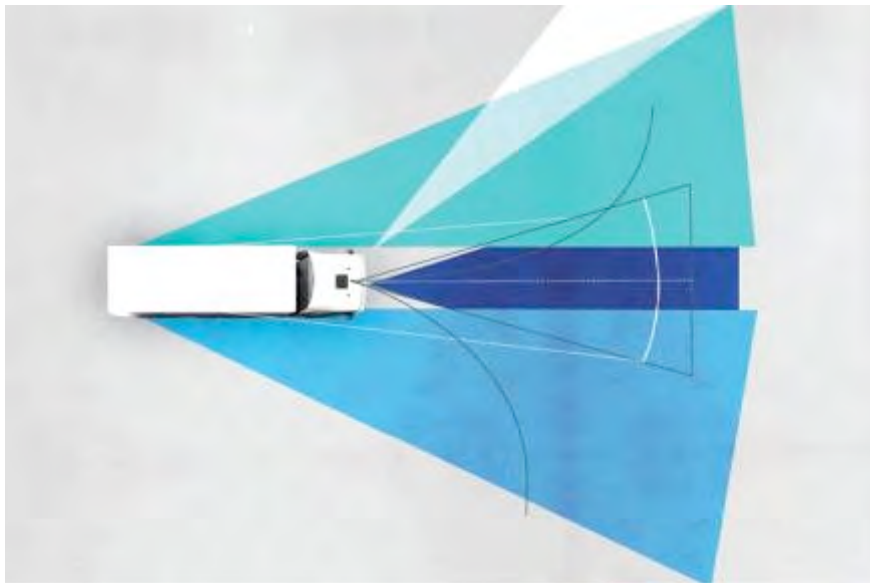




Mobileye Shield+ System

Technical Overview paper

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Mobileye Shield+ System Technical Information

1. Introduction

Mobileye Shield+ is an intelligent blind spot detection system for heavy good vehicles (HGV) that utilizes multi-vision smart sensors and provides an informational assistance system to the drivers and is activated with sufficient time for the driver to avoid dangerous situations. The artificial vision is trained to identify pedestrians, cyclists and motorcyclists (Vulnerable Road Users- VRUs) while ignoring inanimate objects. Furthermore, the artificial vision sensors of the Shield+ are connected to a G-Force system to ensure that the proper parameter combinations are detected (lateral time-to-collision) based on the real time vehicle and VRU trajectories.

This technical overview paper provides key information about the system, how it works, the technical components, and installation assembly combinations and requirements.

2. How the system works

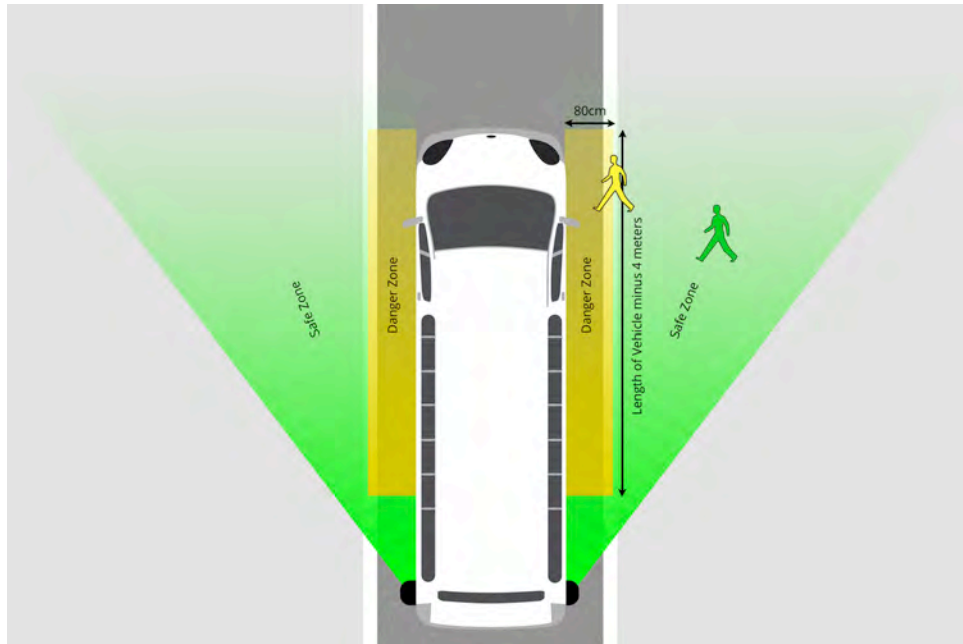
The Shield+ system delivers two kinds of warnings based on the severity of the risk of collision – Danger zone warning and Collision warning.

2.1. Danger Zone Warning (Yellow visual warning) - indicating that a VRU is present in one of the blind spot danger zones of the vehicle alerting the driver to act with caution.

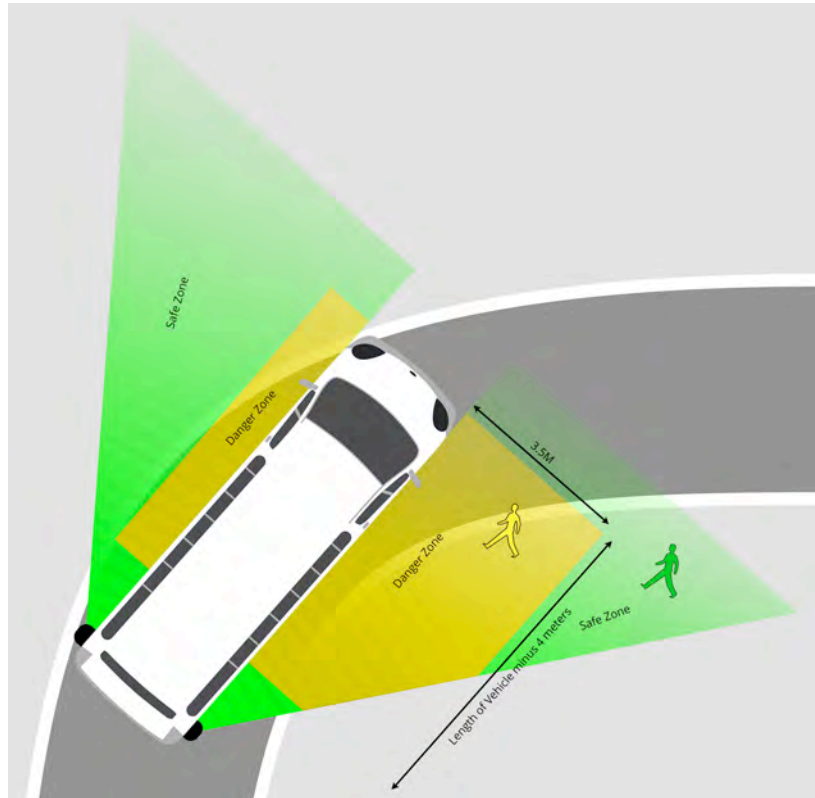


The system defines danger zones for the vehicle that correspond to the drivers blind spots. These danger zones have two type of sensitivity levels based on the driving course of the vehicle:

- Low sensitivity – Narrow danger zone - When the vehicle is traveling in a straight course, the risk of a collision is lower and so the Shield+ rear cameras monitor a narrow danger zone. The following illustration details the dimensions of the low sensitivity narrow danger zone:



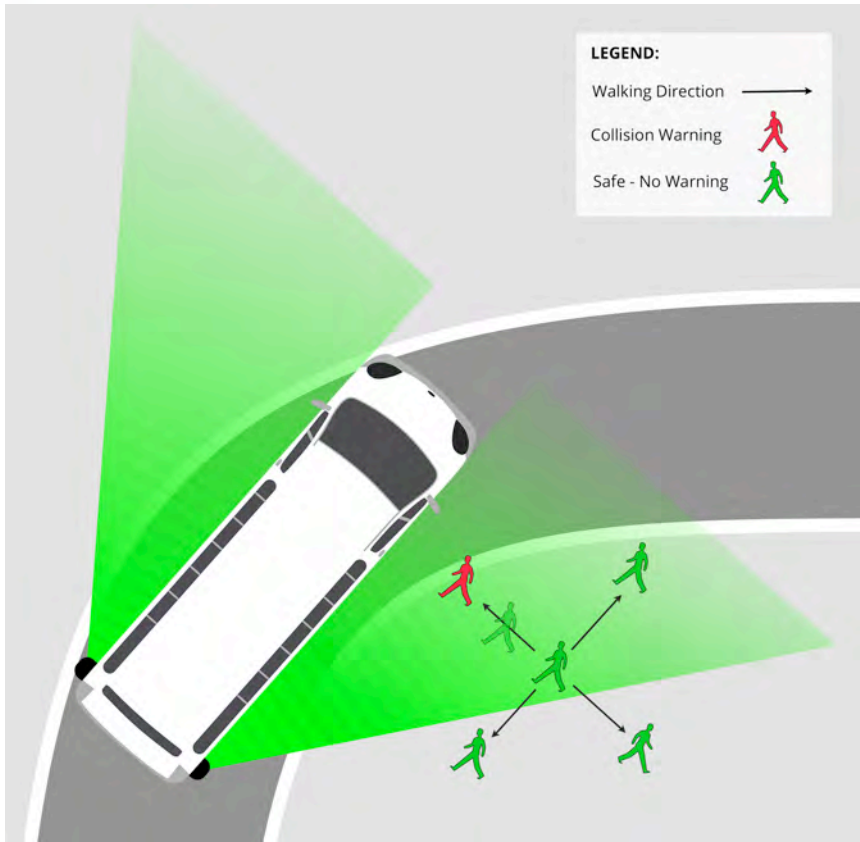
- High sensitivity – Wide danger zone – When the vehicle is in a turning course, the risk of a collision is higher and so the Shield+ rear cameras monitor a wide danger zone. The following illustration details the dimensions of the low sensitivity narrow danger zone:



2.2. Collision Warning (red flashing visual warning and audio warning) - indicating that a VRU and the vehicle are in an imminent collision course, triggered when the lateral time to collision (LTTC) between the VRU and the side of the vehicle shortens to a critical time, alerting the driver to take immediate action to prevent the collision.



The following diagram illustrates example incidents of collision detections:



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The System detects VRUs at the following driving speeds of the vehicle:

VRU Type	Driving speed of the vehicle at which the VRU is detected
Pedestrian	From 1 km/h ¹ to 70 km/h
Cyclist	From 0 km/h to 70 km/h
Motorcyclist	From 0 km/h to 70 km/h

It is important to note that the current version of the system is functional only at daylight.

The Mobileye Shield+ kit includes Mobileye 6 Series front facing camera. For more information on this component please see appendix 1 of this document.

3. System Components (For Part Numbers see appendix 2)

The Shield+ standard kit is composed of the following components:

3.1. Master camera unit

The Mobileye Shield+ Master (main) unit contains the front facing camera, a Gyro Sensor, an audio buzzer and the main processor (EyeQ2™). This camera is mounted on the front windshield and it covers a viewing angle of 37°.



¹ The detection starts only at 1km/h (and not 0 km/h) in order to avoid false warnings when pedestrians are getting on and off the vehicle (bus).



3.2. Master camera display – Eyewatch

The Eyewatch is the display of the master camera, providing the driver of all alerts that are processed from the front camera.²



3.3. Rear camera unit

The Mobileye Shield+ Rear Camera unit contains the camera and the main processor (EyeQ2™). These units are fitted at the rear of the vehicle, one on each side, at a height of approximately 2 meters, covering a viewing angle of 37° from the side of the vehicle.

Shield+ Version 2 camera housing³:



Shield+ Version 1.5 camera housing:



² For a detailed overview of all master camera warnings please see appendix

³ Will be available as of Q2 2017



3.4. Corner camera unit (optional)

The corner camera unit contains the camera and the main processor (EyeQ2™). It is fitted on the front windshield, on the near side of the driver, covering the blind spot projected by the corner pillar of the vehicle with a viewing angle of 37 degrees.



3.5. LED display unit – one unit for each side

The LED display units are fitted in the front part of the vehicle, one on each side of the driver, delivering danger zone warnings and collision warnings to the driver.⁴



⁴ See section 2.2 above



3.6. Mobileye CAN-Sensor

The Mobileye CAN-Sensor is a non-intrusive solution for CAN-Bus connection that allows a quick and easy connection to the vehicle CAN-bus wires by simply placing the Mobileye CAN-Sensor on the vehicle CAN-bus wires without any wire cutting or pinching.



In a case a vehicle has no CAN-Bus, there is a solution component for full analogue installation.

3.7. Mobileye Junction-Box

The Mobileye Junction Box designed as a plug & play connection hub for all the Mobileye Shield+ components.

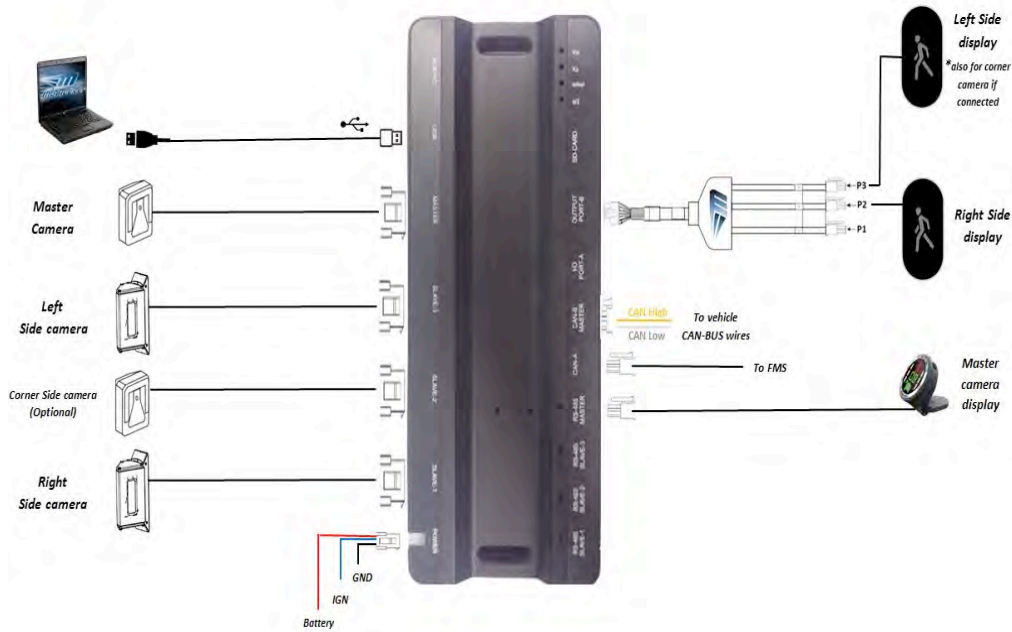


Cables that connect all above components are part of the Shield+ kit. For the cable configuration please see appendix 2.



The following illustration shows the connection scheme of the Shield+ system:

Mobileye Shield+ Basic connection scheme



3.8. Supplementing feature - Hot spot map (Ituran Starlink Component)

The Shield+ system is supplemented with a FMS component provided by Ituran⁵ (3rd party) which collects the information generated by the Shield+ in real-time and provides a clear and simple analysis and understanding of the environment surrounding the vehicle including the potential dangerous hot spots. The information is displayed on a smart web map. The Starlink component has embedded GSM and GPS antennas and comes with a quad band GSM modem.



⁵ ITURAN LOCATION AND CONTROL LTD



4. Shield+ assembly combinations

The system can be assembled in several different combinations according to customer will and to vehicle type. The following diagrams illustrate the main assembly combinations:

4.1. Non articulated vehicle

- **3 Camera**



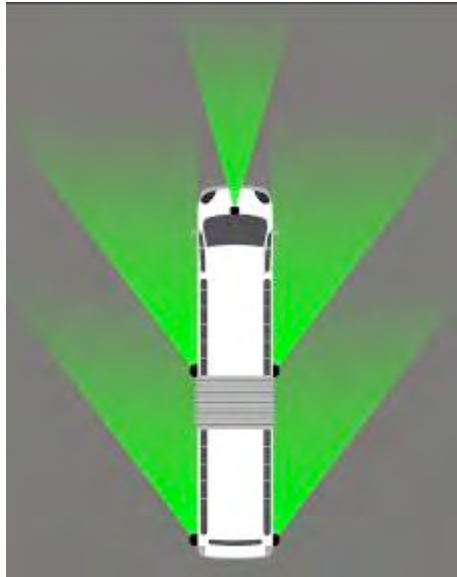
- **4 Camera**





4.2. Articulated Vehicle

- **Articulated Bus**



- **Trailer (or semi-trailer) truck**





- **Double Trailer truck**



5. Installation

Mobileye Shield+ installation must be carried out by an authorized Mobileye dealer or installer. Average installation time per vehicle is approximately 4 hours for two installers. The product was designed in a way that enables a plug and play installation connecting only 5 cables to the vehicle's power and signals.



Appendix 1 – Mobileye 6 series alerts

The Mobileye collision avoidance system helps drivers by acting as a “third eye”, constantly monitoring the road in front of the vehicle. It identifies potentially dangerous situations, and provides audio and visual alerts to assist the driver in preventing or mitigating a collision.

Forward Collision Warning

Mobileye alerts of an imminent collision with a vehicle or motorcycle ahead, both on highways and in urban areas, up to 2 seconds before a collision, allowing enough time to react.



Headway Monitoring Warning

Helps the driver keep a safe following driving distance from the vehicle ahead and provides visual and audio alerts if the distance becomes unsafe.



Intelligent High-Beam Control

Mobileye automatically raises and lowers the high beams without inconveniencing oncoming or preceding traffic. *Available only in certain geographical areas



Speed Limit Indicator & Traffic Sign Recognition

Mobileye recognized traffic signs and speed limit signs (including electronic signs) and supplementary signs’ “reads” the sign and notifies the driver, including if the vehicle exceeds the posted speed limit. *Detects signs declared valid by the Vienna Convention on Road Signs and Signals





Pedestrian & Cyclist Collision Warning

Mobileye alerts you, during day time, with visual and audio warning up to 2 seconds before imminent collision with a pedestrian or bicyclist. (Under 50 Km p/hr).



Lane Departure Warning

Mobileye alerts you with visual and audio warnings when there is an unintentional deviation from the driving lane.





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Appendix 2 – Mobileye Part Numbers

Main Components

Component	Part Number
Master camera unit	ASY000SHM
Master camera display – Eyewatch	ASY0130SH
Rear camera unit	ASY000SHR (Right) ASY000SHL (Left)
Corner camera unit	ASM000SHC
LED display unit	PAC000LED
Mobileye Junction-Box	PACSHIELD
Ituran Starlink component	ITM00223A
Extra Junction box (for more than 4 cameras)	PACSH0002

Cables

Component	Part Number
Cable to Junction-Box - Long Cable, 8m	CAB000161
Cable to Junction-Box - Short Cable, 3m	CAB000162
Cable to junction-Box - 17m Extension Cable	CAB000163
Cable to junction-Box - 3m Extension Cable	CAB000164

The configurations of the cables are as follows:

The master camera and the corner camera come with one cable to junction box - as per customer's request - CAB000161 (recommended for buses) or CAB000162 (recommended for trucks).

Each rear camera comes with one cable to junction box as per customer's request - CAB000161 (recommended for all vehicle types) or CAB000162 and one extension cable CAB000163 (recommended for all vehicle types) or CAB000164.