39th IABSE Symposium – *Engineering the Future*
September 21-23 2017, Vancouver, Canada

Shaking Table Test Using Scaled Model of Reinforced Concrete Column Considering Time Variation from Similitude Conditions

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Abstract

In a scaled model test of RC column, mortar and micro concrete are broadly used as model concrete whose material characteristics are different to that of ordinary concrete for prototype. In this case strain ratio which denotes scale factor of strain becomes not unity, and this is so called strain distortion. Furthermore, from nonlinear material characteristics of concrete, the strain ratio becomes not constant but variable during model tests.

In similitude law, strain ratio is related to scale factor of time. It indicates that time of input ground acceleration used for model tests should be different to that used for prototype tests when variation of strain ratio is occurred. However many researches on dynamic test using RC model have not considered this similitude requirements and this can cause errors in predictions for responses of prototype.

In this study, shaking table tests using RC scaled model considering the strain distortion and the variation of strain ratio were conducted. Predicting the variation of strain ratio by a developed analytical procedure, input ground acceleration of model was modified by following the similitude requirements. Test results shows that accuracy of prediction for response of prototype is significantly improved when using the modified input ground acceleration.

Keywords: similitude law, scaled model test, strain ratio, RC column, shaking table test.

1 Introduction

For a scaled model test of RC column, strain distortion, which implies that strain ratio is not unity, should be considered by applying distorted model of similitude law [1, 2]. Also, the evaluated strain ratio is not constant but variable during scaled model tests due to nonlinearity in concrete.

In general, model concrete are typically not same to ordinary concrete of prototype, but steel is used for both prototype and model reinforcement. In this case, strain ratios for both concrete and steel are different. In this case, a method for evaluation of strain ratio which can represent the behaviour of whole structure is needed. But, there is no such method in Krawinkler and Moncarz [1], so it is not suitable for model test of RC structure.

Several researches provide modified similitude laws and evaluation methods of strain ratio (Meng [3], Kim et al. [4], Cho [5], Lee and Cho [6]). However, these studies do not guarantee exact predictions for responses of prototype and have some limitations.

Scale factor of time is related to strain ratio in the similitude law of Krawinkler and Moncarz [1] which means that time of model should be changed when

https://doi.org/10.2749/vancouver.2017.1790
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