Doctoral Thesis Title: Development of intelligent systems for the monitoring, prediction and resilient management of road infrastructure.

Supervisor/s: Eloina Coll Aliaga; Edgar Lorenzo Sáez

Abstract: The thesis proposes the development of an intelligent system to support the management of road infrastructure through the integration of field data, meteorological information, traffic data and remote sensing with predictive models (Amatebelle et al., 2025), applied to the State road network in the Comunitat Valenciana. The system will be built around a WebGIS viewer that will act as a common platform, onto which new information layers and functionalities will be progressively incorporated as the research evolves.

In its initial approach, the work will focus on two main areas. The first is the generation of alerts and mitigation scenarios for hydrological risks that may affect the road network, integrating meteorological and hydrological information with the network's cartography to identify at-risk sections and access points, estimate alternative routes, and anticipate the impact of an event before it occurs (Oh & Bartos, 2025; Alabbad et al., 2024). The second is the assessment and prediction of pavement condition, combining auscultation data, traffic intensity and type, environmental conditions and remote observation to build models that estimate future deterioration by road section and prioritise conservation works (Kang et al., 2025; Milad et al., 2025).

The models developed in both areas will be validated using indicators of accuracy, reliability and anticipation capacity, comparing their results against real incident records and current management methods, as well as against feedback from the technicians involved and the operational improvement resulting from their implementation. In addition, traffic modelling may be analysed to assess the impact of new developments or industrial projects on the capacity and functioning of the road network.

These lines of work constitute the starting point of the research and may be adjusted throughout the doctorate depending on the results obtained and data availability.

Available Means: The doctorate, under the industrial modality, is carried out in collaboration with MATINSA, a concessionaire responsible for the maintenance and operation of State roads in the Comunitat Valenciana, which provides the physical resources, the doctoral candidate's salary, and any needs covered under the concession contract. There is no additional funding; any extraordinary need will be proposed and assessed as it arises.

References:

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