第５号様式

論文審査の要旨

博士の専攻分野の名称	博　士　（　　工学　　）	氏名	HALWAN　　ALFISA SAIFULLAH
学位授与の要件	学位規則第４条第[1]・２項該当		

論　文　題　目

Shear Creep Failures of Reinforced Concrete Beams without Shear Reinforcement
(せん断補強筋のない鉄筋コンクリートはりのせん断クリープ破壊)

論文審査担当者

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〔論文審査の要旨〕

This dissertation aims to investigate shear creep failures of reinforced concrete beams without shear reinforcement through experimental and numerical studies.

In Chapter 1, the candidate presented the background, purposes, methodology, and outline of this dissertation.

In Chapter 2, the candidate provided a brief literature review on the shear strength of RC beam without web reinforcements and the time-dependent effects on concrete.

In Chapter 3, the candidate presented the detail of experimental works examining the shear performance of RC beams without web reinforcements under different loading rates. This chapter aimed at experimentally investigating the shear performance of reinforced concrete beams without web reinforcement under different loading rates. A total number of nine RC slender beams (with a shear span/depth ratio of 3.0), six RC short beams (with a shear span/depth ratio of 1.9), and some cylinder specimens (for compression and splitting tensile tests) were prepared and sealed using aluminium tapes until a period of 28 days. The seal was removed afterwards and exposed to ambient condition until at least three months from the casting day for promoting drying shrinkage. The RC beams were subsequently tested under three different loading rates which are a normal or static loading rate (10 mm/hr), a slow loading rate (10 mm/100hr) and a very slow loading rate (10 mm/1000hr). The diagonal cracking strength, ultimate load, deflections and shear displacement of RC beam, the compressive strain on the top surface of the beam, and total flexural cracks were measured during experimental work to examine the creep effects. The development of cracks during loading test were also monitored for some of the specimens using acoustic emission (AE) machine. The results indicated that the experimental time could be better controlled, and that the shear strengths at diagonal cracking as well as at failure could be obtained from the experiment.

Additionally, the loading test results showed that the mid-span deflection, compressive strain of the concrete at the top surfaces of the RC beams, and total crack width during the loading test tended to increase with increases in the loading duration. The strength of the concrete was expected to decrease due to the creep effects. Nevertheless, the diagonal cracking strength of the RC slender beams indicated almost constant values under different loading rates. Moreover, the ultimate strengths of the RC slender and RC short beams under the slower loading rates exhibited higher values when compared to those under the normal loading rate.

In Chapter 4, the candidate analytically examined the time-dependent effects on RC beams under different loading rates until the delayed failure and compares the results with the previous experimental ones. The extended discussion with shorter and longer shear span of RC beams was presented through the numerical modelling. As a complement to the previous experimental works, this chapter aimed at investigating the effect of loading rates on the shear capacity of RC beam by non-linear finite element (FE) analysis. The reliability and applicability of a space-averaged time-dependent constitutive model to simulate the failure of RC beam in shear were confirmed. Under slower loading rates, the reduces of shear capacity became more significant with the decrease of the shear spans resulting in the higher contribution of compressive creep. On the other hand, a slight improvement of shear strength occurred with the increases length of the shear span. The greater bending moments were required for the failures of the beams resulting in the relatively higher compression zone under slower loading rates. The penetration of inclined shear cracks higher into the beam became relatively difficult in this case. Furthermore, the increase of ultimate strength observed in the experiments could be explained by a possible rise in fracture energy under slower loading rates and sustained load. The change of fracture energy of concrete only significantly affected the beams which failed in flexural and shear-tension modes. In the case of the beams with very short spans, the influence of the increased in fracture energy was significantly depreciated.

In Chapter 5, the candidate stated the conclusion of this research. Recommendations for future work were also provided.

The examining committee members evaluated that the dissertation met the standard of excellence expected of a doctoral candidate at Hiroshima University. In particular, new experimental evidence revealing effect of sustained loading on shear strength was recognized as high novelty.

備考：審査の要旨は，1,500 字以内とする。