

CENTRE FOR TRANSPORT STUDIES (CET)

2024 Activity Report

“CET is committed to providing high-level technical assistance, experimentation, and innovation in the field of transport infrastructure, with the aim of moving towards more sustainable and resilient mobility.”

During 2024, CET has made a significant effort to fulfill the commitments established in the **four contracts** signed in 2023 with the **Ministry of Transport and Sustainable Mobility**. These contracts have entailed intensive work, but also great satisfaction in strengthening the **technical support provided** to both the **General Directorate of Roads** and the recently created **General Directorate of Sustainable Mobility**.

Recycled materials

CET has carried out extensive work in the **characterization of basic materials, new materials, and recycled materials**, especially regarding hot **bituminous mixtures** that incorporate **reclaimed asphalt**. The main study involved examining how the properties of different types of mixtures vary according to the amount of reclaimed asphalt, and how this influences their **durability**. For this purpose, work was primarily focused on AC and SMA type mixtures, with reclaimed asphalt contents ranging from 10% to 50%. One notable finding from the results is that the resistance to crack propagation decreases as the reclaimed asphalt content increases, particularly at low

temperatures. The outcome of this study is crucial for ensuring the durability of mixtures with high percentages of reclaimed asphalt.

One of the most interesting tests conducted is the **Fénix test**, which evaluates the cracking resistance of bituminous mixtures.

The tests performed, along with the compilation of results from different working groups, will serve as a basis for revising the recommendations established in NT 01/2022 regarding the use of the Fénix test for quality control of pavement works with bituminous mixtures.





Samples for Fénix test.

Analysis of pathologies

As part of the activities related to **technical assistance and regulatory support in roads**, it is also important to highlight the work carried out regarding the **assessment of the causes of various pathologies** observed in the pavements of different sections of the National Road Network. For example, between km 161+850 and 171+500 on the AP-7 highway, where delamination of the wearing course was observed, or in the analysis of the distresses and the structural condition of the pavement on the AP-68 highway between km 79+902 and 221+622, where a rehabilitation proposal was also developed. This proposal served as a basis for drafting the project to assess the infrastructure's condition for the highway's reversion.

Normative support

Additionally, ongoing **monitoring of sections** with already **implemented**

exceptional regulations continues. Throughout 2024, core samples from the **A-32 section between Villacarrillo and Villanueva del Arzobispo** have been analysed. Laboratory tests confirmed that samples from the section constructed with **BBTM 11B mixture** in the wearing course with conventional bitumen and pre-treated crumb rubber additive show greater aging compared to samples from the section with BBTM 11B mixture and polymer-modified bitumen.

Furthermore, the control of the rehabilitation of the right carriageway of the **A-66 highway section between Puerto de Béjar and Aldeanueva del Camino** has been carried out. This involved in-situ recycling with cement, including recycled material from the existing bituminous layers, and structural assessment through deflection measurements of both carriageways.

CET has also participated in the control and performance monitoring of three pavement sections on the **AP-7 highway** between km 130+000 and 130+500. In two of these sections, plastic additives derived from recycled polymer waste were used with penetration-grade bitumen in SMA-type mixtures, while the third section served as a reference, constructed with polymer-modified bitumen and cellulose fibers.

Additionally, surface characteristics such as skid resistance and noise levels are being monitored on two sections constructed on the **VA-30**, where a double layer of cold micro-surfacing has been applied, with and without the incorporation of reclaimed asphalt in the lower layer, using two

different emulsions, one conventional and one high-performance. The experience and knowledge gained from monitoring these sections will, in the medium term, allow for **revising existing regulations** in areas where updates are needed.



Extension of the wearing course layer in the regulatory exception section on the A-32 Villacarrillo-Villanueva del Arzobispo.

Also related to regulatory support, a new methodology has been defined for the assessment of the in-situ density of thin surface layer asphalt mixes (BBTMB), which will serve as the basis for the drafting of a **technical note** to be issued by the **General Road Directorate of the Ministry of Transport and Sustainable Mobility**.

This methodology will make it possible to resolve the discrepancies that had been detected over the years when comparing in situ densities of the cores of this type of mixes with the laboratory reference densities, a problem that ultimately had repercussions on the economic cost of the asphalt layers produced.

Condition of road surfaces

In the field of **pavement surveys and management**, the verification of quality and condition indicators on first-generation highways (shadow toll concessions) has continued throughout 2024. This provides essential support to the **DGC (General Directorate of Roads)** in ensuring control of the pavement condition on these road sections, managed under a shadow toll system. CET's experience in pavement condition surveys makes it a key tool for the centre, which has consolidated its position as a leading organization in the field of studying the surface and structural characteristics of pavements.



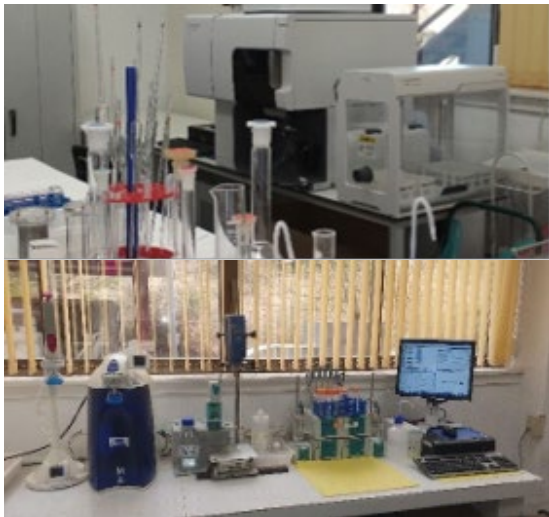
SCRIM measuring.

Regarding **road surface monitoring**, the study of the behavior of a section of semi-rigid pavement rehabilitated in 2017 on the **A-62** has been completed, using instrumentation installed on the pavement. The sensor data obtained have provided valuable information regarding the evolution of reflective cracks in the cement-treated layers, as well as the influence of periods of dry and humid conditions on the subgrade and their potential impact on its bearing capacity.

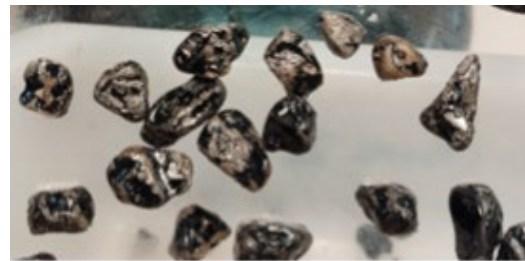
Sustainability and climate change

Within the scope of **sustainability and climate change**, work has been conducted to **characterize the properties of the deicing agents** used for snow and ice removal on roads, as well as their **effects on the pavement and the environment**. To this end, different type of treatments with de-icing agents have been studied, both traditional and newly applied, their mechanisms of action, and their respective advantages and disadvantages.

The potential adverse effects of these agents on bituminous mixtures and binders are being evaluated through specific laboratory tests. The aim of this study is to provide valuable information that will allow the selection of the most suitable de-icing agent under specific conditions.



Devices used in deicing agents' analysis.



Bitumen aggregate affinity test.

Also aligned with decarbonisation and circular economy objectives, CET is developing **HAFIRMA**, a tool for calculating the environmental impacts associated with the construction, maintenance and rehabilitation of road pavements. The tool incorporates the use of reclaimed asphalt and the production of warm and cold bituminous mixtures, and will enable, among other functionalities, the environmental comparison of different construction solutions.



HAFIRMA

Mobility and innovation

In the area of **innovation and mobility**, work has been carried out on a specific order of DGC relating to **connected and autonomous vehicles (CAVs) and the infrastructure adaptation needs** for the growing use of these types of vehicles, equipped with capabilities that enable increasingly automated driving, in road traffic.

In this regard, it is worth highlighting the study carried out on the road characteristics and equipment, including road markings and vertical signs, that play a more important role in facilitating automated driving. Possible roadmaps for achieving the implementation of automated and connected driving have also been analyzed. These roadmaps are understood as documents that express the priorities and implementation phases of the different levels of automated driving.

In the field of **automated mobility**, participation has begun in the **SCALE Project** (Strengthening C-ITS Adoption and Lining-up across Europe). This project, which can be considered a continuation of the **C-Roads Project**, brings together partners from five different countries. The SCALE project, co-funded by the EU within the **Connecting Europe Facility (CEF)** Programme, aims to expand the development of mature **C-ITS (Cooperative Intelligent Transport Systems)** services and support the technical development and impact assessment of new C-ITS use cases in ten

different pilot and operational sites.

Various activities are also being undertaken **to support transport planning**, which in 2024 have focused primarily on assessing greenhouse gas (**GHG**) emissions and other pollutants associated with the operational phase of different transport modes (maritime, rail, road, and air), along with energy consumption. To this end, CET has been working on the development of the tool **HEAT**, which has been commissioned by the Ministry for Transport and Sustainable Mobility (**MITMS**).

Another line of activity in this field involves supporting the Ministry for Transport in the **development of the National Transport Model 2.0**. This model, an upgrade of the current 1.0 version, enables the modeling of transport supply and demand aiming to have a tool for planning new transport services and infrastructures. All these works are essential for data-driven infrastructure planning, based on emission reduction targets and transport efficiency criteria.

Knowledge transfer

Finally, among the **knowledge transfer and dissemination** activities, the following stand out:

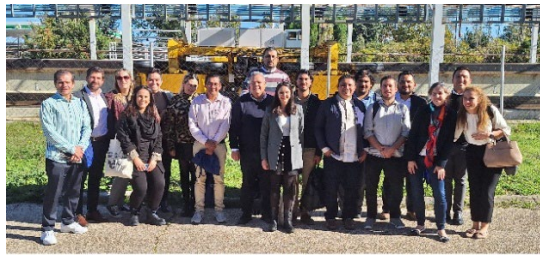
- Active participation in conferences and workshops, such as the Ibero-Latin American Asphalt Congress (**CILA XXII**), the **Road Maintenance Conference (ATC)**, the **Smart Roads Conference (AEC)**, the International Conference on

Construction and Demolition Waste Recycling, and the Global Mobility Call, among others.

- Teaching the course **"Performance Tests Referred to in OC 2/2023 on the Reuse of Bituminous Pavement Layers,"** in a hybrid theoretical-practical format at the CET.
- Strong presence in **UNE and CEN standardization committees** in various lines of activity (materials, monitoring, release of hazardous substances in construction products and aggregates, and road equipment and traffic and road safety); participation in numerous **working groups**, both nationally (committees on various topics of the Road Technical Association (**ATC**)) and internationally (committees of the World Road Association (**AIPCR-PIARC**), the European Forum of Road Laboratories (**FEHRL**), and the Conference of European Road Directors (**CEDR**)). CET also participates in collaborative groups with industry associations, such as ALEAS (part of ASEFMA) and ATEB, which are members of the bituminous mixture and emulsion manufacturing sector, respectively.
- Participation on the editorial boards of several national

technical journals in the sector (Civil Engineering, Roads).

- **Visits from various delegations** to the CET are important.



Visit of a Mexican Delegation (FIIAPP)

CET's activities are aligned with the pillars of the Ministry of Transport and Sustainable Mobility's 2030 Safe, Sustainable, and Connected Mobility Strategy and meet the challenges of **CEDEX 2022-2025 Strategic Agenda** in the field of sustainable, resilient, and digital mobility.