CHAPTER 1
INTRODUCTION

1.1. Introduction

The pre-cast rib and block floor system has become a commercially viable and advantageous flooring system in the housing, commercial and industrial building sector. The system comprises individual hollow-core blocks suspended on pre-cast, pre-stressed concrete lintols. A concrete topping with mesh reinforcing is added to form the suspended slab. The advantages that the pre-cast flooring system has above conventional in-situ reinforced concrete slab systems are:

- The system is modular thus facilitating the construction procedure and the need for a specialist concrete flooring sub-contractor is eliminated.
- Only temporary propping is required and thus expensive formwork is eliminated.
- Erection is fast track and requires no specialized skills.
- With the use of the hollow-core blocks the dead weight can be reduced up to 40%.
- The system is very cost effective in outlying areas where transport costs can become a factor.

The system also retains the high degree of thermal and acoustic insulation that is achieved with a conventional reinforced concrete solution.

Various research programs in literature were investigated to ascertain the use of cold-formed steel sections in rib and block floor slab systems. A detailed overview of the programs are given in Chapter 3. The three main experimental programs that are interrogated in this research project are listed below:

- University of Windsor – 1982 (Addel-Sayed)
- California State University – 1989 (Nguyen)
- University of the Witwatersrand – 2004 (Komacec)
The advantages of using steel sections to replace the conventional pre-cast concrete rib are as follows:

- The architectural aesthetics of the exposed steel sections.
- The use of polystyrene void formers which can be removed and replaced with ceiling board resulting in a modular ceiling system.
- The lightweight properties of the system result in an overall cost reduction on all structural members of the building.
- Faster and more efficient handling on site as a result of the lightweight nature of the steel sections.
- Reduction in transport costs.

1.2. Problem Statement

The above tests revealed that de-bonding occurred between the steel section and the concrete rib at positions of high shear forces. The de-bonding reduced the structural integrity of the composite section at these positions and resulted in early shear failure of the concrete rib. For the composite beam to behave more efficiently the horizontal shear phenomenon would need to be investigated more in depth. The following issues need to be addressed in the study:

- A quantitative assessment of the horizontal shear in the composite beams.
- A comparative study to assess the use of shear-bond connectors to improve horizontal shear.
- Evaluation of vertical shear, flexure, and deflections without the use of shear-bond connectors.
- Design guidelines to use of lipped channel steel sections in rib and block floor systems.

1.3. Objective and Scope of Work
The primary objective of this study is to do an in-depth evaluation of the horizontal shear as well as to assess the vertical shear, flexure and deflections in composite beams using cold-formed steel sections. The scope of work would include:

- Develop a theory to quantitively assess the horizontal shear in composite beams.
- Do a comparative study between the theory and the experimental results obtained from previous research.
- Evaluate the vertical shear in composite members without the use of shear bond connectors.
- Evaluate flexure in composite members without the use of shear connectors.
- Evaluate short term deflections in composite members.
- Propose design parameters for rib and block floor systems using cold formed lipped channel steel sections.