

## Chapter one

### Introduction

#### 1.1 General

Concrete structures are subject to various deterioration processes during their lifetime. Those deterioration processes can be physical, chemical or mechanical. Physical causes of deterioration include the effects of high temperature, alternating freezing and thawing, differences in thermal expansion of aggregate and so on. Chemical attack can either be internal, including alkali silica and alkali carbonate reactions, or external which occurs mainly through the action of aggressive ions such as chlorides, sulphates or of carbon dioxide. Mechanical damage is caused by impact, abrasion, erosion or cavitations.

One of the major mechanisms leading to degradation of concrete structures is corrosion of the reinforcement. To design concrete structures with regard to service life requires that the degradation of the reinforcement has to be predicted in advance. To predict the service life of a concrete structure requires having knowledge about the deterioration mechanisms that a structure can be subject to and the influencing factors like material properties, environmental processes and execution of the works. With respect to, the most common deterioration processes and the various factors affecting durability of concrete are the subject matter. During recent years, much research on the durability aspects of reinforced concrete has been carried out, and lifetime design and assessment based on probabilistic approaches have been developed. The corrosion process transforms steel reinforcement into rust, leading to (a) area reduction and ductility change of the reinforcement bars, and (b) volume expansion that generates splitting

stresses in the concrete, which may crack and spall the concrete cover; this can affect the bond between reinforcement and concrete. The ductility of a corroded bar depends on exposure environments

## **1.2 Importance of the research**

The importance of this research is to provide and an overview to effective of corrosion on load carrying capacity of service life in concrete structures.

## **1.3 Research Objectives**

The overall objective of the research is to investigate the degradation of concrete structures due to reinforcement corrosion; and the possibility for shear force and moment redistribution and limits the load –carrying capacity of concrete structures after corrosion.

## **1.4 Research Questions and Hypotheses**

The structure nature which we considered in this research is subjected to deterioration due to corrosion of steel reinforcement in columns by corrosion rate in the area of reinforcement (see Appendix [A]); the critical column [CL 15] under consideration in this structure which exposed to different ratios of corrosion [0%, 2%, 4%, 6%, 8%, 10%, 12%, 14%, 16%, 18%] [in accordance to ductility variation].

So, the research question, how the reduction in area of steel and change in rebar ductility are effect in the carrying capacity of structures.

## **1.5 Research Methodology:**

The research methodology for this study focused on introducing the introduction of deterioration processes, expected service life of structure, factors for durability of concrete for adoption during design / construction stages, causes of early deterioration of concrete structures, corrosion of reinforcement in concrete, effect of cracking on the life or durability of structure, design and detailing for durability, and design crack width calculation.

In this research we used computer programs named Etabs and Prokon to analysis and redesigns of the structure under consideration .Also limits the load –carrying capacity of concrete structures after corrosion.

## **1.6 Outline of the research:**

The research consists of six chapters beginning with this introductory chapter, stating the background and research objective as mentioned above. In this research, for the readers convenience. The literature reviews stated in chapter (Two): introduction, expected service life of structure, factors for durability of concrete for adoption during design / construction stages, Causes of Early deterioration of concrete structures, corrosion of reinforcement concrete ,Effect of Cracking on the Life or Durability of Structure, design and detailing for durability, and design crack width calculation,

Chapter (Three): The Problem Statements,

Chapter (Four): Results and Discussion of Results,

Chapter (Five): Conclusions and recommendations.