6 STRUCTURES PERFORMANCES OF PRECAST COMPONENTS UNDER IN-PLANE LATERAL CYCLIC LOADING

Nor Hayati Abdul Hamid, Shamilah Anudai @ Anuar, Kay Dora Abd Ghani, Nor Mayuze Mohamad and Nurliza Jasmi

6.1 INTRODUCTION

Poor performances of precast buildings during earthquakes were due to inadequate connections between the structures components, insufficient seating and anchorage and poor workmanship and quality materials used. It is important to investigate their seismic performance by conducting experimental work, analyzing the data and modeling them using nonlinear time history analysis of the earthquakes excitations. Three types of structural components for precast structures and Industrialized Building System (IBS) were designed, constructed, tested, analyzed and modeling in this chapter. These structural components are precast shear-key wall panels, beam-column joints and tunnel form building system. All these components were tested under in-plane lateral cyclic loading at Heavy Structural Laboratory, Faculty of Civil Engineering, Universiti Teknologi Mara, Shah Alam, Selangor. The seismic performance parameters of the buildings include lateral strength capacity, stiffness, ductility and equivalent viscous damping was determined using the measured hysteresis loops during experimental works. The findings from this research works can be implemented and enforced by the government and local authorities to use current seismic codes of practice (Eurocode 8). In Eurocode 8, the special attention needs to focus on the joint detailing of precast structures components while designing and constructing the precast buildings.

The design concepts and detailing of the jointing precast structural components can contribute significantly to the overall seismic performance of precast buildings under earthquakes excitations. A lot of structural damages had occurred during past earthquakes because the civil engineers were not using the current seismic code of practice and poor detailing especially at the jointing system. Recently, precast tilt-up buildings become the most vulnerable structures under earthquake excitations. This is due to lack of attention given to the detailing at joints such as wall-foundation interfaces, wall-column interfaces and beam-column interfaces. A lot of structural failures occurred at these interfaces because the vertical and horizontal loads such as dead load, live load, wind load and earthquake load are failed to transfer them from the joints to the foundation. The first major destructive earthquake was occurred on the tilt-up buildings during the 1964 Alaska Earthquake with M9.2 scale Richter where the collapse of these buildings at Elmendorf Air Force Base, Anchorage Alaska (Berg and Stratta, 1964). Followed by the 1971 San Fernando Earthquake with M6.6 scale Richter, there were severe structural damages to precast wall panels and roofs of the Vector Electronics Building, San Fernando, California (Murphy, 1973).

Consequently, the 1994 Northridge Earthquake caused the connections failure between precast wall panels and precast beams interfaces of the parking garage (Iverson and Hawkins, 1994). Later on, the 1999 Kocaeli Earthquake caused partial collapse of the three agricultural warehouses at Arifiye, Turkey which made from precast wall panels (Krinitzsky *et al,* 2000). Subsequently, the 2001 Bhuj Earthquake had caused a total numbers of 106 precast schools buildings were totally collapse in Bhuj, India (Ghosh, 2001). The