Chapter 1
Introduction

The use of high-strength concrete (HSC) in reinforced concrete structures is becoming popular in all over the world. Production of HSC became more available even under normal site conditions because of the great development in the construction industry. Developments in the concrete technology allow a concrete strength of 100 Mpa or higher to attain without difficulties.

The structural importance of using HSC appears clearly in construction of concrete platforms, marine structures, tall buildings and long-span bridges. Recently, the application of HSC in flat slabs structural system has become more common. In the structural analysis of flat slabs, the punching shear capacity has a noticeable effect on the slab design parameters including slab thickness, the supporting column dimensions, etc. However, the design provisions for the punching shear strength incorporated in the various building codes are essentially follow the empirical procedures derived from tests on slabs specimens of normal strength concrete. Most of the available research works have studied the punching shear for normal-strength concrete (NSC) slabs. The design variables defined to affect the behavior of punching shear of the slabs include the thickness of slab, shear reinforcement, existing of opening, column dimensions and concrete strength. A comprehensive literature review revealed that only a few experimental studies have been conducted on punching shear strength of high-strength concrete flat slabs. Most of these investigations are concerned with centric punching shear behavior of the slabs. The published investigations on the slab behavior under eccentric loading were mostly made conducted on NSC flat slab specimens.

This research work is aimed to study experimentally the punching shear behavior of HSC slabs under eccentric loading. Comparisons of test results with the available analytical methods and design codes were conducted. The study

includes the effect of load eccentricity, the shear reinforcement, slab thickness and the effect of openings on the slab behavior in punching shear. General recommendations on the design methods presented in the widely used design codes.

Applicability of non-linear finite element method, as in corprated in ANSYS software, to predict the shear response of flat slabs has been also investigated.

The research study contains six chapters as follows:

Chapter 1: presents an introduction for the research.

Chapter 2: presents a review on the available research studies on the punching shear behavior of flat slabs. The chapter includes a brief discussion on the building codes provisions for punching shear.

Chapter 3: presents the experimental program conducted in this research, including test slabs details and materials and the testing procedure.

Chapter 4: introduces a through discussion on the experimental results and observations investigating the effect of the studied parameters.

Chapter 5: includes analytical discussion and comparisons between the experimental results and the code predictions. The comparisons also cover the non-linear finite-element results.

Chapter 6: includes the conclusions and recommendations for further research works.