

**AV
'23 CONFERENCE ASPHALT PAVEMENTS 2023**

Hot Asphalt Recycling With High Reclaimed Asphalt Content: Case Studies in Spain and in Czech Republic

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Motto: Let's asphalt out of the crisis

 **ITERCHIMICA**

ITERCHIMICA S.p.A.

- ➔ **Founded in 1967**
- ➔ **An Italian pioneer in asphalt products**
- ➔ **Fully equipped laboratories**
- ➔ **National and international certificates**
- ➔ **Projects in more than 90 countries**
- ➔ **Extensive academic collaborations**



Main product lines

- ➔ Rejuvenators and Recycling agents
- ➔ Polymeric compounds
- ➔ WMA additives
- ➔ Stabilizing and modifying Fibres
- ➔ Anti-stripping agents
- ➔ Colouring materials (surface & mixture)
- ➔ Self-deicing asphalt additives
- ➔ Photocathalytic pollution control





**Vegetable-based rejuvenators
for
Sustainable asphalt recycling**

ITERLENE ACF 2000

ITERLENE ACF 2030

(It has circa 20°C higher flash point)

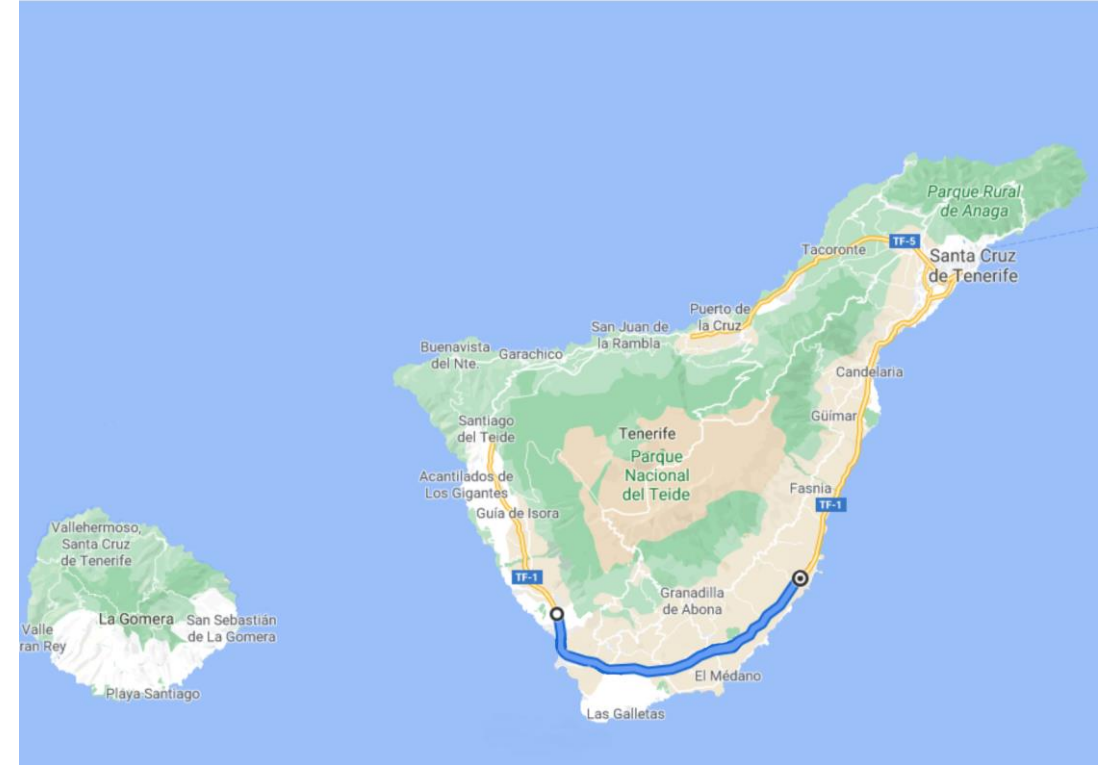
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Case study 1:

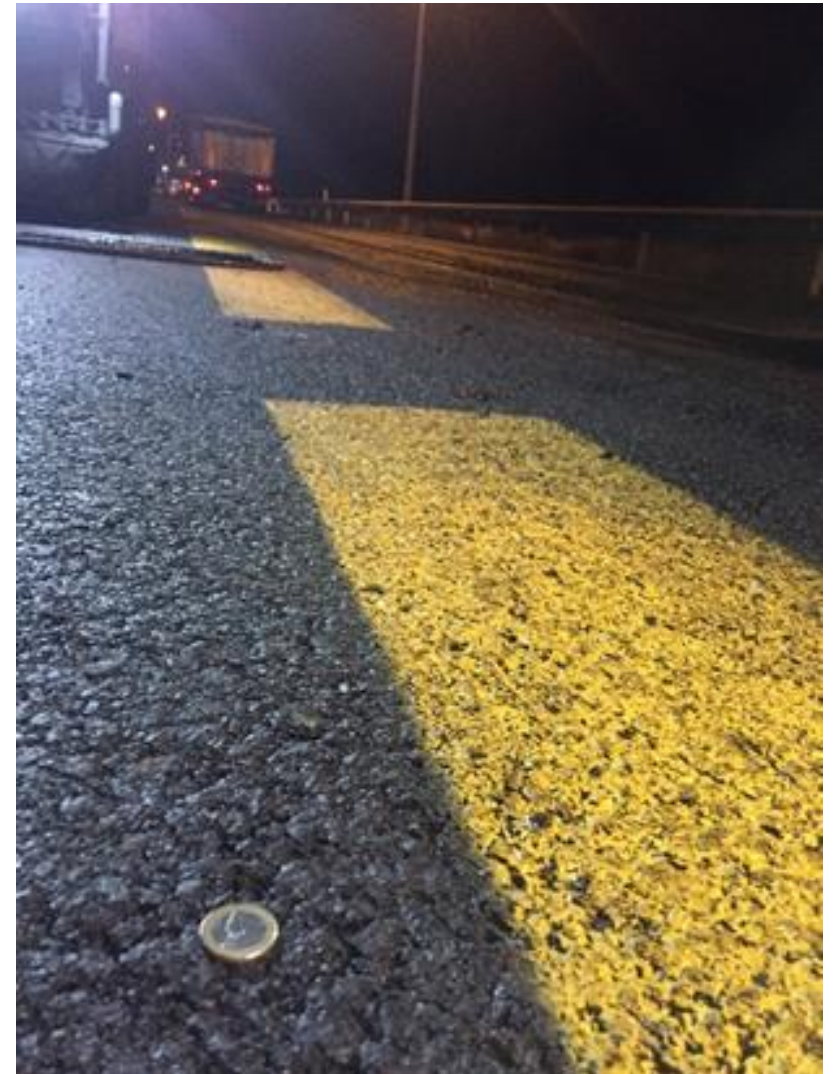
Binder course in Spain

Project 1: profile & location

- ➔ **Location:** Tenerife, Spain
- ➔ **Construction date:** 08/2022
- ➔ **Type of road:** Motorway (TF-1)
- ➔ **Type of mixture:** AC 20mm
- ➔ **Type of layer:** Binder
- ➔ **Paving bitumen:** PEN 50/70
- ➔ **Level of recycling:** 50% Reclaimed Asphalt
- ➔ **Rejuvenator:** ITERLENE ACF 2030 (compared with ITERLENE ACF 2000, the flash point is higher)
- ➔ **Dosage:** 5.48% (on the wt. of aged bitumen)
- ➔ **Contractor:** Sacyr



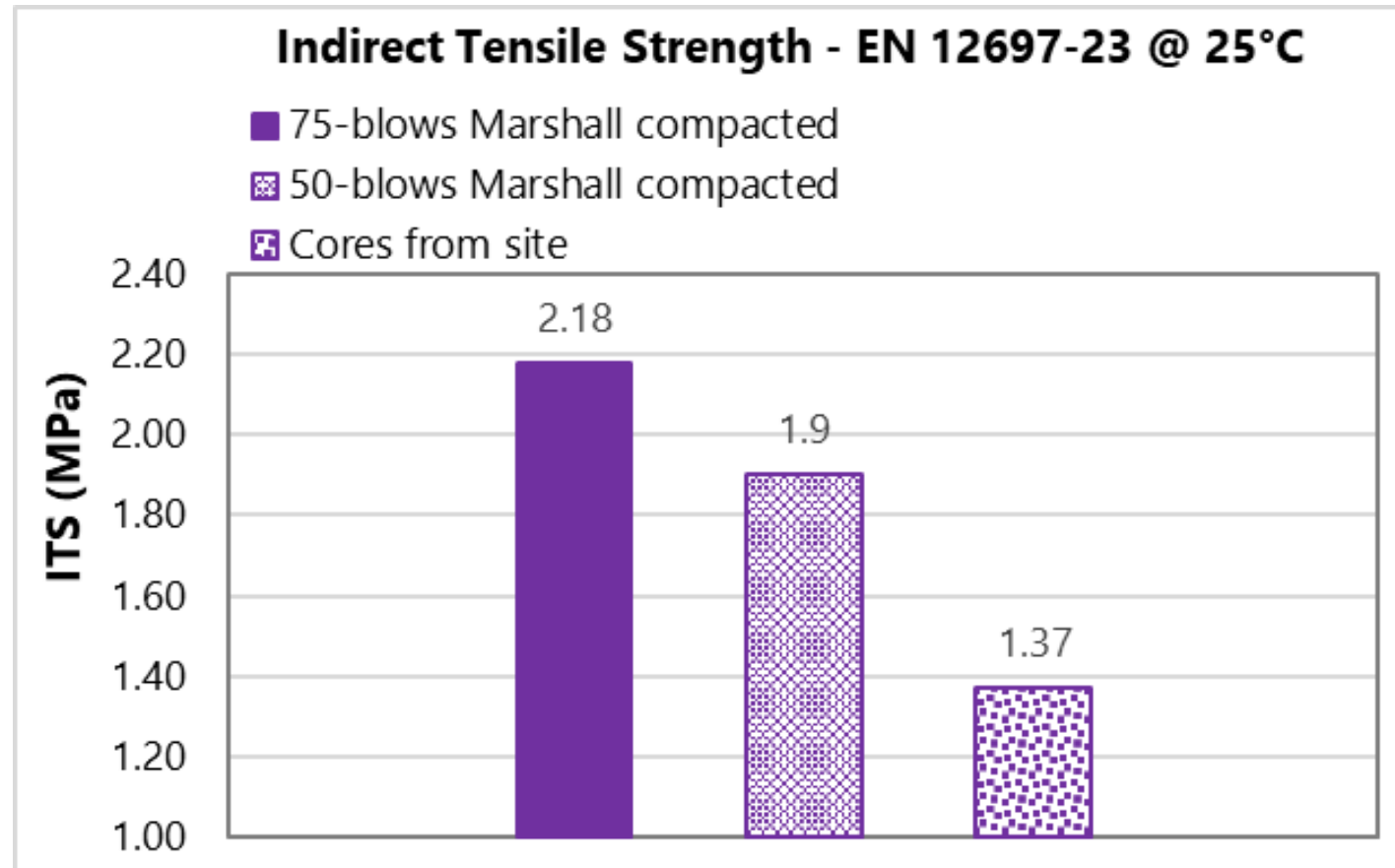
Project 1: The produced and laid recycled mixture



Project 1: Bitumen content and volumetric analysis

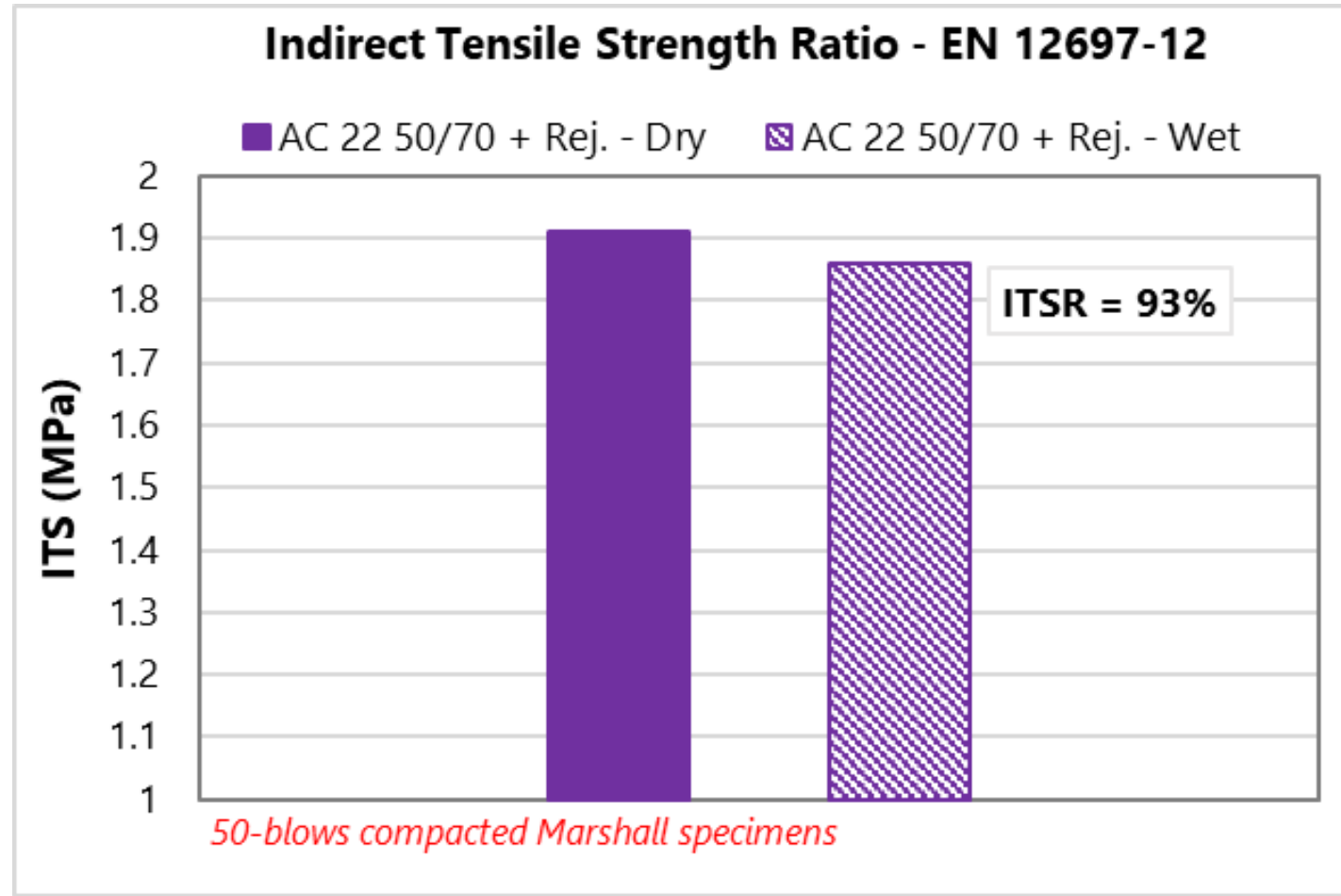
Property	unit	Lab-compacted specimens to the specifications		According	In-situ compacted	Specifications (PG-3)
		75 blows	75 blows	50 blows		
		Ave. values of lab in Spain	Ave. values of lab in Italy	Ave. values of lab in Italy	Ave. results of the cores	
Binder content (by mass of the mix)	(%)	5.81	5.37	5.37	5.37	Min 4.00
Apparent density (Gmb)	Kg/m ³	2469	2506	2474	2367	-
Theoretical maximum specific gravity (Gmm)	Kg/m ³	2600	2620	2620	2620	-
Air voids (Va)	(%)	5.1	4.4	5.6	6.7	4-7
Voids in Mineral Aggregates (VMA)	(%)	19.0	-	-	-	-

Project 1: Mechanical & performance tests



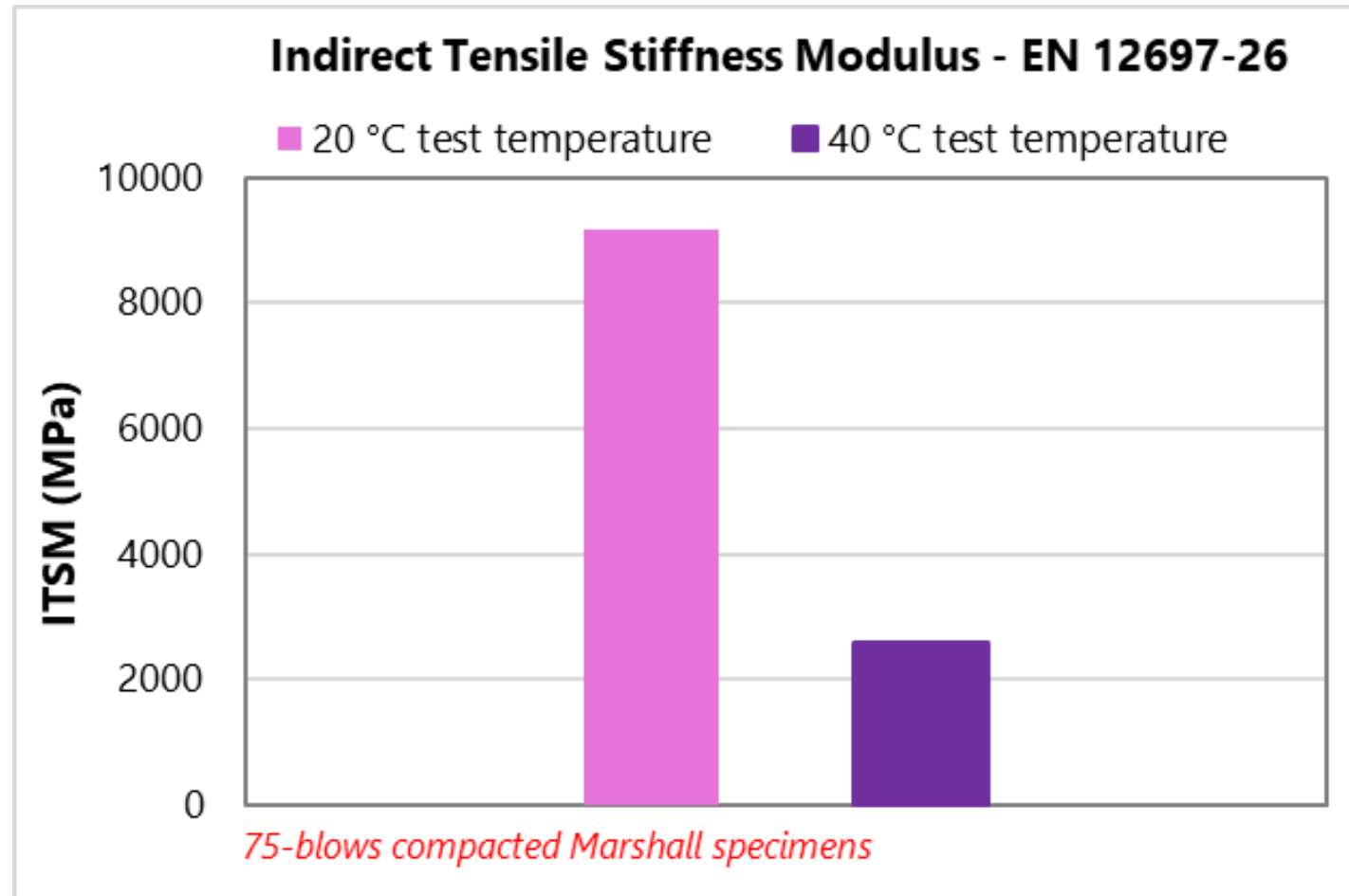
- ➔ The obtained tensile strength complied with the required values for binder layer
- ➔ Higher value for the laboratory manufactured specimens is attributed to re-heating

Project 1: Mechanical & performance tests



- ➔ The obtained tensile strength complied with the specification's required values for 10 binder layer, which is $\geq 80\%$

Project 1: Mechanical & performance tests



➔ As required for the project, higher values obtained both at intermediate and high

temperatures responding to the hot climatic condition of the project location

Project 1: Mechanical & performance tests

Resistance to permanent deformation EN 12697-22			
Property	unit	Test value	* Specifications
Rut Depth (RD)	mm	0.46	-
Proportional Rut Depth (PRD)	(%)	0.77	Max 5.0
Wheel Tracking Slope (WTS)	-	0.01	0.1
*The applied Spanish specification was PG.3			

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Case study 1:

Surface course in Czech Republic

Project 2: profile & location

- ➔ Location: Siřem , Blřany, close to 2218 Rd. $50^{\circ}13'58.7''N$ $13^{\circ}30'25.5''E$
- ➔ Construction date: 2017
- ➔ Type of road: Local access Rd.
- ➔ Type of mixture: AC 11mm
- ➔ Type of layer: Surface course
- ➔ Paving bitumen: PEN 50/70
- ➔ Level of recycling: 50%
- ➔ Rejuvenator: ITERLENE ACF 2000
- ➔ Dosage : 3.75% (on the weight of aged binder)



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Project 2: The produced and laid recycled mixture



Project 2: Post-production tests' results

Test	Standard	Unit	Recycled mix: 50% RA + Rej.	50% RA	Specification limits
Binder content	-	%	5.50	5.30	-
Penetration	EN 1426	dmm	41	25	30 - 55
Softening point	EN 1427	°C	54	60	48 - 60
Air voids	EN 12697-8	%	5.2	3.1	2-6*
2-point bending stiffness modulus	EN 12697-26	MPa	9440	10606	7000**
Low-temp. cracking failure temp.	EN 12697-46	°C	-19.4	-17.9	-

* According to the new specifications, the range is 2-6%

**It is not declared within specs. However, it is commonly considered technically

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Conclusion:

- ✓ According to the results, if recycled mixtures are designed and produced well, they would not be susceptible to low-temperature cracking.
- ✓ A selection of the right rejuvenator avoids the increased risk of low stiffness or resistance to rutting, as shown in these projects.
- ✓ Besides many projects all around the world, thanks to the progress in asphalt recycling agents and plant production equipment, asphalt recycling at high levels is possible without sacrificing the asphalt quality.

Thank you for your attention

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