Overview of data accuracy tests for Sensebits vehicle sensors

Sensebit AB

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Abstract

The Sensebit vehicle sensors were introduced to the traffic data collection market in 2010. The possibility of more extensive and accurate traffic data collection combined with lower installation and maintenance cost quickly gained the attention of traffic authorities. To verify that the detectors produce comparable or better data accuracy than previous systems on the market, several extensive tests have been conducted by traffic authorities and research organizations. This document gives an overview of the latest published results from a major third party test.

The test summarized in this document was performed by the Nordic traffic authorities strategic research cooperation (NordFOU) on the E16 road in Sweden. Three different versions of the sensors were evaluated, which all proved to have an average detection accuracy of 99.8% (excluding test for verge MCs , see section 2), a classification accuracy of 98.7% (five class scheme), an average speed error smaller than 0.8%, and an average length error of -7cm.

1 Introduction

Since the introduction of Sensebits vehicle sensors to the market in 2010, the possibility of more extensive and accurate traffic data collection combined with lower installation and maintenance cost quickly gained the attention of traffic authorities. To verify that the sensors produce comparable or better data accuracy than previous systems on the market, traffic authorities and research organizations have conducted several tests. This documents gives an overview of the latest published results of a major third party test.

In an effort to further improve the accuracy of the sensors and to supply users with objective third-party test results, Sensebit continuously participate in tests conducted by traffic authorities and research organizations in different countries. As tests are completed and results are published, this document will be updated. To make sure you have the latest version, make an inquiry to support@sensebit.se or ask your local Sensebit distributor.

1.1 About the Sensebit vehicle sensors

The Sensebit vehicle sensors utilize magnetometer technology to register high-resolution magnetic profiles of vehicles. The detectors are installed in the road and allow users to conduct all traffic data collection remotely.

By analyzing the magnetic profiles, the vehicle sensors deliver the following parameters on a per vehicle basis:

- Timestamp with millisecond resolution
- Velocity between -200km/h and +200km/h with 0.1km/h resolution
- Vehicle classification (up to 15 classes)
- Length of vehicle, including possible trailer, with 0.1m resolution

All Sensebit vehicle sensors are built on the same technology platform and deliver the same data accuracy for all parameters. Because of this, no distinction is made between the different versions in this document except for when the HD add-on module is used. The HD add-on module can be added to any Sensebit sensor and will improve the speed accuracy.

2 Test results

The referenced test of data accuracy was conducted by the Nordic traffic authorities strategic research cooperation (NordFOU) between 20th and 23th of August 2013 on the E16 road at Amsberg, Sweden. The primary goal was to test various traffic measuring equipment to determine how accurately they classify vehicles according to a set of vehicle classification schemes. A range of measuring equipment and reference equipment was used, including magnetometer based detectors, radar, pneumatic tubes, inductive loops and ANPR cameras. Three versions of the Sensebit vehicle sensors were used in the test: WD-300 (now renamed FLEX), ED-100 (now renamed FLEX Real-time) and ED-100 with the HD add-on module (now renamed FLEX Real-time with HD module).

The organizers of the test arranged for a large number of motorcycles to be driven through the test site at various positions on the road (e.g. very close to the edge of the pavement) to test how it affected different types of measuring equipment. Since these types of passages are very rare in normal traffic conditions, the report states two numbers for the ability to measure traffic volume: total and excluding MC.

2.1 Ability to measure traffic volume

In total, 1 872 vehicles drove in the northwest direction during the test. The Sensebit vehicle sensors reported an average of 1 815 vehicles (97%). The corresponding accuracy excluding MCs were 1 863 (99.5%). [1]

During the same period, 1 405 vehicles drove in the southeast direction. The Sensebit vehicle sensors reported an average of 1 348 (96%) vehicles. The corresponding number excluding MCs were 1 399 (99.6%) [1]

2.2 Ability to classify vehicles

Of the 1 872 vehicles driving in the northwest direction, 1 856 (99.2%) were correctly classified by the Sensebit vehicle sensors in a five class system (*MC, Light motor vehicle, Light motor vehicle with trailer, Heavy motor vehicle, Heavy motor vehicle with Trailer*). [1]

Of the 1 405 vehicles travelling in the opposite direction, an average of 1 379 (98.1%) were correctly classified by the Sensebit vehicle sensors in the same five class system. [1]

2.3 Accuracy of speed estimations

For all vehicles registered by the Sensebit vehicle sensors in the test, the average speed error was smaller than 0.8%. On a per-vehicle-basis, 87.6% of the vehicles had a speed error smaller than 3km/h. For the detectors with the HD add-on module, 97% of the vehicles had a speed error smaller than 3km/h.

The absolute speed errors of the six sensors are presented in Table 1 below. [1]

Sensor version	Direction of traffic	Absolute speed error
With HD add-on module	Northwest	0.06 km/h
Standard	Northwest	-0.20 km/h
Standard	Northwest	1.22 km/h
With HD add-on module	Southeast	-0.07 km/h
Standard	Southeast	-0.64 km/h
Standard	Southeast	-0.87 km/h

Table 1 Absolute speed errors

2.4 Accuracy of length estimations

The average length error of for the Sensebit sensors in the evaluation was -7 cm. For all vehicles registered, 43% of them had a length estimation error smaller than $20\mathrm{cm}$. [1]

3 References

[1] NordFOU, *Analysis of measured data for the calculation of accuracy in vehicle classification and various measurement data*, 2014.