INSTYTUT BADAWCZY DRÓG I MOSTÓW
ROAD AND BRIDGE RESEARCH INSTITUTE
1955 - 2025

Warsaw, 22 - 23 October 2025

II MIĘDZYNARODOWA KONFERENCJA
Nowoczesne nawierzchnie drogowe – recykling i dekarbonizacja

II INTERNATIONAL CONFERENCE
Modern road pavements - recycling and decarbonization

ITALIAN APPROACH TO THE USE OF RAP AS A RAW MATERIAL IN NEW ASPHALT MIXTURES

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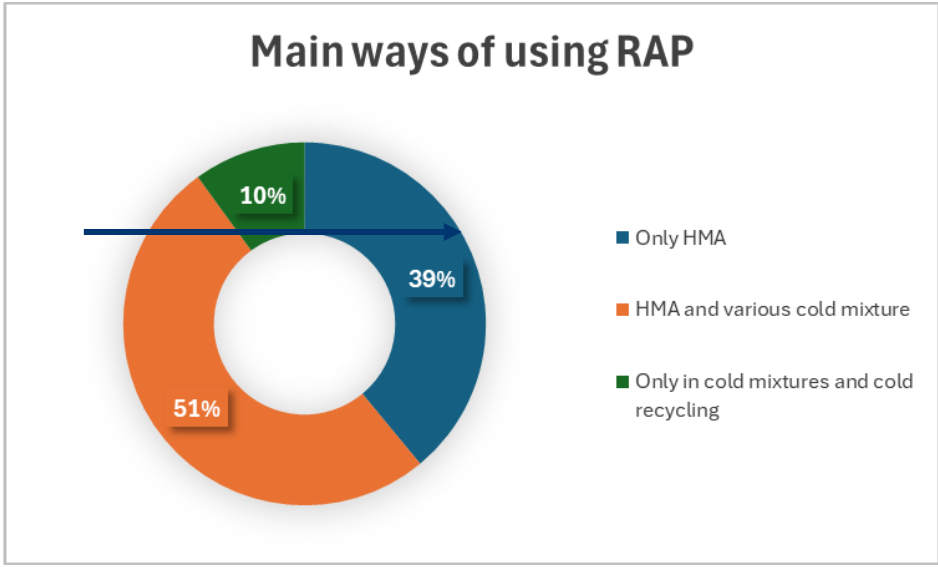
Circular Economy Action Plan

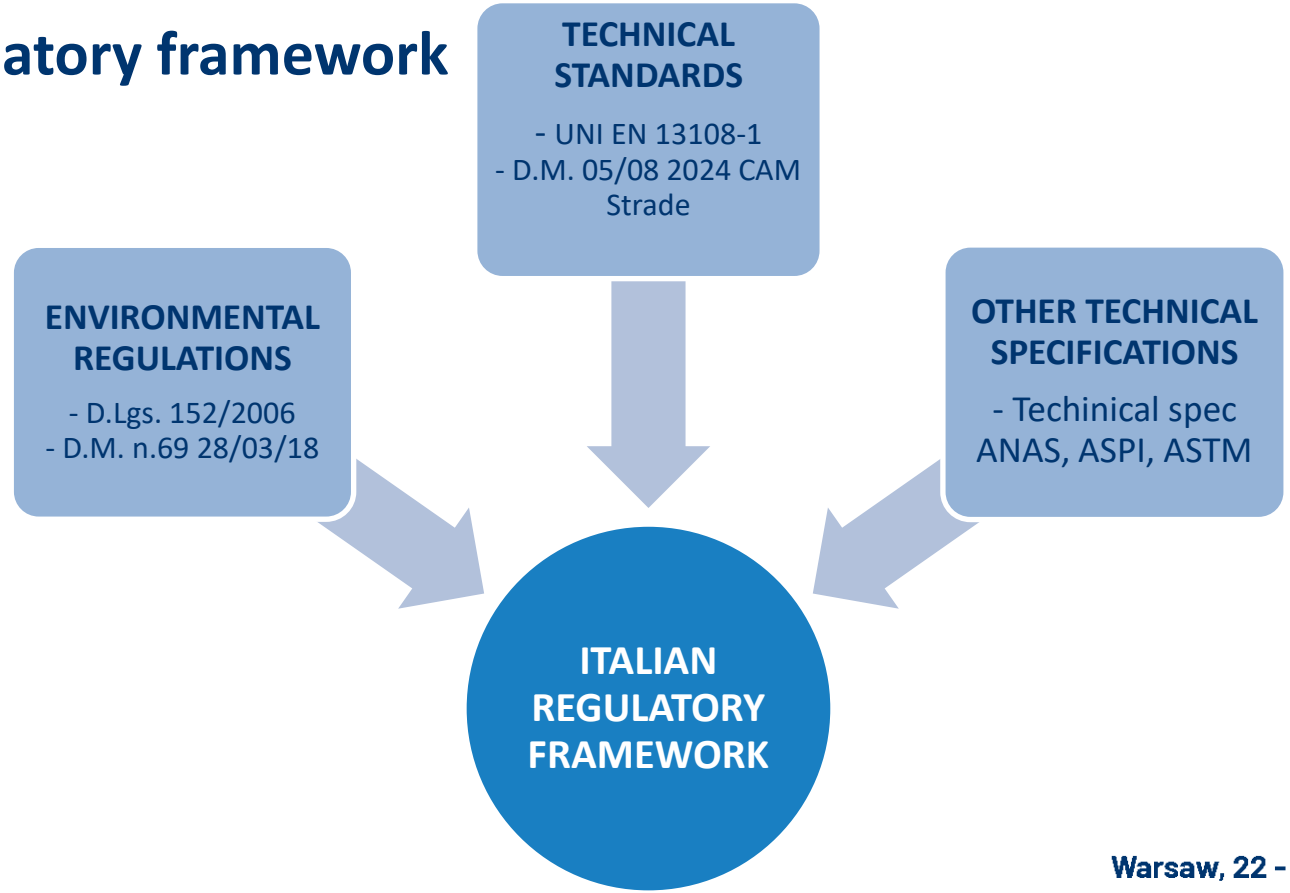
It is one of the main blocks of the **EU Green Deal.** The plan supports the EU´s transition towards a circular economy which is necessary to achieve climate neutrality targets. It aims for a **sustainable built environment** characterized by building material efficiency and reduced climate impact through circularity principles in the whole life cycle of buildings.

Asphalt in figures

- The volume of HMA produced in the European continent in 2021 amounts to **288 million tons,** of which **220 million tons in the EU27**
- Among the main European asphalt-producing countries **Italy stands at around 60% about RAP reutilization.**
- The main methods of use by asphalt producers **in Italy** are divided as follows.



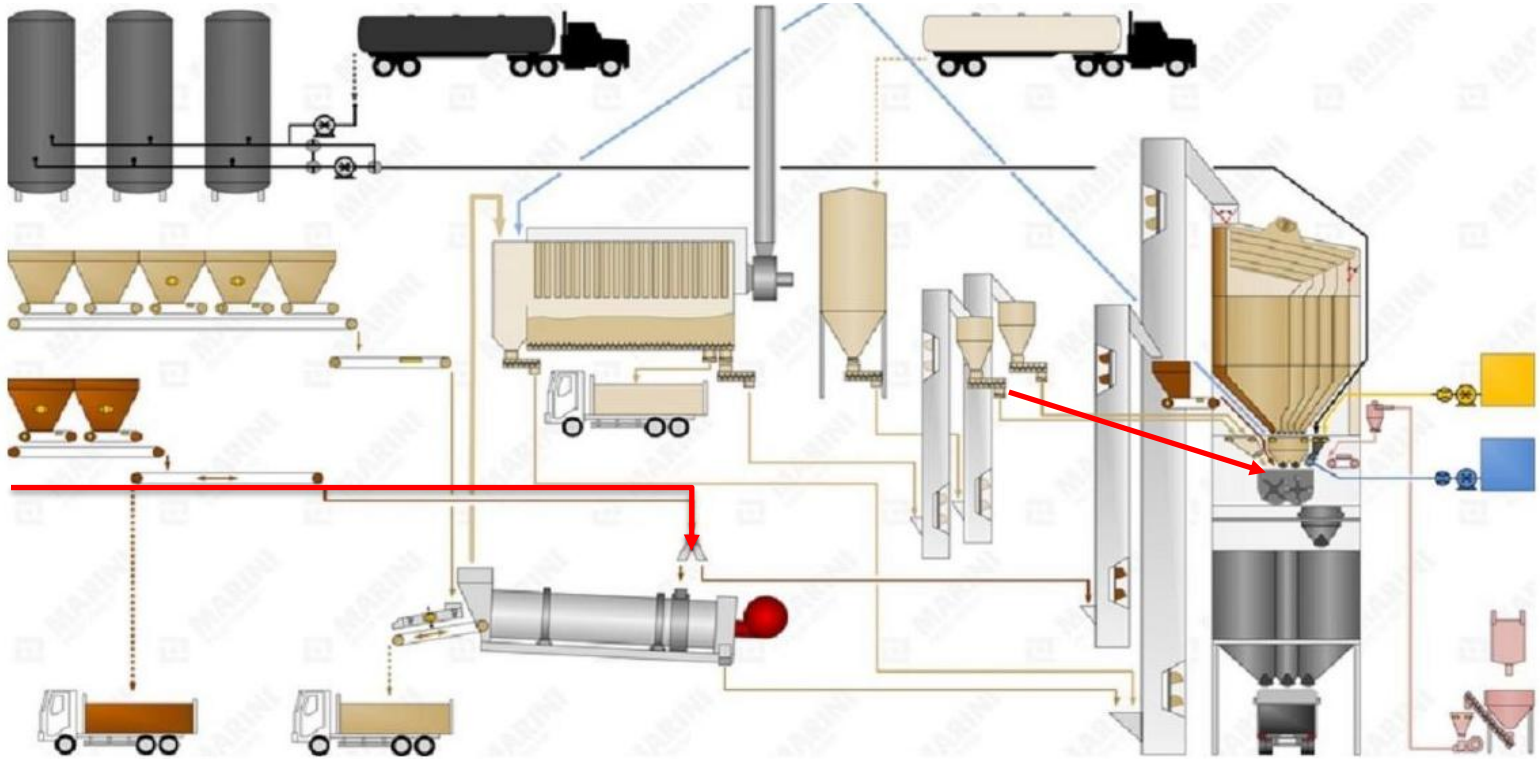
Italian regulatory framework



Italian regulatory framework

- The D.M. 05/08 CAM Strade establishes the **Minimum Environmental Criteria**
- Instead of setting a maximum RAP content, this decree establishes a **minimum percentage to be reused**

Asphalt batch plant



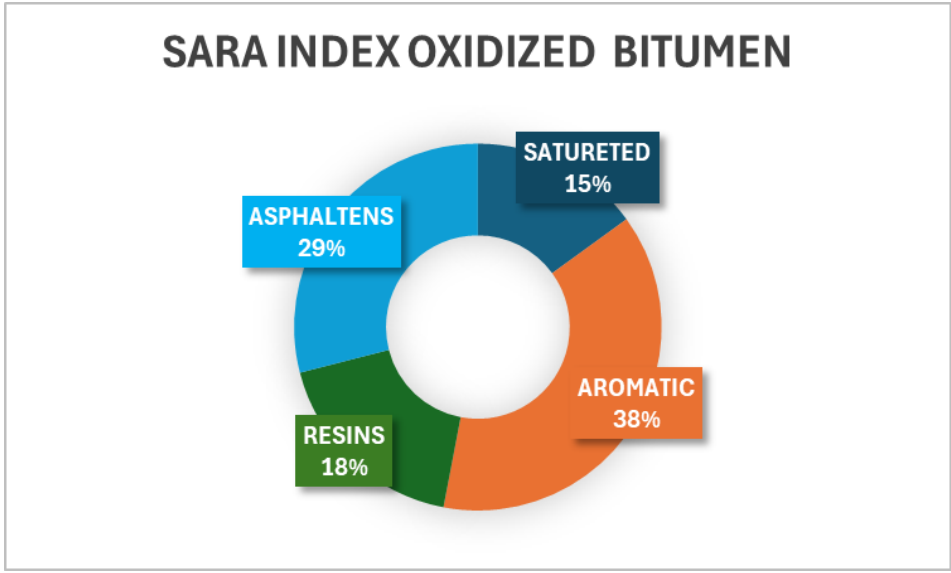
Rejuvenator

The oxidized **bitumen contained in the RAP** is characterized by a SARA index with a high content of ASPHALTENES (the polar and rigid component of bitumen). The unbalance in the composition of the bitumen fractions results in the binder:

deterioration of **rheological properties**;

reduction in **elasticity** and **ductility**;

decrease in **adhesion** to **aggregates**.



Rejuvenator

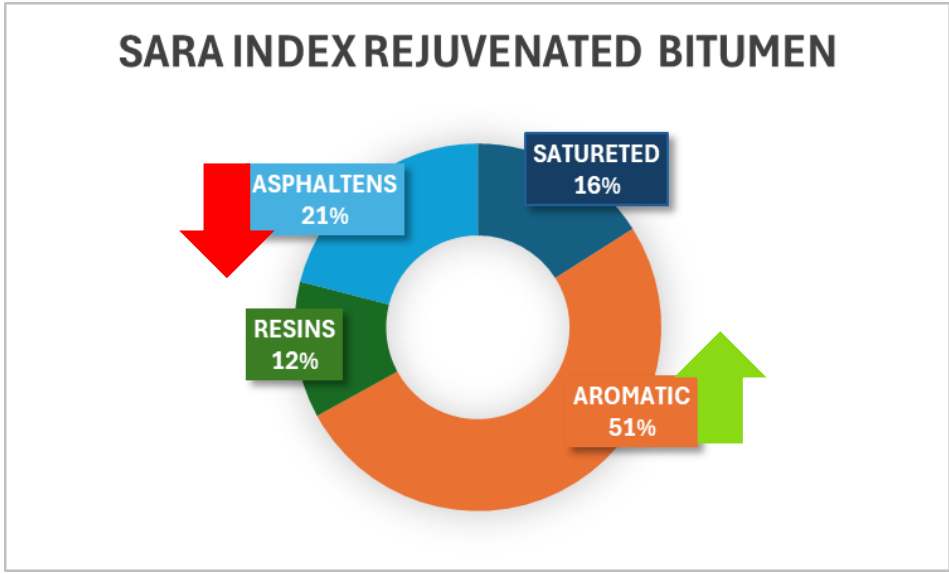
The use of rejuvenators which contains saturated compounds, aromatics, and resins, helps rebalance the composition among the different fractions, reducing the incidence of the asphaltene component. This results in:

a **reduction** in **bitumen viscosity**;

an **increase** in **elasticity**;

a **reduction** in **brittleness at low temperatures**;

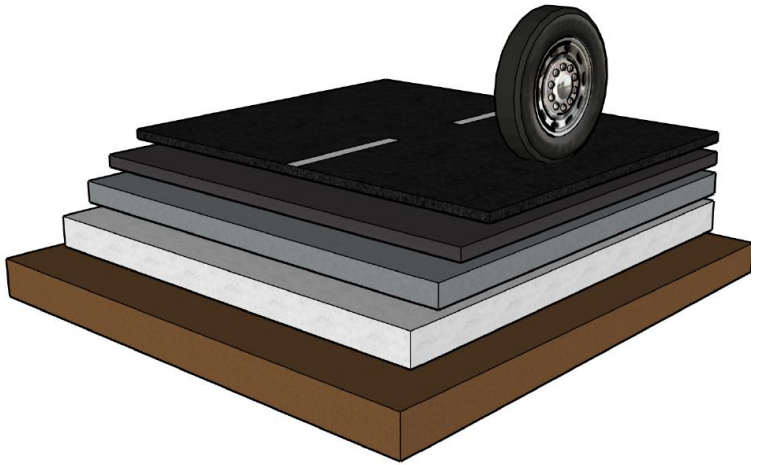
an **improvement** in **adhesion** to **aggregates**.



Super RAP project

This project was carried out in collaboration with the Research and Development Division of STS Mobile Srl and ANAS SpA. The aim of the research was to assess the **maximization** of **RAP use in the production of asphalt mixtures.**

Starting from a standard RAP content based on ANAS Technical specification, it was increased for different mixtures.



POROUS ASPHALT
0% RAP

BINDER LAYER
20% RAP

BASE LAYER
25% RAP

Super RAP project

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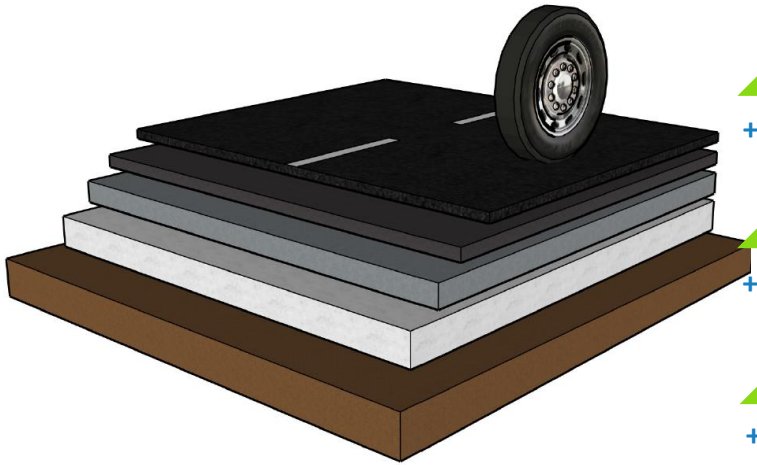


Super RAP project

Mixtures with **RAP content according to ANAS** technical specification were compared to those with **increased RAP content.**

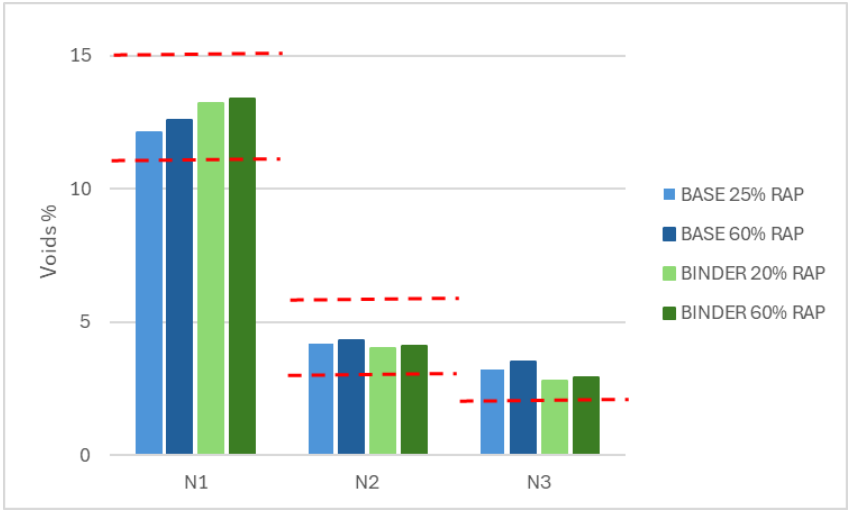
The granulometry and the binder content of each mixture type were defined **to be as consistent as possible with one another.**

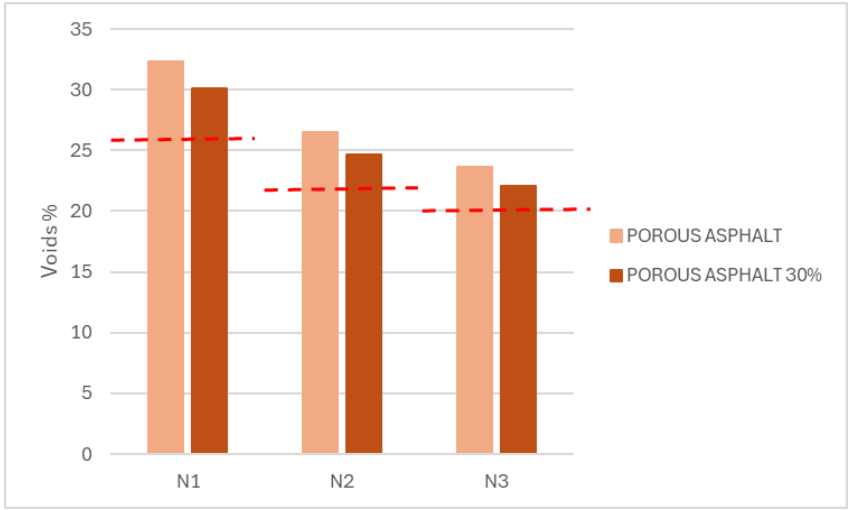
The **rejuvenator content** by weight of RAP it was defined in order **to comply with ANAS technical specification.**

	BASE LAYER	BINDER LAYER	POROUS ASPHALT
%RAP	25%	20%	0%
%Rejuvenator (ACF) bw RAP	0.19%	0.14%	-
%RAP	60%	60%	30%
%Rejuvenator (ACF) bw RAP	0.14%	0.19%	0.14%

Volumetric comparison

Each mixture tested complied with the specifications in terms of air voids content. The key point is that **rejuvenator allows to keep the mixtures workability** even with higher RAP content.

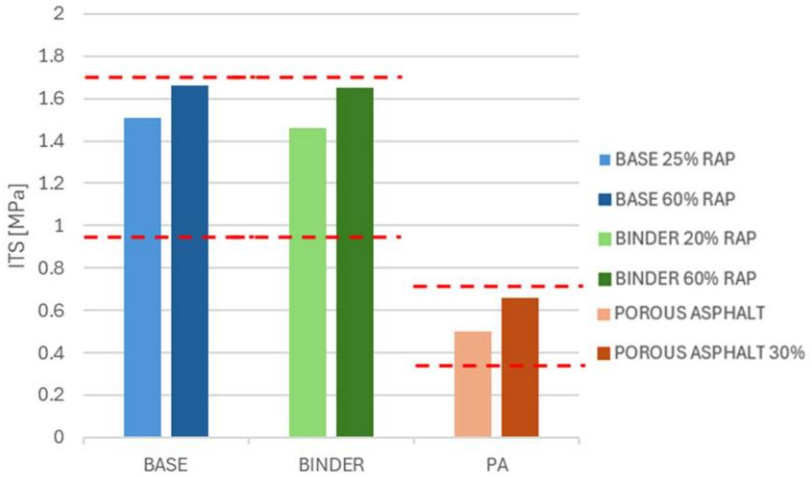




Mechanical characteristics

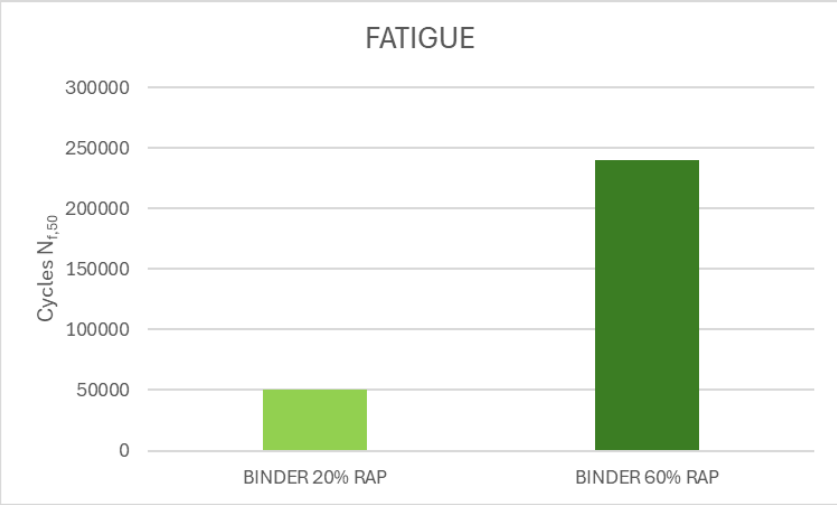
Also considering ITS parameter all the mixtures complied with ANAS specification.

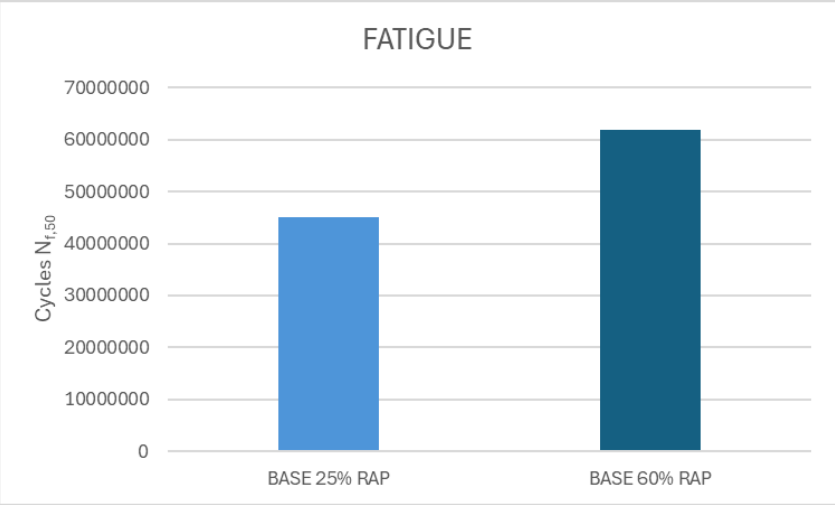
The key point is that **the use of rejuvenator allows to keep the ITS controlled avoiding excessive stiffness.**



Fatigue resistance

Fatigue is one of the main causes of strength loss in road pavements. In this study were performed fatigue test in **4PB configuration @20°C** for Base and Binder Layer respectively with a tension of **730 kPa** and **830 kPa** and a frequency of **10Hz.**





Conclusions

In Italy the reuse of RAP can be considered satisfactory, although there **remains considerable room for improvement.**

The **RAP** reuse supply chain plays a **key role** for **circular economy.**

In the future, **RAP recovery technology** is expected to experience significant advancements, **driven by the environmental European policy.**

An appropriate use of **rejuvenators can significantly enlarge** the **amount of RAP added** into hot mix asphalt without affects the mixtures performances.

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