INVESTIGATING SEISMIC DESIGN OF PRECAST CONCRETE DIAPHRAGMS USING PERFORMANCE BASED DESIGN METHOD

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Keywords: Diaphragm, Precast, Concrete, Seismic Design, Performance Based Design

Precast concrete is an economical, durable and fast construction system which is applicable in building and parking construction. However, the vulnerability of precast flooring systems during diaphragm action under earthquake loading limits using these systems in earthquake prone regions.

The main role of floor diaphragms is bearing gravity loads, transferring lateral loads to vertical lateral load resisting elements and preserving structural integration. Lateral loads are resisted by in-plane action of flooring system. Diaphragm is reinforced to carry in-plane shear, flexure, and anchorage forces (Moehle et al., 2010). In this article a seismic design method based on performance based design philosophy is investigated to design precast concrete double tee diaphragms without topping .

Two square and rectangular structures with insitu shear walls, precast framing and precast double tee flooring systems are investigated to find out their seismic response. Connectors between precast units are modelled by using nonlinear shear spring and nonlinear link elements to model shear connectors and using nonlinear spring element with nonlinear axial spring element to model chord reinforcement. The elements properties are derived from preceding experimental investigations.

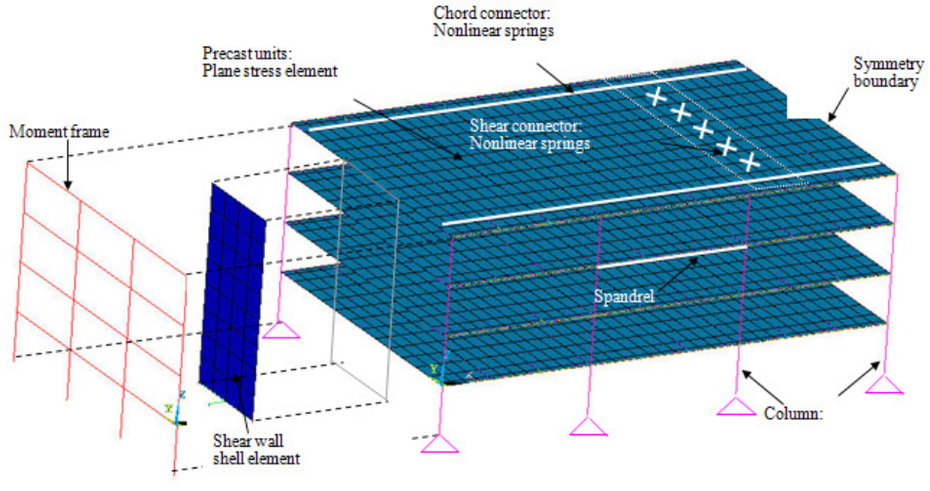

Figure 1. Modeling of evaluation structure

The proposed method's objective is to provide adequate strength and deformability of connectors between precast segments by amplifying lateral forces and shear forces between precast segments. Therefore seismic response of precast diaphragm can be inelastic.

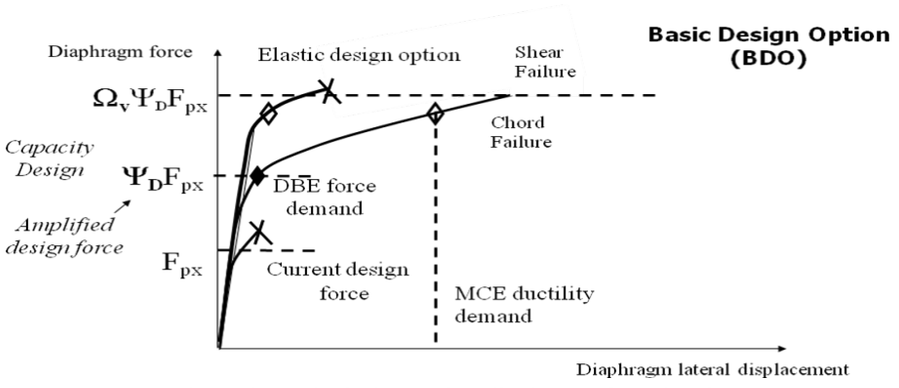

Figure 2. Basic design option diaphragm force levels

In many precast concrete systems with shear walls, the stiffness of the wall can be much more than the stiffness of the diaphragms. Such conditions, using a design method which ensures elastic response for diaphragms may not be feasible. It may be more appropriate, instead, to establish performance criteria that considers: (1) elastic limit response at life safety; and (2) the exhaustion of the diaphragm's available ductility at collapse prevention.

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