Chapter 1
Introduction

Fiber reinforced polymer composites are materials composed of reinforcing fibers like carbon and resin materials like epoxy. Nowadays there is a great demand for the use of composite materials in different fields of life including the constructions field. Composites have a good potential to resolve many construction problems due to their high strength to weight ratio, high tensile strength, high modulus of elasticity and its fatigue resistance. Composites are used as fabrics to wrap around corners and on convex surfaces or as prefabricated laminates in various sizes and shapes. One of the most common types of composites of FRP is Carbon Fiber Reinforced Polymer "CFRP".

In recent years, Carbon Fiber Composite Polymer (CFRP) has been adopted in the field of Structural Engineering to strengthen most of the structural elements. The CFRP is available in the form of fabrics or laminates and may be applied to many of the structural elements including slabs, beams, and columns. Most of the research studies were focused on the behavior of reinforced concrete beams and columns strengthened with CFRP. While RC corbels are fundamental structural elements in bridges and pre-cast industry, published research work on the shear behavior of strengthened corbels is limited.

The objective of this study was to evaluate the performance of externally bonded CFRP fabrics in enhancing the load-carrying capacity in shear of reinforced concrete corbels. The study presents the experimental results of five full-scale concrete corbels strengthened with CFRP fabrics.

Non-linear finite element analysis; NLFEA was carried out using ANSYS-8.0 to investigate the shear behavior of strengthened R.C corbels including the cracking and load-carrying capacities, and the load-deflection response. A parametric study

was conducted to assess the significance of strengthening technique, concrete strength, shear reinforcement, flexural reinforcement content, and shear span to depth ratio. Finally, the ECP-203 provisions on the reinforced concrete corbels were investigated.

Chapter 2

Chapter 2 includes a review on the available research studies on the shear strengthening of reinforced concrete beams and corbels.

Chapter 3

Chapter 3 presents the experimental program including the test corbels details and materials, instrumentation, and testing setup and procedure.

Chapter 4

Analysis and discussion on the experimental results and observations to investigate the potential of the strengthening parameters are introduced in Chapter 4.

Chapter 5

Chapter 5 introduces a comparison between the experimental results and the failure load predictions as per the common building codes as well as NLFEA results. A parametric study using the non-linear analysis to investigate a wide range of corbels parameters is also presented.

Chapter 6

Conclusions and recommendations for further research work are drawn in this chapter.