Numerical Investigation on Anchorage Zone Capacity of Post-Tensioned RPC

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Abstract

The bearing capacity of the anchorage zone is involved in prestressed structures, which is a problem for the local compression zone. This paper used ABAQUS software to simulate the local compression of reactive powder concrete (RPC) under various conditions, according to RPC's deformation characteristics and mechanical properties. The damage parameters are filled in according to the constitutive model. The specimens with the duct have been simulated with different bearing plate lengths, stirrup spacing, and various reinforcement ratios and were studied. The load-displacement curves and ultimate bearing capacity were obtained. The summary and analysis showed that the stirrup spacing could provide a beneficial behavior in controlling the cracks. Moreover, the steel stirrup reinforcement can dissipate the energy in the specimen, and the RPC specimen's local compression bearing capacity is improved by increasing the bearing plate's length.

Keywords: reactive powder concrete (RPC); ABAQUS; bearing capacity.

1 Introduction

Reactive powder concrete (RPC) is a unique type of ultra-high-performance cement-based material with remarkable toughness, super-high compressive strength, and good durability. The combination of prestressed and reactive powder concert structures has become a research priority to meet the building's steady transition to super high-rise and large-span structures.

These structures not only have the strength and seismic performance of the prestressed concrete structures, but they also have the properties of RPC, such as high durability and high ductility, high tensile and compressive strength, and high toughness [1, 2]. Furthermore, post-tensioning can be an elegant assembly method for constructions built of pre-cast prestressed components. As a result, the subject of how to design safe end blocks for post-tensioning tendons is essential. Therefore, exploring the anchorage zone of prestressed RPC is significant. The behavior of steel fiber post-tensioned anchorage zones by enhancing the fiber's tensile strength with ducts, reinforced by the orthogonal ties, and high-strength steel spirals has been investigated by Wei et al. [3-5]. Li et al. [6] studied RPC members' prestressed anchorage zone under various curing conditions and steel fiber ratios. The test results showed that steam curing increases the local bearing capacity of RPC members. Compared to natural curing, results showed that the bearing capacity gradually decreased when the steel fiber ratio exceeded 3%. A recent study was conducted to validate the possibility of extrapolating design specifications for concrete strengths between 80 to 120 Mpa; results showed that high concrete strength could decrease the stress under the concentrated load to a rate corresponding to the starting of the first cracks on

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