EPMS

Evolutive Pavement Management System

movyon

Data-driven decisions
for predictive
pavement maintenance

movyon

Digital engineering for sustainable mobility

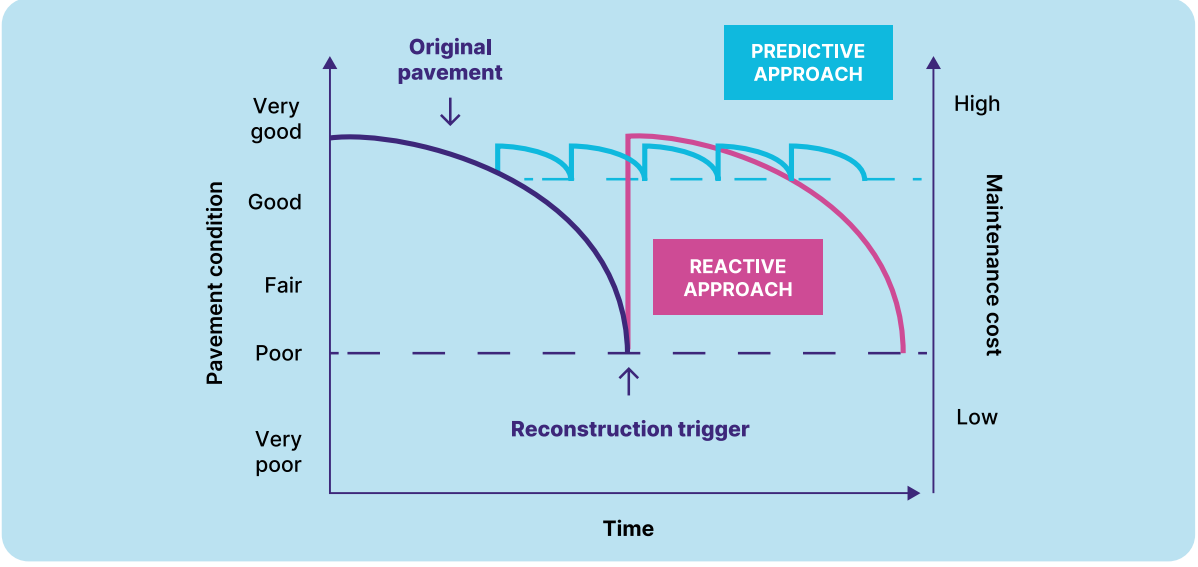
We are leaders in the development and integration of Intelligent Transport Systems solutions and Autostrade per l'Italia's centre of excellence for research and technological innovation.

Maintenance goes Smart

EPMS (Evolutive Pavement Management System) is Movyon's platform for advanced monitoring of road pavement conditions and the optimisation of maintenance interventions.

The system enables comprehensive, life-cycle-based infrastructure management through a predictive approach. It **collects and analyses a wide range of data** from multiple sources, including high-performance survey vehicles, instrumented vehicles and IoT devices.

These technologies enable accurate, large-scale **pavement performance screening without disrupting traffic**. By applying **advanced algorithms**, the platform forecasts the remaining service life of pavements and recommends the most appropriate maintenance actions, with the aim of **maintaining high quality standards** in terms of **skid resistance and surface regularity**, according to the principle of "right treatment, righ time".



*An investment in continuous asset preservation through a data-driven **predictive approach extends infrastructure lifespan** while optimising resource use.*

Prevent problems, optimise costs

The EPMS platform is a decision-support tool for planning and implementing maintenance strategies.

Objectives

Predict
and anticipate potential defects or damage, enabling predictive rather than purely reactive maintenance.

Reduce
maintenance costs.

Extend
infrastructure service life.

Planning
develop **20-year maintenance plans**, optimising resource allocation and budget management through customisable scenarios based on performance indicators, available budget and environmental impact.

System components and architecture

Advanced algorithms correlate descriptive parameters collected by the various monitoring devices.

Based on the processed data, the central system:

provides an estimate of the pavement's **remaining service life**

identifies the **most suitable maintenance intervention** to maintain predefined performance standards, according to different optimisation criteria (e.g. economic or time-based)

The Evolutive Pavement Management System

follows a multi-stage process, transforming raw field data into a predictive, optimised and validated maintenance plan.

01.

Performance screening

Vehicles equipped with **advanced sensors** collect data on key pavement parameters in accordance with applicable reference standards.

Measured parameters include:

- **SFC** (Sideway Force Coefficient)
- **MPD** (Mean Profile Depth)
- **IRI** (International Roughness Index)

02.

Data processing

Data are verified, aggregated and **prepared for analysis**.

This phase includes:

- **creation of homogeneous sections**
  where for each parameter raw data are grouped into variable-length sections with statistically homogeneous characteristics
- **implementation of deterioration curves**
  to estimate the residual service life of each homogeneous section

03.

Preliminary maintenance plan

The system generates an initial plan including: **intervention priorities**, recommended **types of intervention**, **scheduling, cost estimates**. During the generation of the preliminary plan, optimisation algorithms can be applied to achieve specific overall network quality objectives. The system can generate multiple intervention scenarios, **optimised according to multiple criteria** (economic, technical, time-based, environmental), and verifies consistency with the available budget by validating **the best solution** each time.

04.

Validation

The system is equipped with a **dedicated module** designed **to validate the recommended interventions** in the field. This module is optimised for tablet use and allows modifications of interventions based on specific requirements and other operational needs.

05.

Final maintenance plan

The system provides a **comprehensive analysis** of pavement condition, the final list of interventions, priority levels, multi-year timelines.

EAR

(Environmental Asphalt Rating)

The Environmental Asphalt Rating (EAR) is an **environmental impact index** developed by Movyon to be associated with asphalt mixtures used within planned maintenance programmes.

Through this indicator, it is possible to **estimate the environmental impact** of each individual recommended intervention and to compare different scenarios.

Performance screening through smart tyres

The integration of **smart tyres** into the performance screening phase represents **one of the most innovative developments of EPMS**.

It **increases the speed and frequency of surveys** and enables the use of vehicles not originally intended for pavement monitoring.

The technology is based on tyres equipped with **intelligent sensors** capable of generating **performance KPIs** for continuous pavement monitoring.

The system consists of:

smart tyres

each tyre is fitted with an integrated tri-axial accelerometer that **detects vibrations, frequencies and the vehicle's dynamic behaviour** in relation to the pavement surface

antennas and communication infrastructure

each sensorised tyre transmits the collected data to an onboard control unit. The control unit combines this information with GPS positioning and sends the data to the **EPMS platform**

data acquisition platform

an application system responsible for **continuous data collection**

The system converts sensor signals into two main performance KPIs:

- a **parameter representative of ride smoothness**, significantly correlated with the **IRI** indicator
- a **parameter representative of macrotexture**, used for qualitative noise assessment and detection of defects such as raveling

Data are aggregated weekly and transmitted to the EPMS platform to:

- **define new homogeneous sections** based also on Cyber Tyre KPIs
- **highlight critical stretches** on high-speed lanes
- **support the maintenance plan** with additional information
- **integrate surface condition analysis** into the standard process
- **update** intervention priorities

The use of smart tyres makes it possible to:

- **collect data** at normal traffic speeds, on any lane
- **obtain KPIs** across multiple lanes
- **extend the range** of characteristics investigated
- **use different types of vehicles** for data collection

Advantages of the EPMS system

Data-driven decision-making tool to **plan and optimise investments and interventions** based on representative KPIs.

EAR (Environmental Asphalt Rating) index to assess the environmental **impact of maintenance activities**.

Cloud-native platform offering high levels of customisation, portability and data security.

Enables **predictive, not only reactive, maintenance** by leveraging collected data.

Scalable and compatible with major pavement monitoring systems.

Digitalisation and automation of maintenance planning processes.

Service model

EPMS is offered as a service, combining technology and operations into a single solution.
The solution is available in three different service models.

PMS Standard

The platform processes data from high-performance or instrumented vehicles.

PMS Smart Tyre

The platform processes data from vehicles equipped with smart tyres installed on one or more vehicles.

PMS Smart Tyre Premium

The platform collects and processes data from both high-performance vehicles and vehicles equipped with smart tyres.

EPMS transforms pavement data into operational decisions for more efficient infrastructure management.

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