FIBRA - Fostering the implementation of fibre-reinforced asphalt mixtures by ensuring its safe, optimized and cost-efficient use

CEDR Programme: Call 2017 New Materials and Techniques

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Partners: University of Cantabria (Coordinator, Spain); EMPA, Materials Science and Technology (Switzerland); Technische Universität Braunschweig, ISBS Institute für Straßenwesen (Germany); BAM Infra bv (Netherlands), Veidekke Industri AS (Norway), SINTEF AS (Norway)

Roads have great importance in the life of millions of citizens by enabling their mobility and by boosting the economic growth. However, maintaining reliable road performances is becoming increasingly difficult and continuous maintenance of roads is required but presents economic, environmental and social impacts. Fostering durable, cost-effective and eco-friendly practices to reduce maintenance and achieve higher service lives is indispensable.

In this sense, different fibres have been studied for improving the sustainability, resilience and durability of the asphalt mixtures. However, despite the promising results achieved in previous research works and the availability of commercial fibres whose providers ensure a pavement life extension of at least a 50% and asphalt mixture life extension of around 200% (depending on the type of fibre and provider), the use of reinforced-asphalt mixtures is not as widespread as could be expected. This is principally due to the existence of gaps in the state of the knowledge that make National Road Administrations be reluctant to their incorporation.

For this reason, the objective of the FIBRA project is to overcome the technical barriers for the safe and cost-efficient implementation of fibre-reinforced asphalt mixtures (FRAM) by NRAs with which an increase in the asphalt pavements durability could be achieved.

In order to do so, the FIBRA project will start analysing previous experiences with fibres so as to select the most promising ones. The next step will consist of improving the understanding of the functioning of FRAM by means of studying aspects such as blending procedure, rheological behaviour or microstructural properties. This knowledge will lay the foundation for the optimal design of the mixtures that will be characterized based on EU and US mechanical tests. Afterwards, the optimal position of the FRAM layer will be defined in terms of service life extension of the pavement in a life cycle perspective while considering the its performance in different climatic conditions. To do so, numerical simulation with an advanced pavement performance analysis tool and a model scaled accelerated pavement test will be performed. The recyclability potential of the mixtures as well as the effect of fibres on asphalt mixtures with high RAP content will be also analysed at lab scale.

Furthermore, the technology will be up-scaled by producing FRAMs at real asphalt plants. Two different pilot roads have been proposed to validate the technology when different Standards, and weather conditions are considered, enabling in this way a wider adoption.

Finally, the LCA and LCCA methodology will serve to validate the technology from an environmental and economic point of view, where potentially toxic and hazardous pollutants measured during the project will be considered.

Expected Results

The following results are expected at the end of the FIBRA project that would help the NRAs in the development of new road materials and technologies:

1. List of fibres which have been proved to be beneficial for the mechanical performance of the asphalt mixtures.

2. Optimization of the blending procedure through the chemical understanding of the fibre-asphalt interaction and the rheological characterization of fibre-modified asphalt binders.

3. Design and full characterization of two fibre-reinforced asphalt mixes for different purposes: Porous Asphalt for surface layers and Asphalt Concrete for surface, base and binder layers.

4. Definition of the optimal location of the FIBRA fibre-reinforced asphalt mixture by means of an experimentally validated numerical model. This simulation will be complemented by the MMLS3 accelerated pavement testing machine.

5. Awareness of the rate of recyclability of the previously designed asphalt mixtures as well as of the positive effect of fibres in asphalt mixes with high the RA usage.

6. Upgrading to industrial scale the manufacturing process of the new asphalt mixtures.

7. Implementation and monitoring of two test sections to determine the short-term performance of the asphalt mixtures developed during the project under real conditions.