



V-16. HAZARD WARNING DEVICE





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INTRODUCTION

The aim of this document is to describe the new V-16 hazard warning devices, which have been in use since July 2021 and will be mandatory from 1 January 2026.

The new V-16 signal is an orange flashing light that replaces triangles as a means of signalling a stationary vehicle on the road. It must be placed as high as possible on the vehicle when it is immobilised on the road in order to ensure maximum visibility and must communicate its geolocation with the DGT 3.0 platform in order to alert other drivers approaching that point of the road.



Illustration 1. V-16 signal. Source: DGT

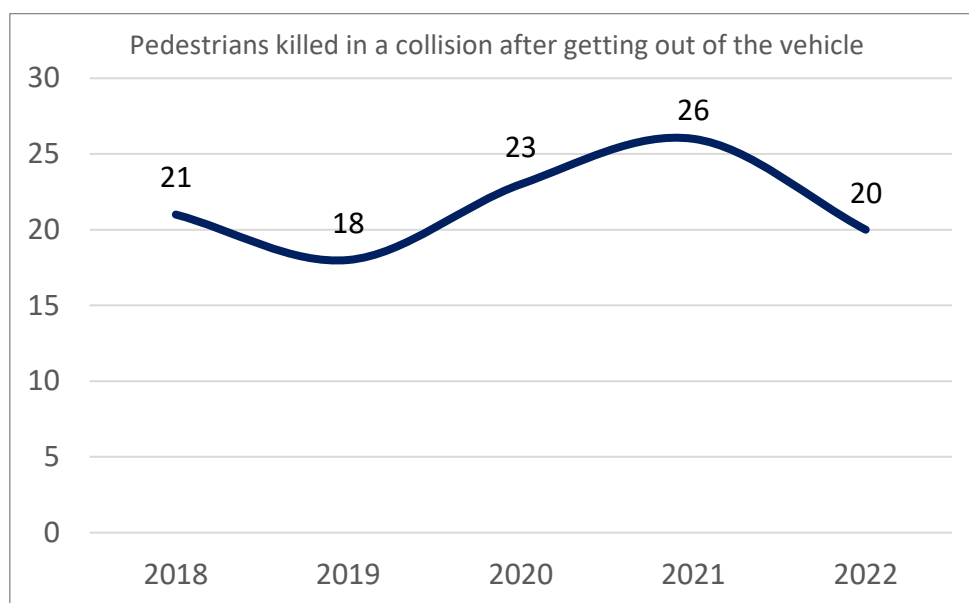
CURRENT CONTEXT

Currently, in the event of an accident or breakdown on motorways and dual carriageways, it is necessary to go 50 metres along the road on foot to place the warning triangle behind a broken down vehicle, which involves the unnecessary risk of walking 100 metres along the road (there and back to the vehicle). This is made worse on single carriageways with two-way traffic, where this distance is doubled by having to place a triangle 50 metres in front and another triangle 50 metres behind the vehicle (in total, 200 metres covered by the pedestrian on this return journey).

Moreover, in adverse weather conditions, such as rain, hail and/or strong wind, the triangle cannot support itself and falls over, thus rendering its signalling function useless. In the event of reduced visibility or the presence of fog on the road, the required visibility of a distance of 100 metres is reduced.

Consequently, these circumstances have led to frequent cases of triangles being abandoned on the road by those who decided not to return to remove the triangles due to the perceived sense of risk.

Furthermore, the latest accident rate analyses show that in Spain in 2019, of the 340 people who died on high-capacity roads, a total of 58 were pedestrians, with an average of 22 pedestrians killed in a collision after getting out of the vehicle in the last 5 years.



It is therefore deemed necessary to develop regulations for a more advanced device that is easy to use and minimises these risks, thus giving rise to the V-16 beacon project.

LEGAL FRAMEWORK

At an international level, United Nations Regulation No. 48 on Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices [2021/1718] states in paragraph 5.21.2 that “...other road users shall be warned of the presence of the vehicle on the road; for example **by means of a warning triangle or other devices**, according to national requirements on road traffic.”

In the European context, *Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport* defines the priority areas and actions for Member States with regard to the deployment of Intelligent Transport Systems, among which are Priority area I: Optimal use of road, traffic and travel data and priority action (b) Provision of EU-wide real-time traffic information services, which has led to Spain’s creation of the National Access Point (NAP) and the development of devices for obtaining up-to-date traffic information, including V-16 devices connected to DGT 3.0.

At the national level, the *General Vehicle Regulations approved by Royal Decree 2822/1998 of 23 December*, establish technical specifications on signs, which include V-16 on the hazard warning device in Annex XI, Vehicle Signs.

Royal Decree 159/2021, of 16 March, regulating assistance services on public roads establishes that from 1 January 2026, the driver of a vehicle immobilised on the road must provide a signal by using an amber light, which must be placed as high as possible on the vehicle to ensure its visibility. The Royal Decree also lists the technical characteristics of this device and the mandatory connection to the National Access Point.

Pursuant to *Royal Decree 159/2021*, the DGT has drawn up the following resolutions and directives focused on the standardisation of this device:

- *Resolution of 30 November 2021 of the Directorate-General for Traffic, defining the protocol and format for sending data from V-16 signals to the National Access Point, within the scope of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport.*
- *Directive MOV 3/2022: Procedure for the certification of V16 signals connected to DGT 3.0 (23 May 2022).*

FUNCTIONALITY

The Safe System, presented as part of the DGT's Road Safety Strategy 2030, which aims to reduce the fatal and serious accident rate by 50% as proposed by the United Nations and the European Commission, provides for the minimisation of the number of situations in which there are driving-related risks and, in turn, places great importance on innovation and technology.

In this context, the V-16 signal is presented as another tool to help to reduce the accident rate, following the principles of the Safe System and covering the fundamental aspects:

As this new device can be installed without the need to exit the vehicle, it provides **greater safety and convenience for the driver** and aims to reduce the high number of fatal collisions that occur when drivers exit their vehicles to place/remove emergency triangles after having suffered an accident on the road.

It increases the physical visibility of broken down vehicles on the road and creates the new concept of "virtual visibility". This device increases visibility to 1000 metres compared to 100 metres for triangles.

It democratises connectivity, making **connectivity available to all vehicles**, both new and old, regardless of model or range.

It is universal, as it can be used by drivers with reduced mobility (who cannot easily exit the vehicle and go to place the triangle on the road).

Through its **connection to the DGT 3.0 connected vehicle platform**, the V-16 signal will provide information on the location of vehicles that pose a danger to other drivers, reducing the possibility of surprise and thus decreasing the likelihood of frontal collisions on the road.

It promotes awareness and use of the National Access Point (NAP) as envisaged in Directive 2010/40/EU.

INTEGRATION INTO DGT 3.0

As indicated above, a fundamental aspect of these devices will be the ability to communicate with DGT 3.0 and, therefore, have the data published in DATEX format on the National Access Point in order to inform other road users of the presence of the stationary vehicle.

Among the use cases developed in the DGT 3.0 application is “Warning of breakdowns on the road”, which will gather information on all breakdowns or accidents occurring on the road in which the vehicle or its load obstructs the road, thanks to the traffic regulations replacing the use of hazard warning triangles with the use of the “V-16 signal”.

When activated by the user in the event of a breakdown or accident, the V-16 signal, which will have to be carried in the glove compartment of every vehicle, will not only emit a warning light signal, but will also connect to DGT 3.0 to transmit its location in real time. When the DGT 3.0 platform receives the information, it will cross-check the data on the incident with Traffic Management Systems (roadside equipment, information from officers on the road, etc.) and other sources of information in order to ensure its accuracy. If the incident is confirmed, it will be stored on the system as active and published to alert any users driving nearby.

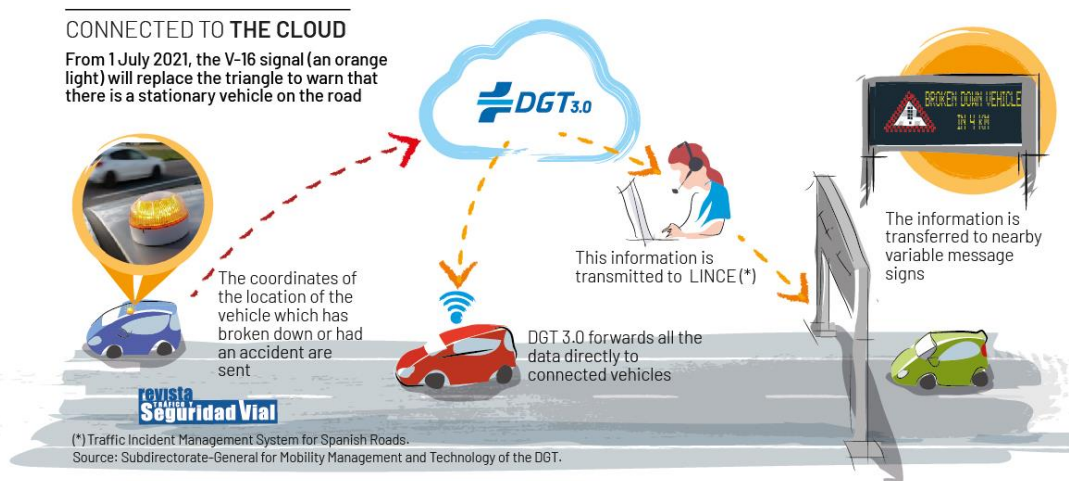


Illustration 2. Operating diagram of the V-16 signal. Source: DGT

The way the incident information reaches the end user will depend on how it is implemented by the third party that uses the information from DGT 3.0 and how they want to offer it to users: in-vehicle navigation systems, mobile apps, satnav, etc.

The DGT has a DGT 3.0-related website where it specifies the most relevant aspects for developing the different use cases envisaged, including that regarding the V-16 signal, which can be accessed at the following link: https://gitlab.cs.cmobility30.es/dgt3.0_esp/caso-de-uso-1

The V-16 signal will therefore be a cooperative element involving various actors, which will have two main functions:

- To share information: The manufacturers of V-16 signalling devices will share the information regarding the vehicle immobilised on the road with DGT 3.0.
- To use information: This encompasses all the actors that will use the information to inform drivers, i.e. vehicle manufacturers, navigation service providers, councils, public transport management platforms, vehicle fleets equipped with telematic systems, insurance companies, mobility apps, etc.

MAIN TECHNICAL CHARACTERISTICS OF THE V-16 BEACON

Listed below are the technical characteristics approved in Spanish regulations that V-16 devices must have in accordance with current regulations, which they must comply with in order to be certified for signalling.

PHYSICAL AND LIGHTING CHARACTERISTICS

The main technical characteristics which the light must have in accordance with the stipulations of Royal Decree 2822/1998, of 23 December, approving the General Vehicle Regulations, are as follows:

- a) *Irradiation: the optical system shall be designed so that the light covers a field of visibility of 360 degrees horizontally and a minimum of ± 8 degrees vertically up and down.*
- b) *Luminous intensity: the intensity must be between 40 and 700 effective candelas at 0 degrees and between 25 and 600 effective candelas at ± 8 degrees. In both cases, this intensity shall be maintained for at least 30 minutes.*
The "ON" time, as defined in the Regulation of the UN Economic Commission for Europe (UNECE) 65, shall not exceed 0.4/flash frequency.
- c) *The "OFF" time, as defined in UNECE Regulation 65, shall be at least 0.1 seconds. The time between immediately consecutive flashes (Δe) for warning lights consisting of groups of several flashes shall be as defined in annex 5 of ECE Regulation 65.*
- d) *IP protection rating: shall be at least IP54.*
- e) *Stability: the equipment shall be designed to remain stable on a flat surface and shall not move in the least favourable direction for its stability when faced with an air flow exerting a dynamic pressure of 180 Pa.*
- f) *Flash frequency: between 0.8 and 2 Hz.*
- g) *The operation of the light shall be ensured at temperatures between -10 °C and 50 °C.*
- h) *Testing: verification of compliance with the characteristics defined in the preceding paragraphs a) to f) shall be carried out in a laboratory accredited in accordance with the standard UNE EN-ISO 17025 by the National Accreditation Agency (or any other National Accreditation Body designated by another Member State in accordance with EC Regulation no. 765/2008 and under the conditions established in article 11 of said Regulation) for UNECE Regulation 65. If the tests are satisfactory, the laboratory shall*

issue a certificate to that effect, indicating the identification marks on the cover of the device.

The device shall be powered autonomously by a cell or battery that shall guarantee its use after 18 months. Devices using a rechargeable battery, provided that the device can be charged in the vehicle itself, shall be deemed to comply with this requirement.

CONNECTIVITY AND COMMUNICATIONS

The device shall communicate its activation, deactivation and geopositioning to the National Access Point, sending its location every 100 seconds when activated. In order to achieve this connectivity, it shall contain all the necessary elements in its casing and shall under no circumstances depend on external elements.

Device communication shall be made using standard UDP protocols:

- Protocol A: Communication protocol between the V-16 device and the information systems of the device manufacturer.
- Protocol B: communication protocol between manufacturers' information systems and the National Access Point.

All the data to be included in the protocols is described in the Resolution of 30 November 2021 of the Directorate-General for Traffic, which is adjoined in Annex II of this document: Regulations.

The communications technology used by the V-16 devices shall be cellular licensed band technology in order to prevent service interference, as provided for in GSMA 4G/5G LPWA standards.

In terms of communications management, security and privacy, the devices shall have:

- Private and secure communications environment (private APN).
- Use of a non-removable SIM card to prevent tampering.
- Automatic and unattended provisioning to avoid intermediate activation procedures that may interfere when an accident or breakdown occurs.

CERTIFICATION OF DEVICES

The certification of devices is carried out following the procedure established in *Directive MOV 3/2022: Procedure for the certification of V16 signals connected to DGT 3.0 (23 May 2022)*.

The list of certified makes and models of connected V-16 devices will be published on the website: <http://www.dgt.es/v16>.

Dispositivos de preseñalización V16

El V16 es un dispositivo de preseñalización de accidentes que viene a sustituir a los clásicos triángulos para indicar que el vehículo ha quedado inmovilizado en la calzada o que su carga se encuentra caída sobre la misma

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Con el propósito de avanzar en el ámbito de la seguridad vial y la reducción de accidentes nace el dispositivo V16, que está llamado a complementar a los tradicionales triángulos de preseñalización de peligro. Se trata de una nueva baliza de color amarillo que está dotada de...

Furthermore, in the General Vehicle Regulations, the following aspects of certification are reflected in the description of the characteristics of the V-16 hazard warning device:

"10. In order to ensure correspondence between the prototypes tested, in accordance with the provisions of paragraph 3(g) of section V-16, Hazard warning device, of Annex XI, and the devices ultimately manufactured, the manufacturer shall hold a certificate of regular verification of production control of V-16 devices. This certificate shall be issued by a technical service for conformity of production designated for UNECE Regulation 65. The requirements for verifying the existence of provisions and procedures to ensure effective control of conformity of production, as well as the samples to be tested, shall be those established for UNECE Regulation 65. 11.

11. The technical services designated for the certification of V-16 devices shall inform the Directorate-General for Traffic of the list of devices that obtain this certification. The designated technical services shall act as a single point of contact between the manufacturers and the Directorate-General for Traffic.

12. In any case, the certificate shall include the analysis of the effectiveness of the communications, as well as the connectivity of the V-16 signals, with the DGT connected vehicle platform."

ANNEX I: TECHNICAL DOCUMENTATION FOR INTEGRATION WITH DGT 3.0

Adjoined is a link which contains the technical documentation for the service offered by the DGT 3.0 platform: https://gitlab.cs.cmobility30.es/dgt3.0_esp/caso-de-uso-1

ANNEX II: REGULATIONS

- ***United Nations Regulation No. 48 on Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices [2021/1718]***

Article 5. GENERAL SPECIFICATIONS

5.21.2 A remark in the communication form (item 10.1. of Annex 1) shall inform other Administrations that more than 50 per cent of the apparent surface in the direction of the reference axis can be hidden by the movable components; and a notice in the vehicle shall inform the user that in certain position(s) of the movable components other road users shall be warned of the presence of the vehicle on the road; for example by means of a warning triangle or other devices according to national requirements for use on the road.

- **Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport:**

ANNEX I

PRIORITY AREAS AND ACTIONS (as referred to in articles 2 and 3)

Priority area I: Optimal use of road, traffic and travel data

The specifications and standards for optimal use of road, traffic and travel data shall include the following:

1. Specifications for priority action (a)

The definition of the necessary requirements to make EU-wide multimodal travel information services accurate and available across borders to ITS users, based on:

- the availability and accessibility of existing and accurate road and real-time traffic data used for multimodal travel information to ITS service providers without prejudice to safety and transport management constraints,
- the facilitation of the electronic data exchange between the relevant public authorities and stakeholders and the relevant ITS service providers, across borders,
- the timely updating of available road and traffic data used for multimodal travel information by the relevant public authorities and stakeholders,
- the timely updating of multimodal travel information by the ITS service providers.

2. Specifications for priority action (b)

The definition of the necessary requirements to make EU-wide real-time traffic information services accurate and available across borders to ITS users, based on:

- the availability and accessibility of existing and accurate road and real-time traffic data used for real-time traffic information to ITS service providers without prejudice to safety and transport management constraints,
- the facilitation of the electronic data exchange between the relevant public authorities and stakeholders and the relevant ITS service providers, across borders,
- the timely updating of available road and traffic data used for real-time traffic information by the relevant public authorities and stakeholders,
- the timely updating of real-time traffic information by ITS service providers.

3. Specifications for priority actions (a) and (b)

3.1. The definition of the necessary requirements for the collection by relevant public authorities and/or, where relevant, by the private sector, of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes, notably for heavy goods vehicles) and for their provisioning to ITS service providers, based on:

- making existing road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes) collected by the relevant public authorities and/or the private sector available to ITS service providers,
- facilitating electronic data exchange between the relevant public authorities and ITS service providers,
- the timely updating of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes), by the relevant public authorities and/or, where relevant, the private sector,
- the timely updating of ITS services and applications by ITS service providers, using this road and traffic data.

3.2. The definition of the necessary requirements to make road, traffic and transport services data used for digital maps accurate and available, where possible, to digital map producers and service providers, based on:

- making existing road and traffic data used for digital maps available to digital map producers and service providers,
- facilitating electronic data exchange between the relevant public authorities and stakeholders and private digital map producers and service providers,
- the timely updating of road and traffic data for digital maps by the relevant public authorities and stakeholders,
- the timely updating of digital maps by digital map producers and service providers.

4. Specifications for priority action (c)

The definition of minimum requirements, for road safety related 'universal traffic information' provided, where possible, free of charge to all users, as well as their minimum content, based on:

- the identification and use of a standardised list of safety related traffic events ('universal traffic messages') which should be communicated to ITS users free of charge,
- the compatibility and integration of 'universal traffic messages' into ITS services for real-time traffic and multimodal travel information.

- **Royal Decree 2822/1998, of 23 December, approving the General Vehicle Regulations.**

V-16. HAZARD WARNING DEVICE

1. It indicates that the vehicle is immobilised on the road or that its load has fallen onto the road.

2. This amber device must be placed as high as possible on the immobilised vehicle to ensure maximum visibility.

3. It shall have the following characteristics:

a) Irradiation: the optical system shall be designed so that the light covers a field of visibility of 360 degrees horizontally and a minimum of ± 8 degrees vertically up and down,

b) Luminous intensity: the intensity must be between 40 and 700 effective candelas at 0 degrees and between 25 and 600 effective candelas at ± 8 degrees. In both cases, this intensity shall be maintained for at least 30 minutes.

The “ON” time, as defined in the Regulation of the UN Economic Commission for Europe (UNECE) 65, shall not exceed 0.4/flash frequency.

The “OFF” time, as defined in UNECE Regulation 65, shall be at least 0.1 seconds.

The time between immediately consecutive flashes (Δe) for warning lights consisting of groups of several flashes shall be as defined in Annex 5 of ECE Regulation 65.

c) IP protection rating: shall be at least IP54.

d) Stability: the equipment shall be designed to remain stable on a flat surface and shall not move in the least favourable direction for its stability when faced with an air flow exerting a dynamic pressure of 180 Pa.

e) Flash frequency: between 0.8 and 2 Hz.

f) The operation of the light shall be ensured at temperatures between -10 °C and 50 °C.

g) Testing: verification of compliance with the characteristics defined in the preceding paragraphs a) to f) shall be carried out in a laboratory accredited in accordance with the standard UNE EN-ISO 17025 by the National Accreditation Agency (or any other National Accreditation Body designated by another Member State in accordance with Regulation (EC) no. 765/2008 and under the conditions established in article 11 of said Regulation) for UNECE Regulation 65. If the tests are satisfactory, the laboratory shall issue a certificate to that effect, indicating the identification marks on the cover of the device.

The device shall be powered autonomously by a cell or battery that shall guarantee its use after 18 months. Devices using a rechargeable battery, provided that the device can be charged in the vehicle itself, shall be deemed to comply with this requirement.

4. This device shall, in any event, communicate its activation, deactivation and geopositioning to the national access point for traffic and mobility. Information on the location of the vehicle involved in an accident shall be sent every 100 seconds and shall cease being sent once the deactivation information has been transmitted.

V-16. HAZARD WARNING DEVICE

5. The cost of communications shall be included in the retail price and communications shall be guaranteed for at least 12 years.

6. The device shall contain all the necessary elements for its operation, including those for communications, inside its casing and shall in no case depend on external elements, such as mobile telephone applications or similar.

7. The list of makes and models of V-16 devices that comply with all the provisions of this section, and are therefore valid for signalling an accident, will be published on the website <http://www.dgt.es/v16>.

8. The service expiry date, which refers to the period of connectivity included with the purchase of the beacon, shall be displayed on both the packaging and the device itself.

9. V-16 hazard warning devices shall be intended exclusively for the visibility of the vehicle involved in an accident and the subsequent sending of this vehicle's location to the Directorate-General for Traffic, and may not include additional features.

10. In order to ensure correspondence between the prototypes tested, in accordance with the provisions of paragraph 3(g) of section V-16, Hazard warning device, of Annex XI, and the devices ultimately manufactured, the manufacturer shall hold a certificate of regular verification of production control of V-16 devices. This certificate shall be issued by a technical service for conformity of production designated for UNECE Regulation 65. The requirements for verifying the existence of provisions and procedures to ensure effective conformity of production control, as well as the samples to be tested, shall be those established for UNECE Regulation 65.

11. The technical services designated for the certification of V-16 devices shall inform the Directorate-General for Traffic of the list of devices that obtain this certification. The designated technical services shall act as a single point of contact between the manufacturers and the Directorate-General for Traffic.

12. In any case, the certificate shall include the analysis of the effectiveness of communications, as well as the connectivity of the V-16 signals, with the DGT connected vehicle platform.

– **Royal Decree 159/2021, of 16 March, regulating assistance services on public roads:**

Transitional provision one. Use of the V-16 “Hazard warning” device, in accordance with the model provided for in Annex XI of the General Vehicle Regulations before the entry into force of this royal decree.

Until 1 January 2026, the hazard warning devices with the dimensions, colour, method of placement and technical characteristics set out in Annex XI of the General Vehicle Regulations, before the entry into force of this royal decree, may continue to be used as V-16 signals in the cases referred to in the General Road Traffic Regulations.

In addition, V-16 warning lights manufactured prior to the approval of this royal decree, which, in any case, comply with all the technical characteristics listed in section five of final provision two, except points 4, 5 and 6 relating to the ability to communicate the activation, deactivation and location of the vehicle involved in an accident to the national access point, may also continue to be used as V-16 signals until 1 January 2026.