Chapter one

introduction

1.1. Introduction

Generally rigid frame systems are not efficient for buildings taller than about 20 stories because the shear component of deflection due to bending of columns and girders causes the drift to be too large. A braced frame improves upon the efficiency of a rigid frame by virtually eliminating the bending of columns and girders. This is because by adding web members such as diagonals or chevron braces, the horizontal shear is resisted by the web. The webs carry the lateral shear predominantly by axial forces in the braces thus minimizing bending of beams and columns.

subsequently we can say braced frame is an efficient structural form and economical for resisting horizontal loading. Because it acts as a vertical truss with the columns as chords and the braces and girders as web members.

In this research we studied different bracing configurations in two different fundamental models in order to study and compare:

- Deflections and drift index of different types of braced frames against rigid frame.
- Total weight of braced frames members against rigid frame.

1.2. Problem statement

The main reason for choosing the wind forces as the main source of lateral force is that the most severe damages in multi-storey steel structures are caused by winds, and since there are lots of possibilities of bracings used in wind resistance, choosing the appropriate one and minimizing the structure weight and subsequently the cost is the major concern in the design of steel buildings.

1.3. Objectives of study

1.3.1. General objectives

1- knowledge of the usable bracing types in wind loads resistance.

2- To learn how to use ETABS program in analysis of the multi-storey steel buildings.

3- To learn how to calculate wind loads according to the requirements of the British standard.

4- Knowledge of methods which use in the analysis of high steel buildings.

1.3.2. Specific objective

1. To study the effect of bracing types on the stiffnesses of multi-storey steel braced frame buildings in form of the ratio of the maximum deflections at the top of the building to the total height (drift index) and compare these ratios with the ratio of the rigid frame.

2. To study the effect of bracing types on multi-storey steel braced frame buildings in form of the weights of members and comparing them with the weights of rigid frame members.

1.4. The research hypothesis

- Using of the braced frames in multi storey steel buildings reduces the drift index of the rigid frame, and the double diagonal bracing type(x-shape) gives a drift index less than the other bracing types .
- Using of the braced frames reduces the total members weights of the rigid frame, and the bracing types in which the diagonals connect to the girder at a significant distance from the girder ends, for example (k-shape, V-shape and quadrangular) gives a total members weights less than the other bracing types.

1.5. Methodology of research study

In order to study the effect of different bracing types on braced frame in terms of lateral displacement of stories and the members weights; two basic models of multi storey steel buildings had been selected ; analyzed and designed for wind loads along both major and minor axes additional to gravity load by Etabs program (linear static analysis had been performed)with different bracing types in each model ; and the results had been compared with the rigid frame.

1.6. Research Outlines

Chapter [1]: includes an introduction to research and clarifies the thesis objectives, the methodology used in this research and Research Outlines.

Chapter [2]: includes a general introduction, structure materials and types with detailed information about the steel structures.

This chapter is also includes an introduction to multi-storey steel structures comprehensive advantages, structural systems and components of multi storey steel buildings, types of bracings, basis of comparisons for Multi-storey buildings.

Also this chapter including a detailed information about braced frame, types, behavior of bracing under lateral and gravity load, behavior of

bracing bent, types of loads in multi-storey buildings with detailed information about wind loads and it calculations.

Also it includes the most important manual methods of calculation forces and drift in multi-storey steel braced frames, computer software which we are used in the analysis of models (Etabs) and fragment of the method which the program is working with (finite element method);and finally it contains the stiffness and drift limitation in tall buildings.

Chapter [3]: includes a general introduction, modeling and frames information's of models which we used in this research, loads (dead, live and wind loads and it calculations), and the analysis and design procedure for models under study.

Chapter [4]: includes the results obtained by Etabs-program and discussing it in form of comparison with rigid frame.

Chapter [5]: includes a conclusion of results that had been reached from chapter four and selection of the optimal configuration of bracings depending on the results of analysis. This chapter is also includes the most important recommendations to the researchers whose wants to expansion in this research.