Alaska Department of Transportation & Public Facilities

Demonstration of Non-intrusive Traffic Data Collection Devices in Alaska

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Foreword

The purpose of this document is to present findings from the Demonstration of Non-Intrusive Traffic Data Collection Devices in Alaska (Project T-2-07-09). This project was initiated by the Alaska Department of Transportation and Public Facilities (DOT&PF) to evaluate innovative methods for detecting traffic. This project procured and field tested two portable non-intrusive traffic detection systems. This report documents the performance of these systems as tested by the DOT&PF personnel, and the feasibility of integrating into the Department's data collection program. This is the project's final report and is intended for data collection staff.

Notice

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13. ABSTRACT (Maximum 200 words)

The purpose of this document is to present findings from the Demonstration of Non-Intrusive Traffic Data Collection Devices in Alaska. This project was initiated by the Alaska Department of Transportation and Public Facilities (DOT&PF) to evaluate innovative methods for detecting traffic. Two different portable traffic detection systems were evaluated: a pole-mount radar system and a ground-mount axle-counting system.

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Testing with the axle-based detection system did not produce valid traffic data. Alaska DOT&PF staff was not able to successfully setup and calibrate the system.

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METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4		mm
ft	feet	0.3048		m
yd	yards	0.914		m
mi	Miles (statute)	1.61		km
		AREA		
in^2	square inches	645.2	millimeters squared	cm^2
ft^2	square feet	0.0929	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
mi^2	square miles	2.59	kilometers squared	km^2
ac	acres	0.4046	hectares	ha
		MASS (weight)		
oz	Ounces (avdp)	28.35	grams	g
lb	Pounds (avdp)	0.454	kilograms	kg
T	Short tons (2000 lb)	0.907	megagrams	mg
		VOLUME		
fl oz	fluid ounces (US)	29.57	milliliters	mL
gal	Gallons (liq)	3.785	liters	liters
ft^3	cubic feet	0.0283	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3

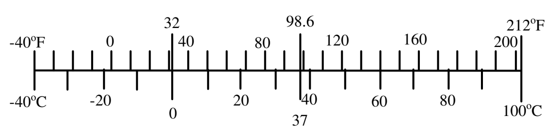
Note: Volumes greater than 1000 L shall be shown in m^3

Symbol	When You Know	Multiply By	To Find	Symbol
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (°F-32)	Celsius temperature	°C
		ILLUMINATION		
fc	Foot-candles	10.76	lux	lx
fl	foot-lamberts	3.426	candela/m^2	cd/cm^2
		FORCE and PRESSURE or STRESS		
lbf	pound-force	4.45	newtons	N
psi	pound-force per square inch	6.89	kilopascals	kPa

These factors conform to the requirement of FHWA Order 5190.1A *SI is the symbol for the International System of Measurements

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	Miles (statute)	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
km^2	kilometers squared	0.39	square miles	mi^2
ha	hectares (10,000 m^2)	2.471	acres	ac
		MASS (weight)		
g	grams	0.0353	Ounces (avdp)	oz
kg	kilograms	2.205	Pounds (avdp)	lb
mg	megagrams (1000 kg)	1.103	short tons	T
		VOLUME		
mL	milliliters	0.034	fluid ounces (US)	fl oz
liters	liters	0.264	Gallons (liq)	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 °C+32	Fahrenheit temperature	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/cm^2	candela/m^2	0.2919	foot-lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	pound-force	lbf
kPa	kilopascals	0.145	pound-force per square inch	psi



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ABSTRACT

The purpose of this document is to present findings from the Demonstration of Non-Intrusive Traffic Data Collection Devices in Alaska. This project was initiated by the Alaska Department of Transportation and Public Facilities (DOT&PF) to evaluate innovative methods for detecting traffic. Two different portable traffic detection systems were evaluated: a pole-mount radar system and a ground-mount axle-counting system. Data was collected from nine sites from July 2008 to February 2010, representing all three DOT&PF Regions.

Results indicate that the pole-mounted system performed accurately in detecting traffic. However, several deployment issues were noted, namely the size and weight of the system's batteries, which impact the system's portability, and the need for a minimum amount of traffic in order to successfully calibrate the system. These deployment issues limit the utility of the system as a replacement for current data collection practices. The pole-mounted system was also briefly tested for its ability to detect pedestrians and bicyclists. The system demonstrated an ability to detect bicycles, but pedestrian detection was not satisfactory.

Testing with the axle-based detection system did not produce valid traffic data. Alaska DOT&PF staff was not able to successfully setup and calibrate the system.

CHAPTER 1. INTRODUCTION

BACKGROUND

This project, Demonstration of Non-Intrusive Traffic Data Collection Devices in Alaska (T2-07-09), was initiated in 2008 to procure and field test two innovative methods for collecting traffic data. These methods were sought as alternatives to conventional data collection practices, such as road tubes and inductive loop detectors, which do not function well in certain data collection environments experienced in Alaska. Specifically, road tubes are difficult to use on gravel roads because they can be easily punctured and pulled out of position. Also, inductive loops are subject to damage as the roadways in which they are installed expand and contract with changing seasons. Tubes and loops have the additional safety issue of exposing personnel to traffic during their installation.

In 2005, the Alaska DOT&PF participated in a pooled fund study to develop and evaluate an innovative method for detecting traffic, the Portable Non-Intrusive Traffic Detection System (PNITDS). Based on the outcome of the PNITDS project, and on the shortcomings of existing practices, the DOT&PF decided to procure three pole-mounted radar systems and three non-intrusive axle-counting systems for deployment and testing.

In May 2008, DOT&PF data collection personnel from each region were trained on the operation of the pole-mounted systems. Data was then collected from nine sites between July 2008 and February 2010. Data collection occurred on a combination of two and four lane roadways in the Fairbanks area (Northern Region), Juneau area (Southeast Region) and the Anchorage area (Central Region). Sensor data was compared to a baseline data source, typically an in place Permanent Traffic Recorder (PTR) station that utilizes inductive loop detectors. Data collection personnel were also tasked with recording information about the roadway geometry, location of the sensor, and notes pertaining to issues related to the system setup or calibration. In addition, the pole-mounted system was used to detect pedestrians and bicyclists at one of the test sites.

The purpose of this report is to document the performance of the non-intrusive detection systems as tested by the DOT&PF personnel. Issues encountered during system deployment and calibration are also noted. In addition, the feasibility of integrating these non-intrusive systems into the Alaska DOT&PF's data collection program is explored in the Conclusion chapter.

POLE-MOUNT SYSTEM DESCRIPTION

The pole-mount system is intended to collect traffic volume, speed and vehicle classification in a variety of locations. When mounted to existing roadside infrastructure, such as a sign, vehicles are detected with a radar sensor in a side-fire fashion. The system uses high-capacity, deep-cycle batteries that are charged and then left to power the system for the duration of the seven-day data collection period. Data is stored in "bins" on the sensor's internal memory. The system is designed to detect motorized traffic, but detection of bicycles and to a lesser extent pedestrians, was also examined for this project.

A complete system is comprised of two or three vertical poles with mounting hardware, a telescoping rod for fine vertical angle adjustment, batteries, and battery box. A laptop or PDA is also needed to configure the sensor and download data at the end of the collection period. As designed, a two-pole setup can host a sensor to a height of 16 feet and a three-pole setup can support a sensor to a height of 24 feet. For sensors mounted at 16 feet, the mounting angle can be adjusted from the ground with a telescoping pole. Higher than this, adjustments need to be made by hand. Based on the results of the PNITDS pooled fund study, the Wavetronix SmartSensor HD was selected for this application. Refer to Table 1 for the Wavetronix sensor's specifications.

Table 1. Wavetronix Sensor Specifications

Specification	**Wavetronix – SmartSensor HD**
Technology	Digital Radar
Traffic Data	- Volume - Speed - 3 User Defined Class by Length
Output Type	- Contact closure - Ethernet serial adapter (TCP/IP Addressable)
Installation Height	15' – 27'
Installation Offset	10' – 50' (sidefire only)
Detection Range	Up to 8 lanes (200' total distance)
Power Supply	9-36 VDC, 7.5 W
Comm. Interface	RS - 232 or RS - 485
Cost	$5,666 (including cabling & software)

A set of nine mechanical drawings for the pole-mounted system was prepared for this project. These drawings were provided earlier in the project's System Specifications document.

Power is supplied by four 12 VDC deep cycle rechargeable 55 amp-hour batteries (Optima Spiralcell) that were purchased for the system. Each battery can support a 7.5-watt Wavetronix HD sensor for a minimum of three days. Four batteries can support the system for nine days without depleting the battery below 20 percent of its capacity. Off-the-shelf battery cases were also procured to house the batteries and any necessary accessories onsite during the test. Refer to Figure 1, a photograph of the pole-mounted system, and Figure 2, system setup during the training in May 2008. Note that the final battery box selected for this project was larger than the box shown in Figure 1. The size and weight of the battery power system was identified as an issue in deploying and transporting the system. This issue is further addressed in Chapter 4.

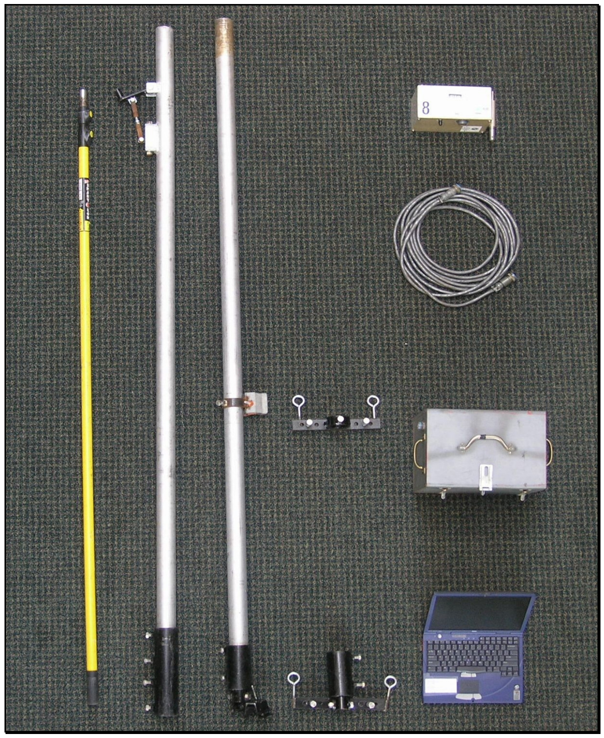


Figure 1. Photo. Pole-mount System Components

Figure 2. Photo. Pole-mount System Installation

SIDEFIRE AXLE CLASSIFICATION SYSTEM DESCRIPTION

The axle classification system evaluated by this project is the AxleLight sensor manufactured by PEEK. This system uses laser sensors mounted on one side of the road to detect traffic volume, speed and axle based classification. The system can classify vehicles with FHWA's 13-class scheme or a user-configurable classification scheme.

Site selection is an important criterion for deploying the system. The system is most often mounted on guardrail adjacent to the roadway. In order to do classification, two AxleLight sensors should be mounted approximately 10 to 15 feet apart on posts (such as guard rail posts). The sensors must be mounted so that the lasers are one to two inches higher than the crown of the roadway. The sensor mounting hardware has fine adjustment capabilities that allow adjustment to the height, horizontal angle and vertical angle of the lasers. Each of these lasers is connected to a data recorder.

The AxleLight uses ranging lasers to determine the distance from the sensor to the vehicle. The sensor constantly outputs a laser beam and vehicles that pass by the sensors reflect the laser back. The laser interprets the information that is reflected back and assigns the axle hit to a lane.

Configuration is mostly a manual process. The sensor's configuration tool reports back the axle hit that was nearest to the sensor and uses that information to determine the dimensions of the first lane. The user can enter a lane width that the sensor adds to the first lane to determine the dimensions of the additional lanes. If the lane geometry differs from this configuration, such as if there is a median, there are options for manually inputting lane information. See Figure 3 for a photo of the system. As discussed further in Chapter 4, calibration proved to be a significant issue in the use of this sensor.

Figure 3. Photo. Axle-Based System Setup

PROJECT GOALS AND OBJECTIVES

The primary goal of this project is to evaluate whether the non-intrusive traffic detection systems can be successfully integrated into the Alaska DOT&PF's data collection program. This evaluation focused on two aspects: first, the performance of the sensor in terms of accuracy when compared to an inductive loop or road tube based counter; and second, the ease of deployment and calibration at a field site.

To be successful, the system must be able to accurately detect traffic in multiple lanes under various conditions without exposing personnel to traffic. This must be accomplished within the existing resources of the Department's data collection program. Two goals and supporting objectives were developed as part of the Evaluation Test Plan to guide the evaluation.

Goal 1: Compare Sensor Performance to Alternate Data Collection Practices in Various Locations

Objective 1-1: Evaluate Performance on High Volume Roads

Objective 1-2: Evaluate Performance on Low Volume Roads

Objective 1-3: Evaluate Performance on Gravel Roads

Objective 1-4: Evaluate Performance for Bike and Pedestrian Detection

Objective 1-5: Evaluate Performance on Roads with Rutting

Objective 1-6: Evaluate Performance in Other Situations

Goal 2: Document Sensor Deployment Issues

Objective 2-1: Document Deployment Issues in Various Locations

Objective 2-2: Document Deployment Issues on Various Post Types

Objective 2-3: Document Calibration Issues

Objective 2-4: Document Maintenance Issues

Objective 2-5: Document System Costs

The Evaluation Test plan was developed to address the following questions:

- How to mount the pole-mount to existing roadside infrastructure (i.e., guard rail posts, roadside signs)?
- Which locations offer ease of installation and best sensor performance?
- Pros and cons of the selected battery system?
- What are the system costs, including all components and sensors?
- Should the systems be incorporated into the Department's data collection program?

CHAPTER 2. TEST METHODOLOGY

BASELINE DATA COLLECTION AND VERIFICATION

Inductive loop detectors and piezo-electric sensors provide an excellent source of baseline data because they are accurate and reliable when correctly installed and calibrated. At least one test in each region was conducted at an existing PTR station. Manual data collection was used for bicycle and pedestrian counts.

Since the system evaluation relies on comparisons between the sensor and a baseline data source, it was important to verify proper performance of the baseline source before each test. Baseline verification for traffic volumes consisted of manually collecting sample data (ideally 50 observations) and comparing the results to a baseline source.

SENSOR CALIBRATION

The traffic sensors must be carefully calibrated before the start of any official data collection. The calibration of a sensor consists of an iterative process including sensor aiming, calibration, and sample data collection. Vendor guidelines were followed and the ease of calibration was documented. Suggested accuracy targets for volume, speed and classification using either the Wavetronix or AxleLight systems is presented in Table 2.

Table 2. Recommended Accuracy Requirements

Traffic Parameter	Accuracy for Typical Applications
Volume	2 to 7 percent
Speed	2 to 5 mph
Classification	10 to 20 percent per class

SENSOR DATA COLLECTION

Data collection consisted of allowing the sensor to automatically record traffic volumes for a specified time (from one to nine days) and extracting the data to a text file for analysis.

At the completion of each test a log document was completed indicating the time and location of the test, as well as the lane/roadway geometry and any issues encountered during setup and calibration. The test log forms are provided in Appendix A.

CHAPTER 3. DATA ANALYSIS

This chapter presents the standard statistical analysis techniques for evaluating the sensors' performance. Data analysis focuses on comparing the sensor volume data against the verified baseline data.

- **Percentage Difference**: The percent difference is an easily understood expression of the difference between data sets. A lower number indicates less difference between the test data and baseline data.

- **Absolute Percentage Difference**: The absolute percent difference is similar to percent difference, but is calculated from the absolute value of the differences for each time interval. This information indicates how close the data collected from the sensors are to the baseline data without the compensating errors caused by data aggregation. Absolute percentage difference is always equal to or greater than percent difference.

- **Scatter Plots**: Scatter plots show the relationship between two sets of numbers as one series of x-y coordinates. Each point on a scatter plot represents aggregated traffic data for a one-hour sample interval as measured on the horizontal axis (baseline data), and the sensor being tested on the vertical axis. All data points falling on a straight line represent perfect agreement between the two compared data sets which provides a powerful, straightforward visual representation of variation between sensor data and baseline data.

- **Correlation Coefficient**: The correlation coefficient is a dimensionless index that ranges from -1.0 to 1.0. It quantifies the linear nature of the data points seen on a scatter plot, providing a measure of each sensor's variation from the baseline data from one time interval to the next. The closer the correlation coefficient is to 1.0, the more closely the data sets match. The Pearson's product-moment correlation coefficient was calculated for each of the evaluation tests.

CHAPTER 4. TEST RESULTS

As described earlier, two criteria were established to guide evaluation activities, examining sensor accuracy and deployment issues. Sensor accuracy is addressed in the following section and deployment issues are covered in the next section, beginning on page 27.

TEST PLAN CRITERION 1: EVALUATE SENSOR PERFORMANCE

The results presented in this section are only for the pole-mounted Wavetronix system. No valid data was collected from the axle-based system (AxleLight) because DOT&PF personnel were not able to get the units to operate successfully. The AxleLight issues are explored in the next section.

The results presented here are primarily for vehicle detection. Bicycle and pedestrian detection was attempted at one location, the South Douglas Highway at John Street in the Southeast Region. See the last test site in this section.

Northern Region – Steese Highway North of Fox, Alaska

This test occurred on a section of Steese Highway, which runs in a northeast/southwest direction just north of Fox, Alaska, a town approximately 10 miles north of Fairbanks. The roadway is a two-lane undivided rural highway, with a 55 MPH speed limit. The Wavetronix SmartSensor HD was installed approximately 16 feet from the traveled way at a height of approximately 16 feet.

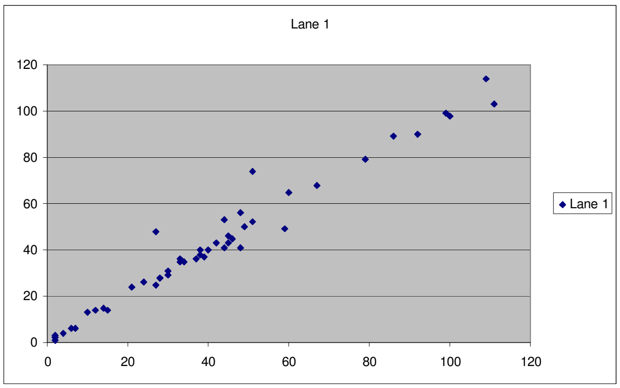
Reported calibration time at this site was one hour. Field notes indicate that there was some difficulty with calibration, as the sensor reported an alignment error. Nevertheless, the data appeared to have good agreement with observed traffic. A clock error in the Wavetronix required a minor adjustment to the collected data (one hour shift) for analysis.

In general, the data showed good correlation between the PTR and the Wavetronix. The correlation coefficient and the scatter plots both indicate high similarity between the data sets. The measures of data distribution (standard deviation and variance) are also similar between the data sets, this also indicates good agreement. See Table 3 for a summary of calculated statistics. See Figures 4 and 5 for scatter plots of the sensor vs. PTR data. As described in Chapter 3, data points falling on a straight line represent agreement between the two data sets. The PTR data is shown on the x-axis and the Wavetronix data on the y-axis.

The absolute percent difference is higher for the northbound lane than southbound (7.4 vs. 4.1 percent). This is likely due to two factors: 1) an unresolved alignment error message reported by the Wavetronix, and; 2) lower volumes in the eastbound lane may have affected calibration and gave a smaller sample for comparison. Overall absolute error was 5.6 percent, and the percent difference, which allows compensating errors due to data aggregation, was 1.6 percent. Both of these values fall within the expected accuracy target of 2 to 7 percent.

Table 3. Steese Highway North of Fox Statistical Summary

	Lane 1 (NB)	Lane 2 (SB)	All
PTR Volume	1,958	2,005	3,963
Sensor Volume	2,014	2,011	4,025
Percent Difference	2.9%	0.3%	1.6%
Abs Percent Difference	7.4%	4.1%	5.7%
Correlation Coefficient	0.9821	0.9959	0.9915



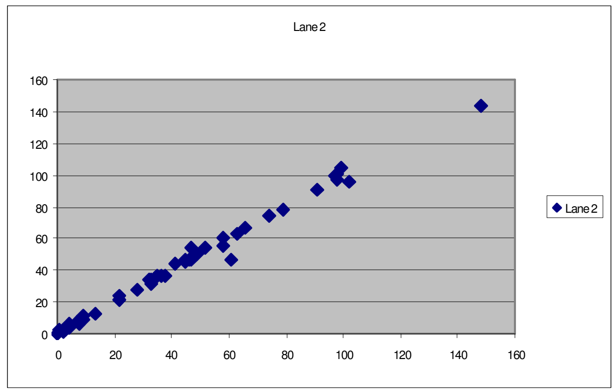


Figure 4. Graph. Per Lane Scatter Plots, Steese Highway North of Fox

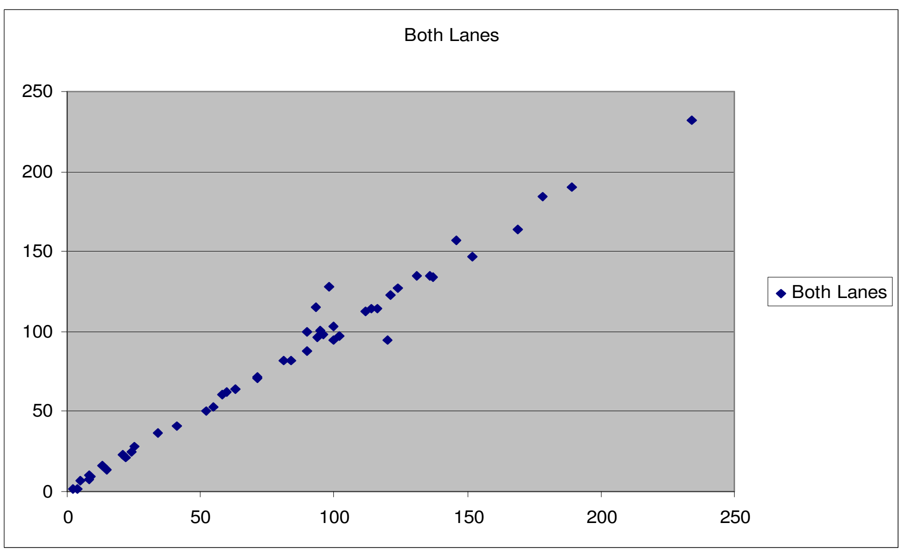


Figure 5. Graph. Both Lanes Scatter Plot, Steese Highway North of Fox

Northern Region – Peger Road at DOT Building

Peger Road is a north/south four-lane roadway in Fairbanks. There is also a center turn lane that is shared by traffic traveling in both directions. The chosen site (near the DOT&PF building at 2301 Peger Road) is in a low to mid-density urban area with a 45 MPH speed limit and signalized intersections. The Wavetronix was installed 22 feet from the edge of the traveled roadway at a height of 16 feet. As with the Steese Highway site, the sensor reported an alignment error, although it appeared to count vehicles correctly. The center turn lane was not included in the analysis because there were no loops available to provide a baseline reference. In addition, staff was not trained on how to setup the Wavetronix to function on a bi-directional lane. A time shift adjustment of nine hours to the Wavetronix data was required to correct for a clock error.

Overall, the data displays good correlation between the Wavetronix and PTR. The lanes farthest from the detector (three and four) showed increased error at higher volumes, as shown in the scatter plots. However, the correlation coefficient and percent difference indicate similarity between the data sets.

Aggregated (all lanes) absolute error was 6 percent, within the target accuracy range. The greater error in more distant lanes may be attributable to the unresolved alignment error reported by the sensor. Table 4 details the computed statistics for this site's data sets.

Table 4. Peger Road at DOT Building Statistical Summary

	Lane 1 (NB)	**Lane 2 (NB)**	**Lane 3 (SB)**	**Lane 4 (SB)**	**All**
PTR Volume	17,363	30,405	26,268	25,268	99,586
Sensor Volume	17,651	30,647	26,779	25,677	100,754
Percent Difference	-1.7%	-0.8%	-0.9%	-1.6%	-1.2%
Abs Percent Difference	5.7%	5.2%	6.6%	6.3%	6.0%
Correlation Coefficient	0.9959	0.9963	0.9940	0.9943	0.9970

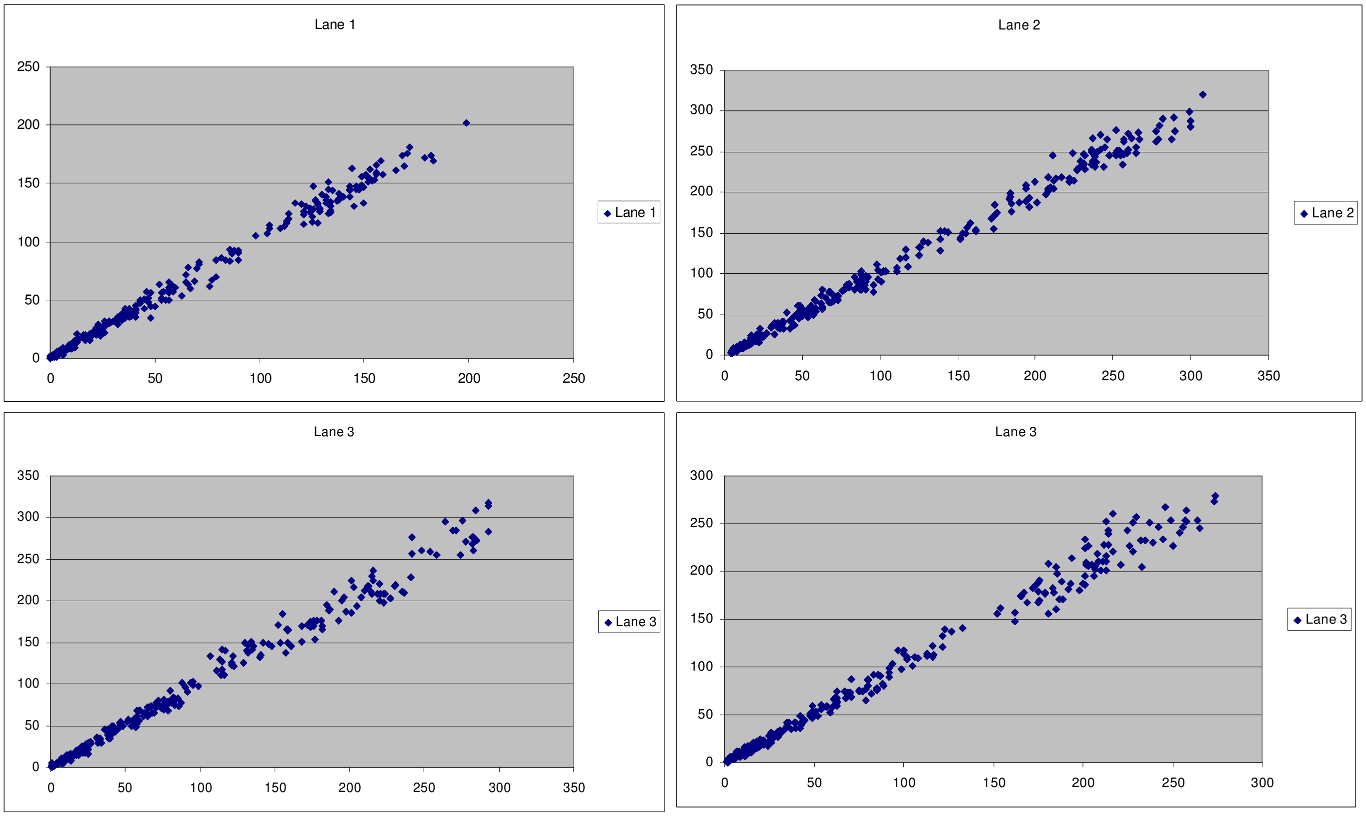


Figure 6. Graph. Per Lane Scatter Plots, Peger Road at DOT Building

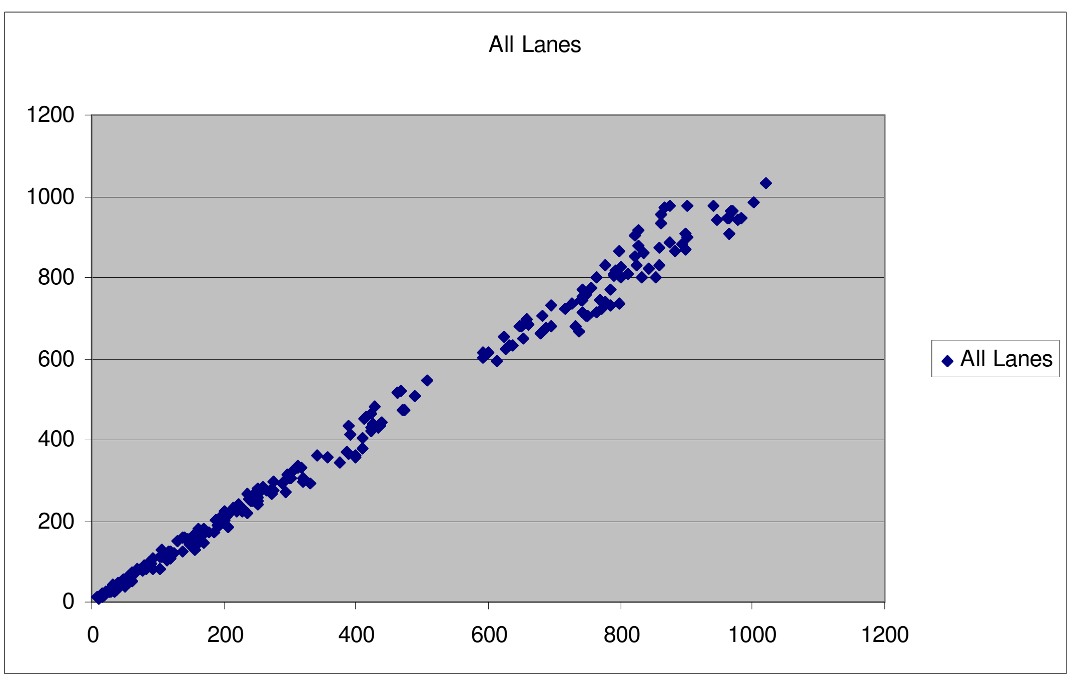


Figure 7. Graph. All Lanes Scatter Plot, Peger Road at DOT Building

Northern Region – North Cushman Street at Illinois Street

The Cushman Street site was located just north of a bridge near the Fairbanks Central Business District (CBD). At this site, Cushman Street runs north/south and has four lanes with a 30 MPH speed limit. The Wavetronix was installed 14 feet from the roadway at a height of 16 feet. No calibration difficulties were reported, but the data from the sensor required a one-hour adjustment to correct for a clock error.

This site shows anomalous error readings from Lane 2 (northbound, inside lane). Where other individual lanes error ranges from 3.2 to 4.4 percent difference, Lane 2 had 13.5 percent difference. There are several different possible explanations for this condition. There is a left-turn lane just to the north of the detection site, and a substantial portion of the traffic could be changing lanes at this location, which can influence Wavetronix accuracy. Also, the volume is much lower in this lane than the others that can affect accuracy through less accurate calibration and lower overall sample sizes. The other lanes all showed very good agreement with percent differences below five percent.

Table 5. North Cushman Street at Illinois Street Statistical Summary

	Lane 1 (NB)	**Lane 2 (NB)**	**Lane 3 (SB)**	**Lane 4 (SB)**	**All**
PTR Volume	47,971	12,160	31,337	20,566	112,034
Sensor Volume	49,423	10,540	32,096	20,738	112,797
Percent Difference	3.0%	-13.3%	2.4%	0.8%	0.7%
Abs Percent Difference	3.2%	13.5%	3.2%	4.4%	4.6%
Correlation Coefficient	0.9995	0.9960	0.9990	0.9960	0.9997

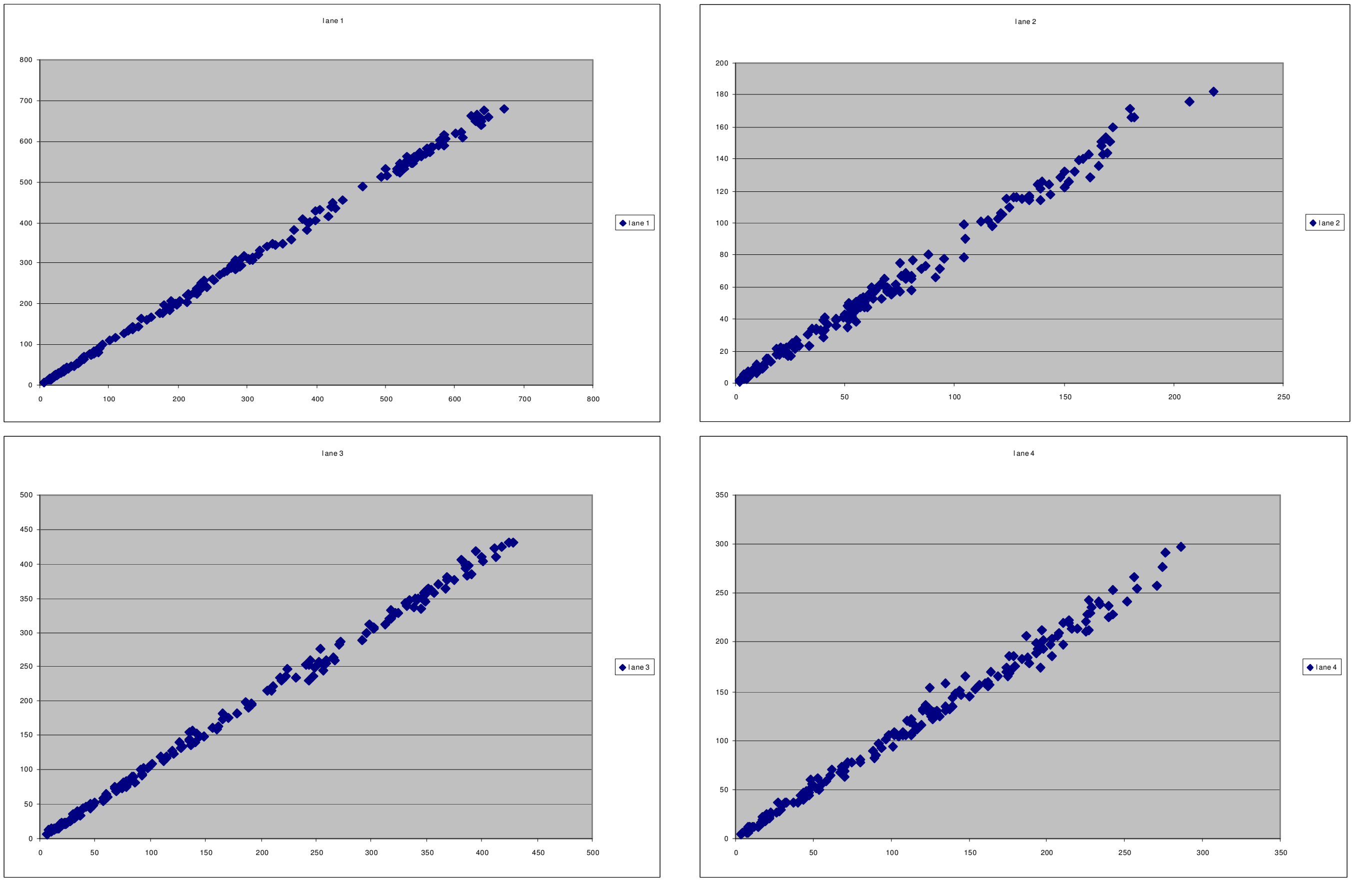


Figure 8. Graph. Per Lane Scatter Plots, North Cushman Street at Illinois Street

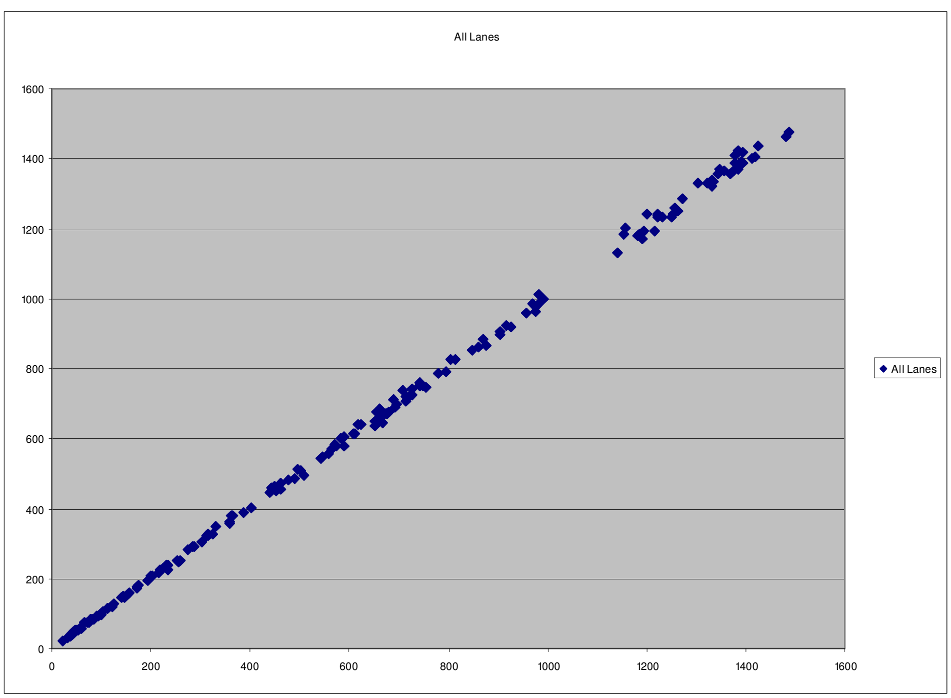


Figure 9. Graph. All Lanes Scatter Plot, North Cushman Street at Illinois Street

Northern Region – Dalton Highway South of Yukon Bridge

The Dalton Highway site is at a remote location near the E.L. Patton Bridge over the Yukon River. This roadway is characterized by low overall volumes with a high percentage of heavy truck traffic. The roadway itself has a hard surface with narrow, gravel shoulders and does not have lanes marked. PTR data is captured as a bi-directional total, so that individual direction/lane data is not available.

Of all test sites examined, the overall accuracy for the Wavetronix was the lowest at this site, with an overall absolute percent difference of 13.8 percent. Several factors may contribute to the comparatively poor performance:

1) The PTR baseline may have inaccuracies that make comparison to Wavetronix data less meaningful.

2) The Wavetronix sensor operates on the principal of directional lanes of traffic. The lack of lane markings may have allowed traffic to travel in either direction in a virtual lane, pushing the limits of the sensor.

3) The low volumes result in small sample sizes and smaller number of vehicles to use during the calibration process.

4) The high proportion of truck traffic may have exacerbated the tendency of a detector to "double count" long or articulated vehicles.

Although the correlation coefficient was still greater than 0.87, the scatter plot and distribution statistics show significant differences between the PTR and Wavetronix data. For future use, manually adjusting detection parameters (lane widths, sensitivities, etc.) may improve sensor performance in difficult conditions such as those at the Yukon River Bridge. Summary statistics are shown in the table below.

Table 6. Dalton Highway South of Yukon Bridge Statistical Summary

	All Traffic
PTR Volume	2,359
Sensor Volume	2,161
Percent Difference	-8.5%
Abs Percent Difference	13.8%
Correlation Coefficient	0.8710

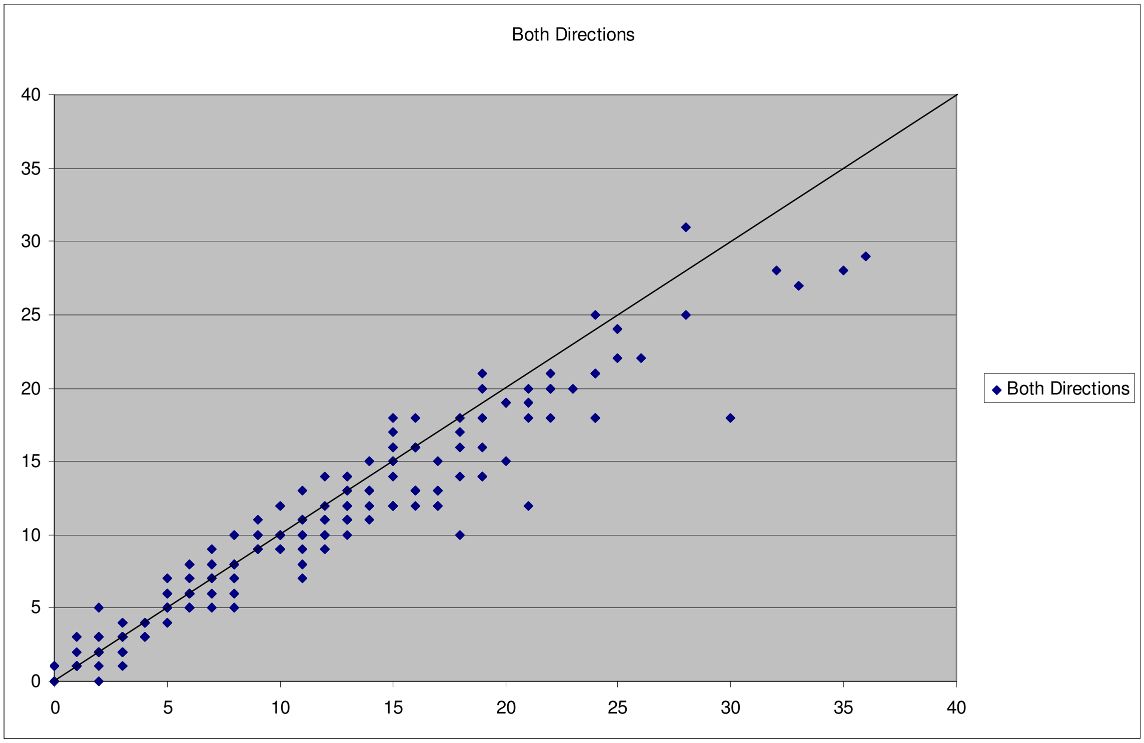


Figure 10. Graph. All Directions Scatter Plot, Dalton Highway South of Yukon Bridge

Northern Region – Mitchell Expressway West of Chena River

Mitchell Expressway is a four lane divided highway west of the Fairbanks CBD with a northwest/southeast orientation. This roadway has a grass median with paved shoulders in both directions and a speed limit of 55 MPH. The Wavetronix was installed 16 feet from the edge of traveled pavement at a height of 16 feet. A one-hour adjustment was needed to correct for a clock error in the sensor, but no other setup difficulties were noted.

Overall sensor performance was very good with an all lanes absolute percent difference was 1.5 percent, and no lane exceeding 4.7 percent. Correlation coefficients were all above 0.99 and measures of distribution were very close for all lanes.

Lane 3 shows the greatest error from the PTR data. The scatter plot shows these errors to be distributed throughout the range of volumes observed. These errors could be accounted for by either sensor or PTR (loop) calibration problems.

Table 7. Mitchell Expressway West of Chena River Statistical Summary

	Lane 1 (NB)	Lane 2 (NB)	Lane 3 (SB)	Lane 4 (SB)	All Lanes
PTR Volume	44,199	9,306	5,731	55,038	114,274
Sensor Volume	44,239	9,567	5,581	55,945	114,944
Percent Difference	0.1%	2.8%	-2.6%	1.6%	0.6%
Abs Percent Difference	0.8%	2.7%	4.7%	1.4%	1.5%
Correlation Coefficient	0.9998	0.9994	0.9981	0.9999	0.9999

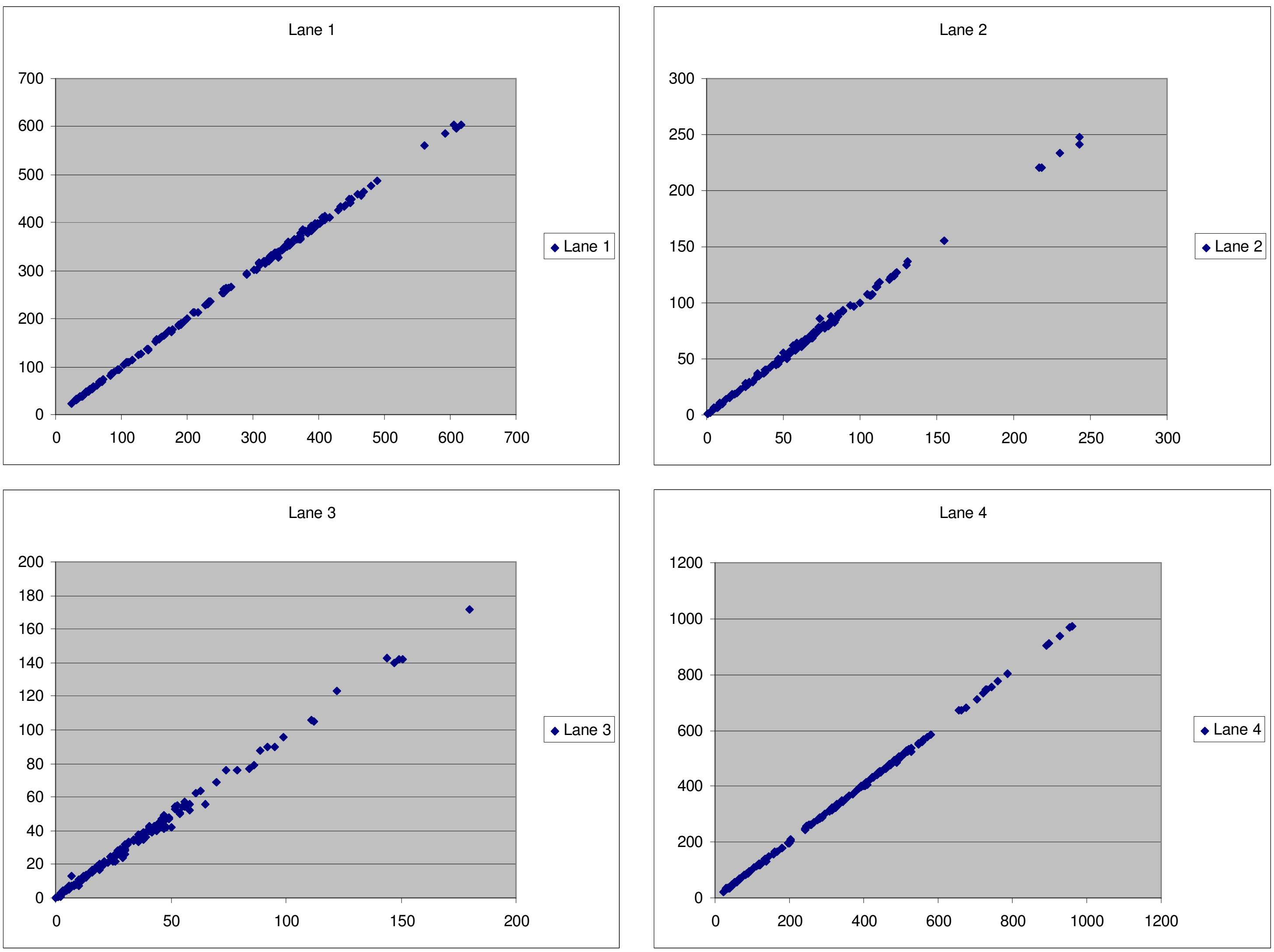


Figure 11. Graph. Per Lane Scatter Plots Mitchell Expressway West of Chena River

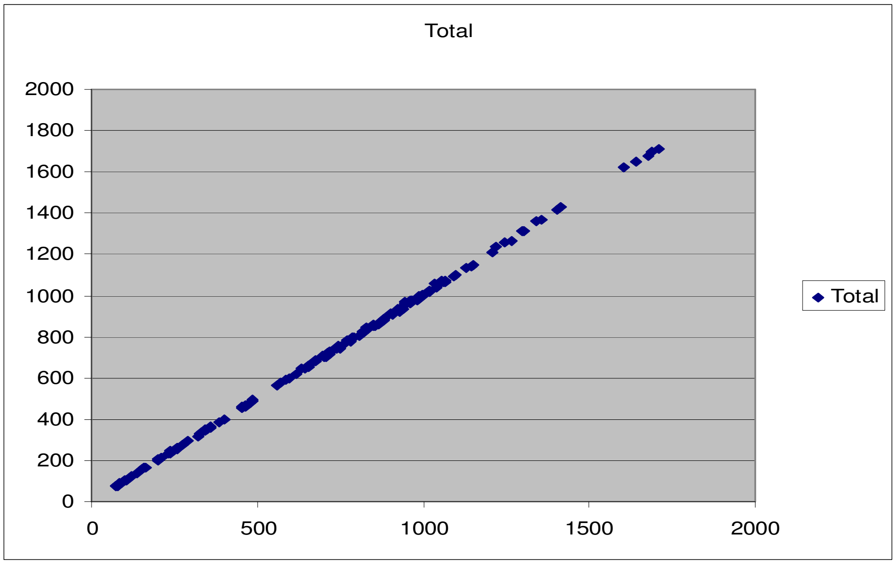


Figure 12. Graph. All Lanes Scatter Plot, Mitchell Expressway West of Chena River

Central Region – Seward Highway at Potter Marsh

Seward Highway in the vicinity of the test site is a two-lane 55 MPH roadway bounded by a large wetland area (Potter Marsh) to the east and a railroad facility to the west. The sensor was installed 25 feet from the nearest traveled lane, at a height of 24 feet.

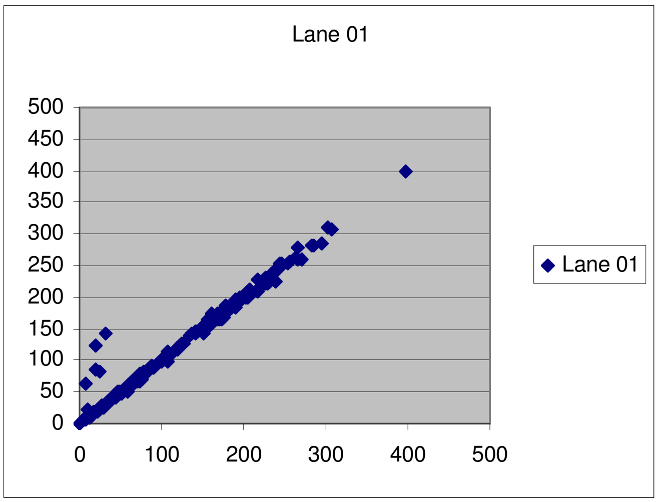
The detection area past the southbound lane was deactivated in the sensor, to prevent detection of trains. Some bicycle traffic was also observed on the shoulder of the roadway, but it is not likely that the sensor detected this. No other issues were reported with installation and calibration.

A large volume of data was returned for this sensor, covering approximately nine months. Examination of this data suggested that the sensor was not properly aligned during most of its operational period. Because of this, only a subset of data was selected for analysis: 11/13/2009 to 11/22/2009. During that time, sensor volumes matched the PTR-recorded volumes. This data also required an adjustment to match PTR time data to Wavetronix time data of 11 hours.

Sensor performance was fair in this test, with an overall absolute percent difference of 5.7 percent. Examination of the scatter plots shows that several anomalous or “outlier” data points are influencing the percent difference calculation, as the correlation coefficient and distribution statistics still indicate a fair degree of agreement between the data sets. These outlier points may be explained by poor lane discipline as snow events may have obscured the pavement markings.

Table 8. Seward Highway at Potter Marsh Statistical Summary

	Lane 1 (NB)	Lane 2 (SB)	Both Lanes
PTR Volume	27,002	27,027	54,029
Sensor Volume	27,377	28,974	56,351
Percent Difference	1.4%	7.2%	4.3%
Abs Percent Difference	3.5%	7.7%	5.7%
Correlation Coefficient	0.9898	0.9021	0.9552



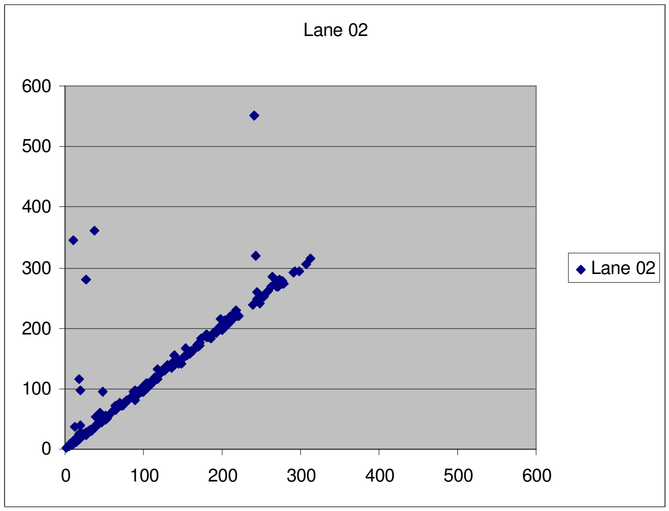


Figure 13. Graph. Per Lane Scatter Plots, Seward Highway at Potter Marsh

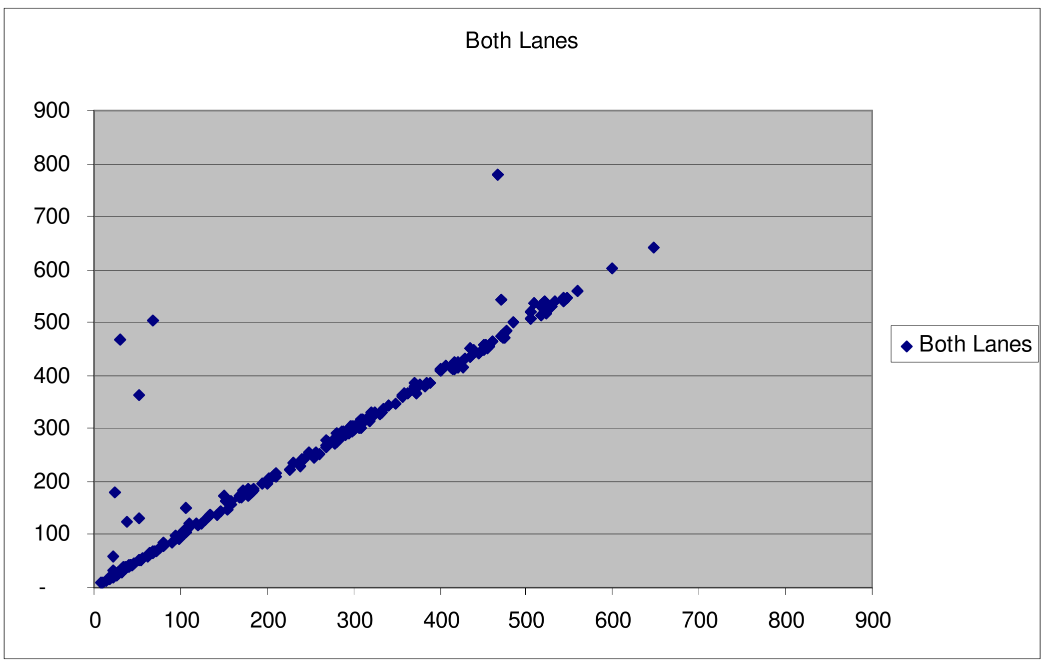


Figure 14. Graph. Both Lanes Scatter Plot, Seward Highway at Potter Marsh

Southeast Region – Glacier Highway/16 Mile PTR Station

Glacier Highway at the test site is an undivided, two-lane rural highway with paved shoulders in each direction. In this case the sensor was installed 20 feet from the nearest traveled lane at a height of 22 feet.

A long calibration period was noted by field personnel during set-up, due to the low traffic volumes on the road. No other issues that would affect volume measurement were noted.

The Wavetronix had very good performance, with an aggregate absolute percent difference of 2.8 percent. Correlation was above 0.99 in all cases and measures of distribution were very close for both lanes and the aggregate volume comparison.

Table 9. Glacier Highway/16 Mile PTR Station Statistical Summary

	Lane 1	Lane 2	Both Lanes
PTR Volume	4,611	4,575	9,186
Sensor Volume	4,589	4,575	9,164
Percent Difference	-0.5%	0.0%	-0.2%
Abs Percent Difference	2.9%	2.6%	2.8%
Correlation Coefficient	0.9986	0.9991	0.9993

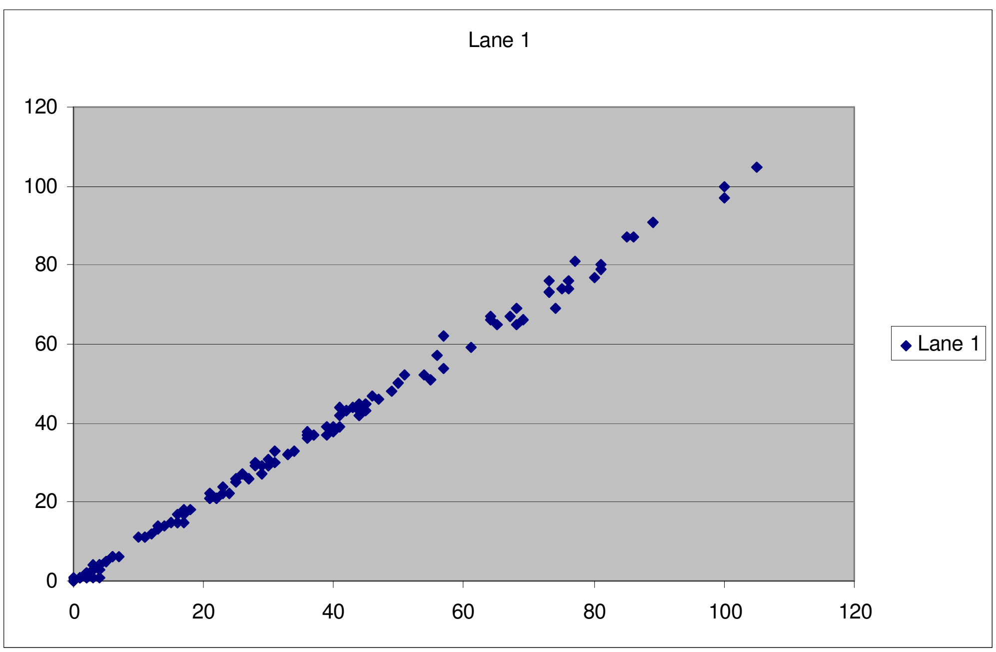


Figure 15. Graph. Glacier Highway/16 Mile PTR Station, Lane 1

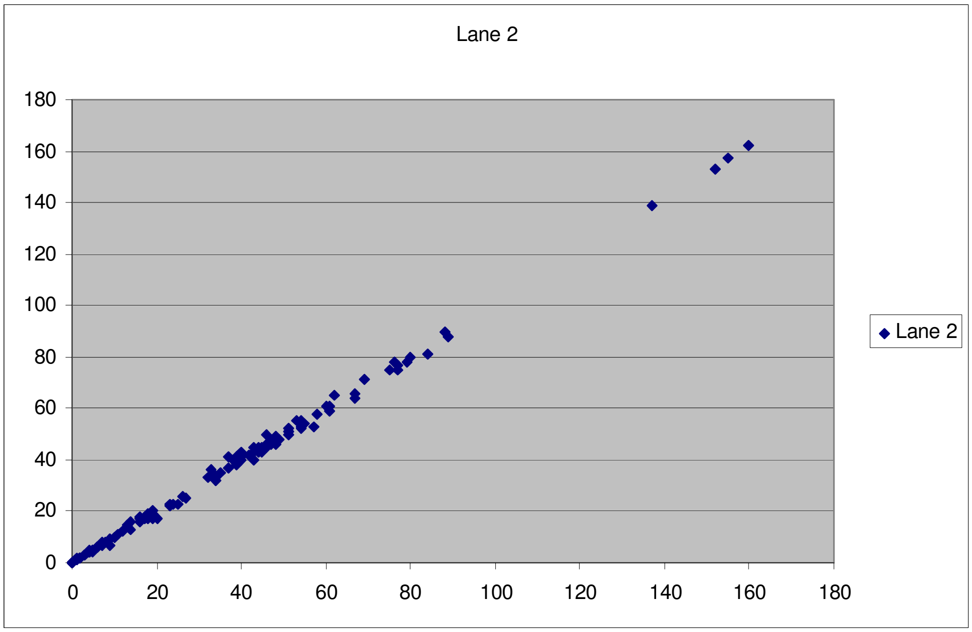


Figure 16. Graph. Glacier Highway/16 Mile PTR Station, Lane 2

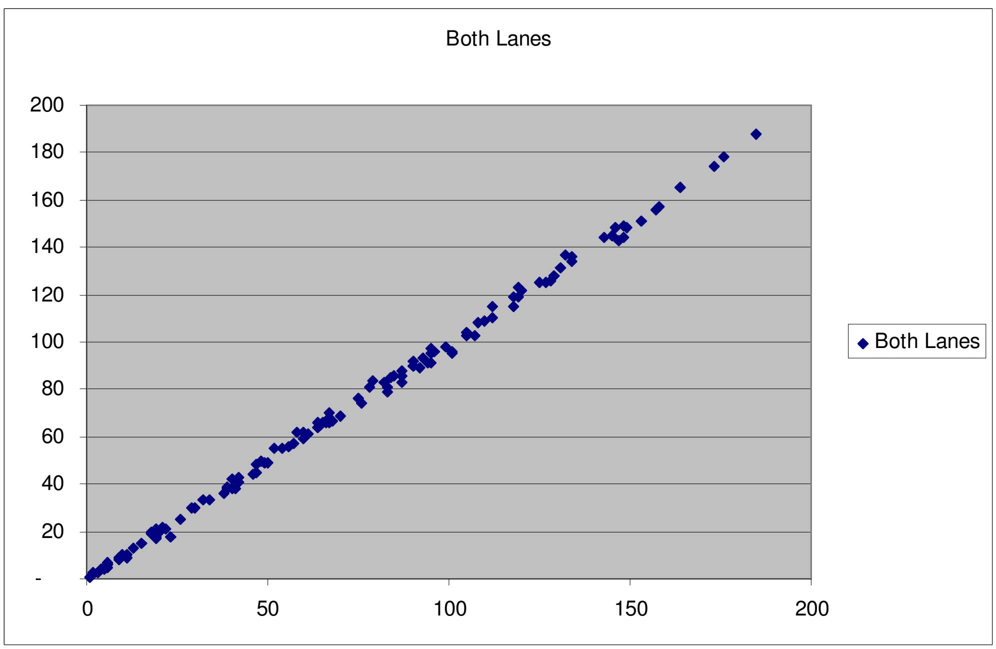


Figure 17. Graph. Glacier Highway/16 Mile PTR Station, Both Lanes

Southeast Region – Riverside Drive

Riverside Drive at the test site runs through a low-density residential/rural area. The roadway geometry is unusual in that wide, paved shoulders may be used by bicycle traffic in addition to a separate bicycle/pedestrian facility located on the east side of the roadway. The sensor for this test was installed 12 feet from the traveled roadway at a height of 15 feet.

Several equipment-related issued were reported during the set-up, consisting of multiple replacements of the "Click 200" device that provided the physical interface between the Wavetronix and the computer used for calibration. Once replaced and correctly connected, the sensor calibrated without further issues.

Performance at this site was again good, with aggregated absolute percent difference at 4.7 percent, which is below the seven percent target. Other measures and the scatter plots reinforce the assessment that the sensor performed well during the test.

Table 10. Riverside Drive Statistical Summary

	Lane 1	Lane 2	Both Lanes
PTR Volume	7,160	7,629	14,789
Sensor Volume	7,282	7,851	15,133
Percent Difference	1.7%	2.9%	2.3%
Abs Percent Difference	4.6%	4.8%	4.7%
Correlation Coefficient	0.9916	0.9949	0.9937

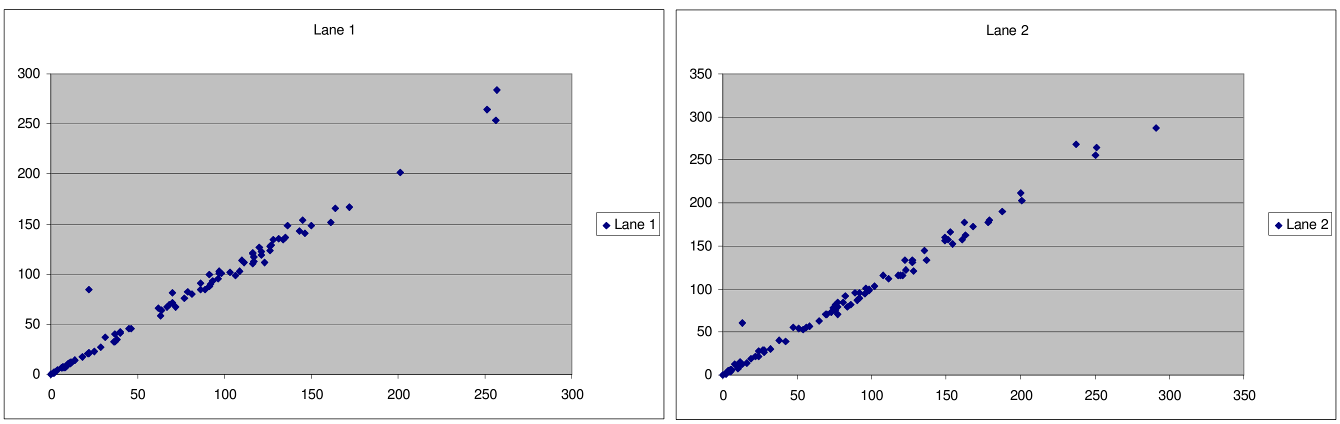


Figure 18. Graph. Per Lane Scatter Plots, Riverside Drive

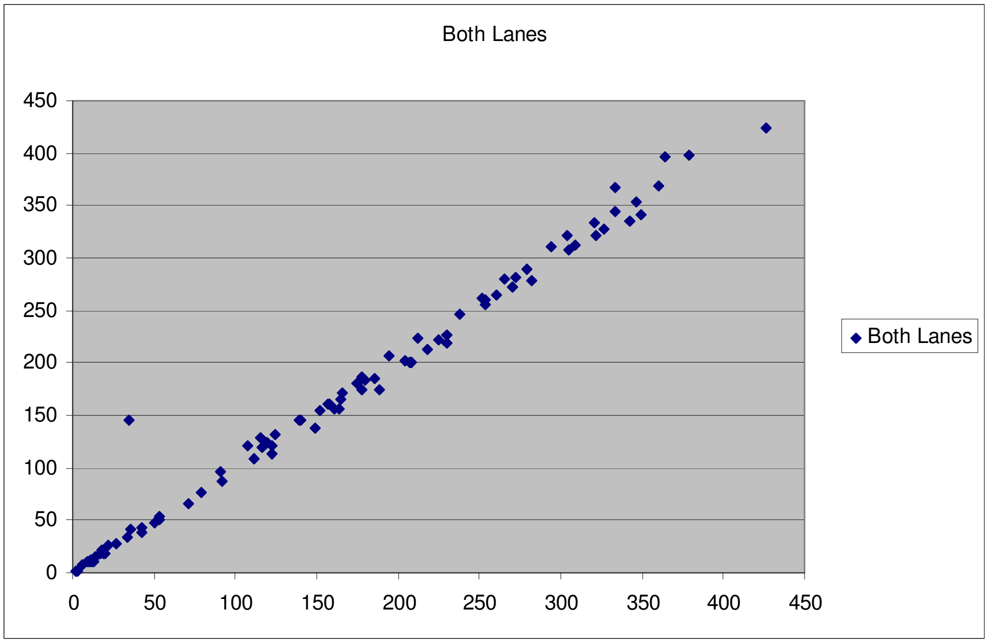


Figure 19. Graph. Riverside Drive Scatter Plot, Both Lanes

Southeast Region – South Douglas Highway at John Street

South Douglas Highway at Johns Street is a residential two-lane undivided roadway with a 40 MPH speed limit, High Occupancy Vehicle (HOV) shoulder and a bicycle/pedestrian facility on the east side of the roadway.

The sensor was installed nine feet from the traveled roadway at a height of 19 feet. This geometry approaches the limit for maximum height at a nine-foot offset recommended by the manufacturer to traffic for optimal performance. Field personnel reported a long calibration period (one hour) due to the low traffic volume. To assist in the calibration process, personnel used their own vehicle to provide a calibration target.

Sensor performance is only fair at this site. The absolute percent differences for each lane were 8.6 and 9.1 percent. The geometry of the installation and small calibration sample likely account for the poorer accuracy at this site. The scatter plots illustrate the divergence of PTR and sensor data.

Table 11. South Douglas Highway at John Street Statistical Summary

	Lane 1 (SB)	**Lane 2 (NB)**	**Both Lanes**
PTR Volume	24,190	24,743	48,933
Sensor Volume	24,151	24,583	48,734
Percent Difference	-0.2%	-0.6%	-0.4%
Abs Percent Difference	8.6%	9.1%	8.8%
Correlation Coefficient	0.9845	0.9809	0.9838

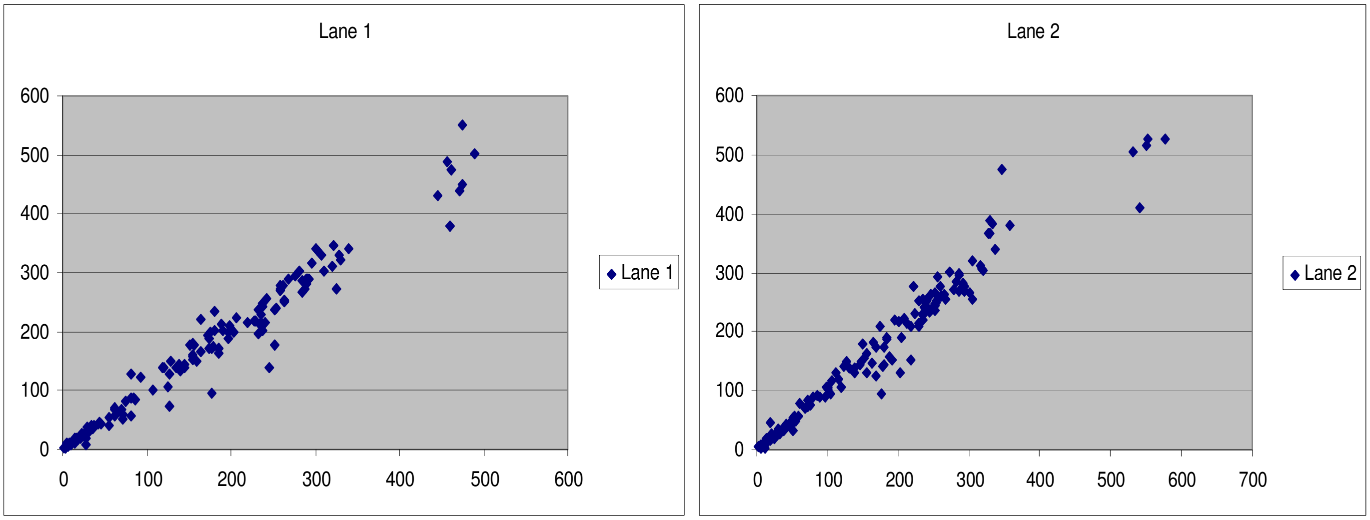


Figure 20. Graph. Per Lane Scatter Plots, South Douglas Highway

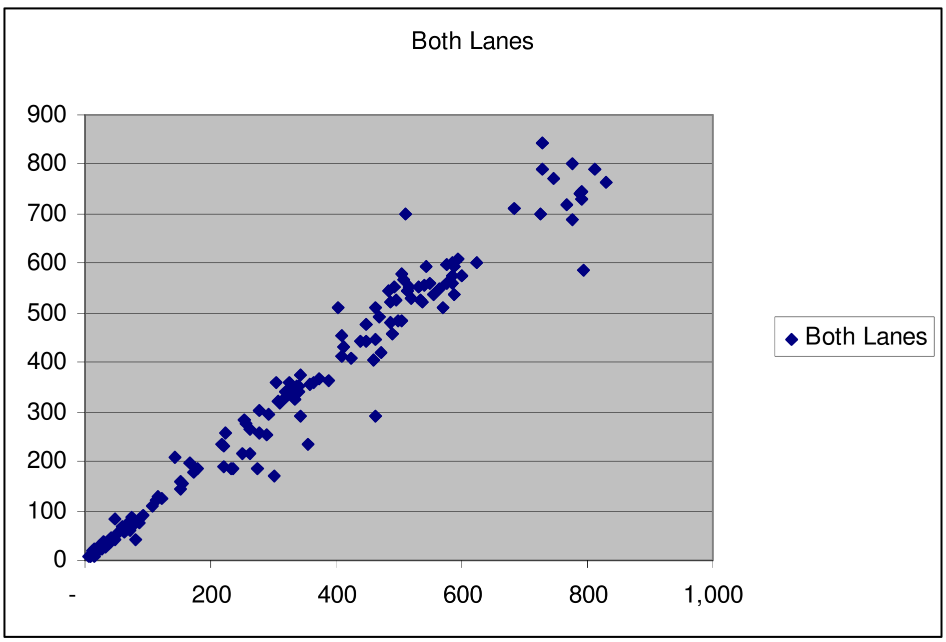


Figure 21. Graph. South Douglas Highway Scatter Plot, Both Lanes

Bicycle and Pedestrian Detection (South Douglas Highway site)

The Wavetronix was also evaluated for its performance with bicycle and pedestrian traffic at the South Douglas Highway site. Data was manually collected, as no automated counter is present for this type of traffic. Manual data collection occurred on February 8, 2010 from 9:45 A.M. to 1:30 P.M. in 15-minute increments. Since the Wavetronix uses one-hour bins for data collection, the manual count was aggregated to a total four hourly data points. The complete hour-level data for bicycles and pedestrians is shown in Table 12 below.

Table 12. Bicycle and Pedestrian Counts

Time	Wavetronix	Bike and Ped Manual Count
10:00:00	4	1
11:00:00	3	4
12:00:00	0	7
13:00:00	3	0
TOTAL	**10**	**12**

Field observations of the unit during testing revealed that bicycles were consistently detected by the detector, but pedestrians were not always detected, and often a group of pedestrians was counted as one. The possibility for bicycles and pedestrians to move in either direction in a detection "lane," the lack of any specific manual tuning for this application, and the small sample size preclude making any definitive statements about the effectiveness of the Wavetronix HD for use with bicycle and pedestrian detection. Discussions with Wavetronix about this application reveal that the unit is optimized solely for vehicular traffic detection suggests that the sensor is not suited to this application.

TEST PLAN CRITERION 2: DOCUMENT SENSOR DEPLOYMENT ISSUES

Axle-Based System

As mentioned earlier, DOT&PF personnel were not able to successfully install and calibrate the AxleLight system. DOT&PF personnel worked directly with the sensor manufacturer for system setup and training. Interviews conducted with these personnel indicate that several attempts were made to make the system operational, primarily in the Southeast Region, but the efforts were eventually abandoned due to the time and effort that was expended. Recent work to get the system repaired and used by the Northern Region is ongoing.

Some additional deployment issues noted for the axle-based system:

- AxleLight system requires a lead acid battery system to power the system for the one-week data collection periods. The size and weight of this battery limits the portability of the device.
- Severe rutting on many of the roadway in Alaska results in vehicle tires being an inch or more lower than the surrounding roadway surface. This lessens the clearance between the pavement and vehicle body as seen by the AxleLight sensor, making site selection and calibration more challenging.
- AxleLight installations require the two roadside units to be aimed parallel to one another. Obtaining and verifying proper alignment proved challenging in the field deployments.
- The mechanism for strapping the units to guard rail posts made it difficult to obtain a secure attachment. Data collection personnel customized this portion of the system.

However, the AxleLight system has been successfully used by other State DOTs, and is being tested in other research projects. For example, AxleLight is included in the pooled fund study *Evaluation of Non-Intrusive Traffic Detection Technologies – Phase III (TPF-5(171)*. Preliminary results from this study indicate that challenges have been encountered with system setup and calibration, but valid data has been obtained from the unit. Final results from this study will be published in August 2010.

Pole-Mount System

Several deployment issues were noted with the pole-mounted system. The primary issue is the weight and size of the battery system, which limits the portability of the system. The seven-day data collection periods used by the Alaska DOT&PF require a battery system of this size in order to power the system.

Other deployment issues noted for the pole-mounted system:

- A minimum number of vehicles are needed for the sensor to auto-calibrate after installation. In some low-volume locations, an excessive amount of time (more than one hour was required to reach this number.

- The sensor occasionally reported an alignment error that could not be corrected, but did not appear to affect detection, and thus was unresolved.

- Incorrect local time settings in the sensor clock resulted in post-processing to match data sets.

Table 13 summarizes the issues reported by data collection personnel on the test log sheets.

Table 13. Deployment Issues (Pole-Mount System)

Location	Issue Description
Northern Region	
Steese Highway North of Fox	• Sensor reported alignment issue that could not be identified by field personnel • Clock offset by one hour
Peger Road at DOT Building	• Sensor reported alignment issue that could not be identified by field personnel • Clock offset by nine hours
North Cushman St at Illinois St	• Clock offset by one hour
Dalton Highway South of Yukon Bridge	• Clock offset by one hour
Mitchell Expressway West of Chena River	• Clock offset by one hour
Central Region	
Seward Highway at Potter Marsh	• None
Southeast Region	
Glacier Highway/16 Mile PTR Station	• Low volume resulted in long calibration times
Riverside Drive	• Hardware failures in “Click 200” interface unit
South Douglas Highway at John St	• Low volume resulted in long calibration times

CHAPTER 5. CONCLUSIONS

POLE-MOUNT SYSTEM

The pole-mounted Wavetronix HD sensor proved to be a capable method for collecting traffic volumes. Extensive testing at nine different locations throughout the state established it as an accurate sensor, with results generally within the percent difference target of 5 percent, see Table 14.

Table 14. Summary of Results

Location	Percent Difference (All Lanes)	Absolute Percent Difference (All Lanes)
Northern Region		
Steese Highway North of Fox	1.6%	5.6%
Peger Road at DOT Building	-1.2%	6.0%
North Cushman St at Illinois St	0.7%	4.6%
Dalton Highway South of Yukon Bridge	-8.5%	13.8%
Mitchell Expressway West of Chena River	0.6%	1.5%
Central Region		
Seward Highway at Potter Marsh	4.3%	5.7%
Southeast Region		
Glacier Highway/16 Mile PTR Station	-0.2%	2.8%
Riverside Drive	2.3%	4.7%
South Douglas Highway at John St	-0.4%	8.8%

The diversity of test locations verified the system performance on four out of the five performance test objectives: high volume roads, low volume roads, gravel roads, and roads with rutting. However, the performance test objective to detect bicycles and pedestrians was inconclusive. Testing on the South Douglas Highway in the Southeast Region provided a relatively small sample size, making definitive statements about the detector's accuracy difficult, but the testing that was done reveals that the sensor is capable of counting bicycles, but not pedestrians. Discussions with the manufacturer indicate the sensor has been developed for vehicular traffic detection only.

The system's deployment issues were also assessed through several different test objectives. The most significant deployment issue is the size and weight of the battery system, which is needed to power the unit for the desired seven days of data collection. Battery system's large size and weight negatively affect how the system can be transported and deployed. Another significant issue is the time required to calibrate the unit in locations with low traffic volumes. A certain amount of traffic is required for the system to auto-calibrate, making the system impractical for use on low-volume roadways. The system also proved difficult to deploy in areas that lack clear lanes and/or direction of travel, such as the Dalton Highway at Yukon Bridge test site. Related to this are roadways that experience poor lane discipline when snow obscures the pavement. Also noted was difficulty in finding roadside infrastructure to attach the system's pole to.

The consensus of the data collection staff is that the Wavetronix system is an accurate traffic counting device that is relatively easy to calibrate, but the deployment issues noted above make it unable to compete with conventional road tubes and loop detector stations. For example, a data collection crew can install 20 road tube systems in a single day, making it a more cost-effective alternative. The utility of a system in a portable application must consider multiple factors, including transportability, site selection, setup time, cost and accuracy. For the Alaska DOT&PF's uses, the Wavetronix system is better suited to permanent or semi-permanent installations.

AXLE-BASED SYSTEM

The axle-based system, AxleLight, was not successfully tested in this project due to difficulty encountered in setting up and calibrating the units. Data collection personnel made several attempts to deploy the system in the Southeast Region, but the efforts there were eventually abandoned due to the time and effort that was expended. Other regions of the state are now experimenting with the device, but no results are available for this report.

CHAPTER 6. RECOMMENDATIONS

Alaska DOT&PF personnel have gained valuable experience in setting up and collecting data with the non-intrusive systems tested through this project. This experience has provided insight into what is needed to meet their data collection needs. The following recommendations are offered for the Department's consideration:

- Investigate other, simpler, sensors that would meet the Northern Region's detection needs for low-volume roads. Other sensors on the market consume less power (reducing battery requirements) and are more quickly deployed (simply aim at the detection zone, no calibration required). Some sensors that may meet these requirements are manufactured by Quixote, Jamar, Telmark, MSedco and ASIM.

- Examine methods used by other public agencies to collect bicycle and pedestrian data and explore how these approaches could be integrated with existing data collection programs.

- Review findings from other research and/or contact state DOTs that have experience with the AxleLight sensor to understand how this system could be better used. Work with the AxleLight manufacturer to get the current systems operational.

- Continue to use and evaluate the non-intrusive systems in order to understand what, if any, environmental factors affect their performance.

- Consider using shorter data collection periods in order to reduce the size and weight of the battery needed to power the non-intrusive systems.

APPENDIX A: TEST LOG FORMS

APPENDIX A

Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Steese North of Fox

Personnel: Breanna Hewitt + Scott Vockeroth

Wavetronix Calibration Process: ________________ Calibration Time: 1 hr.

Installed Height: 16 ft Installed Offset to Traveled Way: 16 ft

AxleLight Calibration Process: ________________ Calibration Time: ______

Installed Height: ___________ Installed Offset to Traveled Way: ______________

Baseline used (manual count, road tube or PTR): PTR

Baseline accuracy (include volume, speed and class): ______________________________

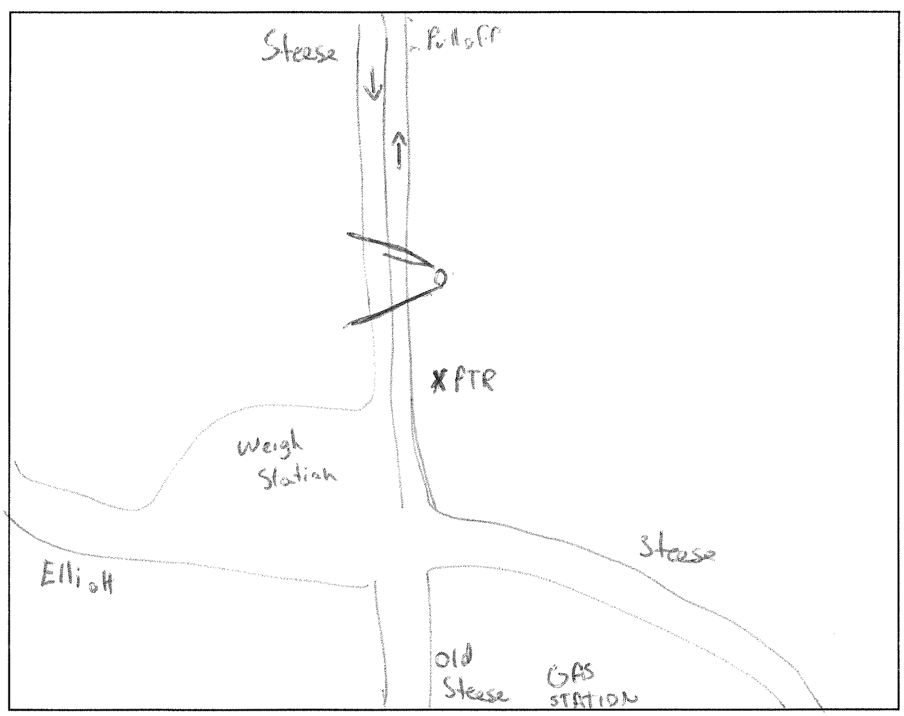
Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	8/6/08	13:00	
End:	8/14/08	17:00	

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:			
End:			

Data File Name: Steese.txt (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch

Speed limit 55



Notes on back…..

• Calibration process was tough, kept saying sensor was not alligned properly yet it was.

Ex

Wavetronics 08/07/08

16:00	17:00	18:00	19:00
48	36	79	68
67	91	105	96

PTR 08/07/08

15:00	16:00	17:00	18:00
27	33	79	67
66	91	99	102

* ~~Big~~ Larger discrepancy in these #'s the other locations

* There is a steesebad.txt file where wavetronics time/date was not correct

APPENDIX A
Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Peger @ DOT

Personnel: Breana + Jordan

Wavetronix Calibration Process: ______________ Calibration Time: ______

Installed Height: 16 ft Installed Offset to Traveled Way: 22 ft

AxleLight Calibration Process: ______________ Calibration Time: ______

Installed Height: __________ Installed Offset to Traveled Way: __________

Baseline used (manual count, road tube or PTR): Loop Box

Baseline accuracy (include volume, speed and class): __________

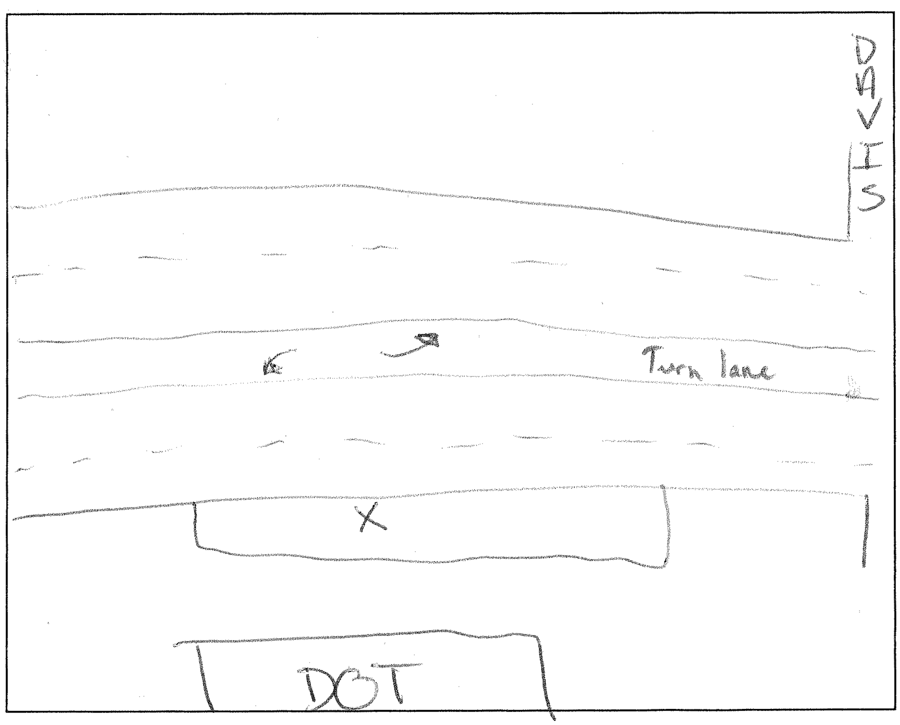
Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	8/20/08	?	
End:	9/4/08	9:00	Dead

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:			
End:			

Data File Name: PEGer.txt (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch

Speed limit 45



Notes on back…..

8/20 - sensor again saying not aligned but picking up traffic in all lanes

Time not correct of Wavetronix => 9 hrs. fast (I think)

Wavetronix 8/21/08

16:00	17:00	18:00	19:00
133	128	111	116
246	219	192	186
27	15	8	4
154	150	148	176
171	188	162	170
731	700	621	652

Pager Loops 8/21/08

07:00	08:00	09:00	10:00
132	126	110	113
252	217	183	185
177	142	146	178
189	175	154	176
750	660	593	652

APPENDIX A
Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Cushman/Illinois St.
Personnel: Breana Hewitt + Kevin McCormick

Wavetronix Calibration Process: ________________ Calibration Time: _______
Installed Height: 16 ft. Installed Offset to Traveled Way: 14 ft.

AxleLight Calibration Process: ________________ Calibration Time: _______
Installed Height: ___________ Installed Offset to Traveled Way: _______________

Baseline used (manual count, road tube or PTR): PTR - cushman
Baseline accuracy (include volume, speed and class): ____________________________

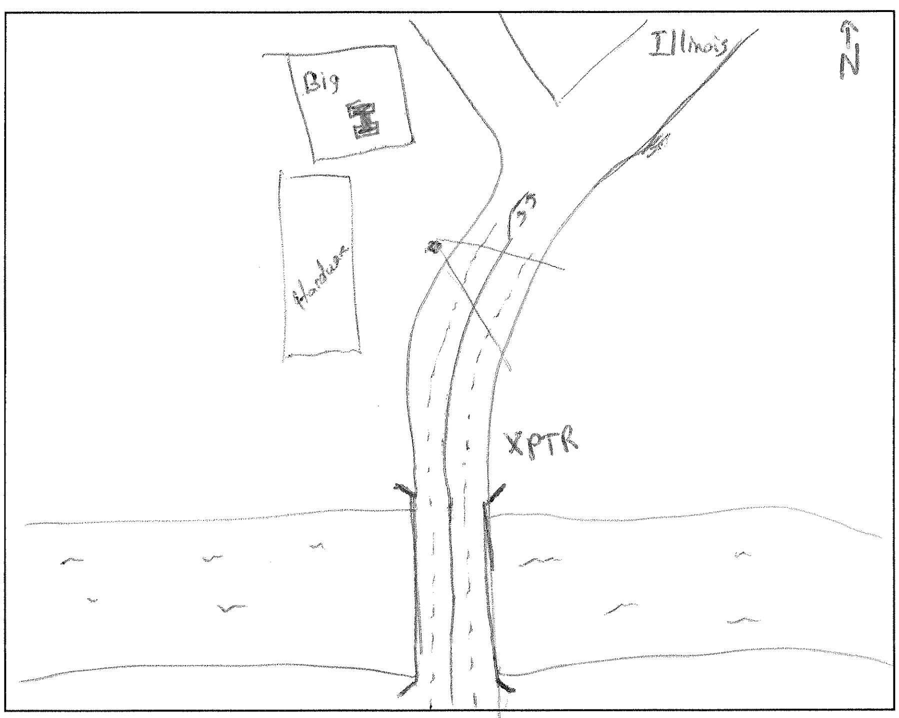
Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	7/24/08	12:00	
End:	8/4/08	13:00	

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:			
End:			

Data File Name: Cushman.txt (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch

Speed limit 30



Notes on back…..

Ex.

Wavetronix

7/25/08

06:00	07:00	08:00
41	80	177
5	17	60
20	82	260
19	47	118

PFR

7/25/08

05:00	06:00	07:00	08:00
42	78	174	234
5	25	62	61
18	86	259	313
17	44	112	135

APPENDIX A

Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Yukon Bridge on Dalton Hwy

Wavetronics - 9/19/08

15:00	16:00	17:00	18:00
18	21	25	18
(12 / 6)	(13 / 8)	(13 / 12)	(8 / 10)

PTR 9/19/08

Counter improperly setup - no directional data only combined

14:00	15:00	16:00	17:00	18:00
24	22	24	18	20

APPENDIX A
Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Parks @ Chena (Mitchell Expressway)

Personnel: Breanna Hewitt + Scott Vockeroth

Wavetronix Calibration Process: Fairly easy Calibration Time: 30 min

Installed Height: 16 feet Installed Offset to Traveled Way: 16 ft.

AxleLight Calibration Process: ________________ Calibration Time: ______

Installed Height: ___________ Installed Offset to Traveled Way: ______________

Baseline used (manual count, road tube or PTR): PTR

Baseline accuracy (include volume, speed and class): ____________________________

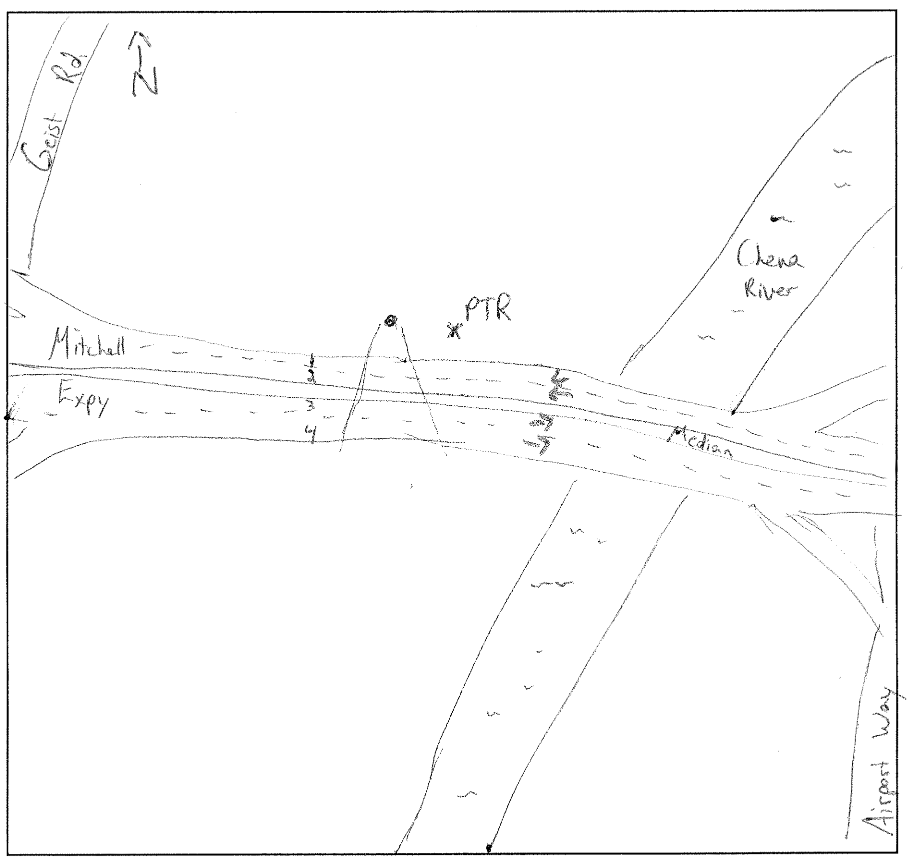
Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	06/24/08	18:00	
End:	07/15/08	14:00	

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:			
End:			

Data File Name: parks@chena.txt (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch

Posted Speed: 55
Pavement condition: good
some rutting



* hours seem to be off, #'s not identical, but close

ex.

Wavetronix 07/11 03:00	04:00	PTR 7/11 02:00	03:00
69	38	68	39
4	3	4	2
2	5	2	5
31	32	31	33

Wavetronix SmartSensor HD Data Collection Log

Location: Seward Hwy at Potter Marsh, just south of Anchorage

Weather: Various

Calibration Process and Calibration Time: Used Wavetronix calibration program

Personnel: Joe Gibbons Sensor Height: ~16' Sensor Offset to First Lane: ~ 25'

Baseline used (if any): Potter Marsh Permanent traffic recorder (PTR)

	Data Collection Period		Battery Voltage
	Date	Time	
Start:	9/24/08		
End:	10/24/09		

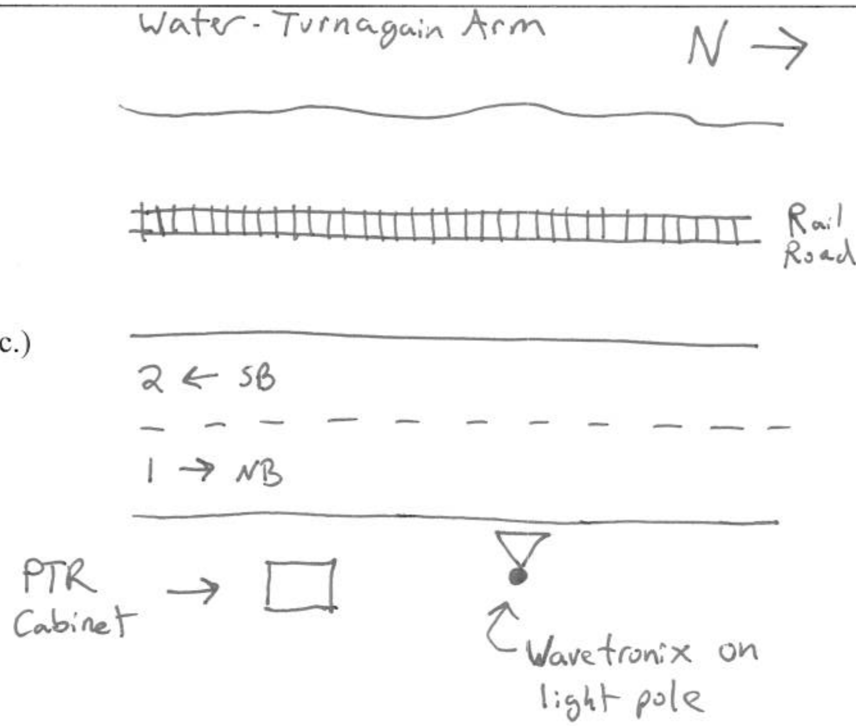
Attached to battery charger, plugged into cabinet

Downloaded Data File Name: wavetronix_all_120809.txt

Site Sketch

Include:

- Roadway(s)
- Roadway
- North Arrow
- Pavement Condition (gravel, rutting, etc)
- Sensor Location (●) and Orientation △
- Identify Lanes (1, 2, etc.)
- Bike/Ped facilities (if applicable)



Additional Notes: The area past the southbound lane, including the rail road was turned off so no readings would be taken. Some bikes ride on the shoulder. No bike trail elsewhere.

Please send test data and test log to
Erik Minge after each test.
eminge@srfconsulting.com
763 249-6739

APPENDIX A
Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: Juneau, AK, 16 Mile PTR (representing Rural w/ shoulders)
Personnel: Andrew Hills and Chris Dionisio

Wavetronix Calibration Process: Used Sensor Alignment readings and Lane Verification multiple times
Calibration Time: 2 hours Installed Height: 22' Installed Offset to Traveled Way: 20'

AxleLight Calibration Process: n/a

Calibration Time: n/a Installed Height: n/a Installed Offset to Traveled Way: n/a

Baseline used (manual count, road tube or PTR): PTR (loops)

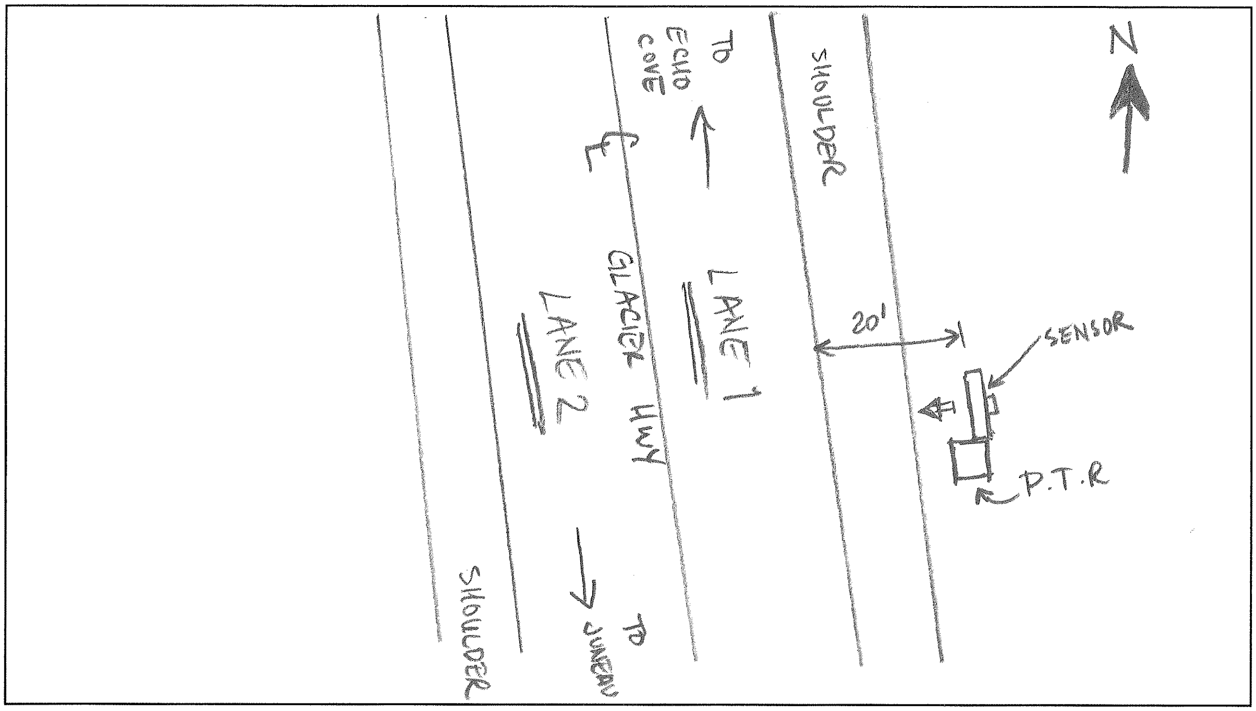
Baseline accuracy (include volume, speed and class):

Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	11/17/2009	11:00 am	Onboard power
End:	11/23/2009	09:00 am	Onboard power

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	n/a	n/a	n/a
End:	n/a	n/a	n/a

Data File Name: "Nov17-23 16mile PTR .txt" (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch



Notes: As before ease of Installation for unit could be improved upon. Device seems well suited for a Permanent station. Very low ADT at location lead to prolonged calibration. Once calibrated the unit performed very well, with no missed traffic observed in_3hours including pedestrians and bicyclists. The interface program is designed well allowing novice users to collect data with ease. The main hic-up at this time would be a difference in onboard Class tree vs. Class tree used in Alaska.

REPORT DOCUMENTATION PAGE	Form approved OMB No.

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13. ABSTRACT (Maximum 200 words)

The purpose of this document is to present findings from the Demonstration of Non-Intrusive Traffic Data Collection Devices in Alaska. This project was initiated by the Alaska Department of Transportation and Public Facilities (DOT&PF) to evaluate innovative methods for detecting traffic. Two different portable traffic detection systems were evaluated: a pole-mount radar system and a ground-mount axle-counting system.

Data was collected from nine sites from July 2008 to February 2010, representing all three DOT&PF Regions. Results indicate that the pole-mounted system performed accurately in detecting traffic. However, several deployment issues were noted, namely the size and weight of the system's batteries, which impact the system's portability, and the need for a minimum amount of traffic in order to successfully calibrate the system. These deployment issues limit the utility of the system as a replacement for current data collection practices. The pole-mounted system was also briefly tested for its ability to detect pedestrians and bicyclists. The system demonstrated an ability to detect bicycles, but pedestrian detection was not satisfactory.

Testing with the axle-based detection system did not produce valid traffic data. Alaska DOT&PF staff was not able to successfully setup and calibrate the system.

14. KEYWORDS: Traffic counting stations, traffic data, axle loads, radar vehicle detectors.			15. NUMBER OF PAGES 64
			16. PRICE CODE N/A
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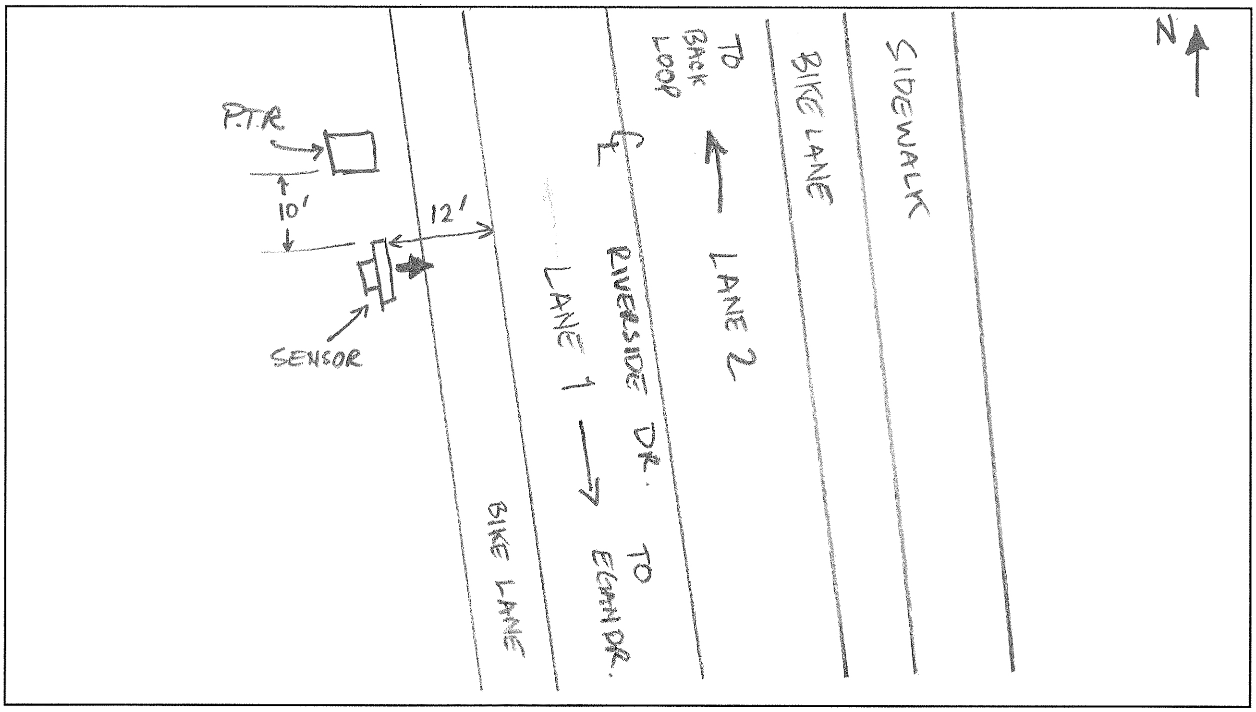
STANDARD FORM 298 (Rev. 2-98)
Prescribed by ANSI Std. 239-18 298-1

Site Sketch



Notes: This was the first temporary installation of the Wavetronix sensor in our region. This installation took a significant amount of time because of the need for equipment replacement. We needed to try 3 "Click 200" units to finally have working components for this setup. Mike Singson (vendor) came to provide a functioning "Click 200" unit and to evaluate the installation location. Installation time was also lengthy due to having to rewire numerous wires for the components multiple times (Between the "Click" units and also from the sensor cable into the PTR cabinet. This also added a potential for faulty setup .
The Wavetronix sensor calibrates itself very well, however requires it a certain amount traffic to do so. We anticipate that calibration will take much longer at more remote installation locations with much lower ADT. We did need to enter the roadway to setup the alignment of the unit.

No traffic or construction incidents occurred during this test period. Light snow and heavy rain and wind occurred during the beginning of the test period. The pavement condition was good with very light rutting. A sidewalk is present on the east side of the roadway. Bike lanes are present on this roadway section.

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763 249-6739

APPENDIX A
Demonstration of Non-Intrusive Traffic Data Collection – Test Log

Location: ____Juneau, AK, S. Douglas @ John St.(representing rural w/ sidewalk)______
Personnel: ____Josh Mahle____

Wavetronix Calibration Process: ___Used Sensor Alignment readings and Lane Verification also added a lane for Ped and Bike counts ___________________________ Calibration Time: 1 hours Installed Height: 19'____ Installed Offset to Traveled Way:9'__________

AxleLight Calibration Process: _____n/a_______________________________________

Calibration Time: n/a___Installed Height: n\a______ Installed Offset to Traveled Way: n\a______

Baseline used (manual count, road tube or PTR): ___ADR (loops) & Manual Ped and Bike Count.____
Baseline accuracy (include volume, speed and class):_______________________________

Wavetronix Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:	2/2/2010	10:00am	
End:	2/9/2010	10:00am	

AxleLight Test			
	Data Collection Period		Battery Voltage
	Date	Time	
Start:			
End:			

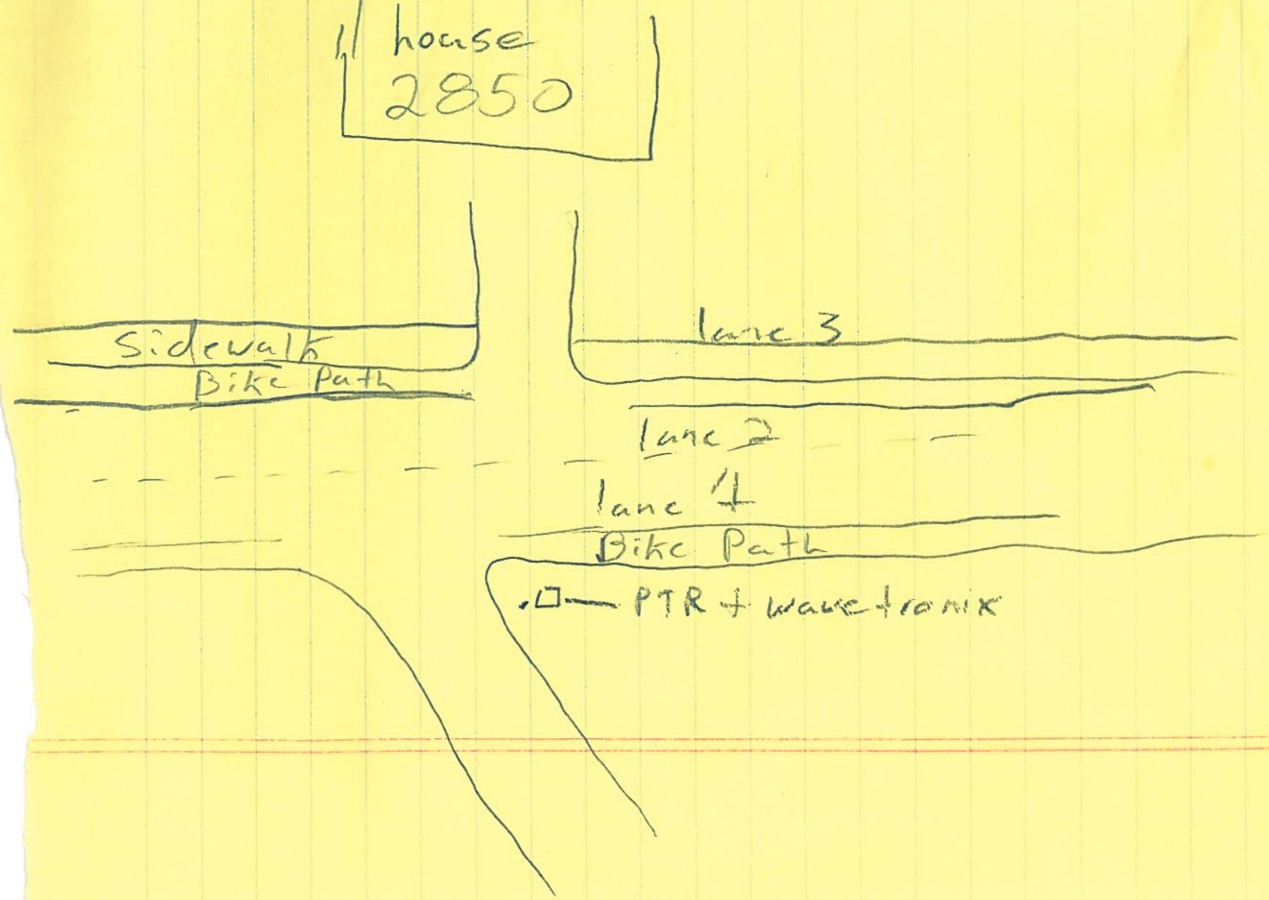
Data File Name: ________________________________ (provide lane specific data in 1-hour increments, send ALL data)

Site Sketch

Include:

- Roadway(s)
- North Arrow
- Posted speed
- Pavement Condition (gravel, rutting, etc)
- Sensor Locations and Orientation 
- Identify Lanes (1, 2, etc.)
- Bike/Ped facilities (if applicable)
- Photo of test site
- Setup process and time
- Calibration process and time
- Did personnel need to enter roadway?
- Was vendor-recommended process modified?
- Was the vendor supportive?
- Were there any traffic incidents? Weather incidents? Construction activity?

Notes: This was the first temporary installation in our region involving a stand-alone power source. The Wavetronix sensor calibrated itself very well, however requires it a certain amount traffic to do so. We had to drive our own vehicle to calibrate the sensor, since this section of roadway does not have adequate ADT for a timely and accurate calibration.


house
2850
Sidewalk
Bike Path
lane 3
lane 2
lane 4
Bike Path
PTR + wavetronix