MESSAGE FROM THE CHAIRMAN OF THE IIFC WORKING GROUP ON FRP BRIDGE DECKS

Fiber-reinforced polymer (FRP) composites have found increased applications in bridge structures in recent years. Applications for strengthening and repair are already well established. A growing number of new bridges have been constructed as all-FRP or hybrid-FRP structures (FRP combined with traditional materials). This increase is predominantly due to the advantageous properties of FRP composites, such as low self-weight, high strength, a high degree of free formability, and substantial resistance to corrosion and fatigue.

In particular, FRP bridge decks are a promising application as was demonstrated by the first generation of all-FRP bridge decks in the USA. All-FRP pultruded decks and sandwich decks were used for rapid replacement of existing concrete, steel or timber decks with minimum traffic interference or for new construction. The decks were shown to increase the allowable live loads or to facilitate the widening of existing bridges via replacement of the heavy concrete decks. Furthermore, construction details could be more simply designed as compared with concrete decks, for example, the waterproofing layer and the associated complicated parapet detailing were not necessary.

All-FRP bridge decks are, today, primarily suited for smaller bridges with spans up to about 20 m. In this span range the increased number of main girders due to the limited transverse span of pultruded decks has not the same importance as for longer spans. From the market point of view this is not a real limitation since about 80% of all bridges have spans smaller than 20 m. If the decks must provide only a transverse load-carrying function and the girders' spacing fits the possible deck span, the bridge span or length is not limited. Since FRP bridge decks are still considerably more expensive than concrete decks, they are basically competitive where light weight, corrosion resistance, and/or rapid installation are demanded. Accordingly, competitive applications are mainly found in movable bridges, historic bridges, and urban environments. FRP decks are often the only solution for preserving historic bridges while upgrading them to modern traffic standards.

A possibility to overcome the limitations of all-FRP construction is the implementation of hybrid-FRP construction, that is, to use FRP composites together with traditional materials, in particular concrete, where each material is optimally used: FRP in tension and concrete in compression. In this respect, not only the deck, but the whole bridge superstructure - consisting of deck, main girders and connections between them - should be considered in the design. The deck normally not only acts in the transverse direction, independently of the girders, but also contributes as top chord of the hybrid girder and the deck-to-girder connection has to provide full composite action. It is planned, therefore, to extend the scope of the IIFC working group from FRP bridge decks to all-FRP and hybrid-FRP bridge superstructures.

Professor Thomas Keller
Swiss Federal Institute of Technology, Lausanne
December 2007