3rd SIIV International Winter School 2022

Pavement Assessment and management towards Smart and Safer mobility

Business Unit Operations

autostrade per l'italia

MOVYON
Tech the Future

Technology,
R&D

TECNE
Sustainable Engineering

Engineering and
implementation

AMPLIA
INFRASTRUCTURES

Construction and
related services

ELGEA
Space for Energy

Energy from
renewable sources

FREETOX
Sostenibilità. Innovazione. Mobilità

Services for
travellers

Autostrade per l'Italia Group

The largest highway operator in Europe

2.855 km
motorway network

2,7 M
daily users

2,1 M
daily vehicle transit

8.700
employees

5
motorway concessions

422 km
tunnels

218
service areas

271
toll stations

1.947
bridges and viaducts

16
toll highways

3,8 bn
operating revenues

2,12 bn
EBITDA

986 M
operating cash flow

1 bn
investments in operations

2,6 bn
equity

MOVYON

Hi.P.E.R Project - *Highway Pavement Evolutive Research*

Autostrade // per l'italia

Business Unit Operations — ***Pavimentazioni e Laboratori***

- *Support to operational units for the organization of the maintenance operations and budget management;*
- *updating of technical regulations and standards for pavement maintenance works;*
- *ensure the execution of high-performance surveys and data processing for the calculation of the IPAV indicator;*
- *material tests during the execution of pavement maintenance works;*
- *manage maintenance works along the network as Project Manager/RUP;*
- *Identify and test innovative solutions on materials, maintenance techniques and asset management methodologies;*

Hi.P.E.R Project - *Highway Pavement Evolutive Research*

- *around **3.000 km** of highway managed*
- ***4,3 million** customers travel along the network every day*

Maintenance plan definition process

01 Maintenance

Every year, we process around 8 million square meters of surfaces area through our maintenance activities.

02 Planning

Thanks to pavement monitoring, we can prioritise maintenance works. The priority is chosen on different criteria.

03 Monitoring

1. Supervision of the pavement through visual inspections on the road.
2. Thanks to the use of high-performance vehicles we are able to know the performance characteristics of the slow lane. (Aran, Summs, Tsd). The surveys are carried out two/three times a year.
3. We have the history of the planned operations and the existing state of the pavements.

04 Our needs

A balance must be found between preventive maintenance, based on monitoring performance indicators, and reactive maintenance, based on the appearance of deterioration that often requires urgent repair. It is essential to optimise the allocation of budgets and maximise the effects of interventions, resulting in an increase in the average service life of the infrastructure.

Hi.P.E.R Project - *Highway Pavement Evolutive Research*

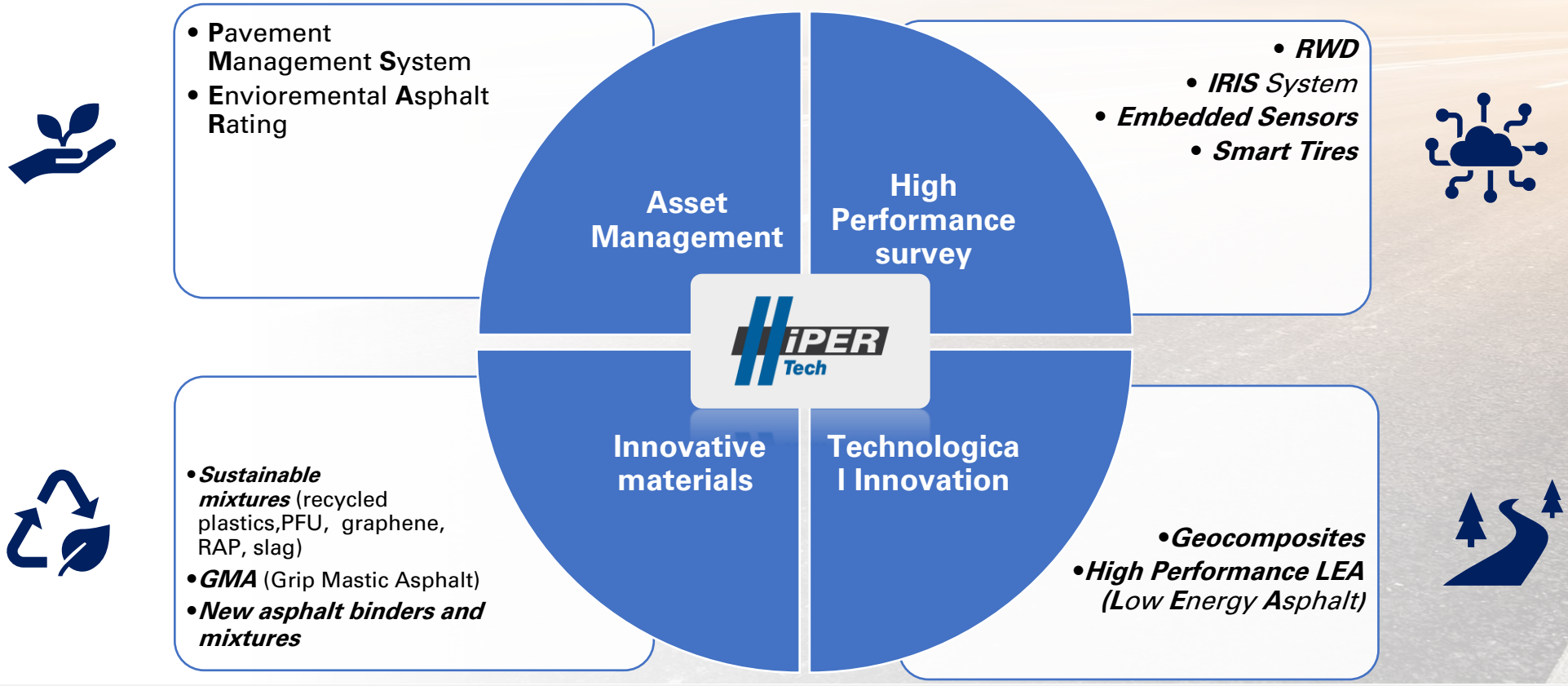
Introduction

This need has led to development of more research activities on different field of pavements.

The research activities are carried out in collaboration with:

UNIVERSITÀ POLITECNICA DELLE MARCHE

MOVYON



Hi.P.E.R Project - *Highway Pavement Evolutive Research*

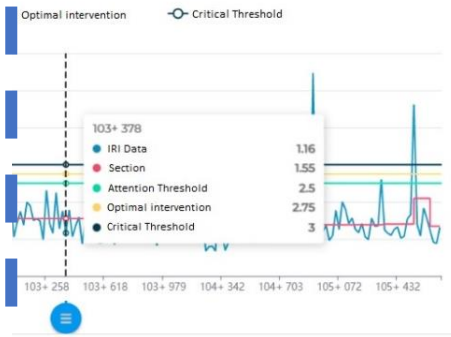
Navigati

Maintenance Plan

EAR – Environme
EAR is an innovative
environmental ir
maintenance operat
ne

Work in progress

- **Embedded Sensors:** A monitoring technology, integrated into the pavement, capable of acquiring "undisturbed" measurements of the main physical characteristics (ex. temperature, humidity, traffic)
- **Smart Tyres:** The interaction between the vehicle and the pavement takes place through the tire which, by means of deformations and vibration, contribute decisively to the amount of grip avaible and to the noise produced. (especially at high speeds).
- **Automatic deteriorations analysis:** algorithms that allow the identification of deterioration of the pavement from the images.



eous

jeneus
IRI,

eterioration curves
ion curves have been
the E-PMS
ize the platform by
meters in each traffic-
network.

modyfing the operation settings.
On the left an example of a PMS maintenace work proposal.

R&D Center of Excellence

We are the Autostrade per l'Italia Group's centre of excellence for technological innovation.
We promote initiatives that find application in roads and motorways, urban and extra-urban contexts.
Open innovation is our strategic approach.
We collaborate with innovative companies, universities and research centers, selecting the best ideas and skills.

MOVYON

Innovation focus

- Energy saving & Sustainability
- Monitoring of Infrastructures
- Pavements & Materials
- Data science & AI
- Smart City
- Smart Roads

MOVYON

MOVYON is the technological enabler for Autostrade per l'Italia's Mercury Programme

MOVYON

ASPI launched Mercury, a program which embeds innovative initiatives and structured in 5 cluster related to sustainability and technological development

INNOVATION SAFETY SUSTENABILITY

CONNECTED INFRASTRUCTURE

Connected Infrastructure's technologies enable **services that improve mobility and information management on motorways**

INTELLIGENT ROADS

Heterogenous solutions related to the **Intelligent Transport System and Connected/Automated mobility** to increase **traffic safety and extend life cycle of infrastructure**

FLEXIBLE PRICING

Increase the efficiency and reliability of tolling station to **simplify the toll payment experience, introduce modular payment and lead to Free Flow**

GREEN SOLUTIONS

Accelerate motorways ecological transition, both from infrastructure and vehicles stand-points, to reduce carbon emissions and speed up ESG scores

URBAN MOBILITY

Initiatives to **integrate highway and urban mobility**

Smart Roads

Our Smart Roads projects focuses on the development and the integration of technologies for Connected Cars. Thanks to the digitization of infrastructure assets, information can be exchanged between infrastructure and vehicles, and between vehicles themselves. We are also implementing new solutions for Smart Service Areas of the future.

BENEFITS

- Data collection for preferences, driving styles, traffic info
- Optimization of traffic flow
- Interoperability of on-board units

Back to overview

MOVYON

Successful pilot on Autostrade per L'Italia motorway network

34
Roadside units ITS-G5

52 km
(Firenze, Bologna)

500
Vehicles/day *

200k+
Cooperative Awareness Messages/day*

Coming soon 2023:

Genova A10 – 52 km

Firenze-Bologna – 86 km

Ready for «over-ip» service

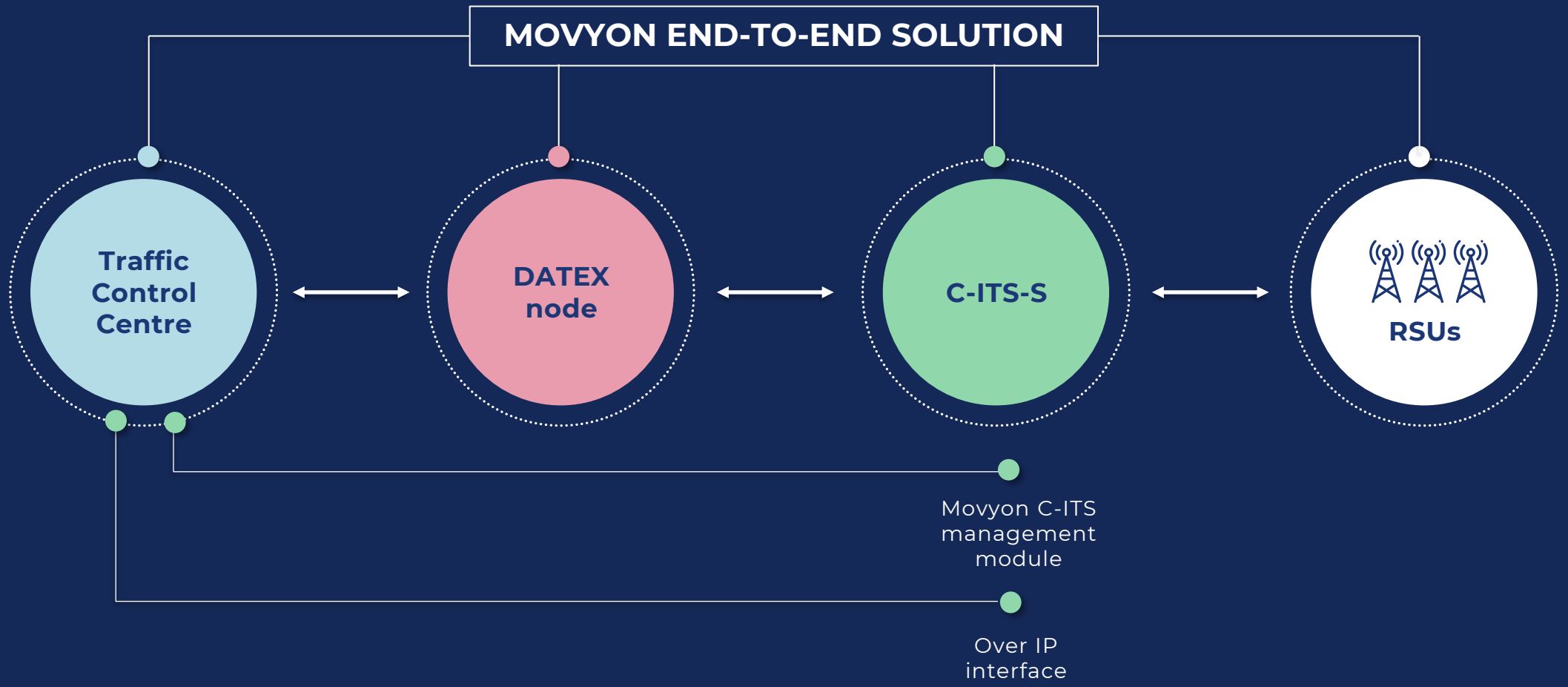
Compliant with C-Roads specifications

Contract with C-ITS PKI *(Trusted Secure Source)*

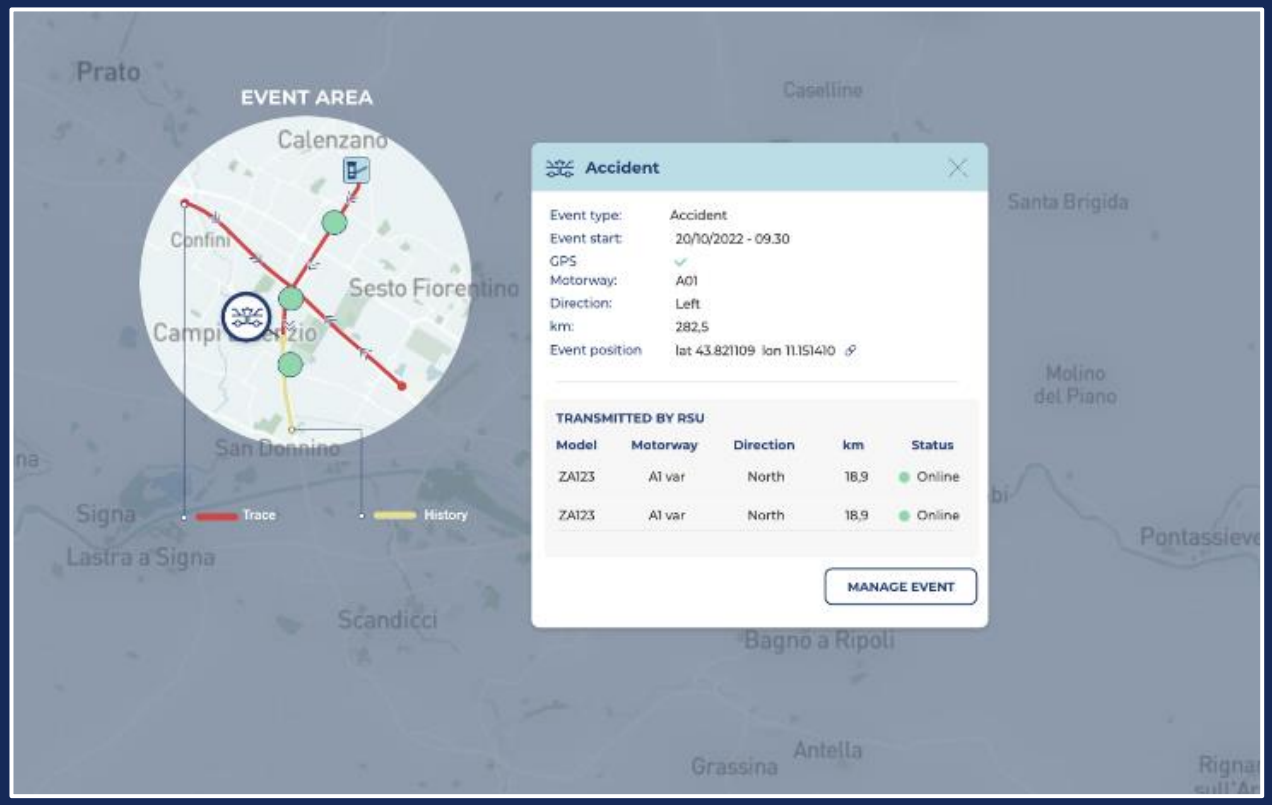
**data from Jul to Oct 2022*

MOVYON

C-ITS system architecture



C-ITS management module



Picture shows C-ITS management module currently integrated with Movyon Traffic Management Platform

C-ITS management module entirely developed *in house*.

It can be easily adapted and customized to the specific needs of the concessionaries and integrated with any other software platforms (e.g. service providers).

No licensed third-party software is used.

History: area of the event
Trace: route entering the event area

MOVYON

V2X Roadside Equipment

C-ITS roadside unit **entirely designed and manufactured by Movyon Electronics**, the Movyon brand working on critical hardware equipment used in Movyon's solutions.

- Dual-Mode: DSRC/802.11p and C-V2X
- Compliant with all V2X standards
- 5.9 GHz Radio: 1 x IEEE 802.11p / C-V2X (3GPP Rel. 14/15)
- Receiver sensitivity up to -97 dBm (802.11p)
- Quad core CPU 1200 Mhz , 2 GB DDR RAM, 8 GB Flash
- PCIe expansion slot for optional modem (LTE or 5G)
- GNSS module (GPS, Galileo, GLONASS, Beidou)
- Ethernet with PoE (48V PoE 802.3at)
- **NO licensed 3rd party software used in the firmware**
- Secure key storage
- ITS G5 Software stack
- Browser GUI for configuration, diagnostic and SW update
- IP67 enclosure protection
- CE RED compliant
- Operating temperature: -40 to +75°C

MOVYON

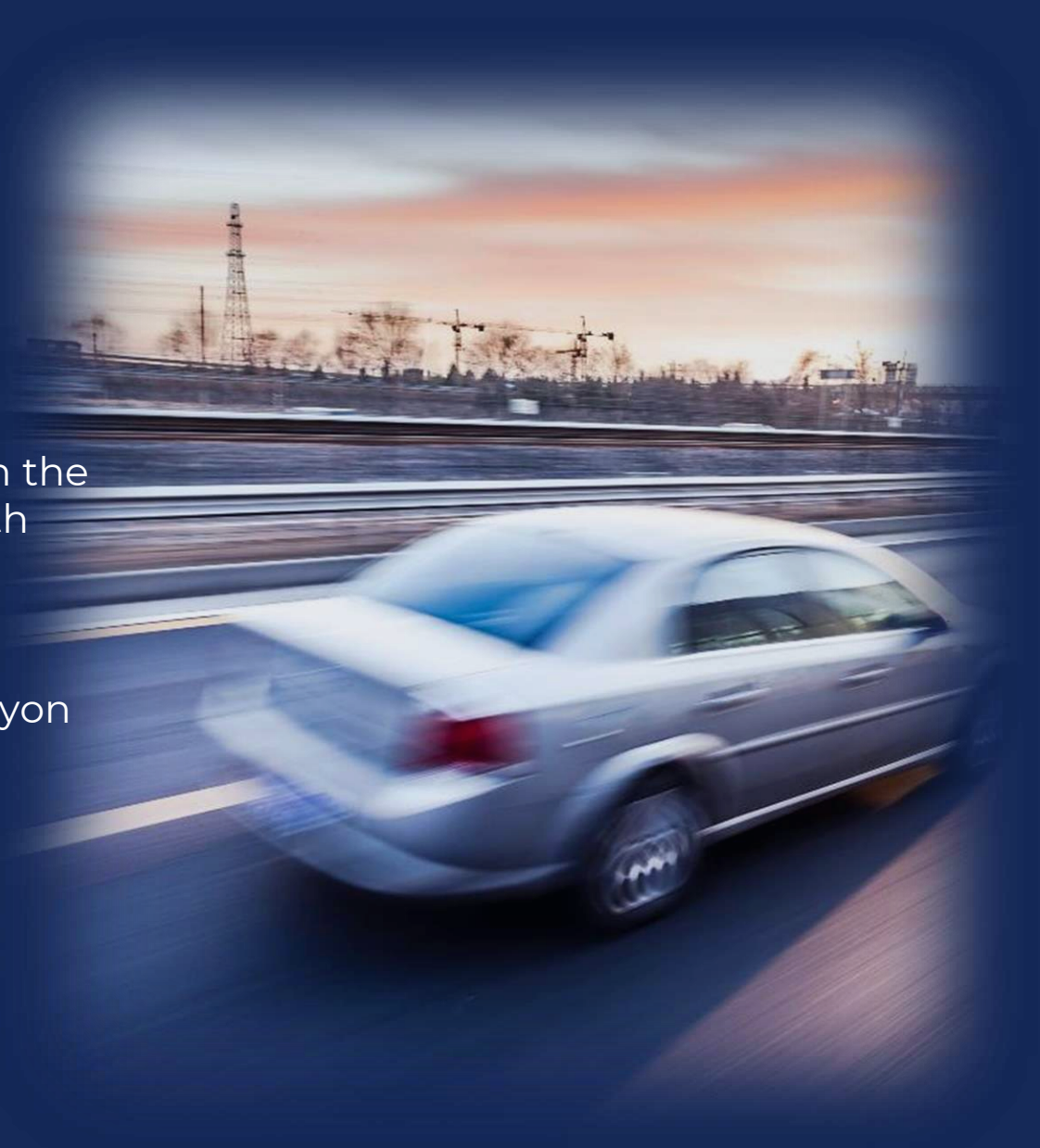
Movyon value for C-ITS

One-Stop-Shop for RSE and Platform

- Highly customizable and easily interoperable with the Traffic Control Centres of Concessionaries and with the platform of service and content providers
- Dual-Protocol (ITS-G5 and C-V2X) proprietary RSU entirely designed and manufactured by Movyon

Tested on a real motorway environment

Validated and approved by VOLKSWAGEN selling C-ITS equipped vehicles



Pavement Maintenance solution integrated with Connected vehicles (through Smart Tyres)

SCOPE

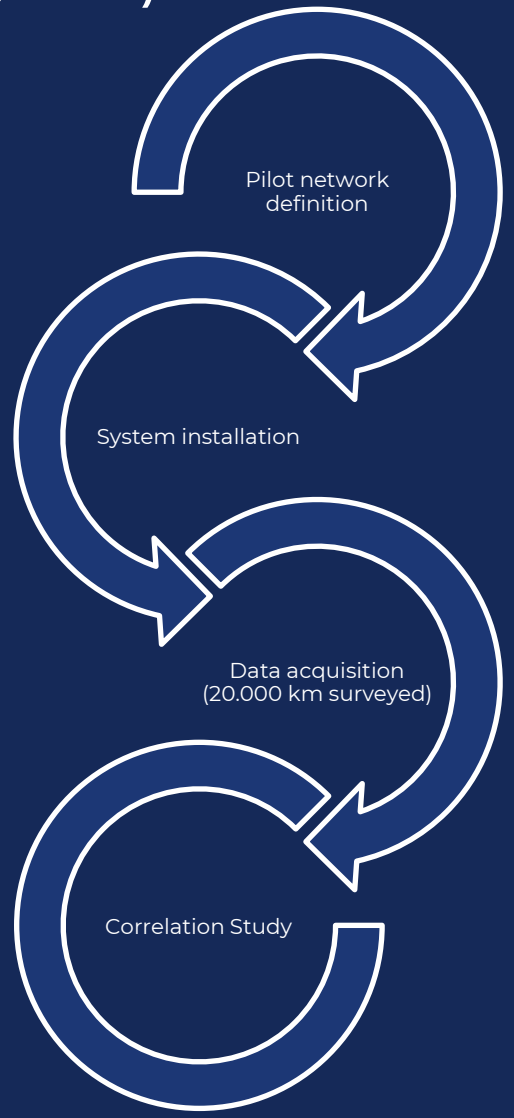
High-speed performance pavement screening using sensorised tyres (partneship with company leader in tyre industry)

FOCUS 1: UNEVENESS

FOCUS 2: NOISE

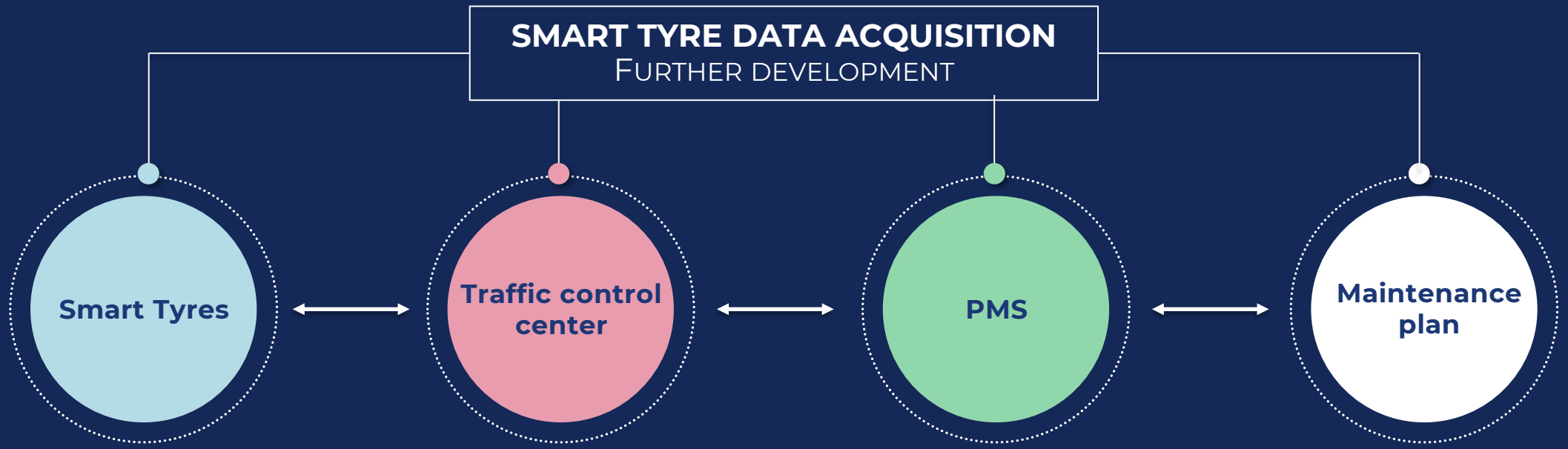
FOCUS 3: DISTRESS DETECTION – RAVELING

FOCUS 4: TEXTURE



MOVYON

Pavement Maintenance solution integrated with Connected vehicles (through Smart Tyres)

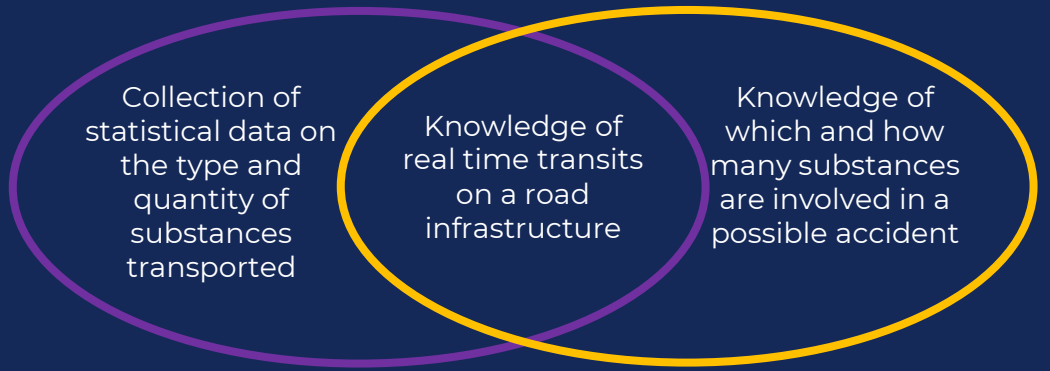


Transportation of **dangerous goods** with the support of **C-ITS**

The current introduction and deployment of V2I and V2V communication, and thus C-ITS, may turn out to be the technology that will finally enable effective and efficient dangerous goods transportation management.

Our goal is to **define** and **test** use cases related to the **use of C-ITS services** to **manage** and **mitigate** the **risk** associated with the **transport of hazardous substances** by road (partnership with truck maker).

August 2018 explosion. A1-A14 highway junction, Bologna.



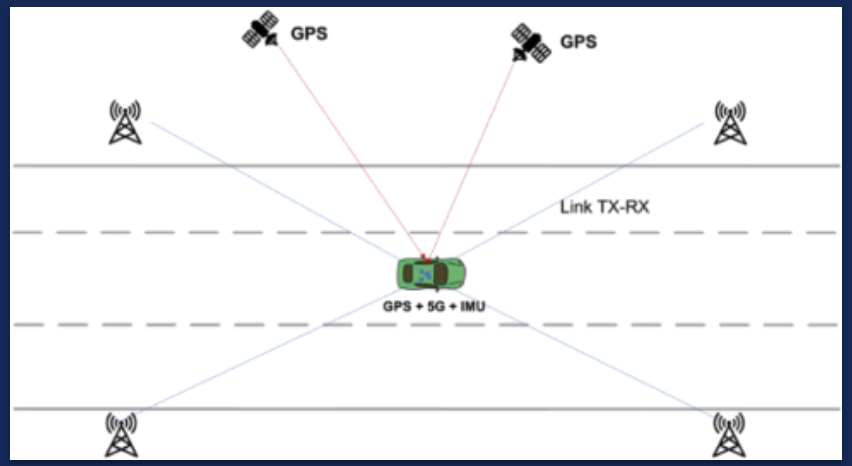
Preventive Risk Management

Protective Risk Management

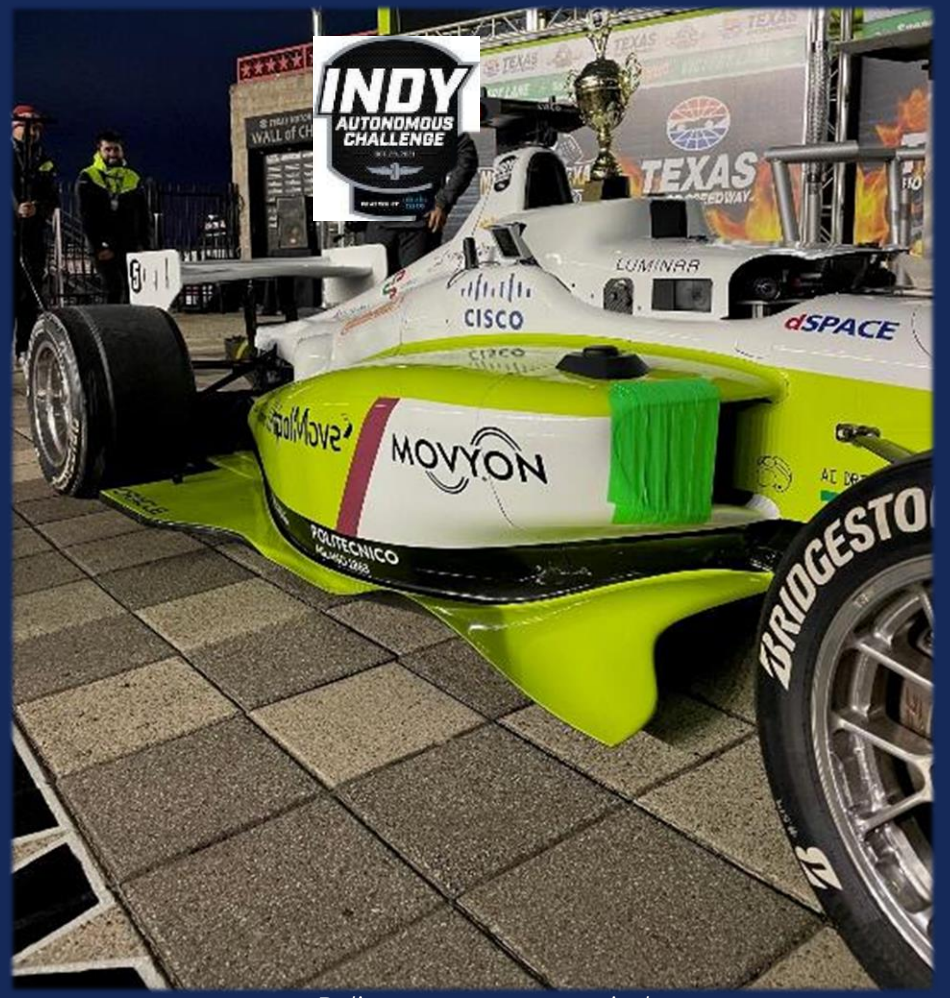
MOVYON

Precision positioning and tracking to support **CCAM**: the role of road operator

Development of a **Proof of Concept** for **tracking** a moving **vehicle** through a **wireless road infrastructure equipped with C-V2X technology**, with the aim of demonstrating the potential of such systems and the **prospects for developing services based on precise positioning** (e.g., autonomous driving).



Example scenario of hybrid vehicle localization



Polimove autonomous indy car

MOVYON


There are infinite paths to **transform the future.**
Technology and innovation are ours.
MOVYON