

# **Bluetooth Traveler Information and Integration**

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

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National Rural ITS Conference – Chattanooga, TN

October 3, 2016

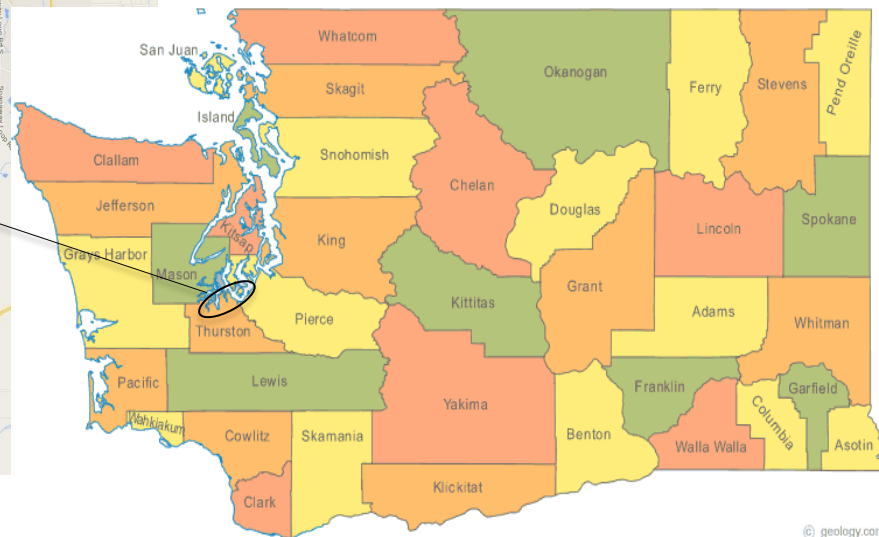
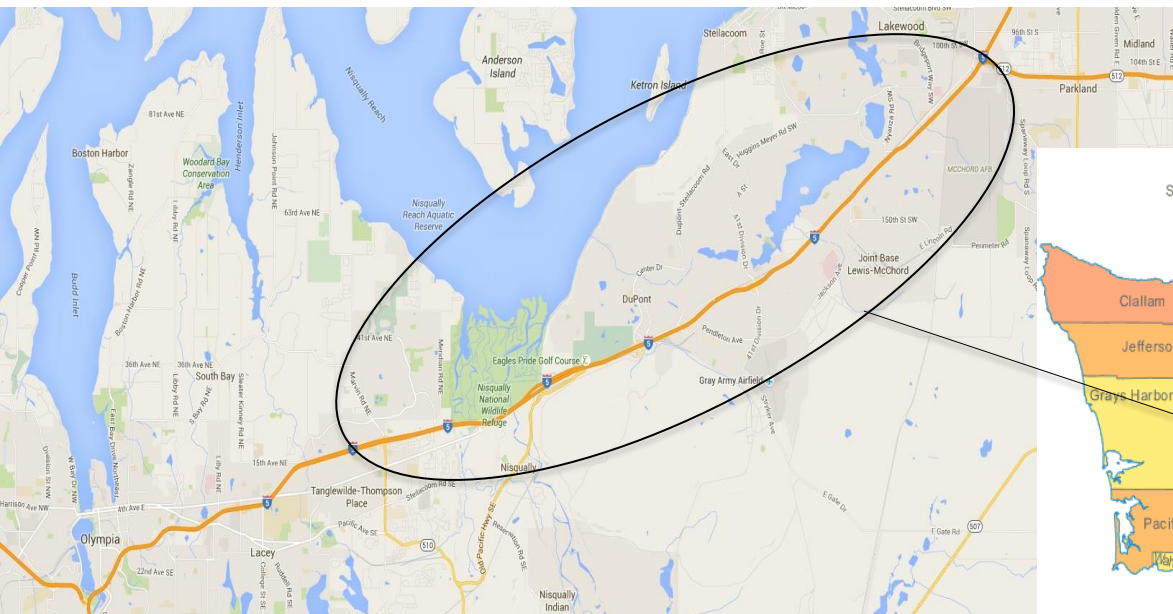
# Presentation Overview

- 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?

# Project History/Goals

## 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**



© geology.com

# 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

# Project Planning/Technology Selection


## Previous study/Proven Technologies Assessed (2013 Presented at the WTI TTI Forum)


**CIVIL & ENVIRONMENTAL ENGINEERING**  
UNIVERSITY of WASHINGTON

**UW STAR LAB**  
Smart Transportation Applications and Research

### Error Assessment for Emerging Traffic Data Collection Devices

Ted Bailey, WSDOT  
Ron Vessey, WSDOT  
Bahar Namaki, Aalborg Univ.  
Yegor Malinovskiy, UW  
Yinhai Wang, UW





# Project Planning/Technology Selection

## 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.**

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

\* 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

# Project Planning/Technology Selection

## 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**



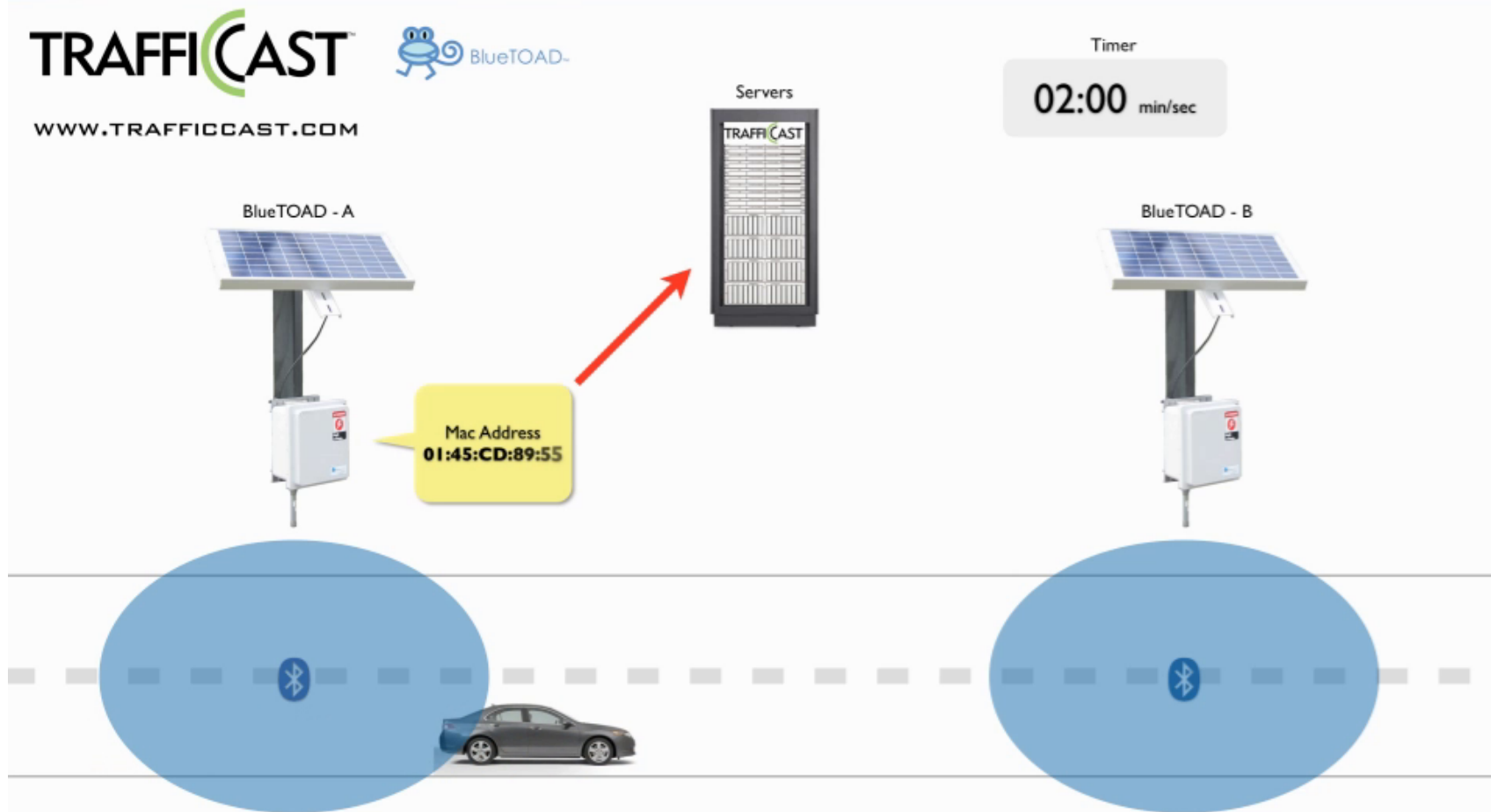
# How It Works

## 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)

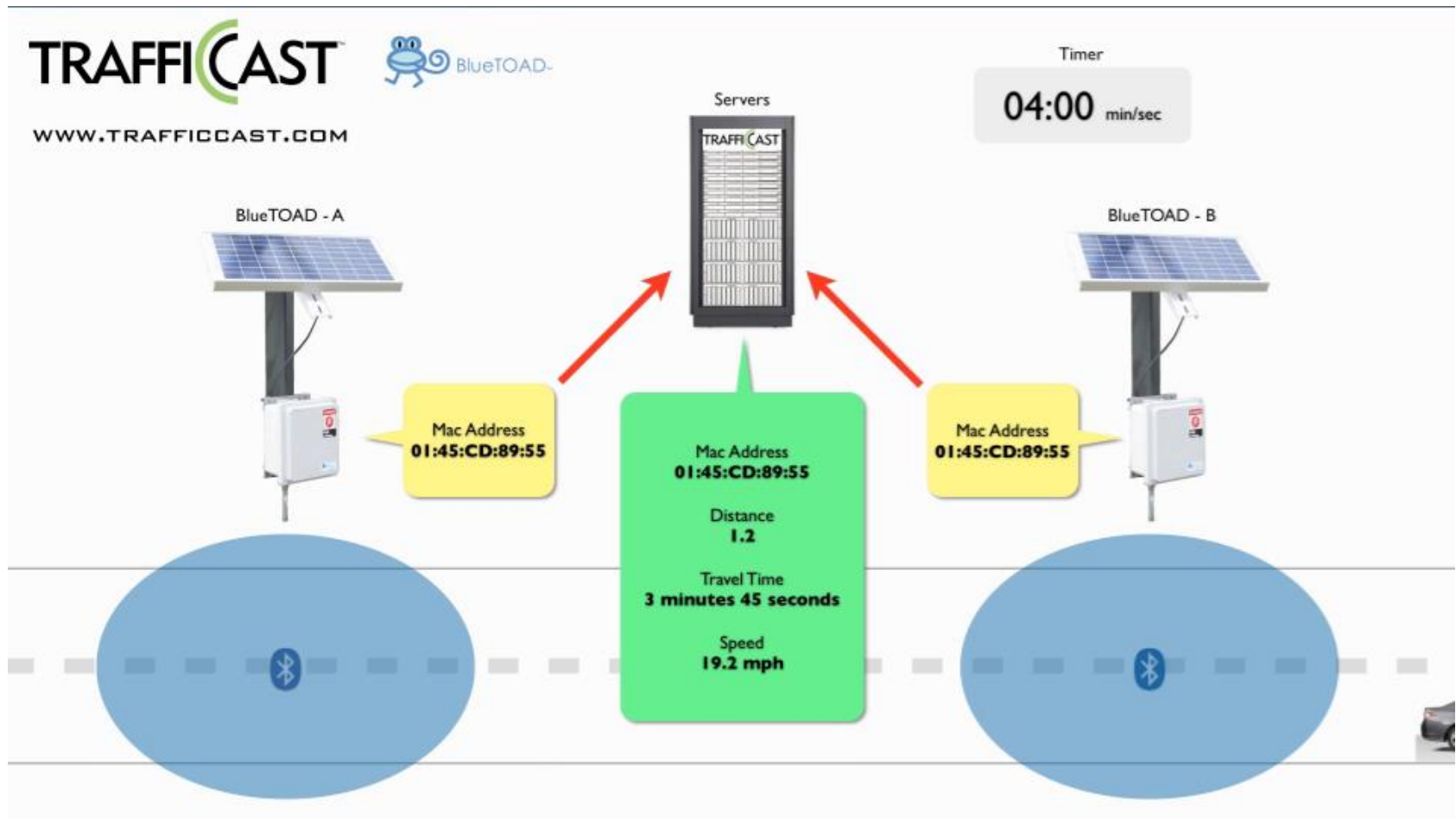


# How It Works



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

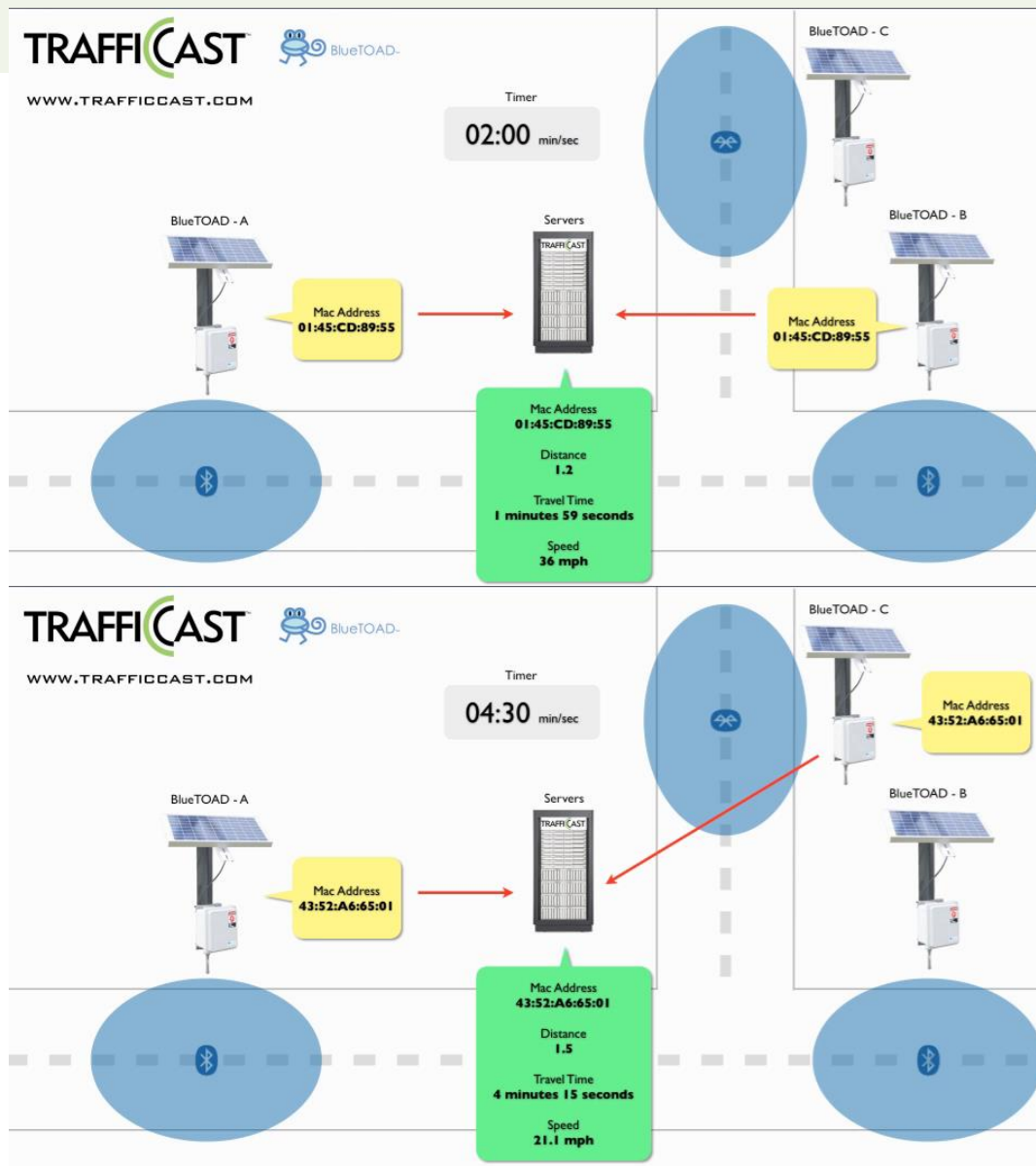
# How It Works



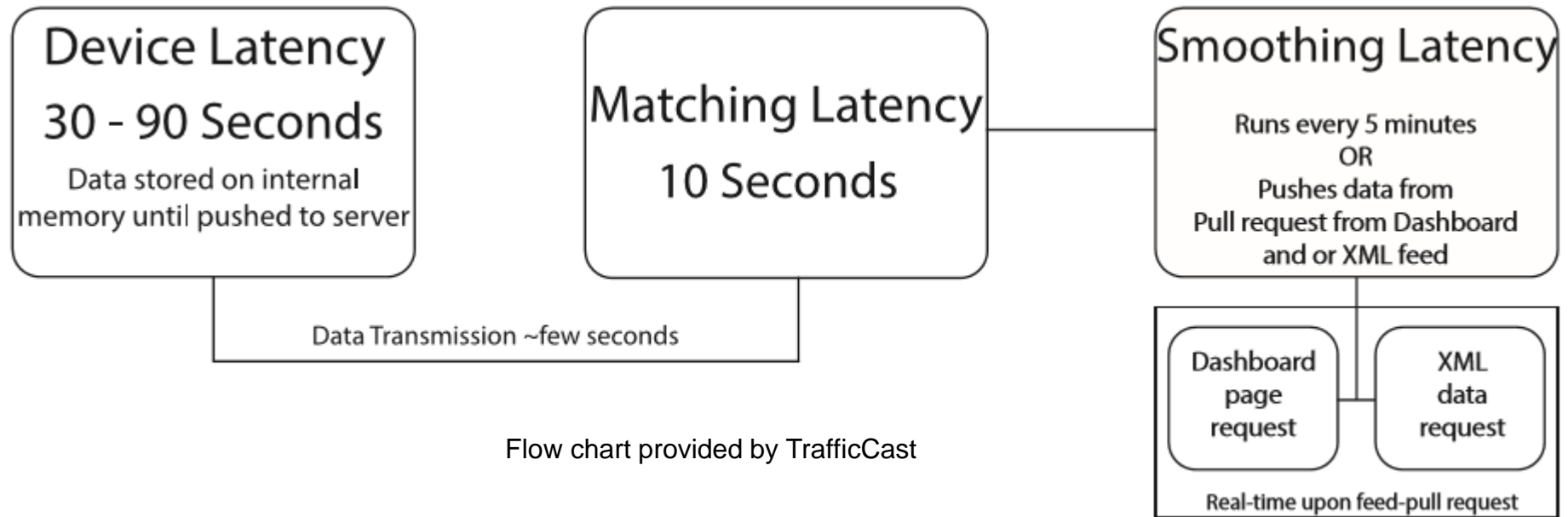
Determines travel time and speed after passing second device

# How It Works

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



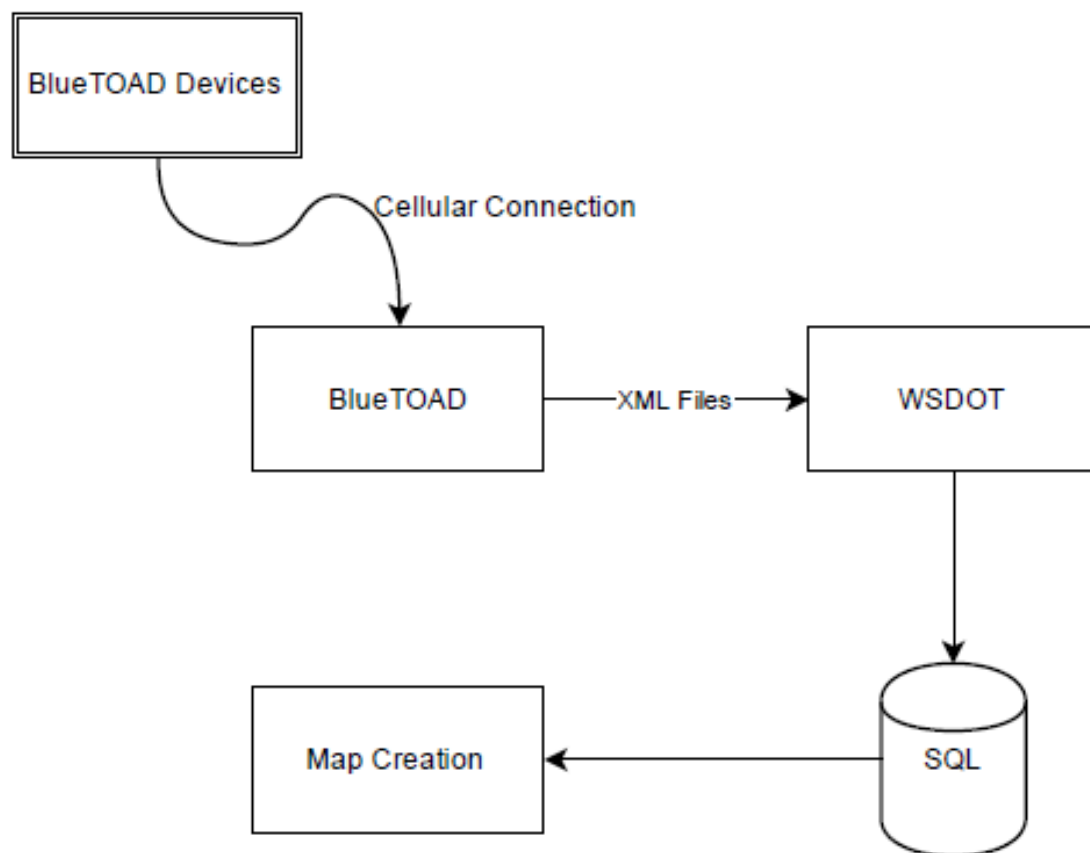
# How It Works



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

# How It Works

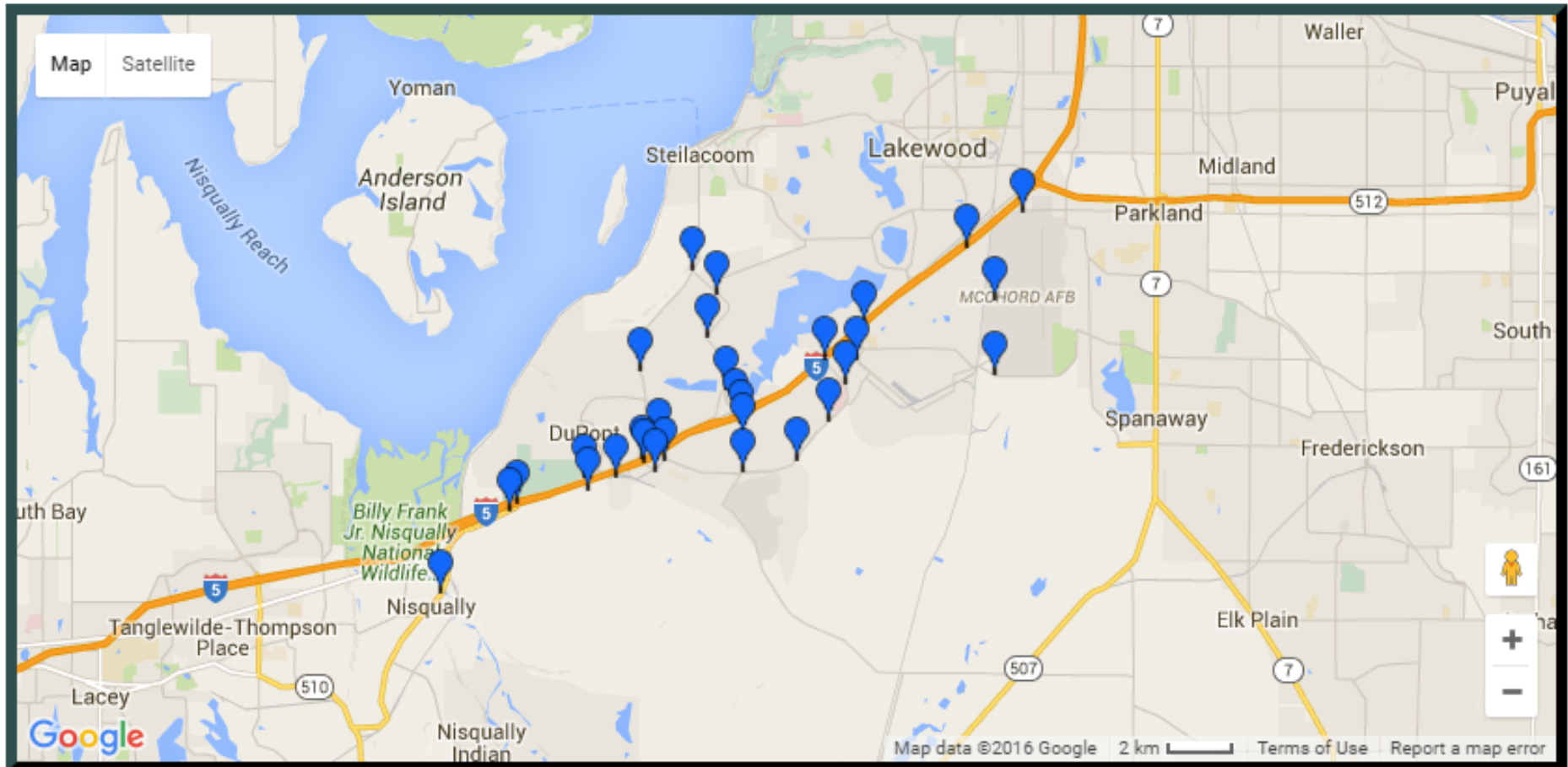
## Data Transfer flow from TrafficCast to WSDOT



# BlueTOAD Site: Devices

## Devices - WSDOT-Or-JBLM ↓

☒ Show Active Devices ☐ Show Inactive Devices





# BlueTOAD Site: New Device Setup

Device ID \*

Device Name \*

Location

Enter coordinates or drag highlighted icon.

Latitude \*

N/S

N

Longitude \*

E/W

W

City

State/Prov/Country

Mile Marker

Section Marker

Settings

Effective Date \*

2016-04-26

Format: 2016-04-26

Valid Until \*

2020-04-26

Format: 2016-04-26

Time Zone \*

Device Model \*

Make Like

XF1 (user-defined)

Active

Inactive

Alarms

Preset Alarms

Use the Alarms menu to create new alarms

☐ Low Voltage


From 00:00 to 23:59 (UMTWRFS)

New

Save Device

Cancel

Device ID is provided by BlueTOAD, pre-assigned to equipment

 WSDOT



# BlueTOAD Site: Pair Creation

Pair ID **TBD** Pair Name \*

From Device \* From Device Name

To Device \* To Device Name

## Attributes

Distance \* Direction \* Speed Limit \* Road Class Smoothing Method \*

XF1 (user-defined) XF2 (user-defined)

## Settings

### Match-Speed Limits

Make Like

Default ▼

Min Speed \* Max Speed \* Stale Time \*

### Speed Map Color Thresholds (% of speed limit)

Orange \* Yellow \* Green \* Blue \*

☐ O/D Only

## Alarms

### Preset Alarms

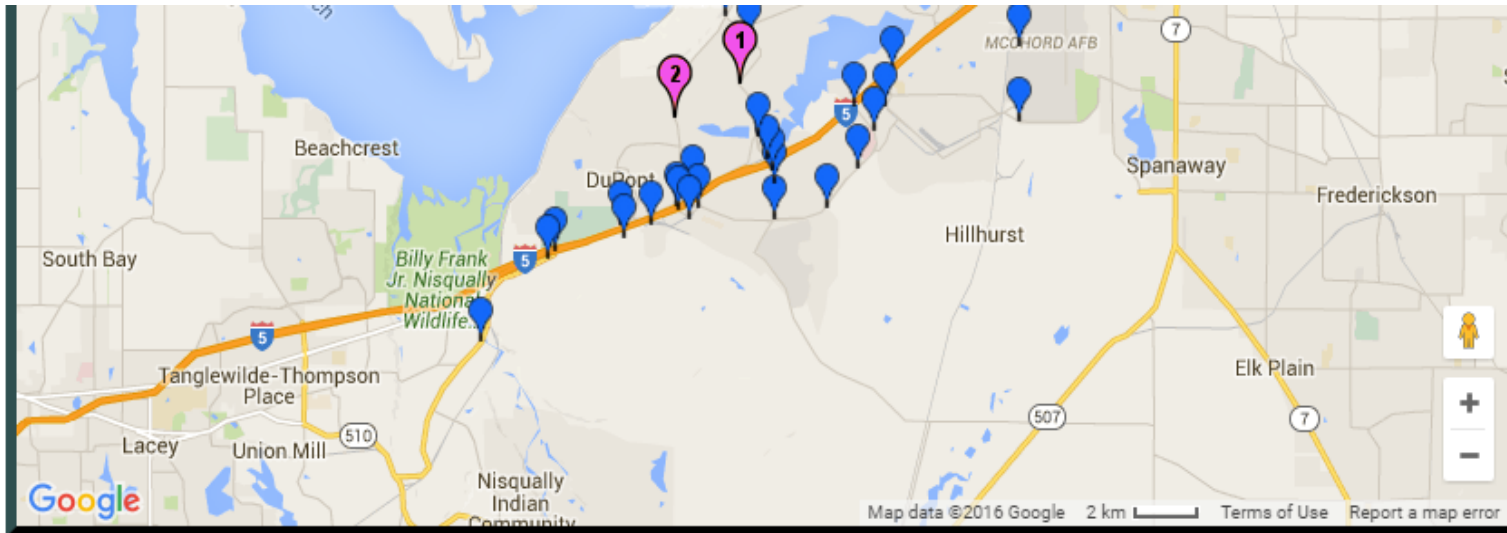
No preset alarms have been created. Use the Alarms menu to create new alarms

Save Pair

Add Reverse

Cancel

# BlueTOAD Site: Pairs



Edit Select

Zoom to Se  
Pair

Clear Sele

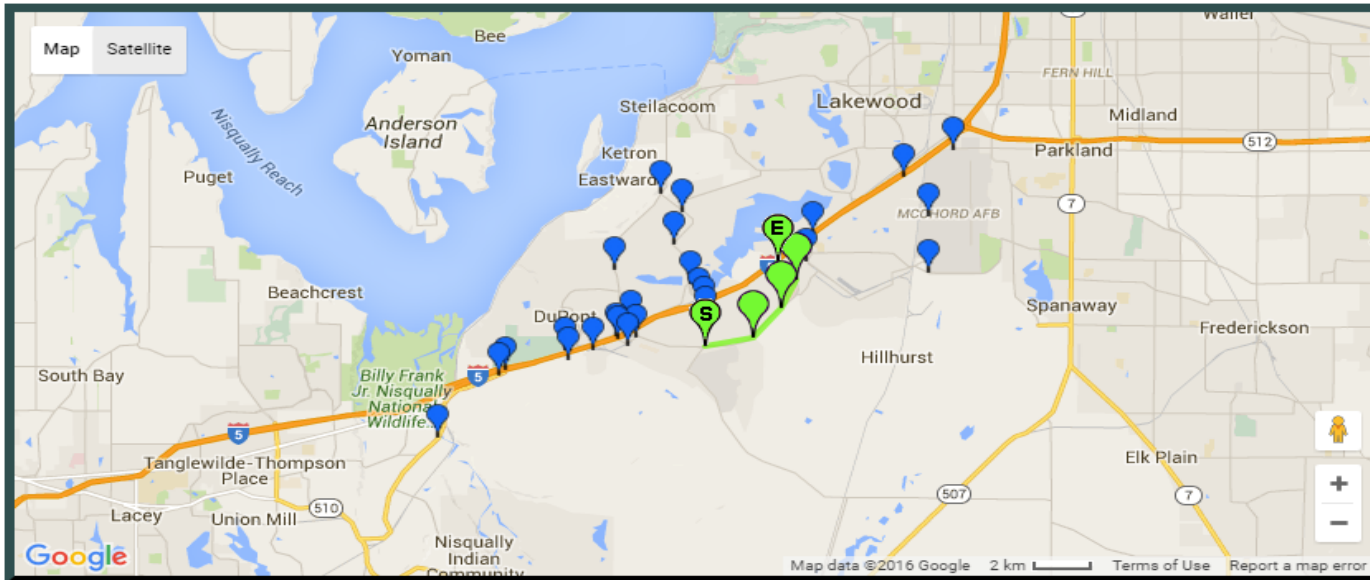
Help

ID	Act	OD	Dist	Dir	From	To	Pair Name	XF1
20984	Y	N	1	SW	5039	5037	32nd Div St/N Gate (East Dr) to 41st Division Dr/ A St I/S	East Gate
20983	Y	N	0.6	NW	5039	5008	32nd Div St/N Gate (East Dr) to DuPont Steilacoom Rd/East Dr I/S	East Gate
21011	Y	N	0.3	S	5024	5028	41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to 41st Division Dr/Colorado Ave I/S	Main Gate
21038	Y	N	0.3	N	5024	5026	41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to I-5 SB Ramp @ 41st Division Dr (North Gate)	Main Gate
20985	Y	N	1	NE	5037	5039	41st Division Dr/ A St I/S to 32nd Div St/N Gate (East Dr)	East Gate
20986	Y	N	1	S	5037	5015	41st Division Dr/ A St I/S to 41st Division Dr/San Francisco Ave I/S	East Gate
21458	Y	N	1.54	E	5037	5010	41st Division Dr/ A St I/S to I St Gate@ DuPont Steilacoom Rd I/S	Integrity Gate

# BlueTOAD Site: Routes

## Routes - WSDOT-Or-JBLM ↓

☒ Show Active Routes ☐ Show Inactive Routes ☒ Show Active Devices ☐ Show Inactive Devices



Add Route

Import Routes

Edit Selected Route

Zoom to Selected Route

Clear Selection


Help


ID	Act	Length	Pairs	From	To	Route Name	XF1	XF2
22883	Y	3.60	4	5029	5038	41st Division Dr/Pendleton Ave I/S to I-5 NB Ramp @ Berkely I/C		
23881	Y	3.00	4	5008	5026	DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @ 41st Division Dr (North Gate)		
23885	Y	5.06	2	5008	5009	DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @Center Drive		
23883	Y	3.70	2	5008	5047	DuPont Steilacoom Rd/East Dr I/S to I-5 SB Ramp @DuPont I/C		
22884	Y	3.60	4	5038	5029	I-5 NB Ramp @ Berkely I/C to 41st Division Dr/Pendleton Ave I/S		
23882	Y	3.00	4	5026	5008	I-5 SB Ramp @ 41st Division Dr (North Gate) to DuPont Steilacoom Rd/East Dr I/S		
23886	Y	5.06	2	5009	5008	I-5 SB Ramp @Center Drive to DuPont Steilacoom Rd/East Dr I/S		
23884	Y	3.70	2	5047	5008	I-5 SB Ramp @DuPont I/C to DuPont Steilacoom Rd/East Dr I/S		

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# BlueTOAD Site: Dashboard

 BlueTOAD<sup>™</sup>  
by TRAFFICAST



[Dashboard](#) [Speed Map](#) [Devices](#) [Pairs](#) [Routes](#) [Reports](#) [Travel Metrics](#) [O/D Studies](#) [MiniTOAD](#) [Alarms](#) [Docs](#) [Account](#) [Admin](#) [Log Out](#)

Tom\_admin

## Dashboard - WSDOT-Or-JBLM ↓

☒ Show Pairs ☒ Show Routes

Type	ID	From	To	*	Name ▼	Speed	Time	Last Match
Pair	20984	5039	5037	●	32nd Div St/N Gate (East Dr) to 41st Division Dr/ A St I/S	18 mph	3:15	04-26 17:57 ▲
Pair	20983	5039	5008	●	32nd Div St/N Gate (East Dr) to DuPont Steilacoom Rd/East Dr I/S	39 mph	0:56	04-26 19:24
Pair	21011	5024	5028	●	41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to 41st Division Dr/Colorado Ave I/S	11 mph	1:42	04-26 19:29
Pair	21038	5024	5026	●	41st Division Dr @ Main Gate Visitor Center I5 NB Ramp to I-5 SB Ramp @ 41st Division Dr (North Gate)	36 mph	0:30	04-26 19:29
Pair	20985	5037	5039	●	41st Division Dr/ A St I/S to 32nd Div St/N Gate (East Dr)	24 mph	2:31	04-26 19:26
Pair	20986	5037	5015	●	41st Division Dr/ A St I/S to 41st Division Dr/San Francisco Ave I/S	34 mph	1:47	04-26 19:29
Pair	21458	5037	5010	●	41st Division Dr/ A St I/S to I St Gate@ DuPont Steilacoom Rd I/S	8 mph	11:52	04-26 18:42
Pair	21010	5028	5024	●	41st Division Dr/Colorado Ave I/S to 41st Division Dr @ Main Gate Visitor Center I5 NB Ramp	33 mph	0:32	04-26 19:31
Pair	21009	5028	5029	●	41st Division Dr/Colorado Ave I/S to 41st Division Dr/Pendleton Ave I/S	19 mph	1:56	04-26 19:29

# 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 I/C) ▼

☐ Show inactive pairs/routes

☒ Show speed limit

Comparison Index #1

☒ Default Historical Average (12 Weeks)

☐ Custom Historical Average

[Remove Comparison](#)

### Days of the Week

☐ Save these settings

☐ All ☐ Sun ☒ Mon ☒ Tue ☒ Wed ☒ Thu ☒ Fri ☐ Sat

[Add Comparison Index](#)

### Output Type

HTML ▼

[Generate](#)

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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)

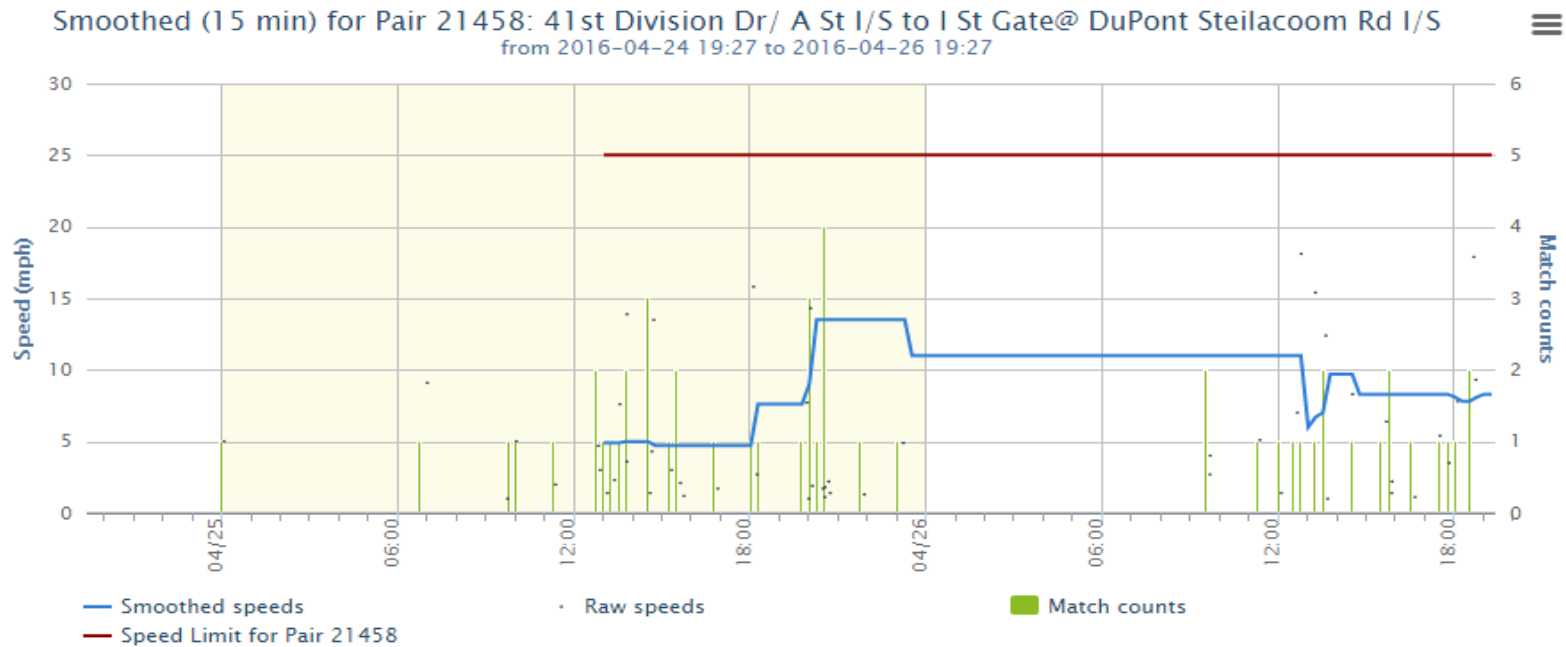
Day of week	Date	Time	Last match time	Travel time (s)	Speed (mph)
Tuesday	04/26/2016	00:00	2016-04-25 23:54:28	393.9	32.9
Tuesday	04/26/2016	00:05	2016-04-25 23:54:28	393.9	32.9
Tuesday	04/26/2016	00:10	2016-04-25 23:54:28	393.9	32.9
Tuesday	04/26/2016	00:15	2016-04-26 00:11:58	393.9	32.9
Tuesday	04/26/2016	00:20	2016-04-26 00:16:48	Not enough matches	
Tuesday	04/26/2016	00:25	2016-04-26 00:22:00	Not enough matches	
Tuesday	04/26/2016	00:30	2016-04-26 00:25:22	Not enough matches	
Tuesday	04/26/2016	00:35	2016-04-26 00:32:00	Not enough matches	
Tuesday	04/26/2016	00:40	2016-04-26 00:37:11	388.7	33.3
Tuesday	04/26/2016	00:45	2016-04-26 00:39:48	388.0	33.4
Tuesday	04/26/2016	00:50	2016-04-26 00:47:03	388.0	33.4
Tuesday	04/26/2016	00:55	2016-04-26 00:49:38	387.7	33.4

# BlueTOAD Site: Reports - Speed

## Chart Options

### Speed display mode

- ☒ Speed
- ☐ Travel Time



To zoom in, drag the mouse over the area to magnify. To hide/show a data series, click the name of the series in the legend bar.

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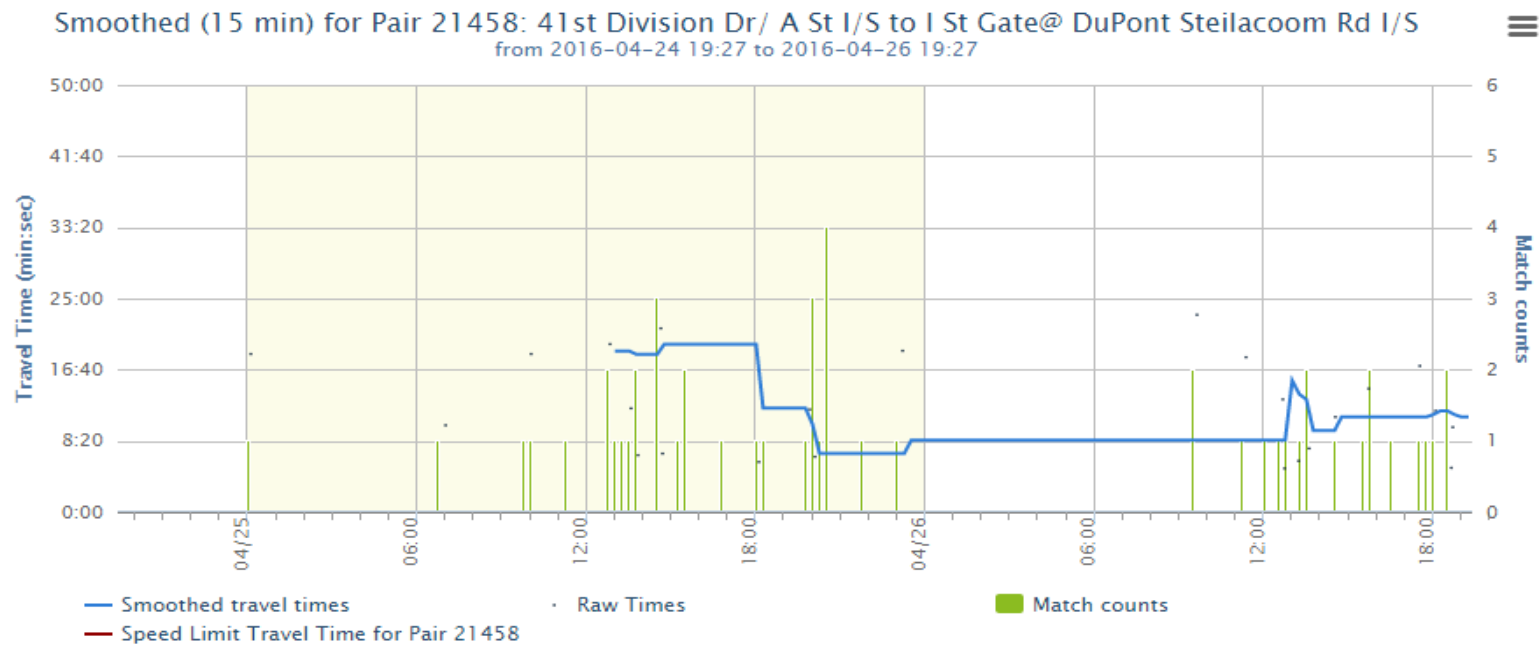
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# BlueTOAD Site: Reports – Travel Time

## Chart Options

### Speed display mode

- ☐ Speed
- ☒ Travel Time



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# BlueTOAD Site: Origin/Destination Studies

## Start Date

2016-03-01 00:00:00

## End Date

2016-04-25 23:55:00

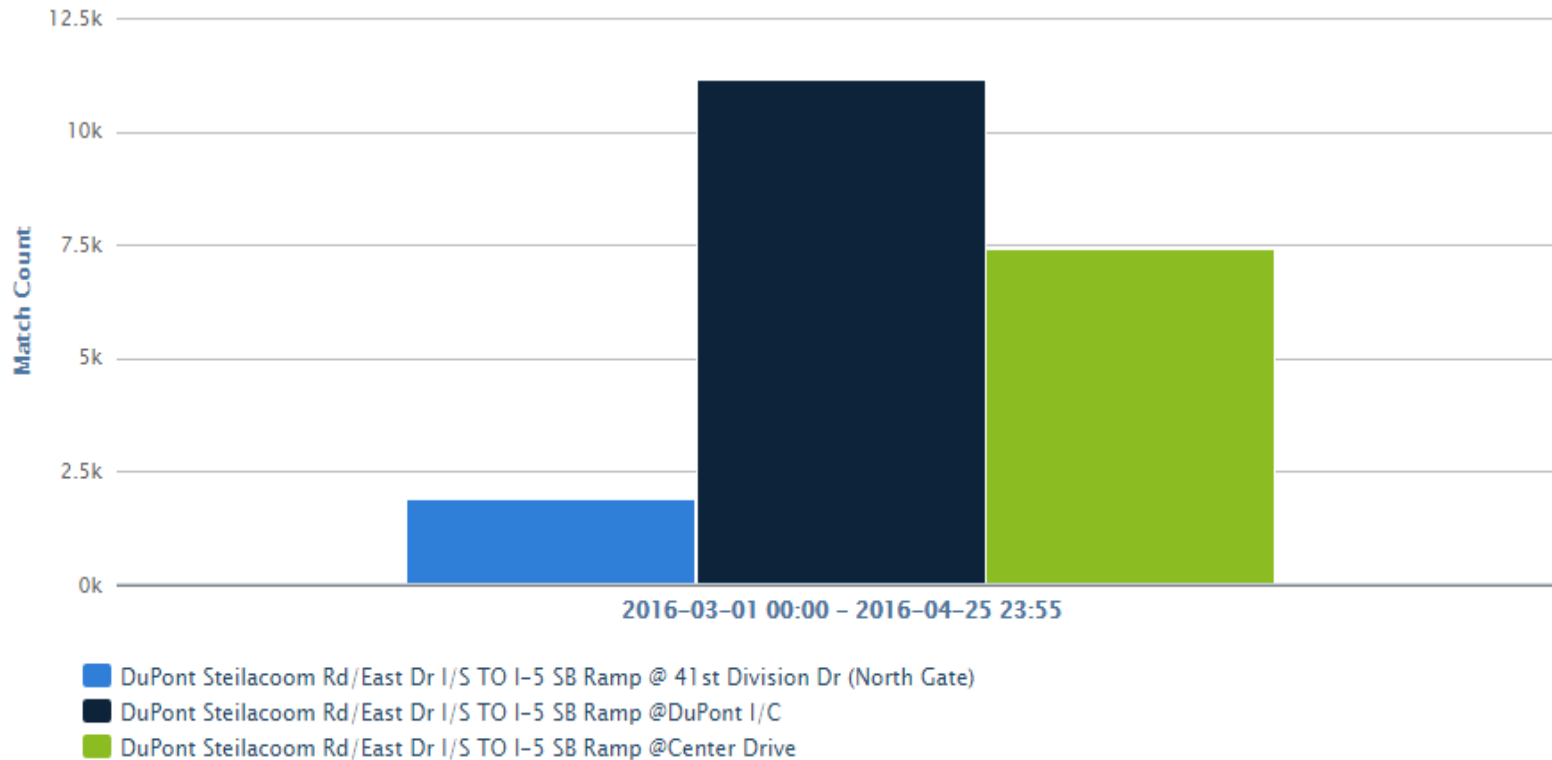
Origin	Destination	Waypoint	Map/Graph Color
DuPont Steilacoom Rd/East Dr I/S	I-5 SB Ramp @ 41st Division Dr (North Gate)		Green
DuPont Steilacoom Rd/East Dr I/S	I-5 SB Ramp @DuPont I/C		Pink
DuPont Steilacoom Rd/East Dr I/S	I-5 SB Ramp @Center Drive		Blue



# BlueTOAD Site: O/D Study Results

## Match count bar chart

Ken's Pet Project – Spring 2016



To zoom in, drag the mouse over the area to magnify. To hide/show a data series, click the name of the series in the legend bar.

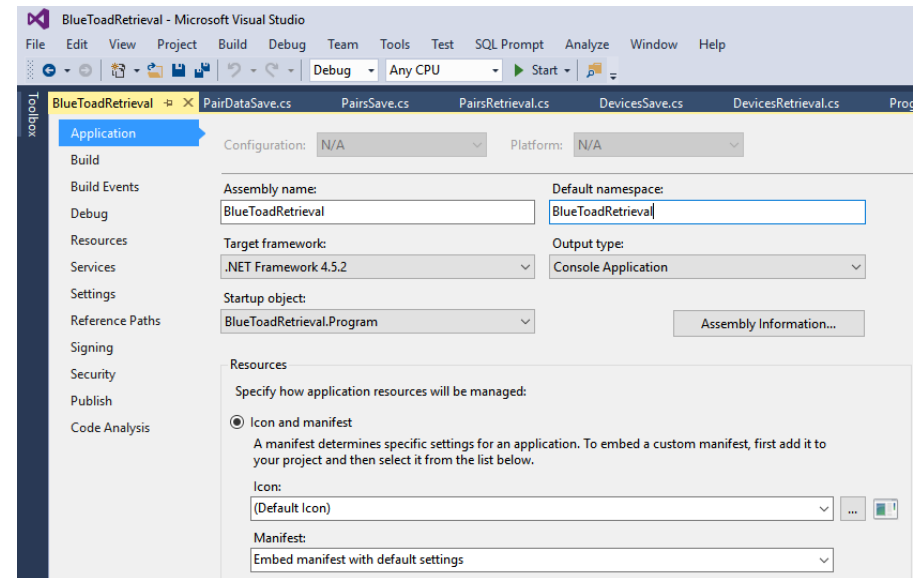
For support, please send email to: [bluetoad-help@trafficcast.com](mailto:bluetoad-help@trafficcast.com)

# Project Implementation

## Process Overview:

1. Complete setup in TrafficCast website
2. Complete setup in WSDOT database (mirrored data)
3. BlueTOAD Data Retrieval

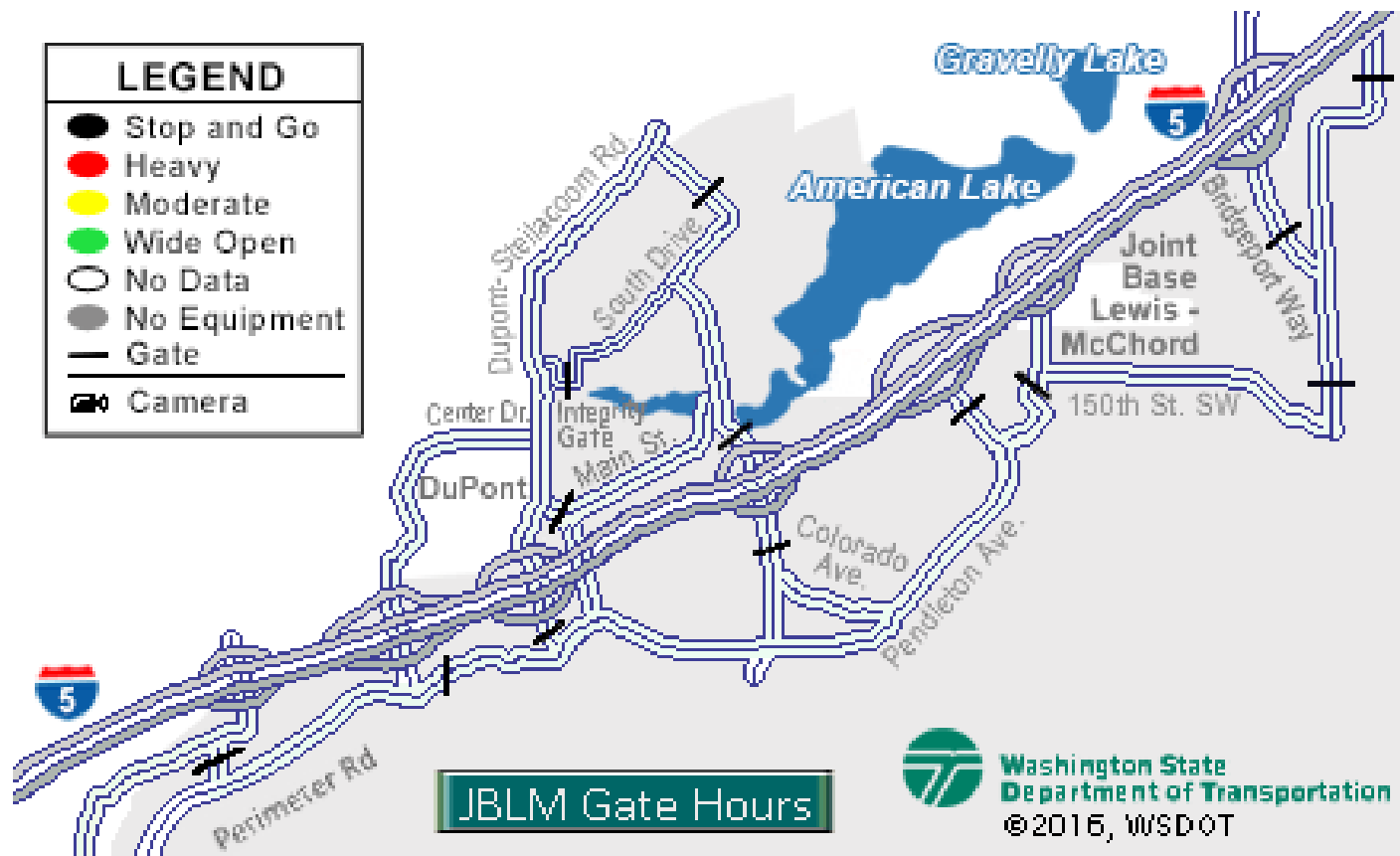
- Each data file requires a secure connection to BlueToad server
- Download devices XML data, save to list
- Add new devices
- Record last detection and voltage
- Download Pairs XML data
- Insert new pairs and update existing ones
- Save the current values to database
- Save history every 10 minutes
- Routes are ignored



# Project Implementation

## Map presentation work

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



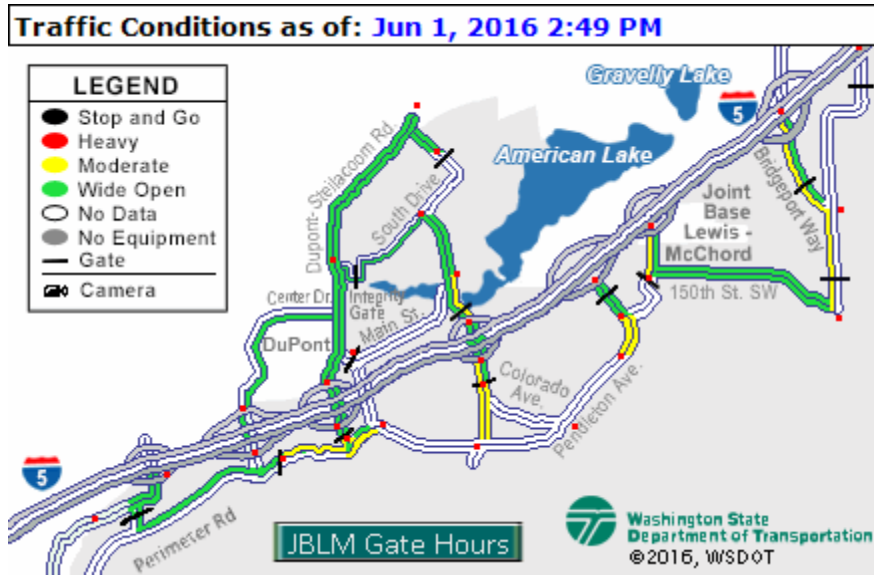
# Project Implementation

## 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

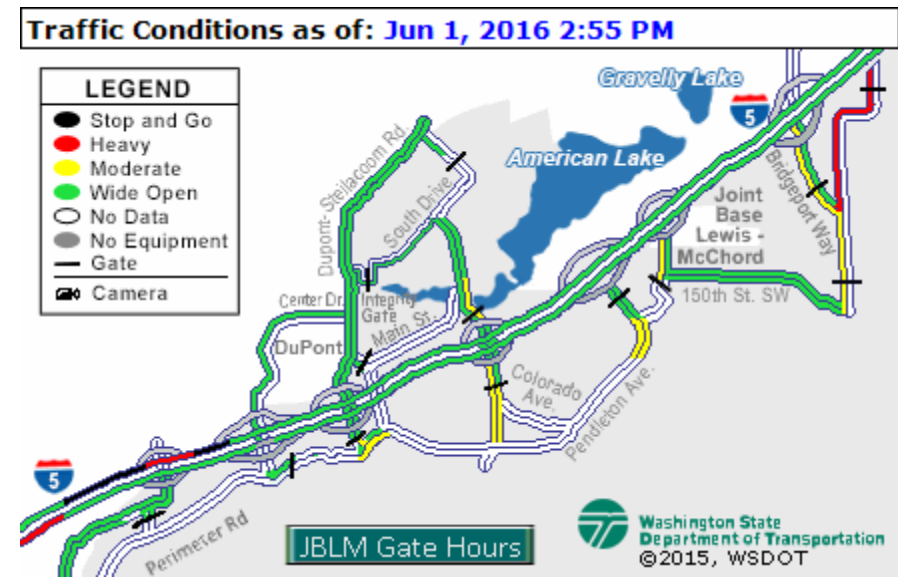
LEGEND	
	Stop and Go
	Heavy
	Moderate
	Wide Open
	No Data
	No Equipment
	Gate
	Camera

# Project Implementation



Showing approximate device locations

Final published map

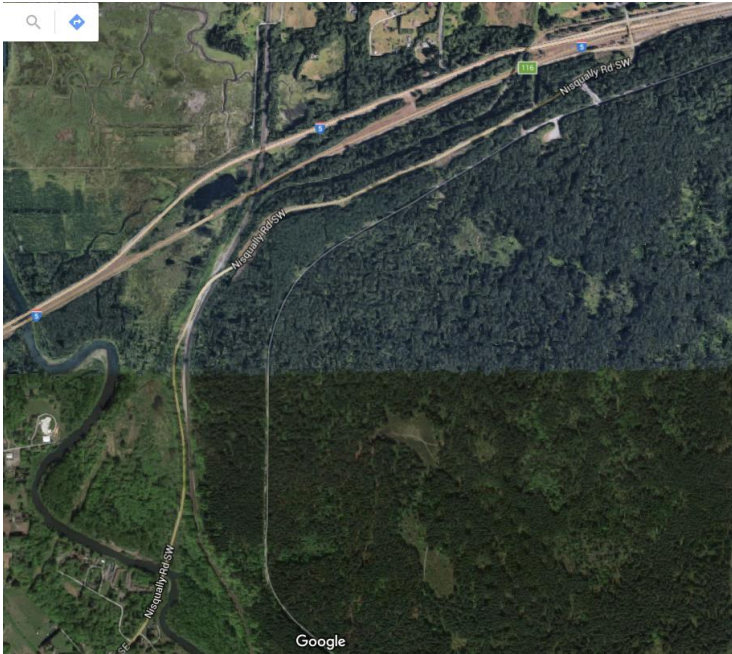


# Project Issues/Challenges

- **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



Google maps

## 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**

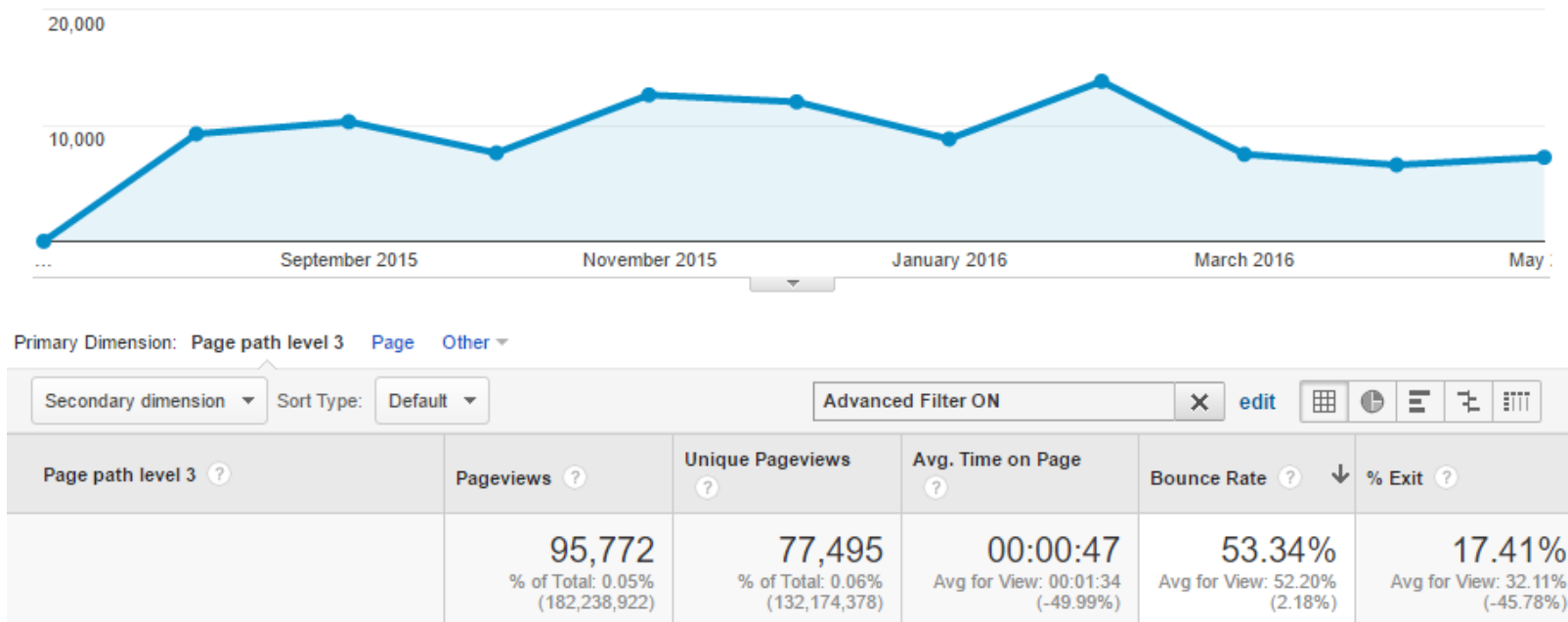


### **Poor Location, Shaded in Trees**

- 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!
- <http://www.wsdot.com/traffic/dupont/jblm.aspx>

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



**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.

#### Tacoma Washington Traffic and Cameras



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



Contact Info: Tony Leingang - [LeingA@wsdot.wa.gov](mailto:LeingA@wsdot.wa.gov) / 253-548-2430

