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Smart Thinking for Smart Mobility

LASERTEC

FOG LASER SYSTEM

LASERTEC-TECNIVIAL

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A8 Galicia Highway. Spain

1. DESCRIPTION

Driving Aid

LASERTEC is a laser beaconing system to assist driving in conditions of reduced visibility (extreme fog, sand, particles in suspension, etc.). LASERTEC allows the driver to see the road layout beyond where the reduced visibility allows other objects to be seen, ensuring greater safety for the road user. This is achieved by activating a laser beam that marks the contour of the road.

Rear-end collisions hazard warning

LASERTEC warns of obstacles, such as stationary vehicles or traveling at abnormally low speeds on the road, by switching beams from fixed to flashing mode.

Laser line is generated with electronic beacons along the road equipped with a semiconductor laser diode that projects a pulsed laser beam that is intercepted by the following beacon. The photons of the laser beam impact the suspended particles (fog, dust, sand,...) producing a clearly continuous line of light to be seen between the beacons.

All this creates a polygonal contour of the road and a clearly defined route for road drivers.

LASERTEC, includes an array sensors to:

1) detect the presence of objects that may intercept the laser beam between beacons.

2) detect potential deviations of laser beam due to impacts and displacements.

Acting onto affected beacons and preventing the view of the road layout from being distorted.

2. COMPONENTS

1 PLC (Programmable Logic Controller)

The brain of the system. The PLC monitor beacon information inputs and other devices sending back orders to turn them on/off, modulate laser diode power or switching beams from fixed to flashing mode warning drivers in case of detecting stationary vehicles or decreased speeds in approaching vehicles.

PLC is controlled via SMS, GPRS, 4G, etc. Communications are carried out by RS485 cable in a BUS configuration and via radio (or both, achieving a redundant communication system.

2 Beacon

Beacons integrate a semiconductor laser diode, presence and position sensors and are connected among each other and with PLC via cable in a BUS configuration and radio (LoRa). Highly robust watertight (IP65) beacon, tested to withstand extreme weather and environmental conditions.

3 Visibility Meter

This device conduct real-time measurements of human eye visibility in meters and sends this information to the PLC to turn the beacons system on and off without the need for human operator intervention.

4 Radar

Stereo Doppler radar is used to detect both moving vehicles and their speed. If a vehicle is detected traveling at a speed considered abnormally low (for example, 40 kmph) for any given section of road, it will communicate with the PLC and will command beacons to change their light beam from fixed to flashing mode, exclusively on that section of road.

3. INSTALLATION

1

The beacons are spaced every 25 meters along the road and anchored onto easy-to-install fiber poles. They are aligned defining a polygonal outline that highlights the road layout.

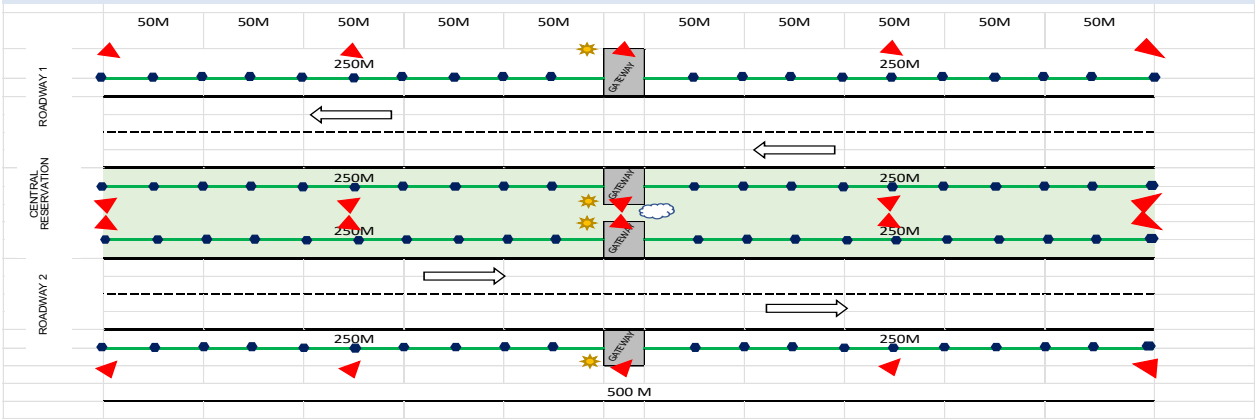
All beacons are connected to each other and to the PLC.

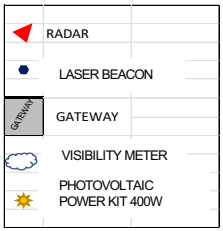
2

Gateway (one every 500 meters of system), installed at the centre of the section and comprising:

1. PLC controller (in a connection cabinet).
2. Photovoltaic power kit. (Optional)
3. Radar and visibility meter: Installed on a pole at a height of 3 meters.

500 METERS SECTION LASER BEACON CONFIGURATION





Gateway

A2 Barcelona Highway. Spain

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4. ENERGY CONSUMPTIONS

CONSUMPTIONS (W) FOR EACH 500 METERS OF ROADWAY (1 SIDE)			
Components	**Qty**	**Unit Comsumtions**	**Total (W)**
Laser beacon	20	1,8	36
Radar	5	0,5	2,5
Gateway	1	20	20
Visibility Meter	0,25	0,7	0,175
Bus RS485	560m	0,15	84
Photovoltaic Kit 400w	1		
Radar feed	550m		
		TOTAL	**142,68**
		K sec (1,25)	**178,34**

CONSUMPTIONS 1 KM OF HIGHWAY

178,34 x 4 x 2= 1.426,72W

Equivalent to 15 x100W light bulbs.

5. STEP BY STEP OPERATION

STEP 1 Fog Detection. The visibility meter detects low visibility (less than 50 m) and sends the information to the PLC.

STEP 2 The PLC sends orders to turn on the beacons, modulating the power of the semiconductor laser diode according to the intensity of the fog by emitting a beam of laser light that shows the road layout.

STEP 3 The radar sends information to the PLC about the speed of vehicles on the road.

STEP 4 Rear-end collision hazard. If the radar detects vehicles travelling at a very low speed or at a standstill, the PLC sends a signal to the beacons to flip the laser beam configuration from fixed to intermittent mode and this new configuration is maintained until the danger of the rear-end collision has disappeared.

6. LASERTEC SAFETY SYSTEMS

1 If the beacon suffers an impact or loses its alignment, it will turn off.

2 If laser beam is intercepted by an object, laser diode reduces its power to the minimum.

After detecting the incident, an auto- validation process begins to return to the correct parameters. In the event of a minor impact, the beacon has capability to turn back on without operator intervention.

7. KEY STRENGTHS

1. LASERTEC allows to see the road layout beyond the human eye can see under adverse visibility conditions.
2. On the grounds of a LASER beam as a coherent light source, it does not generate light pollution or distortion and therefore does not glare.
3. LASERTEC ensures driver safety by warning rear drivers from having to brake suddenly or stop in the middle of the road.
4. A very low power consumption. It can also be a fully autonomous system, powered solar energy (optional).
5. Installation does not interfere with existing road equipment.
6. Easy operation. The entire on/off and operational system can be handled remotely.
7. Real-time alarm and event detection.
8. Low maintenance
9. Truly Safe. LASERTEC has all the safety elements to ensure the safe use of on-road laser technology.
10. Highly versatile and suitable in combination with other road safety equipment.

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8. VALIDATIONS AND AWARDS

LASERTEC, is the system chosen by the MITMA (Spanish Ministry of Transport) to be installed in Spanish roads as a driver aid under extreme fog conditions.

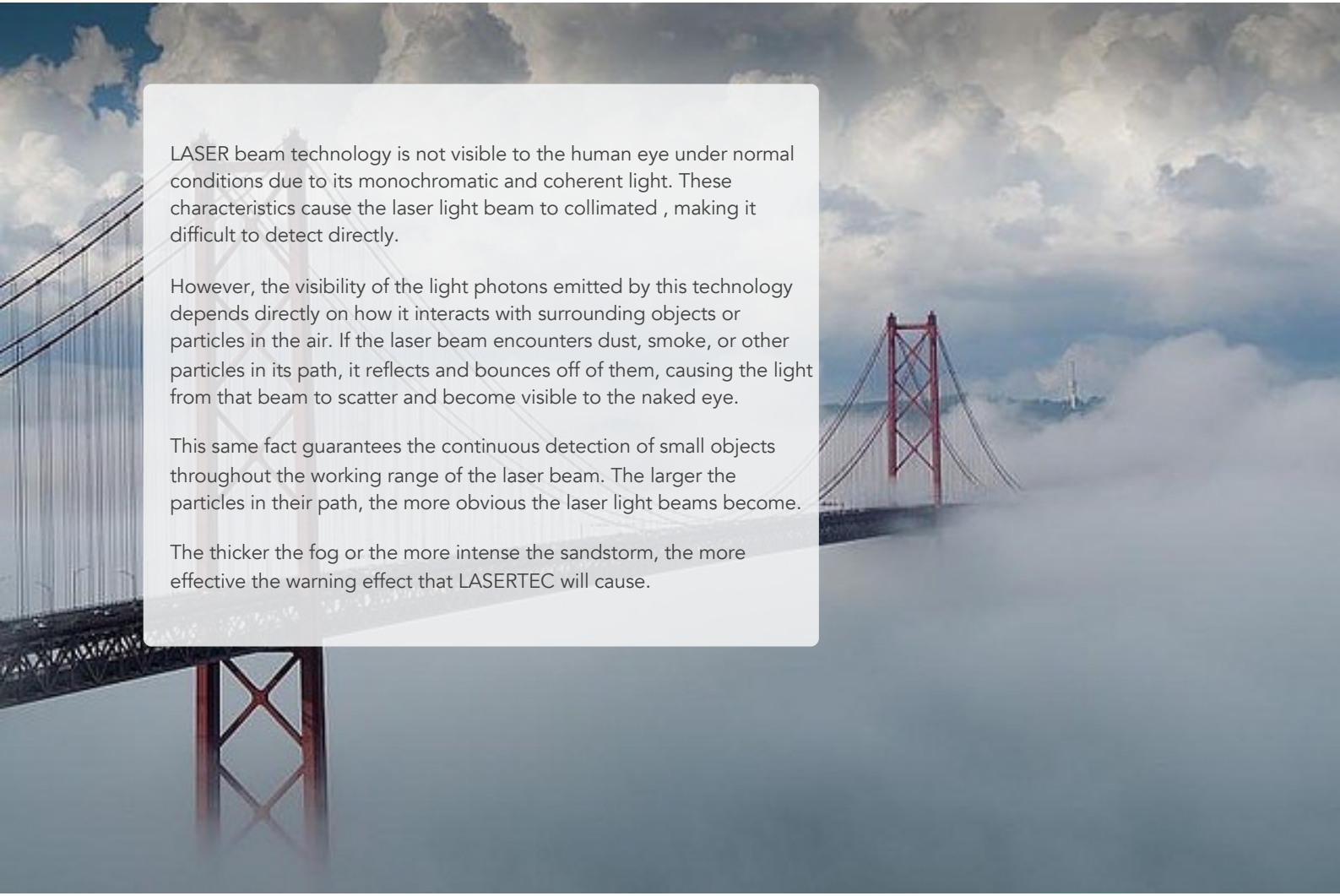
For that, LASERTEC has been validated by the following institutions:

- CTAG. Automotive Technology Centre of Galicia.
- CLPU. Spanish Centre for Pulsed Lasers
- Complutense University of Madrid. Optical Faculty.
- MITMA. Spanish Highway Authorities. Experts Committee composed by technical of different disciplines: meteorology, fluid dynamics, optic and photonic, roads and road safety.

In addition, LASERTEC has been awarded the following awards:

- XVIII ACEX National Award for Safety in Maintenance of roads.
- Finalist of IX International Award of Innovation in Roads, given by Spanish Highway Association

9. LASERTEC TO THE NAKED EYE



LASER beam technology is not visible to the human eye under normal conditions due to its monochromatic and coherent light. These characteristics cause the laser light beam to collimated , making it difficult to detect directly.

However, the visibility of the light photons emitted by this technology depends directly on how it interacts with surrounding objects or particles in the air. If the laser beam encounters dust, smoke, or other particles in its path, it reflects and bounces off of them, causing the light from that beam to scatter and become visible to the naked eye.

This same fact guarantees the continuous detection of small objects throughout the working range of the laser beam. The larger the particles in their path, the more obvious the laser light beams become.

The thicker the fog or the more intense the sandstorm, the more effective the warning effect that LASERTEC will cause.

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