



Experiencing More GFRP Composite Bridge Decks for Vehicular and Pedestrian Bridges

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Summary

Recently, the composite deck has emerged as a promising alternative to a concrete deck for bridge structures. This type of deck has many advantages. It utilizes a lightweight and high-strength material, has good resistance against corrosion, and is highly durable. This paper gives a brief description of the developing procedure of two types of composite decks. The first of these uses a tongue-and-groove connection and the second a snap-fit connection. The snap-fit connection significantly lowers the cost and improves the quality of construction compared to conventional construction techniques that use composite decks with tongue-and-groove connections. Recent applications of these types of composite decks are also presented including the world's largest composite-deck bridge in Korea.

Keywords: GFRP, composite deck, vehicular bridge, pedestrian bridge, tongue-and-groove connections, snap-fit connection.

1. Introduction

To cope with the problems of deterioration and corrosion in conventional steel and concrete materials, highly durable and lightweight fiber-reinforced composites are considered to be one of the most promising alternative materials for civil infrastructure projects. Among the many applications of these materials, composite decks for bridges are highly notable.

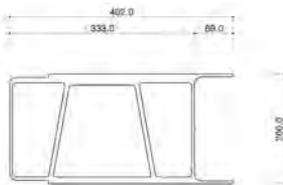


Fig. 1: Profile of a 'Delta Deck'



Fig. 2: Pultrusion

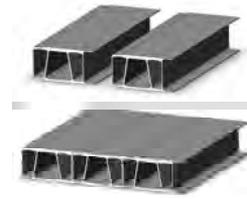


Fig. 3: Assemblage

2. Composite deck with tongue-and-groove connection

Through extensive studies, a composite deck profile that uses a tongue-and-groove connection was developed. It is known as a 'Delta Deck'. As shown in Fig. 1, it has three trapezoidal cells that are 200mm in height. It is fabricated via pultrusion, as shown in Fig. 2. The deck is designed for typical

girders with spacings ranging from 2.5 to 3.0m under the DB24 Korean Highway truck load (with a rear axle load of 94.1kN). As shown in Fig. 3, pultruded deck tubes are assembled by bonding them together with epoxy to create a deck panel that is used as part of the bridge.

Several bridges have been constructed in Korea by using the composite deck with tongue-and-groove connection. These bridges are Gwangyang Bridge, Gaejung Bridge, Pyungtaek Bridge, Cheongae Bridge and Noolcha Bridge. Noolcha Bridge is currently the largest composite-deck bridge in the world.

3. Composite deck with vertical snap-fit connection

Fig. 4 shows the developed profiles of a snap-fit deck for pedestrian bridges. Fig. 5 shows an illustration of a deck assembly by snap-fitting. Developed snap-fit decks significantly improve construction workability and quality, provide snap-fit mechanical connections with or without adhesive bonding, and reduce the necessary installation time and associated costs. Furthermore, the snap-fit deck is easily applicable to curved bridge, whereas this is not the case for tongue-and-groove type of deck. Vertical snap-fit connections provide easy assembly and disassembly if decks are connected without adhesive bonding. This advantage enables the application of snap-fit decks not only to temporary bridges but also to road-mats for use with oil and gas development, disaster relief, and military operations, as well as mining, logging and construction activities. It is hoped that the development of the vertical snap-fit connection will pave the way for far wider applications of composite decks.

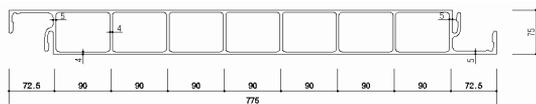


Fig. 4: Section of a composite deck with a snap-fit connection



Fig. 5: Deck assembly by snap-fitting

The developed composite decks with snap-fit connection are successfully applied to build several pedestrian bridges and a walkway expansion project such as Wolchul-Mountain Bridge, Osanchun Bridge and walkway expansion at Hangang Bridge.

4. Conclusion

This paper presented a brief description of two different types of composite deck developed in our study. The first utilizes tongue-and-groove connections while the second uses vertical snap-fit connections. The tongue-and-groove composite decks have been applied to many bridges in Korea, including the world's largest composite-deck bridge located at the Busan Newport area and other several bridges. The snap-fit composite decks have been applied to several pedestrian bridges in Korea including the walkway expansion project of Hangang Bridge.

Construction of additional vehicular and pedestrian bridges is planned with the composite decks. Due to many advantages of the composite deck, more applications of the composite decks are anticipated.