

論文 / 著書情報
Article / Book Information

題目(和文)	PBOメッシュとCFRPグリッドによるコンクリートはりの新たなせん断補強方法
Title(English)	Innovation of Shear Improvement in Concrete Beams by Internally Reinforcing PBO Mesh and CFRP Grid
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

専攻 : Department of	Civil Engineering	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 Doctor of	(Engineering)
学生氏名 : Student's Name	Sirapong SUWANPANJASIL		指導教員 (主) : Academic Advisor(main)	Prof. Junichiro NIWA	
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

In order to develop a new challenge of FRPs for concrete beams, this research presented a new alternative shear improvement by using high performance textile composites such as PBO mesh and CFRP grid as a direct replacement of conventional steel stirrups at the shear span inside concrete beams. Experimental programs in this study were separated into three main parts. The first part was the elementary test for investigating the basic mechanism and the compatibility between the internal mesh/grid and the concrete surrounding them. The bending test of eight concrete elements internally reinforced in flexure with PBO mesh and CFRP grid was investigated. The actual tensile strength of the reinforcing mesh/grid from the bending test was compared with the ultimate tensile strength obtained from the uni-axial test.

After that, the concrete beam tests were investigated with a total of seventeen specimens. The four-points loading tests were conducted until the failure of specimens. The results in terms of shear capacities, shear carried by the internal mesh/grid, load-displacement relationships, cracks patterns, failure modes and shear resisting mechanism were presented and discussed. Finally, the suitable models for evaluating the shear carried by internal PBO mesh and CFRP grid were introduced and the calculated results were compared with the experimental results. The contents in the thesis were divided into seven chapters as summarized below.

Chapter one introduced the origin and the background behind the idea of this research. The main objectives and outline of the dissertation were also explained in this chapter.

Chapter two described the development of FRP materials for concrete structures, limitations of the FRPs and also the existing guidelines and standards for them. In addition, the physical and mechanical properties of the PBO mesh and the FRP grid which were the reinforcing materials used in this study were also provided in this part.

In Chapter three, the elementary test for the internal reinforcing PBO mesh and CFRP grid was presented. The dimensions and details of concrete elements in each case were described. The results from the bending test showed a good reinforcing efficiency from the internal composites. The failure mode of each specimen was depended on the amount and

coating method of the reinforcing materials. The actual tensile strength of the composites from the loading tests was not far from its ultimate strength, indicating that this internal reinforcing system was reasonable for applying to other concrete structures in further studies.

Chapter four focused on concrete beam test with PBO mesh, a total of nine concrete beams varying in the number of PBO mesh layers, the width of PBO mesh in the shear span, and the reinforcing configuration of the mesh were tested. The reinforcing meshes were coated by the resin to assemble the small fibers into a group and were wrapped around the compression and tension bars as a replacement of steel stirrups before casting concrete. The results showed that the shear capacity and the shear carried by internal PBO mesh increased significantly with a higher number of the internal mesh layers; however, the shear capacity decreased when the width of internal mesh in the shear span was expanded. In addition, the difference in reinforcing configuration of the internal PBO mesh showed a great impact on the shear performance of concrete beams reinforced with internal PBO mesh.

In case of concrete beam test with CFRP grid presented in Chapter five, eight concrete beams with and without CFRP grids in the shear span were tested. The parameters were the number of CFRP grid strips in the shear span and the spacing of grids which was varied between 50 mm and 100 mm. The reinforcing grids were attached at the two sides of the shear span by the binding wires as commonly used for steel stirrups before casting concrete. The experimental results revealed that the shear capacity and the shear carried by internal CFRP grids were significantly improved with a higher amount of grid strips, however, the increasing ratio of shear capacity was not proportional to the shear reinforcement ratio. Moreover, the location of internal grid in the shear span was very important for the shear resisting effectiveness of the reinforcing grids since the more number of grid strips located near the center of the shear span was much more effective to resist the propagation of diagonal shear crack than the grid strips at the edge.

Chapter six explained about the truss analogy method for modelling the shear carried by internal PBO mesh and CFRP grid. The validation of the proposed models exhibited a satisfied agreement with experimental results. Discussion about the reinforcing efficiency between the proposed method and the existing methods from the guidelines (JSCE, ACI) was also mentioned in this chapter.

Finally, the conclusions of this study and recommendations for further study were given in Chapter seven.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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