CERTIFICATE CONCERNING DESIGN AND CONSTRUCTION OF ELECTRONIC SPEED MEASURING DEVICES

I, Nathan Dumler, do certify under penalty of the laws of the State of Washington that the following is true and correct:

I have been employed as a technician by American Traffic Solutions for 14 months. I became a speed validation technician in 2018 and have over 1000 hours performing speed validation tests. I am nationally certified as a RADAR and LIDAR operator. The City of Kirkland currently uses the AutoPatrol™ 3D radar fixed speed safety camera system, an electronic speed measuring device provided through a contract with American Traffic Solutions, Inc. ("ATS"). Part of my duties include monitoring regular testing of the AutoPatrol 3D radar fixed speed safety camera systems used by the City of Kirkland.

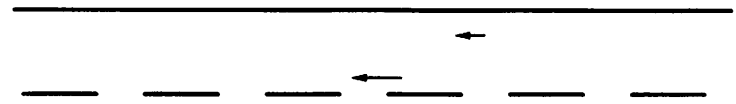
ATS contracted with the City of Kirkland to provide an Automated Speed Enforcement ("ASE") system designed to record the speed of a vehicle and obtain photographs or other recorded images of the vehicle and the vehicle's registration plate while the vehicle is traveling in excess of speed limits in certain safety zones within posted limits.

The ASE program includes the use of the AutoPatrol 3D radar fixed speed safety camera systems at the following locations within the City of Kirkland:

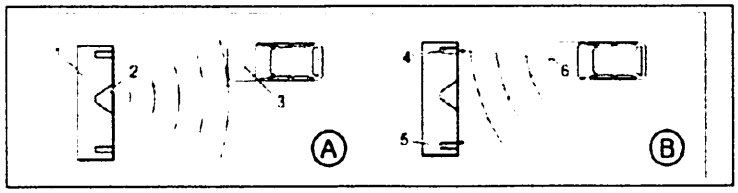
Location Code	Location Description	Lanes Monitored
KRKF001	NB 132nd Ave NE @ Muir Elementary/Kamiakin Middle	1
KRKF002	SB 132nd Ave NE @ Muir Elementary/Kamiakin Middle	1
KRKF003	EB 80th St @ Rose Hill Elementary	1
KRKF004	WB 80th St @ Rose Hill Elementary	1

The AutoPatrol 3D radar fixed speed safety camera system operates by measuring vehicle speed, as well as position relative to the radar to calculate and differentiate multiple vehicles in the radar beam. The speed of a moving vehicle is measured by Doppler radar. Doppler radar is a generally accepted technology used for measuring speed. The AutoPatrol 3D radar technology is used throughout the US and Europe as well as other countries and is approved by the Swiss national metrology institute- METAS.

The AutoPatrol 3D radar fixed speed safety camera system uses a tracking radar sensor for measuring vehicle speeds and detecting speed violations. The AutoPatrol 3D radar is aligned at a fixed angle across the road. The AutoPatrol 3D radar emits a horizontal beam over the road surface as represented by the illustration below. The tracking radar can simultaneously detect multiple vehicles and measure their speed, distance, angle and movement within the radar beam. The radar tracks multiple vehicles by reconstructing vehicle movement from the measured object speed, angle and distance values. If a vehicle passes a defined trigger line, the radar outputs the vehicle's speed and lane information. The camera connected to the tracking radar uses this information to determine if there is a speed violation and to capture photographs showing the measured speed and lane on the databar of the captured images.



The tracking radar utilizes the Doppler Effect for speed determination. If an electromagnetic wave is emitted at a moving object, then the wave is reflected back from the moving object. The frequency of the wave received back by the radar shifts based on the speed of the moving object and its direction of travel. The tracking radar continuously determines this frequency shift of each object to calculate the object's speed. The tracking radar consists of two receiving antennas integrated into a single radar sensor. This configuration allows the radar to measure the distance and angle of the vehicle relative to the position of the radar sensor. Illustration A and B show the measurement principle in simplified form. The radar sensor emits a radar beam (illustration A). The radar beam is reflected by the vehicle (illustration B). The two receivers receive the reflected radar beam. The radar sensor evaluates the return frequency, as well as the phase difference of the reflected radar beam from both of the receivers. With the aid of these values the radar sensor calculates the vehicle position.



1 Radar sensor
2 Transmitter
3 Detected vehicle
4 Receiver A
5 Receiver B
6 Reflected signal

Prior to operation each day, the system performs a system self-test. This self-test performs an electronic tuning fork test to produce a specific frequency and returns an associated speed value. Only if the return value meets the acceptance criteria to show that the system is operating correctly will the system enter measure mode. Unless a self-test is successful, the system will not enter measure mode and no violations will be captured. Additional information stored as metadata within each image includes coordinates of the vehicle position at the time of capture. This information is extracted and utilized through a secondary speed verification process to provide yet another means to validate offender speed and position based on the two images obtained and image analytics. In addition to the internal system checks and the manufacturer calibration certification, the 3D radar system is subject to routine and independent calibration check of the speeds produced by the system at least annually by a qualified technician.

Each day the computer which controls the fixed speed safety camera system is rebooted. The reboot is initiated each day and each time the computer is rebooted an internal check is performed on all operations of each fixed speed safety camera system, including the clocks, sensors, camera and speed calculating hardware and software, in order to verify that all operations are functioning correctly. When the internal check detects a problem with one of the operations on a given fixed speed safety camera system, then that particular fixed

speed safety camera system is inactivated and a request for service is relayed to ATS support personnel. This means that violations cannot be issued until any internal problem is fixed.

Speed validation tests are regularly performed on each installed and operable AutoPatrol 3D radar fixed speed safety camera system. The test is conducted by having a LIDAR Operator obtain true measurements of up to five vehicles per lane in the ascending and/or descending direction. The speed of the vehicle is captured by the LIDAR Operator and then relayed via cellular to an ATS Technician. The ATS Technician then compares the vehicle speed measured by the AutoPatrol 3D radar fixed speed safety camera system to the speed measured by the LIDAR Operator to ensure the accuracy of the AutoPatrol 3D radar fixed speed safety camera system. ATS maintains the results of each test in a Validation Report. The speed validation for each system was performed on the following date and the systems at each location were found to be in proper working order:

Location Code	Location Description	Date of Test
KRKF001	NB 132nd Ave NE @ Muir Elementary/Kamiakin Middle	10/25/2019
KRKF002	SB 132nd Ave NE @ Muir Elementary/Kamiakin Middle	10/25/2019
KRKF003	EB 80th St @ Rose Hill Elementary	10/25/2019
KRKF004	WB 80th St @ Rose Hill Elementary	10/25/2019

Preventative maintenance, including visual inspections, is regularly performed on the AutoPatrol 3D radar fixed speed safety camera systems. Preventative maintenance activities include: cleaning of the cameras and housing, general site inspection of environment and road conditions, inspection of poles, bases and enclosures, and inspection of system cables and connections. The location and date that preventative maintenance is performed is recorded in the Preventative Maintenance Log, which along with the Validation Report(s) referenced above, is attached hereto.

I am a custodian, or otherwise qualified witness, as to the attached records. I make this declaration based on personal knowledge, and if called and sworn as a witness, I could and would testify as set forth in the following paragraph.

Attached as Exhibits are: Exhibit A - Speed Validation Reports, Exhibit B - Preventative Maintenance Logs, and Exhibit C - Annual System Verification Certificate for all AutoPatrol 3D radar fixed speed safety camera systems installed and used by the City of Kirkland. All documents and materials included as Exhibit A, Exhibit B and Exhibit C are authentic and are what they purport to be, and accurately describe the matters set forth therein. All such records are business records in that they are: (1) records kept in the ordinary course of business; (2) created at or near the time of the transactions or events reflected therein by, or based on information from, a person with knowledge of the transaction or events; and (3) kept as part of a regular business activity.

Based upon my education, training, experience, and knowledge of the AutoPatrol 3D radar fixed speed safety camera system, it is my opinion that the system is so designed and constructed as to accurately employ measurement techniques based on a division of distance over time in such a manner that it will give accurate measurements of the speed of motor vehicles.

I, Nathan Dumler, certify (or declare) under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

Dated this _20th_ day of November. 2019 in _Mesa, Arizona

Nathan Dumler

Nathan Dumler, Speed Validation Technician

Calibration Report

JENOPTIK

System: OK

Type:	24F_ST_3
Serial Number:	590-113/63686
Firmware Version:	G1J
Firmware Checksum:	0x788A
Configfile:	TR6000chk.xml
Versions:	E77, H43, H8N, H8M, H53
Date:	16.04.2019
Time:	12:00:37
Temperature:	24,7 °C
Humidity:	59 %

Test Measurements: OK

Simulated Speed [km/h]	Measured Speed [km/h]	Measured Angle [deg]	Measured Distance [m]
10,0	10,1	0,0	3,5
50,0	50,1	0,0	3,7
100,0	100,2	0,0	3,7
200,0	199,8	0,0	3,7
250,0	249,9	0,0	3,7
300,0	300,0	0,0	3,7

Frequency Test: OK

	required	measured
f_0:	24,120 GHz	24,118 GHz
Δf_{01}:	7.250 kHz	7.254 kHz
Δf_{02}:	9.000 kHz	9.034 kHz
Δf_{03}:	10.000 kHz	10.053 kHz
Rel. Tx Pwr:	-35,00 dB	-32,16 dB

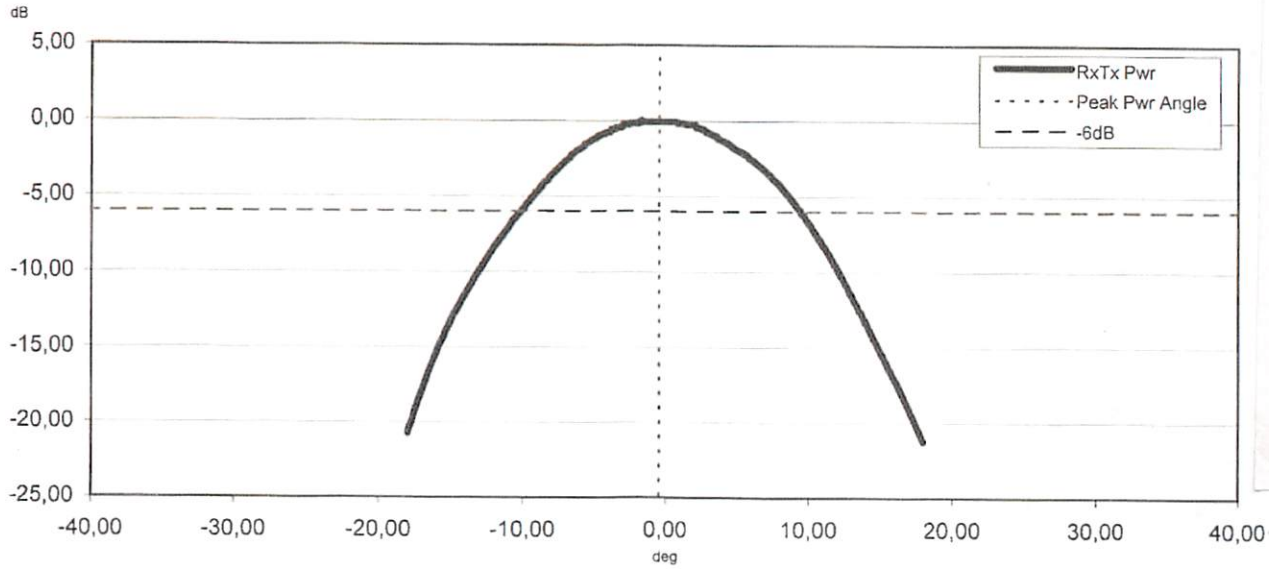
Beam Characteristics: OK

	required	measured
RxTx Pwr:	-38,00 dB	-35,54 dB
Peak Pwr Angle:	0,00 deg	-0,43 deg
Beam Width:	20,00 deg	19,86 deg

Boardtest: OK

	required	measured
Voltage (+3.3 V):	3,30 V	3,30 V
Voltage (+1.8 V):	1,80 V	1,80 V
Voltage (+1.2 V):	1,20 V	1,20 V
Voltage (+6.0 V):	6,00 V	6,02 V
Voltage (+5.0 V):	5,00 V	5,01 V
Voltage (-5.0 V):	-5,00 V	-4,95 V
Voltage (+4.1 V):	4,10 V	4,09 V
Voltage (-4.1 V):	-4,10 V	-4,05 V
Crystal Frequency:	0,00 Δppm	-41,78 Δppm
Temperature (Board):	25,0 °C	23,1 °C
Temperature (Acc.Sensor):	25,0 °C	26,4 °C
Temperature (Frontend):	25,0 °C	26,3 °C

Beam Characteristics:



Certified by:

PASSED

go

Calibration Report

JENOPTIK

System: OK

Type:	24F_ST_3
Serial Number:	590-113/63669
Firmware Version:	G1J
Firmware Checksum:	0x788A
Configfile:	TR6000chk.xml
Versions:	E77, H43, H8N, H8M, H53
Date:	15.04.2019
Time:	08:24:00
Temperature:	23,0 °C
Humidity:	58 %

Test Measurements: OK

Simulated Speed [km/h]	Measured Speed [km/h]	Measured Angle [deg]	Measured Distance [m]
10,0	10,1	0,0	3,5
50,0	50,1	0,0	3,7
100,0	100,2	0,0	3,7
200,0	199,8	0,0	3,7
250,0	249,9	0,0	3,7
300,0	300,0	0,0	3,7

Frequency Test: OK

	required		measured	
f_0:	24,120	GHz	24,118	GHz
Δf_{01}:	7.250	kHz	7.321	kHz
Δf_{02}:	9.000	kHz	9.091	kHz
Δf_{03}:	10.000	kHz	10.100	kHz
Rel. Tx Pwr:	-35,00	dB	-31,80	dB

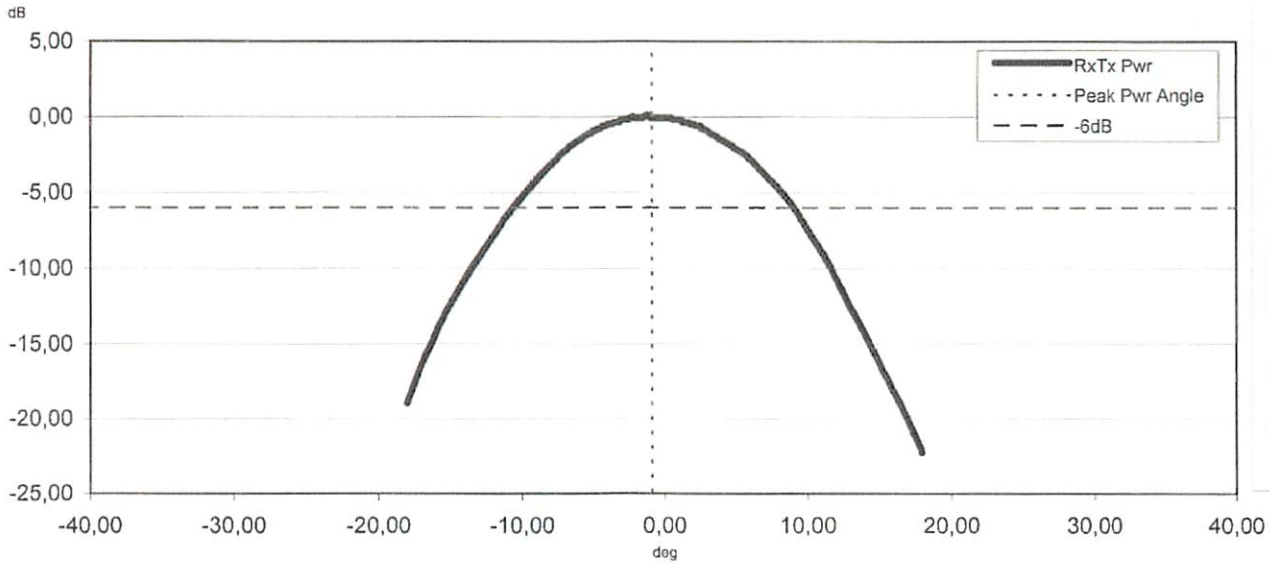
Beam Characteristics: OK

	required		measured	
RxTx Pwr:	-38,00	dB	-35,22	dB
Peak Pwr Angle:	0,00	deg	-0,86	deg
Beam Width:	20,00	deg	19,86	deg

Boardtest: OK

	required		measured	
Voltage (+3.3 V):	3,30	V	3,28	V
Voltage (+1.8 V):	1,80	V	1,79	V
Voltage (+1.2 V):	1,20	V	1,21	V
Voltage (+6.0 V):	6,00	V	6,05	V
Voltage (+5.0 V):	5,00	V	5,03	V
Voltage (-5.0 V):	-5,00	V	-5,01	V
Voltage (+4.1 V):	4,10	V	4,10	V
Voltage (-4.1 V):	-4,10	V	-4,06	V
Crystal Frequency:	0,00	Δppm	-46,01	Δppm
Temperature (Board):	25,0	°C	22,8	°C
Temperature (Acc.Sensor):	25,0	°C	25,4	°C
Temperature (Frontend):	25,0	°C	25,1	°C

Beam Characteristics:



Certified by:

PASSED

go

Speed Validation Report
Client: Kirkland, WA

Validation Date October 25, 2019

- KRKF001 - NB 132nd Ave NE @ Muir Elementary/Kamiakin Middle
  - Radar Serial Number: 590-112/63669
- KRKF002 – SB 132nd Ave NE @ Muir Elementary/Kamiakin Middle
  - Radar Serial Number: 590-112/63686
- KRKF003 – EB 80th St @ Rose Hill Elementary
  - Radar Serial Number: 590-112/63684
- KRKF004 – WB 80th St @ Rose Hill Elementary
  - Radar Serial Number: 590-112/63664

Equipment:
Pro-Lite Plus Hand held Lidar Serial Number: LP03606
Certification Date: January 19th, 2019
Lidar Operator: Charles Goodrich
RLC Operator: Nathan Dumler

A speed validation test was conducted for the sites listed above. The Lidar Operator, Charles Goodrich, obtained true measurements of five vehicles per lane in the ascending and/or descending direction. Those speeds were obtained using a Kustom Signals Pro-Lite+ hand held Lidar instrument. The speed of the vehicle is captured by the Lidar Operator and then relayed via cellular to the RLC Technician, Pasquale Mosso. The RLC Technician is monitoring the vehicle speed at the Fixed Speed Camera system simultaneously to ensure the accuracy of the system. The speed validation tests performed on the above-listed dates confirmed the accuracy of the Fixed Speed Camera systems at each location.

I, Nathan Dumler, certify that the information contained in this report is true and accurate.

Nathan Dumler

Signed: _____
Date: November 20th, 2019
Mesa, Arizona
American Traffic Solutions
Speed Integrity Team

Certificate of Achievement

Speed Integrity Technician

Has successfully completed the 16 hour course for
Speed Integrity Technician

This course encompasses all the necessary tasks required to perform the duties as a Speed Integrity Technician. Through this course each participant is required to display the proper competency through written and practical examinations. In addition, this course certifies each participants as a Lidar operator.

Presented to: *Charles Goodrich*

This Day: March 29, 2016

American Traffic Solutions™

Matthew Gioia
Police Traffic Laser/Radar Instructor

RDLD Certificate of Achievement V1.0 American Traffic Solutions, Inc., 7681 East Gray Road, Scottsdale, AZ 85260 Certificate # RDLD-0811-CHI-07

Certificate of Achievement

Speed Integrity Technician

Has successfully completed the course for Speed Inegrity Technician

This course encompasses all the necessary tasks required to perform the duties as a Speed Integrity Technician. Through this course each participant is required to display the proper competencies in Radar and Laser Technology. In addition, this course certifies each participants as a Lidar operator.

Presented to: *Pasquale Mosso*

This Day: August 01, 2018

American Traffic Solutions™

Tylor Yochim
Radar Instructor

RDLD Certificate of Achievement V1.0 American Traffic Solutions, Inc., 7681 East Gray Road, Scottsdale, AZ 85260 Certificate # RDLD-0811-AZ-02

SOUTHERN CALIFORNIA RADAR/LASER CERTIFICATION LABORATORY

P.O. Box 2397
Borrego Springs, CA 92004
619-922-3504

I certify that the Kustom Pro-Lite+, Serial Number LP03606 was tested on January 16, 2019 and was calibrated to be within the Manufacturers specifications for accuracy.

- This unit meets or exceeds the NHTSA standards for accuracy.
- This unit is on the IACP Conforming Product List.
- This units tests meet the standard set forth in cvc 40802().

Test Results

Test	Min	Max	Read	Pass
Visual/Function	-	-	Inspect	Yes
Range @ 100 ft.	-.5	+.5	100.0	Yes
Beam Width	-	.003	.0013	Yes
Acquisition Time @ 60MPH	-	.3Sec	.18Sec	Yes
35MPH	-2 MPH	+1MPH	35MPH	Yes
50MPH	-2 MPH	+1MPH	50MPH	Yes
65MPH	-2 MPH	+1MPH	65MPH	Yes
Pulse Width	-	<100nS	22.4nS	Yes
PRF	200	200	200	Yes
Sight Accuracy	N/A	-.003	.001	Yes
Oscillator Frequency	19.9980 MHz	20.0020 MHz	19.999 MHz	Yes
Beam Power Total/7mm	-	175uW 26uW	155 uW 15.8uW	Yes Yes

By: _____ Date: January 16, 2019

I certify (or declare) under penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

This unit has passed all applicable tests set forth by the NHTSA and IACP. The Unit has passed all tests per the manufacturers test procedures and values. I hereby certify the data is accurate and stable within the environmental parameters set forth by all applicable agencies

William F. Dunable, MS/CIS, FCC Lic# PG-11-50-2350

By: _____ Date: 1/16/19 At: Borrego Springs, California
William F. Dunable, MS/CIS

ORIGINAL SCALED by _____

Serving Law Enforcement Since 1995
www.SoCalRadar-laserCertificationLab.com

VERRA MOBILITY

SELF-ACCURACY TEST
Kustom Signals Pro-Lite+ Lidar Speed Measurement Tool

DATE: 10/25/2019

Start of shift "Self Diagnostic test" time: 7:00 AM

Start of shift Distance check: 100' lidar

End of shift "Self Diagnostic test" time: 3:00 PM

End of shift Distance check: 100'

City and State: Kirkland, WA

Lidar Serial Number: LP03606

Certification Date: January 19th, 2019

OPERATOR: Charles Goodrich

I, *Charles Goodrich*, certify that the Kustom Signals Pro-Lite+ Lidar speed measurement device was setup, tested, and operated in accordance with the manufactures specifications to include its self-diagnostic check.

Further, I certified that the self-check distance was completed and accurate.

Signature:
Date: 10/25/2019

American Traffic Solutions™

Speed Validation Worksheet

Date	10/25/2019
Time	11:13am
Site ID	KRKF001
Location	Kirkland, Washington
Address	NB 132nd Ave NE @ Muir Elementary/Kamiakin Middle
Posted Speed Limit	20MPH
Trigger Speed Limit	26MPH
Speed Type	Fixed Speed/ School Zone
Lidar Technician	Charles Goodrich
AutoPatrol Technician	Pasquale Mosso
Lidar Serial Number	LP03606
Radar Serial Number	590-112 / 63669
Detection Type	Autopatrol-Radar
Measure Mode Capture	Yes
Photo enforcement signs present	Yes
Pass/ Fail	Yes
Ascending or Descending	Descending

City Lane	Times	Lidar Speeds	AP Speeds	Delta	Comments
1	11:13:37	26	26	0	
1	11:15:06	20	19	0	
1	11:15:16	22	22	0	
1	11:15:56	30	30	0	
1	11:16:03	29	30	0	

American Traffic Solutions™

Speed Validation Worksheet

Date	10/25/2019
Time	11:16am
Site ID	KRKF002
Location	Kirkland, WA
Address	SB 132nd Ave NE @ Muir Elementary/Kamiakin Middle
Posted Speed Limit	20MPH
Trigger Speed Limit	26MPH
Speed Type	Fixed Speed/ School Zone
Lidar Technician	Charles Goodrich
AutoPatrol Technician	Pasquale Mosso
Lidar Serial Number	LP03606
Radar Serial Number	590-112 / 63686
Detection Type	Autopatrol-Radar
Measure Mode Capture	Yes
Photo enforcement signs present	Yes
Pass/ Fail	Yes
Ascending or Descending	Descending

City Lane	Times	Lidar Speeds	AP Speeds	Delta	Comments
1	11:16:18	32	32	1	
1	11:16:27	28	28	-1	
1	11:16:46	39	38	1	
1	11:17:09	27	26	0	
1	11:17:22	29	28	0	

American Traffic Solutions™

Speed Validation Worksheet

Date	10/25/2019
Time	11:30am
Site ID	KRKF003
Location	Kirkland, Washington
Address	EB 80th St @ Rose Hill Elementary
Posted Speed Limit	20MPH
Trigger Speed Limit	26MPH
Speed Type	Fixed Speed/ School Zone
Lidar Technician	Charles Goodrich
AutoPatrol Technician	Pasquale Mosso
Lidar Serial Number	LP03606
Radar Serial Number	590-112 / 63684
Detection Type	Autopatrol-Radar
Measure Mode Capture	Yes
Photo enforcement signs present	Yes
Pass/ Fail	Yes
Ascending or Descending	Descending

City Lane	Times	Lidar Speeds	AP Speeds	Delta	Comments
1	11:35:12	24	24	0	
1	11:36:00	30	29	0	
1	11:36:28	26	26	0	
1	11:36:36	32	32	0	
1	11:37:13	25	25	0	

American Traffic Solutions™

Speed Validation Worksheet

Date	10/25/2019
Time	11:30am
Site ID	KRKF004
Location	Kirkland, Washington
Address	WB 80th St @ Rose Hill Elementary
Posted Speed Limit	20MPH
Trigger Speed Limit	26MPH
Speed Type	Fixed Speed/ School Zone
Lidar Technician	Charles Goodrich
AutoPatrol Technician	Pasquale Mosso
Lidar Serial Number	LP03606
Radar Serial Number	590-112 / 63664
Detection Type	Autopatrol-Radar
Measure Mode Capture	Yes
Photo enforcement signs present	Yes
Pass/ Fail	Yes
Ascending or Descending	Descending

City Lane	Times	Lidar Speeds	AP Speeds	Delta	Comments
1	11:32:21	21	21	0	
1	11:32:26	22	21	0	
1	11:33:17	22	22	0	
1	11:33:26	29	28	0	
1	11:33:46	24	24	0	