

## Durability of all-composite civil engineering structures – development of an inspection and diagnosis system

### Summary

This work addresses the durability of structures that comprise glass fibre reinforced polymer (GFRP) pultruded profiles and gratings and the development of an inspection, diagnosis and rehabilitation system for this type of materials. Therefore, the research programme aims at contributing to the assessment of structures made with these innovative composite materials and the understanding of their actual performance under real service conditions. The programme is being developed in 6 main stages: (i) literature review; (ii) development of an inspection system; (iii) field study; (iv) laboratory study; (v) development of degradation models for selected anomalies likely to occur in GFRP elements, and (vi) dissemination of results. The literature review focused on the material properties, the development of the inspection and diagnosis system to be used in the field study, and on the research of the state-of-the-art regarding the laboratory study.

The field study, developed in collaboration with Portuguese end-user companies and GFRP manufacturers, included the inspection of a relatively large number of GFRP structures, with different ages and located in different types of environments. The laboratory study will complement the conclusions of the field study, comprising experimental tests on small- and full-scale specimens extracted in-situ, the accelerated ageing of the GFRP material under some of the most aggressive environmental agents of the field study (UV and chemical environments), thus allowing the evaluation of the changes in physical, mechanical and aesthetical properties of GFRP profiles. Alongside the laboratory studies, some degradation models were developed for the most common anomalies detected in the field study, with the purpose of quantifying and predicting the degradation associated to a particular anomaly when the GFRP material is exposed to different environmental conditions. The results obtained will provide extensive data about the durability of GFRP constructions that will be useful for the development of design guidelines and technical specifications for production and installation, thereby contributing to encourage the use of these materials in civil engineering applications.

### Keywords

Fibre reinforced polymers (FRP), glass fibre reinforced polymer (GFRP) pultruded profiles, inspection system, diagnosis techniques, natural ageing, accelerated ageing, experimental tests, models.



Biological colonization



Fibre blooming



Corrosion of bolted elements



Cracking

Common anomalies in GFRP elements.



Natural ageing (top) and QUV chamber (bottom).



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