The 2021 World Congress on
Advances in Structural Engineering and Mechanics (ASEM21)
GECE, Seoul, Korea, August 23-26, 2021

Effects of Diaphragm Flexibility on the Seismic Design Acceleration of Precast Concrete Diaphragms

*Dichuan Zhang[1)],Robert Fleischman[2)] , Deuckhang Lee[3)]

1) School of Engineering and Digital Sciences, Narzarbayev University, dichuan.zhang@nu.edu.kz
2) Department of Civil Engineering and Engineering Mechanics, University of Arizona
3) Department of Architectural Engineering, Chungbuk National University

ABSTRACT

A new seismic design methodology for precast concrete diaphragms has been developed and incorporated into the current American seismic design code. This design methodology recognizes that diaphragm inertial forces during earthquakes are highly influenced by higher dynamic vibration modes and incorporates the higher mode effect into the diaphragm seismic design acceleration determination using a first mode reduced method, which applies the response modification coefficient only to the first mode response but keeps the higher mode response unreduced. However, the first mode reduced method does not consider effects of diaphragm flexibility, which plays an important role on the diaphragm seismic response especially for the precast concrete diaphragm. Therefore, this paper investigated the effect of diaphragm flexibility on the diaphragm seismic design acceleration for precast concrete shear wall structures through parametric studies. Several design parameters were considered including number of stories, diaphragm geometries and stiffness. It was found that the diaphragm flexibility can change the structural dynamic properties and amplify the diaphragm acceleration during earthquakes. Design equations for mode contribution factors considering the diaphragm flexibility were first established through modal analyses to modify the first mode reduced method in the current code. The modified first mode reduced method has then been verified through nonlinear time history analyses.

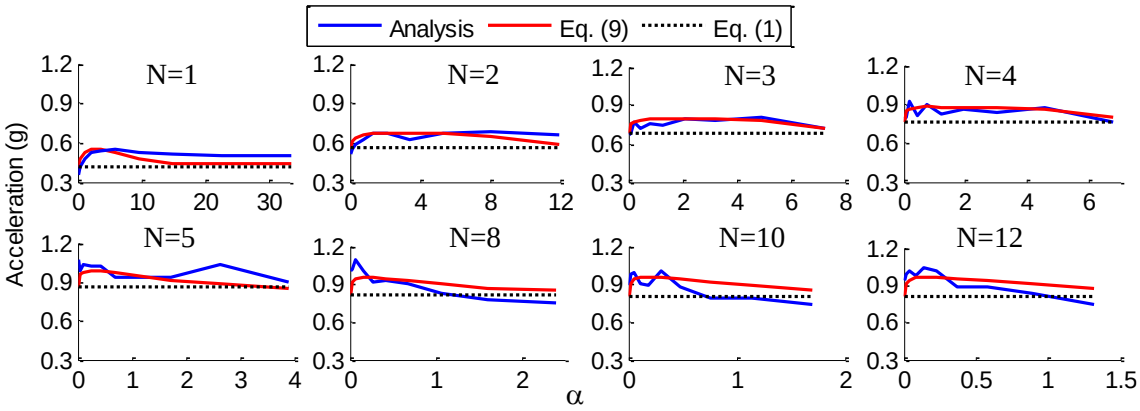

Fig. 1. Diaphragm acceleration demand comparison