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論文審査の要旨（2000 字程度）

This thesis is entitled "**Flexural and Shear Performance of Steel-encased Precast Spun Concrete Piles**". It consists of seven chapters with an emphasis on a comprehensive study on the flexural and shear performance of steel-encased precast spun concrete (SC) piles using large-scale experimental data and numerical modeling in order to implement a practical design concept for the ultimate behavior under large earthquakes.

After stating background and objectives (**Chapter 1 "Introduction"**) and review of related codes and papers (**Chapter 2 "Literature review"**), **Chapter 3 "Detailed analysis of flexural behavior of steel-encased precast concrete piles based on existing experimental data"** presents an analysis using the test data of eleven precast SC pile specimens, taken from other papers and sources, to investigate the bending moment capacity, damage process, and failure criteria for flexural failure. For all specimens, the following features are observed in the loading test: the damage at failure state is characterized by local buckling of steel, concrete crushing at the outer layer of concrete, and spalling at the inner layer of concrete. Further, it is observed that the dominant mechanism changes from concrete crushing to steel buckling with an increase in axial load or reduction in steel to concrete strength ratio.

Chapter 4 "Axial-flexural capacity predictions by design codes" describes the applicability of stress distribution-based methods given in guidelines by AIJ-CFT (2008), Eurocode 4 (2004), and ANSI/AISC 360-16 (2016) for bending capacity of columns/composite members under axial-flexural loads. The applicability of strain compatibility-based method in the draft guidelines for SC piles in the AIJ committee (called "draft AIJ-Pile") is also examined. For this purpose, a database of 79 bending tests on SC piles is prepared. The scope of the dataset is defined by characteristic parameters including the ratio of axial load to axial load carrying capacity (called "axial load ratio") (-0.4–0.5), pile diameter to thickness ratio (36–133), member slenderness ratio (6.0–18.8), concrete compressive strength (81–123 MPa) and steel yield strength (301–521 MPa). Modifications are proposed to the "draft AIJ-Pile" for moment capacity to give conservative predictions with an error of less than 20% for all specimens in the database.

Chapter 5 "Numerical model development for flexural behavior" presents the development of a fiber-based finite element model of SC piles to simulate the moment-drift behavior under axial-flexural loads up to and beyond the peak response. The model is characterized by a single beam-column element in the damage zone at the base. The stress-strain relationship of steel in the damage zone follows a pipe or tube buckling model. For this, a hysteretic model for steel is developed with a linear falling branch and a constant stress branch after initiation of buckling. The enhancement of concrete strength due to confinement by steel casing is considered by using a confined concrete model. The member behavior is validated with the experimental data on thirteen specimens covering axial load ratios of -0.40 to 0.52 times the section capacity. It is found that the numerical model is able to simulate the flexural behavior of SC piles for axial load ratio from 0 to 0.30.

Chapter 6 "Experimental study on the shear behavior of steel-encased precast concrete piles" presents shear tests on 400 mm diameter SC piles conducted with the axial load ratio as the main parameter to investigate the shear capacity, damage process, and failure criteria for shear failure. For the SC pile with high compression axial load ratio of 0.5 and shear span to diameter ratio of 0.5, a brittle shear failure mode is observed, accompanied by a sudden loss of axial capacity to half of the initial value. From the extent of shear yielding along the cross-section, it is found that the entire section did not yield in shear at failure and the revision was proposed for the shear capacity equation in the "draft AIJ-Pile".

Chapter 7 "Conclusions and recommendations" summarizes the main results stated in each chapter and the conclusions obtained from this study. In addition, some suggestions for future study are stated.

This work on flexural and shear performance of steel-encased precast spun concrete piles has a significant impact on the engineering community to secure safety of buildings and deserves a doctor of philosophy.