

Publishable Summary

When the phases consist on a fibrous material dispersed in a continuous matrix phase, the resulting composite material is commonly known as Fibre Reinforced Polymer (FRP). Composites, as a structural material, offer the designer a combination of characteristics not available in traditional materials. Density, stiffness and strength are the properties that initially come to mind when thinking of FRP, and these would certainly be the design drivers for materials selection for components for future transport infrastructures.

FRPs are commonly used for strengthening existing concrete and steel structures in civil engineering. In the last decade there has been a concerted effort to migrate FRPs into the construction industry for use in primary load bearing applications. Potential capacity of these materials has not yet been exploited enough due to the complex manufacturing processes for composites components in construction. Until now manufacturing techniques are mainly based either on inefficient manual processes or on processes like pultrusion. Although the pultrusion is a very efficient process, it does not allow to a proper fibre orientation or to adopt variable section to each individual structure.

Trans-IND (new industrialised construction process for transport infrastructures based on polymer composite components) was a large-scale collaborative integrating research project funded by the European Commission within the 7th Framework Programme. The project, which was active from June 2009 till May 2013, is completed and has achieved successfully all its targets.

The overall objective of the project was to develop a cost-effective integrated construction process that enables the maximum capability of industrialisation of components for transport infrastructures (road and pedestrian bridges, underpasses, containing walls, acoustic and safety barriers) using fibre reinforced polymer based materials (FRP's). The tangible result of the project is an integrated Trans-IND system that combines technical solutions that can be applied during all phases of construction process supported by software platform. An important aspect is that the Trans-IND system is to enable the reduction of the life cycle costs of FRP's transport infrastructure through automation and process optimization, so that bridges can be made out of FRP components around 10% cheaper than conventional bridges.

Trans-IND covered the whole range of activities from gathering customer needs and requirements to specification for modular design of the transport infrastructure components, off-site components manufacturing, logistics, transport and on-site assembly and disassembly together with the ICT (Information and Communication Technologies) tools needed to manage and handle the whole process. The off-site manufacturing is flexible answering both to the whole range of transport infrastructures and building components and its variable demand. The on-site assembly benefits from modular and adaptive plug-in joint solutions arising from the concept design of the components, together with the use of RFID or QRcodes for improved material flow control and traceability, lightweight cranes, intelligent positioning systems, ICTs and robotics applications.

The main breakthrough of the Trans-IND approach was a holistic, flexible, cost-effective, performance and sustainable knowledge-based industrialisation system of FRP components for transport infrastructures through the whole integration of the construction process fulfilling users and clients demands addressing their needs and requirements, social acceptance, standardization, on-site needs, industrial models, design, procurement, manufacturing process, logistics and assembly.

The ultimate goal was the efficiency of resources in the whole process and life cycle from procurement, manufacturing off site, logistics, assembly on site, operation and disassembly, by re-engineering the construction process towards a cost-effective manufacturing process integrating the entire supply and value chain. It contributes to the transformation of the EU industry from a resource-intensive to a knowledge-intensive one.