PMG | TECHNOLOGIES

TEST REPORT

SPEED ENFORCEMENT CAMERA VALIDATION TESTS

SAFEPACE ENFORCER CAM (DFD-0 24*) “THE INTERCEPTOR”
SP ENFORCER CAM (DFD-1 18*) “THE ENFORCER”

Contract No.: **18-7026**
Report No.: **RP18-0008 Rev. 1**

Presented to:
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Date: 2017-08-29

SUMMARY

Pursuant to a request from **LOGIX ITS GROUP**, we performed validation tests on two speed enforcement cameras: a **SP ENFORCER CAM (DFD-1 18°) NAMED THE ENFORCER AND A SAFEPACE ENFORCER CAM (DFD-0 24°) NAMED THE INTERCEPTOR**. The purpose of testing was to validate the accuracy of two speed enforcement cameras by testing them for a wide range of speeds in a controlled environment and comparing the data from the cameras' data acquisition system with the data from the calibrated data acquisition system installed on the test vehicle.

Testing was performed at the PMG Technologies Test and Research Center in Blainville (Quebec), on **May 23, 2017**.

All tests results are presented in this test report.

The minimum, maximum and average relative differences between the speed data recorded by each of the cameras and the reference data recorded by the data acquisition system for each target speed are as follows, based on 10 runs at each target speed:

Target speed	The Enforcer, Camera DFD-1 (18°)				The Interceptor, Camera DFD-0 (24°)			
	Min	Max	Average		Min	Max	Average	
24.9 mph (40 km/h)	**0.00 %**	**1.25 %**	**0.72 %**	**0.2 mph**	**0.25 %**	**1.75 %**	**0.82 %**	**0.2 mph**
37.3 mph (60 km/h)	**0.00 %**	**2.15 %**	**0.96 %**	**0.4 mph**	**0.00 %**	**1.66 %**	**0.78 %**	**0.3 mph**
49.7 mph (80 km/h)	**0.37 %**	**2.75 %**	**1.48 %**	**0.7 mph**	**0.50 %**	**1.62 %**	**0.97 %**	**0.5 mph**
62.1 mph (100 km/h)	**1.30 %**	**3.19 %**	**2.00 %**	**1.2 mph**	**0.01 %**	**2.4 %**	**0.77 %**	**0.5 mph**
74.6 mph (120 km/h)	**1.24 %**	**4.98 %**	**2.60 %**	**1.9 mph**	**0.08 %**	**1.67 %**	**0.64 %**	**0.5 mph**
93.2 mph (150 km/h)	**2.65 %**	**5.15 %**	**3.52 %**	**3.3 mph**	**0.00 %**	**2.38 %**	**0.74 %**	**0.7 mph**
TOTAL			**1.88 %**	**1.3 mph**			**0.79 %**	**0.5 mph**

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INTRODUCTION

The purpose of testing was to validate the accuracy of two speed enforcement cameras by testing them for a wide range of speeds in a controlled environment and comparing the data from the cameras' data acquisition system with the data from the calibrated data acquisition system installed on the test vehicle.

TEST SPECIMEN 1 (DFD-1), THE ENFORCER

Manufacturer	Body style
LOGIX ITS INC.	**SP ENFORCER CAM**
Sensor beam angle	Camera lens
18 ° HORIZONTAL X 7.5 ° VERTICAL	**16 mm**

TEST SPECIMEN 0 (DFD-0), THE INTERCEPTOR

Manufacturer	Body style
LOGIX ITS INC.	**SAFEPACE ENFORCER CAM**
Sensor beam angle	Camera lens
24 ° HORIZONTAL X 7.5 ° VERTICAL	**12 mm**

TEST VEHICLE DATA

Class of vehicle	Body style	Make, model
PASSENGER CAR	**MINI VAN**	**TOYOTA, SIENNA**

INSTRUMENTATION

DATA ACQUISITION AND TRANSMISSION SYSTEM

The data acquisition system used as a reference for the tests is an Racelogic VBOX 3i navigation system which measures motion, position and orientation in real-time and provides accurate results even in tree-covered environments. A photoelectric sensor was also used to trigger the data acquisition system.

Data recorded by the VBOX 3i included:

- duration;
- distance covered;
- heading;
- vehicle speed;
- date, start and end time.

The VBOX's specifications are as follows:

Position (cm)	Velocity (accuracy) (km/h)	Heading (deg)	Timing (s)
> 1 m 95% (with SBAS DGPS)	0.1 (averaged over 4 samples)	0.1	0.01

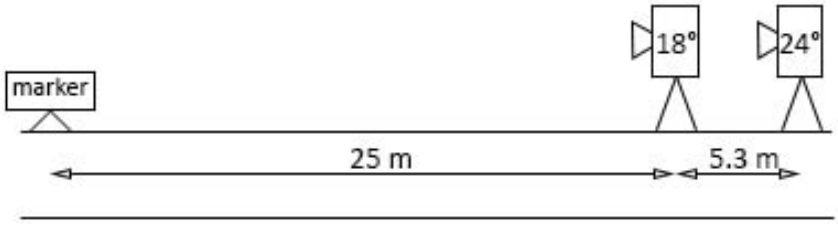
TEST PROCEDURE

TEST CONDITIONS AND FACILITIES

The test was conducted on PMG's BRAVO high-speed oval track, which presents two 1 mile (1.6-km) straight sections and can accommodate hands-off neutral speeds up to 180 km/h within the curved ends. Testing was performed on the straight sections of the track, on a clear, fogless and rain-less day with no strong winds, when the surface of the track was dry.

TEST SET-UP AND METHODOLOGY

The VBox 3i acquisition system and a photoelectric cell were installed on a test vehicle provided by PMG. The two speed enforcement cameras and a reflective marker for the photoelectric cell were set-up along the track in the following manner:



Tests were conducted at target speeds of 24.9, 37.3, 49.7, 62.1, 74.6, and 93.2 mph (40, 60, 80, 100. 120 and 150 km/h). The target speed was reached and the vehicle's cruise control system was locked at that speed before the vehicle entered the test zone. Ten runs were conducted at each of the target speeds. The speed data recorded by the VBOX 3i and by the two cameras are presented in the test results.

TEST RESULTS

TARGET SPEED: 24.9 MPH (40 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**25.4** (40.8)	**25.1** (40.4)	**0.3** (0.4)	**0.98 %**	**25.6** (41.2)	**0.2** (0.4)	**0.98 %**
2	**Not recorded**	–	–	–	–	–	–
3	**25.2** (40.6)	**24.9** (40.1)	**0.3** (0.5)	**1.23 %**	**25.3** (40.7)	**0.1** (0.1)	**0.25 %**
4	**24.8** (39.9)	**24.5** (39.5)	**0.3** (0.4)	**1.00 %**	**25.2** (40.6)	**0.4** (0.7)	**1.75 %**
5	**24.9** (40.0)	**25.0** (40.2)	**0.1** (0.2)	**0.50 %**	**24.7** (39.8)	**0.2** (0.2)	**0.50 %**
6	**24.9** (40.0)	**24.6** (39.6)	**0.3** (0.4)	**1.00 %**	**25.1** (40.4)	**0.2** (0.4)	**1.00 %**
7	**24.9** (40.1)	**24.6** (39.6)	**0.3** (0.5)	**1.25 %**	**25.0** (40.3)	**0.1** (0.2)	**0.50 %**
8	**24.8** (39.9)	**24.9** (40.0)	**0.1** (0.1)	**0.25 %**	**24.5** (39.4)	**0.3** (0.5)	**1.25 %**
9	**25.0** (40.2)	**25.1** (40.4)	**0.1** (0.2)	**0.50 %**	**24.9** (40.0)	**0.1** (0.2)	**0.50 %**
10	**24.8** (40.0)	**24.9** (40.0)	**0.1** (0.0)	**0.00 %**	**24.8** (39.9)	**0.0** (0.1)	**0.25 %**
11	**25.0** (40.2)	**25.1** (40.4)	**0.1** (0.2)	**0.50 %**	**25.3** (40.7)	**0.3** (0.5)	**1.24 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	0.00 %	**1.25 %**	**0.72 %**	**0.25 %**	**1.75 %**	**0.82 %**

TARGET SPEED: 37.3 MPH (60 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**37.7** (60.6)	**38.1** (61.3)	**0.4** (0.7)	**1.16 %**	**37.7** (60.7)	**0.0** (0.1)	**0.17 %**
2	**37.5** (60.3)	**37.5** (60.3)	**0.0** (0.0)	**0.00 %**	**37.7** (60.6)	**0.2** (0.3)	**0.50 %**
3	**37.4** (60.2)	**37.5** (60.3)	**0.1** (0.1)	**0.17 %**	**36.8** (59.2)	**0.6** (1.0)	**1.66 %**
4	**37.5** (60.3)	**38.0** (61.2)	**0.5** (0.9)	**1.49 %**	**37.8** (60.8)	**0.3** (0.5)	**0.83 %**
5	**37.4** (60.3)	**37.3** (60.1)	**0.1** (0.2)	**0.33 %**	**37.5** (60.3)	**0.1** (0.0)	**0.00 %**
6	**37.3** (60.0)	**37.7** (60.7)	**0.4** (0.7)	**1.17 %**	**36.7** (59.0)	**0.6** (1.0)	**1.67 %**
7	**37.6** (60.5)	**38.4** (61.8)	**0.8** (1.3)	**2.15 %**	**37.7** (60.6)	**0.1** (0.1)	**0.17 %**
8	**37.6** (60.6)	**37.4** (60.2)	**0.2** (0.4)	**0.66 %**	**37.4** (60.2)	**0.2** (0.4)	**0.66 %**
9	**37.5** (60.3)	**38.1** (61.3)	**0.6** (1.0)	**1.66 %**	**37.1** (59.7)	**0.4** (0.6)	**1.00 %**
10	**36.8** (59.3)	**37.2** (59.8)	**0.4** (0.5)	**0.84 %**	**37.3** (60.0)	**0.5** (0.7)	**1.18 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	0.00 %	**2.15 %**	**0.96 %**	**0.00 %**	**1.66 %**	**0.78 %**

TEST RESULTS (CONT.)

TARGET SPEED: 49.7 MPH (80 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**50.1 (80.6)**	**51.4 (82.7)**	**1.3 (2.1)**	**2.61 %**	**49.4 (79.5)**	**0.7 (1.1)**	**1.36 %**
2	**49.9 (80.2)**	**50.0 (80.5)**	**0.1 (0.3)**	**0.37 %**	**49.4 (79.5)**	**0.5 (0.7)**	**0.87 %**
3	**50.0 (80.4)**	**51.0 (82.1)**	**1.0 (1.7)**	**2.11 %**	**49.7 (80.0)**	**0.3 (0.4)**	**0.50 %**
4	**49.6 (79.9)**	**51.0 (82.1)**	**1.4 (2.2)**	**2.75 %**	**48.9 (78.7)**	**0.7 (1.2)**	**1.50 %**
5	**50.3 (80.9)**	**51.3 (82.6)**	**1.0 (1.7)**	**2.10 %**	**50.6 (81.4)**	**0.3 (0.5)**	**0.62 %**
6	**49.7 (80.0)**	**50.0 (80.4)**	**0.3 (0.4)**	**0.50 %**	**50.0 (80.4)**	**0.3 (0.4)**	**0.50 %**
7	**49.5 (79.6)**	**49.9 (80.3)**	**0.4 (0.7)**	**0.88 %**	**49.8 (80.2)**	**0.3 (0.6)**	**0.75 %**
8	**50.1 (80.6)**	**50.8 (81.8)**	**0.7 (1.2)**	**1.49 %**	**49.7 (80.0)**	**0.4 (0.6)**	**0.74 %**
9	**49.8 (80.1)**	**50.3 (80.9)**	**0.5 (0.8)**	**1.00 %**	**49.0 (78.8)**	**0.8 (1.3)**	**1.62 %**
10	**7 (79.9)**	**1 (80.7)**	**4 (0.8)**	**00 %**	**0 (78.9)**	**7 (1.0)**	**1.25 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	0.37 %	**2.75 %**	**1.48 %**	**0.50 %**	**1.62 %**	**0.97 %**

TARGET SPEED: 62.1 MPH (100 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**62.4 (100.5)**	**64.2 (103.3)**	**1.8 (2.8)**	**2.79 %**	**62.5 (100.6)**	**0.1 (0.1)**	**0.10 %**
2	**62.4 (100.4)**	**64.4 (103.6)**	**2.0 (3.2)**	**3.19 %**	**62.3 (100.2)**	**0.1 (0.2)**	**0.20 %**
3	**62.2 (100.1)**	**63.4 (102.0)**	**1.2 (1.9)**	**1.90 %**	**60.7 (97.7)**	**1.5 (2.4)**	**2.40 %**
4	**62.3 (100.2)**	**63.1 (101.5)**	**0.8 (1.3)**	**1.30 %**	**62.4 (100.4)**	**0.1 (0.2)**	**0.20 %**
5	**61.7 (99.2)**	**62.6 (100.8)**	**0.9 (1.6)**	**1.61 %**	**61.5 (98.9)**	**0.2 (0.3)**	**0.30 %**
6	**62.2 (100.2)**	**63.1 (101.5)**	**0.9 (1.3)**	**1.30 %**	**61.8 (99.4)**	**0.4 (0.8)**	**0.80 %**
7	**62.4 (100.4)**	**63.8 (102.7)**	**1.4 (2.3)**	**2.29 %**	**62.5 (100.6)**	**0.1 (0.2)**	**0.20 %**
8	**61.6 (99.2)**	**63.0 (101.4)**	**1.4 (2.2)**	**2.22 %**	**61.6 (99.1)**	**0.0 (0.1)**	**0.10 %**
9	**62.2 (100.1)**	**63.4 (102.0)**	**1.2 (1.9)**	**1.90 %**	**63.5 (102.2)**	**1.3 (2.1)**	**2.10 %**
10	**62.5 (100.6)**	**63.4 (102.1)**	**0.9 (1.5)**	**1.49 %**	**61.7 (99.3)**	**0.8 (1.3)**	**1.29 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	1.30 %	**3.19 %**	**2.00 %**	**0.10 %**	**2.40 %**	**0.77 %**

TEST RESULTS (CONT.)

TARGET SPEED: 74.6 MPH (120 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**74.8** (120.5)	**75.8** (122.0)	**1.0** (1.5)	**1.24 %**	**74.8** (120.4)	**0.0** (0.1)	**0.08 %**
2	**74.8** (120.4)	**76.9** (123.7)	**2.1** (3.3)	**2.74 %**	**75.0** (120.7)	**0.2** (0.3)	**0.25 %**
3	**74.9** (120.6)	**76.3** (122.8)	**1.4** (2.2)	**1.82 %**	**74.9** (120.5)	**0.0** (0.1)	**0.08 %**
4	**75.0** (120.6)	**78.7** (126.6)	**3.7** (6.0)	**4.98 %**	**75.2** (121.1)	**0.2** (0.5)	**0.41 %**
5	**75.2** (121.1)	**77.1** (124.0)	**1.9** (2.9)	**2.39 %**	**74.8** (120.3)	**0.4** (0.8)	**0.66 %**
6	**74.4** (119.8)	**77.4** (124.6)	**3.0** (4.8)	**4.01 %**	**73.2** (117.8)	**1.2** (2.0)	**1.67 %**
7	**74.8** (120.4)	**76.0** (122.3)	**1.2** (1.9)	**1.58 %**	**73.9** (118.9)	**0.9** (1.5)	**1.25 %**
8	**75.2** (120.6)	**76.9** (123.7)	**1.7** (2.7)	**2.23 %**	**74.7** (120.2)	**0.5** (0.8)	**0.66 %**
9	**74.9** (120.6)	**76.4** (123.0)	**1.5** (2.4)	**1.99 %**	**75.6** (121.6)	**0.7** (1.0)	**0.83 %**
10	**74.5** (119.8)	**76.7** (123.4)	**2.2** (3.6)	**3.01 %**	**74.1** (119.2)	**0.4** (0.6)	**0.50 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	1.24 %	**4.98 %**	**2.60 %**	**0.08 %**	**1.67 %**	**0.64 %**

TARGET SPEED: 93.2 MPH (150 km/h)

Test run	VBOX 3i	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Recorded speed mph (km/h)	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference	Recorded speed mph (km/h)	Absolute difference mph (km/h)	Relative difference
1	**93.4** (150.4)	**96.3** (155.0)	**2.9** (4.6)	**3.06 %**	**94.0** (151.3)	**0.6** (0.9)	**0.60 %**
2	**94.0** (151.2)	**96.8** (155.8)	**2.8** (4.6)	**3.04 %**	**93.5** (150.5)	**0.5** (0.7)	**0.46 %**
3	**93.8** (150.9)	**96.3** (154.9)	**2.5** (4.0)	**2.65 %**	**93.6** (150.6)	**0.2** (0.3)	**0.20 %**
4	**94.3** (151.7)	**97.8** (157.4)	**3.5** (5.7)	**3.76 %**	**95.3** (153.4)	**1.0** (1.7)	**1.12 %**
5	**93.7** (150.8)	**96.6** (155.5)	**2.9** (4.7)	**3.12 %**	**93.9** (151.1)	**0.2** (0.3)	**0.20 %**
6	**94.1** (151.4)	**98.9** (159.2)	**4.8** (7.8)	**5.15 %**	**95.5** (153.7)	**1.4** (2.3)	**1.52 %**
7	**93.5** (150.5)	**97.0** (156.1)	**3.5** (5.6)	**3.72 %**	**94.0** (151.3)	**0.5** (0.8)	**0.53 %**
8	**93.3** (150.1)	**96.5** (155.3)	**3.2** (5.2)	**3.46 %**	**93.3** (150.1)	**0.0** (0.0)	**0.00 %**
9	**93.8** (150.1)	**97.3** (156.6)	**3.5** (5.6)	**3.71 %**	**96.1** (154.6)	**2.3** (3.6)	**2.38 %**
10	**94.1** (151.4)	**97.4** (156.8)	**3.3** (5.4)	**3.57 %**	**94.4** (152.0)	**0.3** (0.6)	**0.40 %**

Variation in relative difference	The Enforcer, Camera DFD-1 (18°)			The Interceptor, Camera DFD-0 (24°)		
	Min	Max	Average	Min	Max	Average
	2.65 %	**5.15 %**	**3.52 %**	**0.00 %**	**2.38 %**	**0.74 %**

Note: Calculations for the Absolute and Relative Differences were made in km/h and then converted to mph. For precise references, look at the results in km/h.

CONCLUSION

Testing was conducted as planned. In test run 2 at 24.9 mph (40 km/h), the data acquisition system was not triggered properly and no data was recorded. No other incident was noted during testing.

The minimum, maximum and average relative differences between the speed data recorded by each of the cameras and the reference data recorded by the data acquisition system for each target speed are as follows:

Target speed	The Enforcer, Camera DFD-1 (18°)				The Interceptor, Camera DFD-0 (24°)			
	Min	Max	Average		Min	Max	Average	
24.9 mph (40 km/h)	**0.00 %**	**1.25 %**	**0.72 %**	**0.2 mph**	**0.25 %**	**1.75 %**	**0.82 %**	**0.2 mph**
37.3 mph (60 km/h)	**0.00 %**	**2.15 %**	**0.96 %**	**0.4 mph**	**0.00 %**	**1.66 %**	**0.78 %**	**0.3 mph**
49.7 mph (80 km/h)	**0.37 %**	**2.75 %**	**1.48 %**	**0.7 mph**	**0.50 %**	**1.62 %**	**0.97 %**	**0.5 mph**
62.1 mph (100 km/h)	**1.30 %**	**3.19 %**	**2.00 %**	**1.2 mph**	**0.01 %**	**2.4 %**	**0.77 %**	**0.5 mph**
74.6 mph (120 km/h)	**1.24 %**	**4.98 %**	**2.60 %**	**1.9 mph**	**0.08 %**	**1.67 %**	**0.64 %**	**0.5 mph**
93.2 mph (150 km/h)	**2.65 %**	**5.15 %**	**3.52 %**	**3.3 mph**	**0.00 %**	**2.38 %**	**0.74 %**	**0.7 mph**
Overall average			**1.88 %**	**1.3 mph**			**0.79 %**	**0.5 mph**

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APPENDIX A

TEST PHOTOGRAPHS

1. View of speed enforcement camera DFD-1 – SP ENFORCER CAM 18°.

2. View of speed enforcement camera DFD-0 – SAFEPACE ENFORCER CAM 24°.

3. View of the vehicle used for testing.

4. View of the test set-up with oncoming test vehicle in the distance.

5. View of the exit of the test area, with reflective marker.

6. View of the instrumentation onboard the vehicle used for testing.

7. View of the photoelectric cell installed on the vehicle.

8. Image captured by camera DFD-0 at 40 km/h (cropped).

9. Image captured by camera DFD-0 at 100 km/h (cropped).

10. Image captured by camera DFD-0 at 150 km/h (cropped).

11. Image captured by camera DFD-1 at 40 km/h (cropped).

12. Image captured by camera DFD-1 at 100 km/h (cropped).

13. Image captured by camera DFD-1 at 150 km/h (cropped).

PMG | TECHNOLOGIES

APPENDIX B

TEST INSTRUMENTATION

TEST INSTRUMENTATION

The following instrumentation was used for the speed enforcement cameras validation tests.

Description	Manufacturer	Model	Serial No.	Calibration due date
Data acquisition system	RaceLogic	VBOX 3i	22466	2018-02-02
Computer	Dell	XFR	XFR-5	N/A
Photoelectric cell	SIck	WL24	N/A	N/A

PMG | TECHNOLOGIES

APPENDIX C

SPECIFICATIONS OF THE TEST SPECIMENS

TRAFFICLOGIX

Enforcer Cam

The revolutionary Enforcer Cam offers the pinpoint accuracy of optical time-of-flight sensing technology to record traffic violations with real time photos. It is the first ever fully integrated 2D multi-beam infrared speed enforcement camera. With a 16 channel light sensor that uses highly efficient algorithms, the camera can identify exact vehicle speeds and precise vehicle location while remaining undetectable to radar or laser detectors. Data is transmitted to the SafePace cloud, where it can be accessed from anywhere and exported for further use.

Features

Unique 16 beam infrared detection and ranging technology provide **precise speed detection.**
Unparalleled tracking of multiple vehicles via infrared, unlike radar technology which is unable to differentiate between simultaneous passing vehicles.
Infrared technology fully operational in all weather conditions including fog, rain, snow, or intense heat or cold.
Complete scene awareness feature builds a complete 3d model of surroundings that calculates **true velocity of each vehicle**, unlike other speed cameras which can only measure speed relative to sensor.
System is optimized to reduce power required to operate sensors, offering **longer autonomous operation** and **reduced power supply requirements.**
The system has a **zero software footprint** with no software installation. Data is accessible from anywhere with an internet connection.
Flexible, user-friendly camera mounts allow for precise camera set up and installation.

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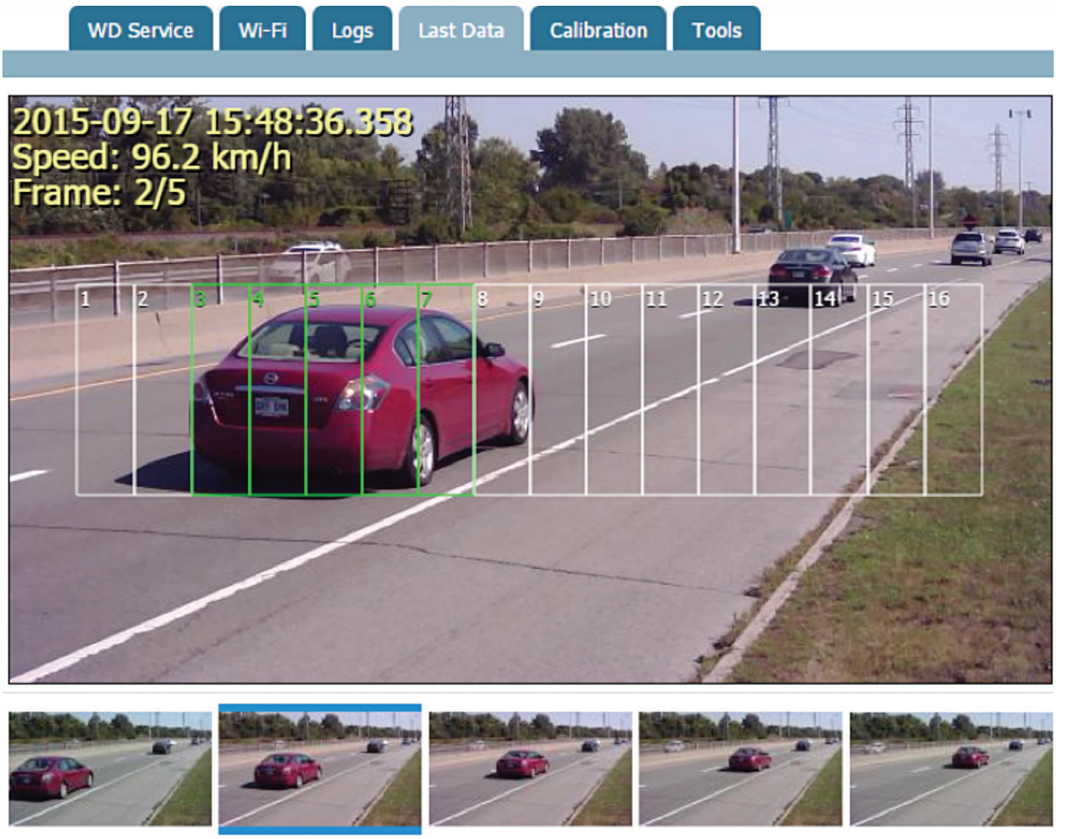
Technical Specifications

ITEM	MIN	TYPICAL	MAX	UNITS
POWER SUPPLY VOLTAGE		12		V DC
CURRENT CONSUMPTION		0.6		Amps
CURRENT FOR EXTERNAL LOAD (OPTIONAL)				Amps
POWER CONSUMPTION		8		Watts
CPU FREQUENCY	300	800	1200	MHz
IMAGING RESOLUTION	640 x 480	1920 x 1080	1920 x 1080	pixels
NUMBER OF TRAFFIC LANES SENSED	1	2	3 *	
MOUNTING HEIGHT	2	2.5	3.8	m
EFFECTIVE RANGE OF SPEED SENSOR	10	15	30	m
SIM CARD SIZE		Standard		
SPEED SENSOR LED WAVELENGTH		940		nm

** Not recommended*

Communication

802.11 b/g/n (client and hotspot modes)
GSM 3G/4G (configurable to other standards)
Standard wired Ethernet 100BASE-TX



TRAFFIC LOGIX
SAFEPACE® ENFORCER CAM PRODUCT SPECIFICATIONS

Traffic Camera Specifications

SafePace® Enforcer Cam Product Specifications

This document is supplied as a guide for the SafePace Enforcer Cam product. Reasonable care has been taken in preparing the information it contains. However, it is possible that this document contains omissions, technical inaccuracies, or typographical errors. Product specifications are subject to change without notice and should not be considered commitments by Traffic Logix Corporation. Traffic Logix Corporation does not accept responsibility of any kind for customers' losses due to the use of this document.

Trademarks

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DESCRIPTION

SafePace Enforcer Cam is a fully integrated multi-beam infrared speed enforcement camera developed by Traffic Logix. The camera uses a 16-channel light sensor to actively illuminate an area of interest and, based on precise time-of-flight measurements, determine vehicle speed and location. In addition the low intensity infrared light emitted by the camera is invisible to Radar Detectors.

SafePace Enforcer Cam works with Web Director, which allows you to remotely manage your SafePace Enforcer Cam cameras right from your computer, with detailed reporting, customized alerts, and real-time data. You can see statistics for each camera, change settings, check battery levels and import ticket data without having to travel to the various camera locations.

SafePace Enforcer Cam is also available as part of our mobile speed trap solution which can be deployed roadside to detect speed violations and immediately issue tickets or notifications.

HIGHLIGHTS

Powerful Quad-Core ARM CPU – The SafePace Enforcer Cam uses a power-efficient Quad-Core ARM® Cortex®-A9, for high speed image processing and three modes of communication.

Advanced Connectivity – The SafePace Enforcer Cam includes GSM (3G/4G), Wi-Fi and Ethernet connectivity options.

Supreme Accuracy in All Conditions – The SafePace Enforcer Cam uses a unique 16-beam IR detection and ranging technology, capable of providing efficient and precise multi-target tracking and precise speed calculation regardless of the weather conditions (fog, rain, snow, intense heat or cold, day or night).

True Velocity Technology – Because of complete scene awareness the SafePace Enforcer Cam is capable of building a complete model of its surroundings. This allows us to calculate the true velocity of each target.

Point and Go Installation – Simple and straightforward installation process allows you to have the camera up and running quickly.

Low Power Consumption – Our unique algorithms were developed and optimized to reduce the power required to drive the sensors, and to leverage lower-power components, hence providing more autonomy and reducing power supply requirements. The smarter signal processing also allows it to deliver a higher level of performance for a specific level of power.

All Specifications Subject to Change Without Notice

TECHNICAL SPECIFICATIONS

LEDDAR Sensor

- Range of speed sensor: up to 35 meters
- Number of traffic lanes: up to 2
- LED wavelength: 940 nm
- Sensor Beam Angle: 24° horizontal × 7.5° vertical
- OCR/Back plate/Front plate: Server-based. Back plate.
- Speed measurement range: 0 to 170 km/h (110 mph)
- Mounting height: 2 meters to 3.8 meters

Camera/Imaging

- Resolution (H × V): Full HD, 1920 × 1080 pixels
- Camera Lens: CS mount; fixed focal length; suitable for day/night time operations

Processor/Storage/OS

- CPU: 800 MHz Quad-core ARM A9
- Memory: 2GB of RAM
- Storage: 8 GB of flash (non-volatile) storage
- Ticket Buffer: approximately 400 tickets
- Operating System: Custom-built Linux

Illuminator (available on request)

- Internal/External: Extermal
- Model: AXTON Smart AT-32S-A 30° Infrared Illuminator (850nm)
- Wavelength: 850nm

Electrical Specifications

- Power supply voltage: 12 V DC
- Current consumption: 3 Amps
- Power consumption: 12-51 Watts
- Current for external load: 9 Amps

Mechanical Specifications

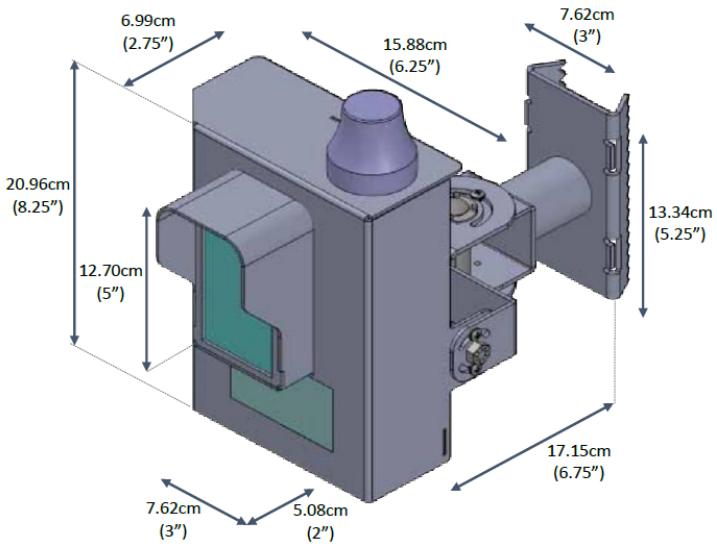
- Operating temperature: -20° C to 65° C
- IP rating: IP65.

- Camera Housing: Aluminum, light gray.
- Weight: 1.66 kg / 3.65 lbs
- Dimension of camera: 20.96 cm (H) × 15.88 cm (W) × 6.99 cm (D)

All Specifications Subject to Change Without Notice

Dimensions

Camera Dimensions (not including antenna): 20.96 cm (H) × 15.88 cm (W) × 6.99 cm (D)



All Specifications Subject to Change Without Notice

Communication

- Wi-Fi: Wi-Fi 802.11 b/g/n (client and hotspot modes)
- GSM: 3G/4G (2G compatible)
- SIM card size: Standard
- Ethernet: Standard wired Ethernet 100 BASE-TX

Configurable Options

- SafePace Enforcer Cam is highly configurable and the on board camera interface allows you to adjust the following parameters among others:
  - Official Local Speed Limit
  - Violation Speed Limit (Limit which triggers the recording of a speed violation)
  - Number of images recorded for each speed violation
- SafePace Enforcer Cam keeps a detailed log of internal events which allows you to perform a complete audit of its operations.

Packaging Options

- Mobile speed trap system
- Fixed installation managed through Web Director
- Illuminators (for nighttime operation)

All Specifications Subject to Change Without Notice

WARRANTY

Two Year Warranty

Two year warranty on parts and labor excluding damage related to vandalism, abuse, and/or theft

Subject to the following conditions, Traffic Logix Corporation ("Traffic Logix") warrants that the SafePace Enforcer Cam camera (the "Product") is free from defects in materials and workmanship.

This limited warranty begins on the invoice date of your purchase of the Product and extends:

- For TWO (2) calendar years on the camera, and
- For ONE (1) calendar year on the batteries.

This limited warranty extends only to the original purchaser of the Product when purchased either directly through Traffic Logix or through an authorized Traffic Logix distributor and is not assignable or transferable to any subsequent purchaser or end-user. Traffic Logix's obligation and liability under this warranty are expressly limited to repairing or replacing, at Traffic Logix's option, defective products. In no circumstances shall Traffic Logix's liability, whether in contract or tort, under any warranty, in negligence, or otherwise, exceed the amount of the purchase price of the product. Traffic Logix shall not be liable for special, indirect, or consequential damages of any kind. This warranty does not cover damages resulting from normal wear and tear, incorrect installation or operation, use other than for the product's intended purposes, vandalism, and extraordinary environmental circumstances. Traffic Logix reserves the right to charge for these damages to the product at rates normally charged for repairing such products not covered under this warranty. Damages resulting from any physical changes or alterations made to the product other than Traffic Logix will render this warranty **VOID**. Using any parts or accessories not supplied or approved by Traffic Logix, such as battery chargers, will further render the warranty **VOID**.

Traffic Logix neither assumes, nor authorizes any person to assume for it, any other liability in connection with the sale of the Product, and there are no agreements or warranties collateral to or affecting this limited warranty.

THE LIMITED WARRANTY SET FORTH IN THIS AGREEMENT IS THE EXCLUSIVE AND SOLE WARRANTY APPLICABLE TO THIS PURCHASE. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED.

Traffic Logix does not warrant that any of its products will meet or comply with the requirements of any applicable federal, state or local safety code, law, regulation or ordinance ("Applicable Safety Laws"). Buyer acknowledges that Traffic Logix's products are to be used only in accordance with the attached Conditional Terms of Use and any Applicable Safety Laws. Buyer agrees that there shall be no coverage or benefits of any kind under this limited warranty if it is determined by Traffic Logix that the Product was not installed or used in accordance with the Conditional Terms of Use or Applicable Safety Laws, or if the Product has been altered in any way by anyone other

than Traffic Logix, or if the Product has been subject to any misuse or accident. In addition, Buyer assumes and agrees to indemnify Traffic Logix for all risk, liability or expense that results from any installation or use of the Product that is not in accordance with the Conditional Terms of Use or any Applicable Safety Laws.

Warranty Replacement Procedure

In order to submit a claim for the repair or replacement of the Product under this limited warranty, proceed as follows:

1. Contact Technical Support. **Do *NOT*** ship your defective product to Traffic Logix prior to contacting Technical Support.
2. A Technical Support Agent will evaluate the Product to determine if it is defective. You may be required to do some troubleshooting as part of this evaluation.
3. If the Product is defective, then you will need to submit your contact information, and proof of purchase (including the date or purchase), in order to obtain repair or replacement parts.
4. The Technical Support Agent will provide you with a Return Materials Authorization number and instructions on how to have the defective parts repaired or replaced.