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論文審査の要旨及び審査員

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論文審査の要旨（2000 字程度）

The thesis entitled "**Structural Behavior of Cast-in-place Concrete-filled Steel Tube Piles**" is a comprehensive study of the axial-flexural and shear performance of cast-in-place concrete-filled steel tube (CFST) piles using experimental data and numerical modeling in order to implement a practical design concept for the ultimate behavior under large earthquakes.

Chapter 1 "Introduction" presents the current Japanese design practice and research on piles and foundation members of buildings, and states the objective which is the clarification of the ultimate behavior in axial-flexure and shear of CFST piles.

Chapter 2 "Literature review" summarizes the available literature focusing on experimental works, methods to simulate the axial-flexural response, and numerical modeling. It also presents approaches to obtaining the axial-flexural and shear capacities of CFSTs by examining provisions in the current Japanese, North American, and European CFST design standards.

Chapter 3 "Large-diameter concrete-filled steel tubes: Flexural test database, analysis, and design considerations" addresses the need to establish suitable approaches to obtain the axial-flexural capacity of CFST piles using a comprehensive database of large-diameter CFST flexural tests compiled from the literature. The test results are reviewed in detail, and the main findings from previous studies are summarized. Experimental results from the compiled database are used to evaluate the suitability of different approaches to calculate the moment capacity. In addition, seven sets of stress-strain models are selected to evaluate their accuracy in simulating the moment-curvature response of large-diameter CFSTs and Sakino et al.'s model is found to give the best results in terms of the overall moment-curvature response and moment capacity. Finally, a simplified method to obtain an idealized moment-curvature response of CFSTs is developed.

Chapter 4 "Fiber-based models to simulate axial-flexural response of concrete-filled steel tube piles" presents stress-strain models and numerical modeling approaches to simulate the nonlinear behavior of circular CFST piles. A fiber-based approach is used to simulate the response under combined axial-flexural loading. The suitability of the proposed numerical model is verified using existing test results of large diameter CFST piles covering a wide range of diameter-to-thickness ratios, axial load ratios, internal reinforcement ratios, and loading types. The verification process evaluates both local and global responses of the CFST members. The advantages and limitations of the existing modeling approaches are also discussed based on the comparison of simulated and measured responses.

Chapter 5 "Numerical modeling of noncompact and slender concrete-filled steel tubes under axial compression" states the need to establish numerical modeling approaches specifically targeted for noncompact and slender CFSTs. A database of experimental studies of axially-loaded noncompact and slender CFST stub columns is compiled from the literature. The database is used to calibrate and validate the modeling parameters for the FE model of CFSTs. Based on the validation with the experimental results, modeling recommendations are provided to simulate the full-range axial load-displacement response of CFSTs. The compiled database is used in conjunction with the results from the FE analysis to evaluate the same stress-strain models examined in Chapter 3 for a fiber-based analysis. Based on the results of quantitative comparisons, the most appropriate stress-strain models are identified as Sakino et al.'s model for the fiber-based analysis of CFSTs.

Chapter 6 "Experimental and analytical study on shear behavior of concrete-filled steel tube piles" discusses the hysteretic behavior, shear capacity, damage progression, and capacity-contribution of the steel tube and concrete. The experimental results are used with the existing test data to evaluate the approaches to calculate the shear capacity of CFST piles. A detailed finite-element model is developed and validated with the test results. The validated model is used to understand the shear-resisting mechanism and relative capacity contributions of the steel tube and concrete. The results highlight the need to revise the current approaches used to calculate the shear capacity of CFST piles.

Chapter 7 "Conclusions and recommendations" summarizes the achievements in the following three viewpoints: understanding the structural behavior of realistic-size CFST piles under axial load ratios representative of actual design conditions, identifying methods to compute the ultimate capacities in axial-flexure and shear, and establishing numerical tools appropriate for the design and analysis of CFST piles.

The work on flexural and shear performance of cast-in-place concrete-filled steel tube piles has a significant impact on the engineering community and academia to secure the safety of buildings and is considered sufficient for the degree of Doctor of Philosophy.