

## CONTRACT INFORMATION

**Location:** A7 Genova-Serravalle

**Customer:** Autostrade per l'Italia

**Duration of monitoring service:** operational for 38 months

**Project start date:** 2016

## RECOGNISE

The "OF Ghost Driver" system was installed with an aim of detecting any transit of vehicles on the wrong side of the motorway at the junctions in the direction of Genoa and Milan near the Genoa Bolzaneto motorway toll booth.

## PROJECT DESCRIPTION

**Forty-four fibre-optic sensors** embedded in the asphalt were installed transversely in the direction of travel.

The installation of the system was quick (3 nights) and minimally invasive: it does not involve any protrusion from the ground and allows any **removal/restoration** of the asphalt without interfering with the system. The special laying configuration combined with the use of carefully selected suitable materials gives durability, resistance to external weather conditions and **mechanical stress**.

The measurements were carried out with a frequency of five hundred information per second from each sensor simultaneously, transmitted through approximately **900 m of optical fibre** laid on site, more than twenty thousand information per second acquired by the system, **which is operational H24-365D**.

The measurement technique applied is the **semi-distributed** one with deformation and temperature sensors connected to a single optical interrogator on which the Edgateway **software is installed for real-time** analysis of the quantities monitored.



## PROJECT DETAILS

The proposed monitoring system is modular, so it is possible to expand or reduce the number of sensors proposed, so as to be able to adapt the configuration of the system to the needs / requests of the customer. Specific monitoring area:

- ▶ Junction access ramps: 1 carriageway;
- ▶ Track width: 6.3m;
- ▶ Maximum vehicle speed: 60Km;

The sensors will be installed inside the asphalt following appropriate procedures defined by the type of surface.

## POSITIONING OF THE SYSTEM IN THE ASPHALT

- ▶ Near access ramps to the motorway;
- ▶ At the exit of parking areas;
- ▶ Near bridges and viaducts.

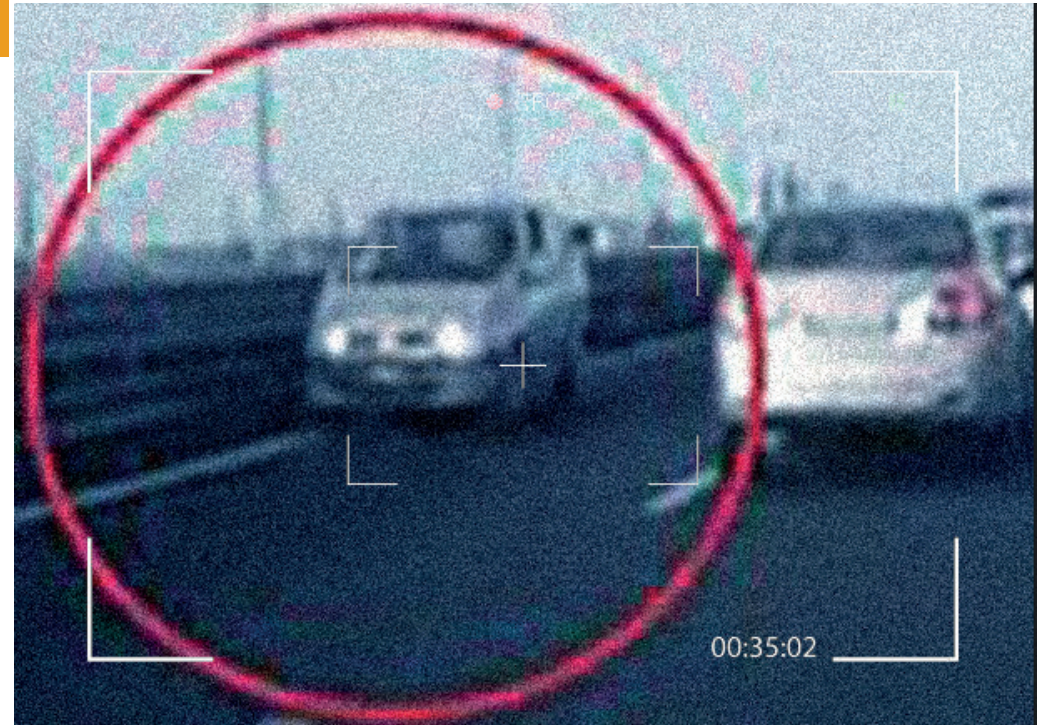
## PROPERTIES

- ▶ Real-time (high frequency) monitoring of vehicles entering the highway;
- ▶ Acoustic and luminous alarms connected and controlled by the ghost driver system;
- ▶ Real-time connection with the operator's control room;
- ▶ Information about the number of vehicles passing through, their weight, speed, number of axles of heavy vehicles.

## THE NUMBERS

- ▶ 500 sensors installed
- ▶ 900 m of optical fibre
- ▶ 3 nights for system installation
- ▶ 20.0000 information per second
- ▶ H24-365D

The "OF Ghost" monitoring system is integrated into the client's web platform and has been interfaced with specially designed visual and sound barriers. This system alerts the user in contravention and the manager of the road network, at the same time.



## MOBILE INTEGRATION & DATA FEED

Deformation can be read remotely using Tablet, PC and Smartphones

## MULTIPLEXING

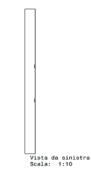
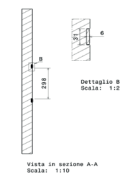
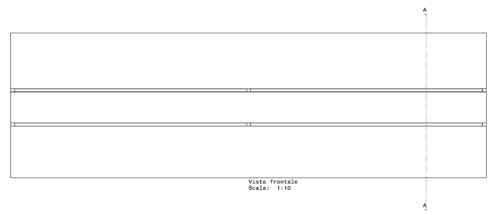
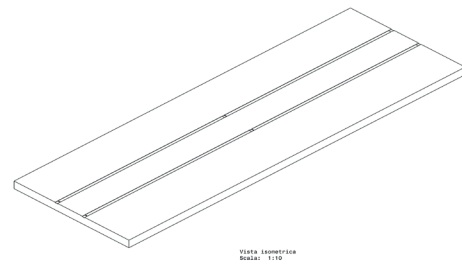
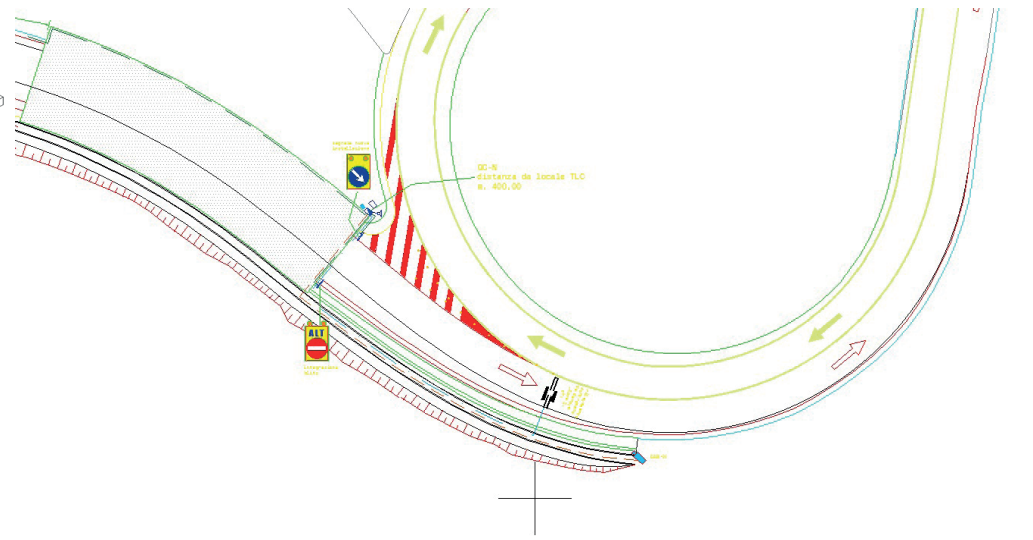
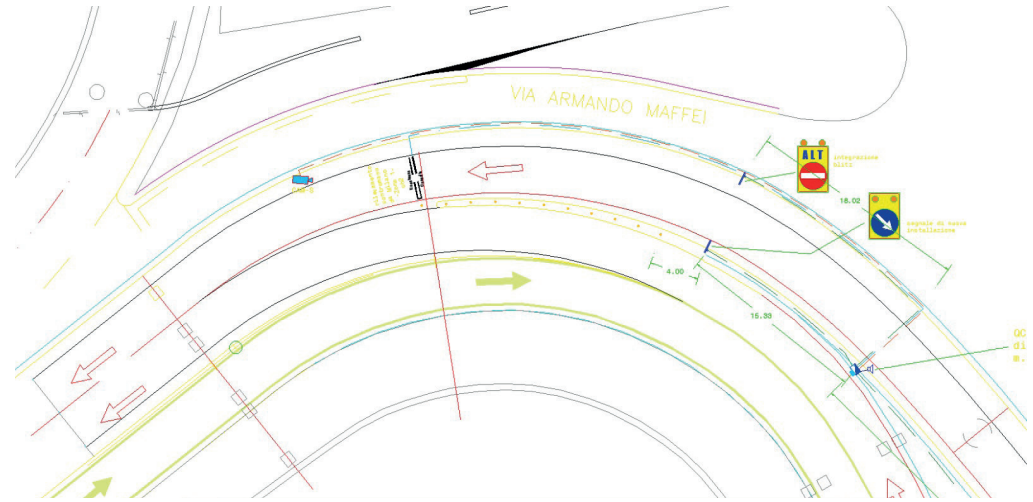
Multiple sensor readable at the same time, installed on the same fiber.



# CONTROL OF WRONG-WAY ACCESS TO THE BOLZANETO STATION JUNCTION.

## CONFIGURATION OF THE SYSTEM

- ▶ **Number of ramps junction:** 2
- ▶ **Ramp width:** 6.3m
- ▶ **Number of Measuring Lines per ramp:** 2
- ▶ **Sensors per line:** 20
- ▶ **Optical fiber:** 500m
- ▶ **Optical interrogator:** 4 channel, 500Hz
- ▶ **Sampling rate:** 1
- ▶ **Type of sensors:** Acrylate with fiberglass transducer
- ▶ **Strain 80 Sensors**
- ▶ **Connecting bushings 8**
- ▶ **Junction boxes 4**
- ▶ **Fiber optic connection 1.000m**
- ▶ **Interrogator 4 channels 500Hz 2**
- ▶ **Installation/calibration/testing service 8 days**



## WHY CHOOSE "OF" SYSTEM

**Optical fiber sensing is a passive measuring instrument, immune to the environment, long-lived, eco-sustainable and with reduced maintenance costs. Buildings, roads, bridges, tunnels, railways, trains.**

Vehicles in constant motion, people on the street, operators at work. In a world in constant activity and movement, monitoring infrastructure means checking the health of structures and guaranteeing the safety of the users. The "OF" solutions create a nervous system of sensors that monitor the structures and their critical elements, activating a timely and constant remote control.

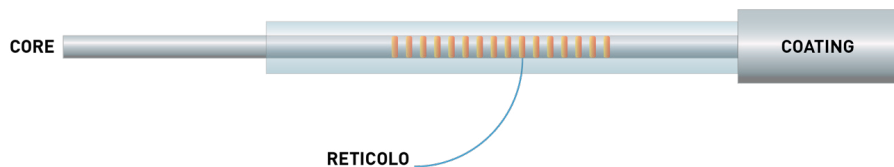
The proprietary data processing software EG-NTSG and the IoT-NTSG software platform, process the data, analyse the information and estimate the state of the structure, with the ultimate aim of optimizing the planning of maintenance activities.

**Our systems prevent failures, damage, for the safety and health of all.**

## ADVANTAGES OF THE SYSTEM

- ▶ Chance to place the data acquisition tool at **large distance** (km) from the monitoring area, without reducing the accuracy of the measurement;
- ▶ **Multiplexing**, up to 160 sensors, even of different types, applied in series on the same fibre;
- ▶ Reduce the required wiring to monitor a structure.
- ▶ **High sensitivity**;
- ▶ **Small size** and insertion possibilities inside composite materials;
- ▶ **Sensors are passive**, do not generate and are not affected by electric and magnetic fields.
- ▶ **Reduction of maintenance costs** and energy consumption up to 17 times less than traditional systems with copper cables: a valid tool on the way to aecological transition

## THE FIBRES, THE SENSOR, THE MATERIALS



### FBG - fibre Bragg Grating

The grating is "written" in the fibre core with an ultraviolet laser. The grating is the sensor itself.

### Grating dimension: 0.5-2 cm.

A peculiar characteristic of the FBG technology is that on a single optical cable can be wired in series, for the measurement of various parameters, using different sensors such as strain gauges, accelerometers and temperature sensors. The acquisition is performed with just one interrogation system.

### DIAMETER

Core: 5-9  $\mu\text{m}$   
Cladding: 125  $\mu\text{m}$   
Coating: 170-250  $\mu\text{m}$

### COMPARISON

Human hair:  
About 90  $\mu\text{m}$

**COATING**  
plastic protection

**CORE**  
glass

**CLADDING**  
glass

