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Concrete Deck Slab Reinforced with Non-Corrosive GFRP Bars

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Summary

The corrosion of steel reinforcement and the cracking of concrete are the main causes of the deterioration and structural deficiency of reinforced concrete structures. To overcome the corrosion problem of steel reinforcement in concrete, the steel reinforcing bar (rebar) should be coated or replaced with non-corrosive materials. Recently, non-corrosive GFRP (Glass Fiber Reinforced Polymer) rebars have been developed by the Korea Institute of Construction Technology in Korea. This paper summarizes the results of laboratory tests and field applications of GFRP rebar reinforced concrete structures. The newly developed GFRP rebars have successfully been implemented in the field as reinforcement for the concrete deck slab of a four-span of continuous steel box girder bridge. Prior to the field application, extensive laboratory tests were conducted to identify the short-term as well as long-term performances of GFRP rebars as reinforcement for concrete structures. The tensile strength of GFRP rebars is 1.6 times greater than that of conventional steel bars. The long-term performance tests include durability test and creep rupture test. The results of laboratory tests are discussed in this paper. The total length and width of the bridge are 200 m and 10.45 m, respectively. GFRP bars with diameters of 16 mm and 19 mm were used as the top reinforcement of a quarter of the 250-mm thickness concrete deck slab of the second span. The conventional steel bars were used for the bottom reinforcement of the deck. Excepting the crack width limit, the concrete deck slab was designed in accordance with Korean Highway Bridge Design Code. The crack width limit of 0.5 mm for FRP bars reinforced concrete members was employed in the design according to ACI 440.1R-06. Fiber optic sensors were mounted to GFRP rebars at critical locations of the deck for long-term monitoring. For comparison purpose, the same type of sensors was also mounted to the concrete deck reinforced with conventional steel bars. The bridge was completed on October 2007 and will be opened to traffic in 2008. The results of the field monitoring of the concrete deck under dead load are discussed in this paper.

keywords: GFRP bars; Concrete deck; Experiment; Field test; Monitoring

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