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Experimental Characterisation of Composite Panels for Railway Flooring

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Abstract : Railway transportation is considered the most economical and sustainable way to travel. However, future mobility brings important challenges to railway operators. The main target is to develop solutions that stimulate sustainable mobility. The research and innovation goals for this domain are efficient solutions, ensuring an increased level of safety and reliability, improved resource efficiency, high availability of the means (train), and satisfied passengers with the travel comfort level. These requirements are in line with the European Strategic Agenda for the 2020 rail sector, promoted by the European Rail Research Advisory Council (ERRAC). All these aspects involve redesigning current equipment and, in particular, the interior of the carriages. Recent studies have shown that two of the most important requirements for passengers are reasonable ticket prices and comfortable interiors. Passengers tend to use their travel time to rest or to work, so train interiors and their systems need to incorporate features that meet these requirements. Among the various systems that integrate train interiors, the flooring system is one of the systems with the greatest impact on passenger safety and comfort. It is also one of the systems that takes more time to install on the train, and which contributes seriously to the weight (mass) of all interior systems. Additionally, it presents a strong impact on manufacturing costs. The design of railway floor, in the development phase, is usually made relying on a design software that allows to draw and calculate several solutions in a short period of time. After obtaining the best solution, considering the goals previously defined, experimental data is always necessary and required. This experimental phase has such great significance, that its outcome can provoke the revision of the designed solution. This paper presents the methodology and some of the results of an experimental characterisation of composite panels for railway application. The mechanical tests were made for unaged specimens and for specimens that suffered some type of aging, i.e. heat, cold and humidity cycles or freezing/thawing cycles. These conditionings aim to simulate not only the time effect, but also the impact of severe environmental conditions. Both full solutions and separated components/materials were tested. For the full solution, (panel) these were: four-point bending tests, tensile shear strength, tensile strength perpendicular to the plane, determination of the spreading of water, and impact tests. For individual characterisation of the components, more specifically for the covering, the following tests were made: determination of the tensile stress-strain properties, determination of flexibility, determination of tear strength, peel test, tensile shear strength test, adhesion resistance test and dimensional stability. The main conclusions were that experimental characterisation brings a huge contribution to understand the behaviour of the materials both individually and assembled. This knowledge contributes to the increase the quality and improvements of premium solutions. This research work was framed within the POCI-01-0247-FEDER-003474 (coMMUTe) Project funded by Portugal 2020 through the COMPETE 2020.

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