CHAPTER 1

Introduction

1.1 Introduction

The task of structural modeling is arguably the most difficult one facing the structural engineer, requiring critical judgement and sound knowledge of the structural behavior of tall building components and assemblies. Also, the analysis results must be interpreted and appraised with discernment for use with the real structure, in order to serve as a reasonable basis for making design decisions.[3]

Tall towers and buildings have fascinated mankind from the beginning of civilization, their construction being initially for defense and subsequently for ecclesiastical purposes. Tall commercial buildings are primarily a response to the demand by business activities to be as close to each other and to the city center, as possible, thereby putting intense pressure on the available land space. Also, because they form distinctive landmarks, tall commercial buildings are frequently developed in city centers as prestige symbols for corporate organizations. Further, the business and tourist community, with its increasing mobility, has fuelled a need for more, frequently high-rise, city center hotel accommodations. [3]

In last two decades, the tall building concept was wildly spread over the world. Sequently, a great revolution occurred for materials and machines that used in construction. As a result to this development, many forms of building appeared to satisfy the increasing desire in this industry. The unique mechanical properties of structural steel gave it the priority in tall building construction. As every construction case, it was necessary to study the steel behavior under the effect of different loads on tall building. The main problem faced was the

decrease of degree of stability of the building while increasing the height. Because the light weight of the steel comparing with its capacity, many solutions and suggestions stated to support the frame by using (a proper lateral force resisting frame, bracing system or may combined them both) bracing system according to the architectural and structural state of building. For the same reason, many types of form of tall building skeleton used to satisfy the stability condition. Eventually, the structural designer had to deal with this variables to get the best results for the studied case. [3]

The methods of analysis presented are, almost without exception, static, and assume linear elastic behavior of the structure. Although wind and earthquake forces are transient in nature, it is reasonable and practical to represent them in the majority of design situations by equivalent static force distributions. Although recognizing that concrete and masonry behave in a nonlinear manner, a linear elastic analysis is still the most important tool for deciding a tall building's structural design. Techniques do exist for the prediction of inelastic behavior, but they are not yet sufficiently well developed to be appropriate for undertaking a detailed analysis of a highly indeterminate tall building structure. Methods suitable for both preliminary and final analysis are described and, where appropriate, detailed worked examples are given to illustrate the steps involved. Although computer-based matrix techniques form the most versatile and accurate methods for practical structural analysis, attention is also devoted to the more limited and approximate continuum techniques. These serve well to provide an understanding of structural behavior and their generalized solutions indicate more clearly and rapidly the influence of changes in structural parameters. Such an understanding can be valuable in selecting a suitable model for computer analysis. [4]

1.2 Objectives

The objectives of the research were summarized as follows:

1. Awareness of the structural forms of tall building.
2. Awareness of bracing system types.
3. Study the simulation of tall building using structural analysis software program (ETABS 2013).
4. Study the degree of stability of selected types of structural forms of tall building using different types of bracing.
5. Compare the behavior of tall buildings to select the frame with minimum weights.

1.3 Methodology

The tools that used in this research were stated as follows:

1. The standard ASCE 7-10 - the minimum design loads for buildings and other structures – was used to get the loads that applied to buildings.
2. The structural analysis software program - ETABS 2013 - was used to analyze the selected tall building forms.
3. The standard AISC 360-10 - specification for structural steel building was used for design of the frames.
4. The standard AISC 14.0 database manual was used to get the steel sections.

1.4 Thesis Outline

This research consist of five chapters. Chapter one shows a brief overview about tall building, used tools in the study, objectives and thesis outline. Chapter two describes types of tall building frames and bracing system. Also, the structural steel types, information about the structural analysis computer program (ETABS 2013), the loading types, and the loads be

determined. Chapter three explains the modelling of frames of tall building the analysis results in tables and figures. In chapter four the results were discussed, and building behavior was studied to find out the minimum building weight. Finally, the chapter five includes conclusions and recommendations.