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Evaluation of Seismic Resistivity of CFT Steel Pillar

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Summary

Aiming at establishment of a new seismic design method in which ductility is taken well into account, a series of alternating bending tests under constant axial compressive force with Concrete Filled Tubular, called CFT, steel pillar models were carried out. The study based on experimental results enabled the quantitative evaluation of seismic resistivity of CFT pillars. The fruits obtained through this study will be reflected in Model Code for Railway Hybrid Structure Design to be made public by Japan Ministry of Transport in 1997.

1. Introduction

Newmark's energy preservation rule is well known as a concept of the seismic design, where the ductility of pillars is taken into consideration. This idea is to check the bending yield point capacity to horizontal seismic load as corrected according to the ductility of pillars. In order to apply such a seismic design method to CFT pillars, it is necessary to establish the method of quantitatively evaluating the yield point load, yield point displacement and also relationship between the limit plastic displacement and the pillar components. Therefore, the study was done according to the following steps.

Step1 Alternating bending test with CFT pillar models
Step2 Analytical study on yield point load and yield point displacement
Step3 Statistical study on quantitative evaluation of ductility

2. Alternating bending test on CFT pillar models

The alternating bending test under axial compressive force with 1/3 models of CFT pillars was executed. The experimental parameters are diameter-thickness ratio, axial compressive force, concrete strength, and steel pipe strength.

3. Analytical study on yield point load and yield point displacement

The yield point load and yield point displacement were calculated with a fiber element model dominated by elasto-plastic stress-strain relationship of steel and concrete materials. *Figure 1* shows the comparison between the experimental values and the calculated ones.

4. Statistical study on quantitative evaluation of ductility

The expression of quantitatively evaluated ductility was induced from the recurrence analysis based on experimental results as well as on analytical ones. *Figure 2* shows the comparison between the calculated ductility and experimental one.

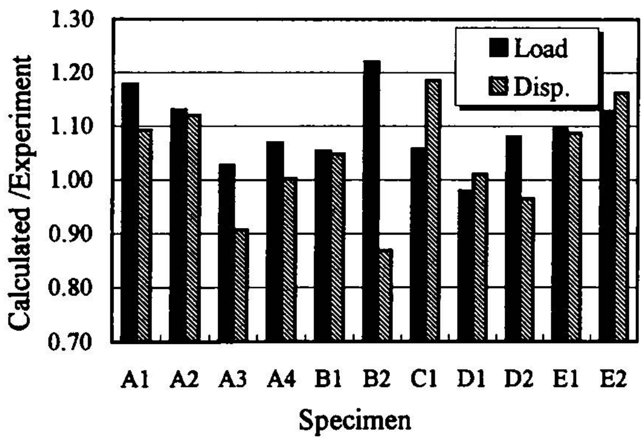

Fig 1 Yield Point Load & Displacement

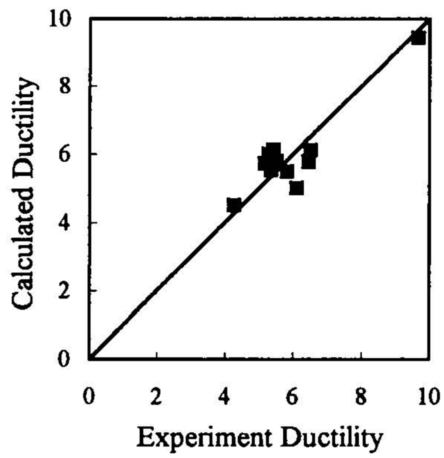

Fig 2 Ductility

5. Conclusions

The quantitative evaluation expression for seismic resistivity of CFT pillars was induced. As a result, a more rational and accurate evaluation of yield point load, yield point displacement, and ductility necessary for the seismic design of CFT pillars has been made possible.