CHAPTER 1

INTRODUCTION

1.1 Background of the research

Beam is a main element in structural system. It is horizontal member that carries load through bending (flexure) action. Therefore, beam will deflect when it is loaded. Beam transfers the loading from slab to columns walls or girders. Generally, beam carry gravitational loads but can also be used to carry horizontal loads (i.e. loads due to a gust of wind or an earthquake).

Beams are characterized by their profile (shape of their cross section) their length and their material. In contemporary construction, beams are typically made of steel, reinforced concrete or wood. One of the most common types of steel beam is the I-beam or wide flange beam, commonly used in steel- frame buildings and bridges.

Internally, beams experience both compressive and tensile stress as a result of the loads applied. Under gravity loads, the top of the beam is under compression while the bottom of the beam is under tension, having the middle layer of the beam relatively stress-free.

Beam will deflect when it is loaded. Deflection is an important issue to the beam. Large deflection could lead to beam failure (Ahmad, 1999). There are several methods that can be used for beam analysis. The methods include Double Integration Method, MacCaulay Method, Moment Area Method, Virtual Work Method, Super Imposed Method, Coupled Beam Method, Energy Method and Castigliano Theorem (Ishak and Sulaiman, 1999). These methods can be considered as analytical solution. In analytical solution, it is assumed that beam supports were located at the beam neutral axis. On the effect of wide support, there are several composite slab experimental tests that use pour stop or end stop at the edge of the slab or beam. One example of this condition was obtained from Abdullah, R (2004). The pour stop at the outer side of the support may provide some stiffness to bending. While in fixed end condition, beam is rigidly connected to supports such as columns and therefore its stiffness increases.

1.1.1 Beam Support

Generally, there are three types of beam support that are idealized in design and analysis which are roller, pin and fixed.

i) Roller

- Roller provides resistance in one direction only. Figure 1.1 shows roller connection.

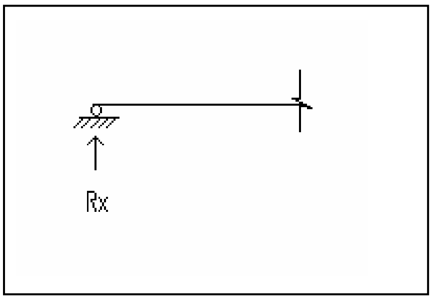

Figure 1.1: Roller Support

ii) Pin

- Pin joint will prevent beam to move in *y* direction and *x* direction, but allow beam to rotate. Therefore, no moment induce in this connection.

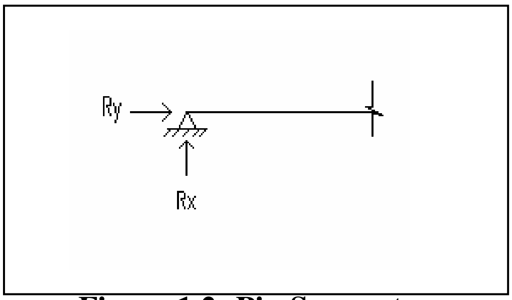

Figure 1.2: Pin Support

iii) Fixed end

- Fixed end provide resistance in both x and y direction and rotation and therefore able to persist moment.

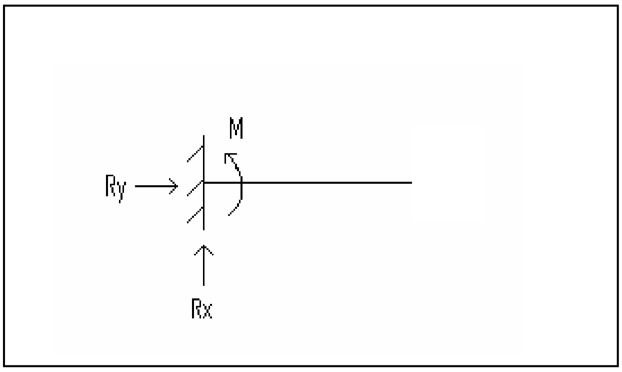

Figure 1.3: Fixed End Support

1.2 Statement of Problem

Traditionally, analytical methods assumed beams to be supported at their neutral axes. In these methods, eccentricity between beam support and beam neutral axis is neglected. However, in most bending tests, beam specimens are supported at the bottom face. This produces a vertical eccentricity between beam support and beam neutral axis. Beams are also rested on wide support as oppose to point supports Pour stops were introduced at the outer side of support in most of composite slab test. For monolithically joint beam, column size effect beam stiffness. What are the effects of the eccentricity, support width and column size to beam stiffness?

1.2 Objectives

The objectives of this project are

i) To determine the effect of eccentricity between beam support and neutral axis to beam stiffness.
ii) To determine the effect of wide support as oppose to point support.
iii) To determine the effect of column size to beam stiffness.

1.4 Scope of Work

The scope of the work carried out in this study is limited to:

i) Linear stress analysis of hypothetical beams
ii) The models are 2-D Finite Element in plane stress condition, using linear elastic materials
iii) Beam and column materials were made from concrete unless stated.
iv) Analysis are performed to examine
    - The effect of vertical eccentricity at support.
    - The effect of restraining the beam, ends at supports on the beam stiffness.
    - The effect of column beam size to stiffness.