CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

There are many types of frame in steel construction industry. Portal frame is one of the famous frame that is widely used especially for single-storey industrial building. The dominance of the steel construction for single-storey non-domestic buildings is demonstrated when the estimation of usage of steel frames by non-domestic buildings is more than 90% (Davidson & W. Owens, 2012). Steel is more preferred to be used as material for portal frame. There are some characteristics of steel that allow it to be chosen as material for portal frames. They are relatively light, long-span and durable. Besides that, they are very simple, can be quickly erected, and developments in steel cladding have enabled architects to design economical buildings with attractive appearance to meet a wide range of applications and budgets. Portal frame has great stability against lateral and vertical actions. This make portal frame the best choice of single-storey building. A portal frame can be very rigid and stable in plane with moment-resisting connections (Davidson & W. Owens, 2012).

There are some advantages of using portal frames. Portal frames can span 15-45 meters easily without support. This will allow larger area of free floor space to be used which is very suitable for single-storey industrial building. Erection of portal frames can be 20% quicker than common building. Besides that it is more economical because metal
in portal frame is lesser than a truss frame. The cost also can be saved by using universal beams to construct (University Deakin, 2004).

The 3D portal frame that going to be analyzed in this research is to be 12m in total height. The width of the portal frame is 12m also as shown in Figure 1.1 below. As the frame has 12m in height, it is sustaining wind load. Wind load is considered in this research.

![Figure 1.1: Side View and Dimension of 3D Portal Frame](image)

The portal frame is offset with 5m distance until 40m to form a single-storey industrial building. According to Figure 1.2 below, there are extra bracing at the top middle of the roof because there are opening because it is the entrance of the building.

![Figure 1.2: Top View and Dimension of 3D Portal Frame](image)
1.2 PROBLEM STATEMENT

2D Portal frames are easy to be analyzed manually. However, it is hard to analyze 3D portal frame. There are a few layer portal frames connecting by bracing to form 3D portal frames. The structure is complicated. It also takes a lot of time to analyze it which also cause higher cost to design a structure with 3D portal frame. There are a lot of software can be used to analyze portal frame. ANSYS is one of the software that very useful in analyzing complicated structure. Modeling 3D structure is also very easy by using ANSYS. By using ANSYS, it helps to save a lot of time and cost when designing a structure.

Although there are much research on truss, beam, column, frame and bridge outside, but they are mostly on 2D analysis and not applicable when it comes to the real construction of it. There is less research on 3D portal frame using ANSYS program also due to unfamiliar using of ANSYS to analyze 3D structure. In this research, maximum deflection, deformed shape, and checking according to Eurocode 3.

1.3 OBJECTIVE

Research objectives are an important part for every project or thesis in order to conduct the research well. It acts as guidance for researcher to achieve the final objective and avoid researcher to digress. Objectives are also important for researcher to understand and remind themselves of the criteria and testing that should be done in a research. The main objectives of this research are:

(i) To determine the behavior of 3D portal frame
(ii) To make sure the portal frame pass all the code checking
(iii) To make sure the portal frame is stable against deflection and deformation
(iv) To determine the response behavior of portal frame under deflection
(v) To determine the behavior of portal frame under point load and wind load