them)

• Regular meetings/timelines for WSDOT Field crews/JBLM Access

• “Temporary”/Pilot project - one year limitation (but not actually)

• Acknowledge impacts of routine Leadership changes at JBLM
How It Works

Simple Installation:

• Band mount box and solar panel
• Attach Ethernet cable, Bluetooth antenna, and solar panel cable
• Install and connect battery
• Turn it on (auto discovery)
How It Works

- Detects anonymous Bluetooth signal
- Registers vehicle passing within 200 feet of detectors
How It Works

TRAFFICAST

Determines travel time and speed after passing second device
How It Works

- Correlates whichever pair of devices a vehicle triggers
- Calculates travel times based on speed and distance
How It Works

- According to TrafficCast, time from device to XML averages 3 minutes.
- Acceptable latency for our purposes for flow map production.
How It Works

Data Transfer flow from TrafficCast to WSDOT

1. BlueTOAD Devices
2. Cellular Connection
3. BlueTOAD
4. XML Files
5. WSDOT
6. Map Creation
7. SQL
BlueTOAD Site: Devices

Map showing the locations of devices with blue markers along a route.
Device ID is provided by BlueTOAD, pre-assigned to equipment.
<table>
<thead>
<tr>
<th>ID</th>
<th>Act</th>
<th>OD</th>
<th>Dist</th>
<th>Dir</th>
<th>From</th>
<th>To</th>
<th>Pair Name</th>
<th>XF1</th>
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</thead>
<tbody>
<tr>
<td>20984</td>
<td>Y</td>
<td>N</td>
<td>1</td>
<td>SW</td>
<td>5039</td>
<td>5037</td>
<td>32nd Div St/N Gate (East Dr) to 41st Division Dr/ A St I/S</td>
<td>East Gate</td>
</tr>
<tr>
<td>20983</td>
<td>Y</td>
<td>N</td>
<td>0.6</td>
<td>NW</td>
<td>5039</td>
<td>5008</td>
<td>32nd Div St/N Gate (East Dr) to DuPont Stellacoom Rd/East Dr I/S</td>
<td>East Gate</td>
</tr>
<tr>
<td>21011</td>
<td>Y</td>
<td>N</td>
<td>0.3</td>
<td>S</td>
<td>5024</td>
<td>5028</td>
<td>41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to 41st Division Dr/Colorado Ave I/S</td>
<td>Main Gate</td>
</tr>
<tr>
<td>21038</td>
<td>Y</td>
<td>N</td>
<td>0.3</td>
<td>N</td>
<td>5024</td>
<td>5026</td>
<td>41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to I-5 SB Ramp @ 41st Division Dr (North Gate)</td>
<td>Main Gate</td>
</tr>
<tr>
<td>20985</td>
<td>Y</td>
<td>N</td>
<td>1</td>
<td>NE</td>
<td>5037</td>
<td>5039</td>
<td>41st Division Dr/ A St I/S to 32nd Div St/N Gate (East Dr)</td>
<td>East Gate</td>
</tr>
<tr>
<td>20986</td>
<td>Y</td>
<td>N</td>
<td>1</td>
<td>S</td>
<td>5037</td>
<td>5015</td>
<td>41st Division Dr/ A St I/S to 41st Division Dr/San Francisco Ave I/S</td>
<td>East Gate</td>
</tr>
<tr>
<td>21458</td>
<td>Y</td>
<td>N</td>
<td>1.54</td>
<td>E</td>
<td>5037</td>
<td>5010</td>
<td>41st Division Dr/ A St I/S to I St Gate @ DuPont Stellacoom Rd I/S</td>
<td>Integrity Gate</td>
</tr>
</tbody>
</table>
BlueTOAD Site: Routes

Routes - WSDOT-Or-JBLM

Add Route
Import Routes
Edit Selected Route
Zoom to Selected Route
Clear Selection
Help

<table>
<thead>
<tr>
<th>ID</th>
<th>Act</th>
<th>Length</th>
<th>Pairs</th>
<th>From</th>
<th>To</th>
<th>Route Name</th>
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<tbody>
<tr>
<td>22883</td>
<td>Y</td>
<td>3.60</td>
<td>4</td>
<td>5029</td>
<td>5038</td>
<td>41st Division Dr/Pendleton Ave I/S to I-5 NB Ramp @ Berkely I/C</td>
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<tr>
<td>23881</td>
<td>Y</td>
<td>3.00</td>
<td></td>
<td>5008</td>
<td>5026</td>
<td>DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @ 41st Division Dr (North Gate)</td>
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<tr>
<td>23885</td>
<td>Y</td>
<td>5.06</td>
<td>2</td>
<td>5008</td>
<td>5009</td>
<td>DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @Center Drive</td>
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<tr>
<td>23883</td>
<td>Y</td>
<td>3.70</td>
<td>2</td>
<td>5008</td>
<td>5047</td>
<td>DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @DuPont I/C</td>
</tr>
<tr>
<td>22884</td>
<td>Y</td>
<td>3.60</td>
<td>4</td>
<td>5038</td>
<td>5029</td>
<td>I-5 NB Ramp @ Berkely I/C to 41st Division Dr/Pendleton Ave I/S</td>
</tr>
<tr>
<td>23882</td>
<td>Y</td>
<td>3.00</td>
<td>4</td>
<td>5026</td>
<td>5008</td>
<td>I-5 SB Ramp @ 41st Division Dr (North Gate) to DuPont Steilacoom Rd/East Dr I/S</td>
</tr>
<tr>
<td>23886</td>
<td>Y</td>
<td>5.06</td>
<td>2</td>
<td>5009</td>
<td>5008</td>
<td>I-5 SB Ramp @Center Drive to DuPont Steilacoom Rd/East Dr I/S</td>
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<tr>
<td>23884</td>
<td>Y</td>
<td>3.70</td>
<td>2</td>
<td>5047</td>
<td>5008</td>
<td>I-5 SB Ramp @DuPont I/C to DuPont Steilacoom Rd/East Dr I/S</td>
</tr>
</tbody>
</table>

For support, please send email to: bluetoad-help@trafficcast.com

## Dashboard - WSDOT-Or-JBLM

<table>
<thead>
<tr>
<th>Type</th>
<th>ID</th>
<th>From</th>
<th>To</th>
<th>Name</th>
<th>Speed</th>
<th>Time</th>
<th>Last Match</th>
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<tbody>
<tr>
<td>Pair</td>
<td>20984</td>
<td>5039</td>
<td>5037</td>
<td>32nd Div St/N Gate (East Dr) to 41st Division Dr/ A St I/S</td>
<td>18</td>
<td>3:15</td>
<td>04-26 17:57</td>
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<td>5008</td>
<td>32nd Div St/N Gate (East Dr) to DuPont Stellacoom Rd/East Dr I/S</td>
<td>39</td>
<td>0:56</td>
<td>04-26 19:24</td>
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<tr>
<td>Pair</td>
<td>21011</td>
<td>5024</td>
<td>5028</td>
<td>41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to 41st Division Dr/Colorado Ave I/S</td>
<td>11</td>
<td>1:42</td>
<td>04-26 19:29</td>
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<tr>
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<td>5024</td>
<td>5026</td>
<td>41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to I-5 SB Ramp @ 41st Division Dr (North Gate)</td>
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<td>0:30</td>
<td>04-26 19:29</td>
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<td>5039</td>
<td>41st Division Dr/ A St I/S to 32nd Div St/N Gate (East Dr)</td>
<td>24</td>
<td>2:31</td>
<td>04-26 19:26</td>
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<tr>
<td>Pair</td>
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<td>5037</td>
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<td>41st Division Dr/ A St I/S to 41st Division Dr/San Francisco Ave I/S</td>
<td>34</td>
<td>1:47</td>
<td>04-26 19:29</td>
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<tr>
<td>Pair</td>
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<td>5037</td>
<td>5010</td>
<td>41st Division Dr/ A St I/S to I St Gate@ DuPont Stellacoom Rd I/S</td>
<td>8</td>
<td>11:52</td>
<td>04-26 18:42</td>
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<tr>
<td>Pair</td>
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<td>5028</td>
<td>5024</td>
<td>41st Division Dr/Colorado Ave I/S to 41st Division Dr @ Main Gate Visitor Center I5 NB Ramp</td>
<td>33</td>
<td>0:32</td>
<td>04-26 19:31</td>
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<tr>
<td>Pair</td>
<td>21009</td>
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<td>5029</td>
<td>41st Division Dr/Colorado Ave I/S to 41st Division Dr/Pendleton Ave I/S</td>
<td>19</td>
<td>1:56</td>
<td>04-26 19:29</td>
</tr>
</tbody>
</table>
**BlueTOAD Site: Historical Reports**

**Reports**
- Pair/Route Report
- Comparison Report
- **Historical Report**
- Device Report
- Alarm Report

**Generate Report**

**BlueTOAD Pair / Route**

- Pair 20996: (Pendleton Ave / Main St. Gate to I-5 SB Ramp @DuPont /C)

- Show inactive pairs/routes
- Show speed limit

**Comparison Index #1**

- Default Historical Average (12 Weeks)
- Custom Historical Average

**Days of the Week**

- All
- Sun
- Mon
- Tue
- Wed
- Thu
- Fri
- Sat

**Output Type**

- HTML

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# BlueTOAD Site: Reports

## Report Parameters

Pair / Route  
Route 22883: (41st Division Dr/Pendleton Ave I/S to I-5 NB Ramp @ Berkely I/C)

Start Date  
2016-04-26

End Date  
2016-04-26

Period  
0:00 to 23:55

Type  
Smoothed Speed (5-min)

<table>
<thead>
<tr>
<th>Day of week</th>
<th>Date</th>
<th>Time</th>
<th>Last match time</th>
<th>Travel time (s)</th>
<th>Speed (mph)</th>
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<tbody>
<tr>
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<td>04/26/2016</td>
<td>00:00</td>
<td>2016-04-25 23:54:28</td>
<td>393.9</td>
<td>32.9</td>
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<tr>
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<td>2016-04-25 23:54:28</td>
<td>393.9</td>
<td>32.9</td>
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<tr>
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<td>00:10</td>
<td>2016-04-25 23:54:28</td>
<td>393.9</td>
<td>32.9</td>
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<tr>
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<td>2016-04-26 00:11:58</td>
<td>393.9</td>
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<tr>
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<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
<td>00:25</td>
<td>2016-04-26 00:22:00</td>
<td>Not enough matches</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
<td>00:30</td>
<td>2016-04-26 00:25:22</td>
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<td></td>
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<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
<td>00:35</td>
<td>2016-04-26 00:32:00</td>
<td>Not enough matches</td>
<td></td>
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<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
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<td>2016-04-26 00:37:11</td>
<td>388.7</td>
<td>33.3</td>
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<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
<td>00:45</td>
<td>2016-04-26 00:39:48</td>
<td>388.0</td>
<td>33.4</td>
</tr>
<tr>
<td>Tuesday</td>
<td>04/26/2016</td>
<td>00:50</td>
<td>2016-04-26 00:47:03</td>
<td>388.0</td>
<td>33.4</td>
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<tr>
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<td>04/26/2016</td>
<td>00:55</td>
<td>2016-04-26 00:49:38</td>
<td>387.7</td>
<td>33.4</td>
</tr>
</tbody>
</table>
BlueTOAD Site: Origin/Destination Studies

<table>
<thead>
<tr>
<th>Origin</th>
<th>Destination</th>
<th>Waypoint</th>
<th>Map/Graph Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>DuPont Steilacoom Rd/East Dr I/S</td>
<td>I-5 SB Ramp @ 41st Division Dr (North Gate)</td>
<td></td>
<td>Green</td>
</tr>
<tr>
<td>DuPont Steilacoom Rd/East Dr I/S</td>
<td>I-5 SB Ramp @DuPont I/C</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>DuPont Steilacoom Rd/East Dr I/S</td>
<td>I-5 SB Ramp @Center Drive</td>
<td></td>
<td>Blue</td>
</tr>
</tbody>
</table>
Match count bar chart

Ken's Pet Project – Spring 2016

For support, please send email to: bluetoad-help@trafficcast.com
Process Overview:

1. Complete setup in TrafficCast website
2. Complete setup in WSDOT database (mirrored data)
3. BlueTOAD Data Retrieval
   - Each data file requires a secure connection to BlueToad server
   - Download devices XML data, save to list
   - Add new devices
   - Record last detection and voltage
   - Download Pairs XML data
   - Insert new pairs and update existing ones
   - Save the current values to database
   - Save history every 10 minutes
   - Routes are ignored
Map presentation work

- Graphic artist created new map in Photoshop
- Road segments which correspond with pairs are given unique colors
Map coloring program

- Speeds are associated to colors
  - Black – 10% and below of posted speed limit
  - Red – 11 to 35%
  - Yellow – 36 to 76%
  - Green – 77% and above
- Retrieve flow data and device locations from database
- Find the box which has both devices in a pair on opposite edges
- Within box change segment color to appropriate speed color
- Add date and time to image
- Publish to web and mobile app
Project Implementation

Traffic Conditions as of: Jun 1, 2016 2:49 PM

Final published map

Showing approximate device locations
Project Issues/Challenges

• Permitting
  • JBLM – one week
  • Pierce County – one year minimum, just completed August 2016
  • Thurston County – “Sure, no problem”

• TrafficCast Server down
  • Maintenance performed by vendor affected production feed
  • Called support line
  • Quick response from vendor directed to use a backup system
  • Have to remember to change back

• Responsive service from vendor? Helpful?
  • Initial ordering issues due to Tesla buying up inventory of items that make up BlueTOAD devices
  • When issues came up, vendor was genuinely concerned and helpful

• Ongoing funding/operations costs
  • 30 units @ $35K/yr for cellular connectivity and data processing fees can add up
Project Issues

Rural Geography and Challenges:
Hills, trees, lack of southern exposure to sunlight
Utility power generally unavailable (required solar, battery backup)
Communications – cell signal/strength, radio if used
Project Issues

Solar Power, device locations

Panel Too Flat and Shaded

Better Location (Across Intersection)
Project Issues

Solar Power, device locations

Panel Too Steep

Poor Location, Shaded in Trees

• Unable to get permission to install along main road due to permitting requirements from county.

• Installation required routine monitoring and extra battery replacement (now relocated)
Public Outreach/Measuring Success

- Attempts to post website/information inside common areas (PX, etc.)
- Multiple local newspaper/online blog interviews and articles
- At local agency open houses
- Through WSDOT Communications
- System Reports – Coming Soon
- Web page hits - steady trend (source: Google Analytics)
- Plan to make available for programmatic API access
Summary: Lessons Learned, Overall Experience

- Installation details (example: WSDOT installation - $2K to reposition equipment)
- Use of this technology is being implemented as a good model for other area efforts (Port Alliance – Seattle/Tacoma)
- Great team effort amongst stakeholders required for success
- Experience to date: We recommend this vendor and product for consideration
- Next Steps: Project Phase 2 - Exploring other ways to achieve same results - different technology/different funding configuration
- Coming soon: Pre-planned public detours using normally closed JBLM installation roads during emergencies – their willingness and interest is a result of building great partnerships with projects like this one.
Questions?

KNOW BEFORE YOU GO
NEW JBLM TRAFFIC FLOW MAP NOW AVAILABLE

- Backups at your gate? Check the WSDOT Flow Maps and Mobile App for the quickest route to take!
- Automated system available at your convenience!

Through a partnership with WSDOT & JBLM, 30 Bluetooth readers were installed at key installation intersections. The information is linked with WSDOT traffic flow maps, available to the public.

Joint Base Lewis-McChord Traffic and Cameras

Traffic Conditions as of: Feb 24, 2016 1:39 PM

NOTICE: ROADS IN DARK GREY AREAS ARE FOR MILITARY ACCESS ONLY

New JBLM Traffic Flow Map available on the Mobile App and on your desktop.

View of the JBLM Corridor on the WSDOT mobile app.

You can access the JBLM Traffic Flow Map from the Tacoma Flow Map webpage!

Contact Info: Tony Leingang - LeingaA@wsdot.wa.gov / 253-548-2430