論文 / 著書情報
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論 文 要 旨

THESIS SUMMARY

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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

This study proposes the so-called "UFC-PC hybrid structure", or the hybrid structure which consists of Ultra high strength fiber reinforced concrete (UFC) girder at the middle part of span, and prestressed concrete (PC) segmental girders at both ends. In order to develop the UFC-PC hybrid structures, the focus is on the utilization of UFC in each part of the structure. First, the use of UFC as the permanent formwork for the prestressed concrete segmental girder is developed. Then, the proper joint connection between UFC and PC girder is clarified and determined, which is one of the most essential processes in developing UFC-PC hybrid structure. The objectives of this study are, firstly, to investigate the shear behaviors of RC beams using UFC U-shaped permanent formwork, and secondly to investigate the shear behavior of proposed Perfobond Leisten (PBL) with cast-in-place UFC joint connection for UFC-PC hybrid girders.

Chapter one introduces the general background of UFC-PC hybrid structure, together with scope and objectives of this study. Outline of the dissertation is also briefly explained in this chapter.

Chapter two reviews the basic knowledge and the use of UFC, along with the hybrid structural system technologies. Mechanical properties and structure with practical use of UFC are introduced. Previous researches on performance of composite and hybrid structure using UFC are also reviewed.

In chapter three, the experimental study on shear behavior of RC beams using UFC U-shaped permanent formwork is presented. UFC U-shaped permanent formwork with the shear keys and screws and bolts construction system is introduced. Nine RC beams that used UFC U-shaped permanent formwork were subjected to four-point bending tests. Experimental parameters were the interface and presence of screws and bolt system, thickness of permanent formwork, presence of stirrups and shear span to effective depth ratio (*a/d*). Shear behaviors of RC beams using UFC permanent formwork and reference specimen were compared in terms of shear capacities, crack patterns and load-displacement relationship. Shear resistance mechanisms were also discussed based on the effect of each experimental parameters. The results indicated that by using the UFC permanent formwork, the shear capacity of RC beams significantly increased. Moreover, the compatibility between RC and UFC permanent formwork was formed by using the shear keys and screws and bolts system. With the increase of the thickness of UFC formwork, the shear capacity of RC beams using a

UFC permanent formwork increased. Furthermore, failure mode of RC beams using UFC changed depending on the shear span to effective depth ratio. Compression strut formed in a UFC permanent formwork in the case of shear span to effective depth ratio of 2.16 and 1.00. The diagonal crack model together with tensile stress obtained from the tension softening curve were used to investigate the contribution on shear carried by UFC permanent formwork. The calculation results showed good agreement with the experimental results. In addition, the significant weight reduction of beams comparing with normal RC beams was also examined.

Chapter four focuses on joint connection for the UFC-PC hybrid girders. The Perfobond Leisten (PBL) filled with cast-in-place UFC joint connection is proposed as the connection method for UFC-PC hybrid girders. A push out test of twelve PBL connectors with cast-in-place UFC connection specimens was performed in order to investigate the shear behavior of PBL with cast-in-place UFC connection. Thickness of PBL, diameter of PBL hole, diameter of transverse rebar inside PBL, prestressing stress on the connection part and the ratio of spacing to diameter of PBL were selected as parameters in the experiment. The results indicated that PBL with cast-in-place UFC was sufficient to transfer the shear forces between two segments. Moreover, the shear resisting mechanisms were clarified. The contribution on shear resistance characteristics comes from end-bearing resistance of UFC, dowel action of UFC in the hole of PBL, resistance of transverse rebar and the prestressing stress on the connection. In addition, by inducing prestressing stress on the connection part, the shear capacity drastically increased due to the frictional resistance. Finally, predictive equation is modelled based on the shear resistance mechanism of the connection. The proposed calculation method can provide a reasonable agreement with the experimental results.

In chapter five, the effect of bending moment on the shear capacity of the PBL with cast-in-place UFC connection is presented. Four-point bending tests of three UFC-PC hybrid girder specimens were carried out. Three locations of the PBL with cast-in-place UFC connection were varied along the shear span in order to vary the bending moment that occurred on the connection. The results revealed that shear capacity of PBL with cast-in-place UFC connection gradually decreased with the increase of bending moment on the connection. However, the failure patterns of all specimens showed similar behavior with other specimens from the push out test experiments.

Finally, chapter six presents the conclusions of this study and recommendations for further study.