

**THE BEHAVIOUR OF CONCRETE FILLED THIN WALLED
STEEL COLUMN UNDER CONCENTRIC LOAD**



**INSTITUT PENGURUSAN PENYELIDIKAN
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR, MALAYSIA**

DISEDIAKAN OLEH:

**PUAN CLOTILDA PETRUS
EN JOE DAVYLYN NYUIN**

DECEMBER 2009

TABLE OF CONTENTS

PENGHARGAAN	i
TABLE OF CONTENTS	ii
LIST OF FIGURES	vi
LIST OF TABLES	vii
ABSTRACT	viii

CHAPTER 1 INTRODUCTION

1.1 Introduction	1
1.2 Background	1
1.3 Problem Identification	3
1.4 Objectives of Research	4
1.5 Scope of Work	6
1.6 Organization of Report	7

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction	9
2.2 Concrete filled steel tubes column	9
2.2.1 Confinement effect	11
2.2.2 Bond strength	15
2.2.3 Short CFT column	16
2.2.4 Slender CFT column	17

2.3 Concrete filled thin walled steel tubes column	17
2.3.1 Local buckling of steel shell	20
2.3.2 Local buckling in CFT	21
2.3.3 Residual Stresses in steel tubes	22
2.3.4 Basic Effective width formula	24
2.4 Stiffened CFT	28
2.2.5 Ductility and post failure strength reserve	33
2.5 Overview on the design code provision on CFT	34
2.5.1 Eurocode 4	35
2.5.2 American Concrete Institute (ACI)	36
2.5.3 American Institute of Steel Construction (AISC)	38
2.5.4 British Standard 5400 (BS5400)	40

CHAPTER 3 METHODOLOGY

3.1 Introduction	41
3.2 Stiffening Method	42
3.2.1 Preparation of Built-up Steel Tubes	43
3.2.2 Material Properties	47
3.3 Axially loaded Stub Column with tab stiffeners	48
3.4.1 Experimental Program	49
3.4.2 Test Set-up and instrumentation	53

CHAPTER 4 RESULTS AND DISCUSSIONS

4.1 Introduction	56
4.2 The material properties	57

4.3 Experimental Results	58
4.4 Failure mechanism	58
4.5 Compressive Strength	61
4.6 Effect of different parameters on load bearing capacity	62
4.6.1 Effect of stiffeners height	63
4.6.2 Effect of tab stiffener	66
4.6.3 Effect of different tab stiffeners spacing	69
4.6.4 Effect of cross sections shape	71
4.6.5 Effect of different loading conditions	74
4.7 Effect of different parameters on ductility	78
4.7.1 Effect of stiffeners height	79
4.7.2 Effect of tab stiffener	81
4.7.3 Effect of different tab stiffeners spacing	82
4.7.4 Effect of cross sections shape	83
4.8 Load carrying capacity predictions	84

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions	88
5.5 Recommendations	91
References	92

ABSTRACT

Concrete filled steel tube (CFT) column is a structural system with excellent characteristics structurally and economically as compared to other types of column system. The enhancement of CFT structural behaviour is contributed by the confinement effect provided by the steel tubes to the concrete core. The confinement effect is very effective in circular cross-section as compared to rectangular or square cross-sections. Therefore, stiffening measures are normally employed when square or rectangular tubes are used, especially for thin walled steel section. This study was looking at the potential of utilizing concrete filled square thin walled steel section with a newly proposed stiffening system as structural composite column. The effectiveness of the proposed stiffening system in terms of strength and ductility was studied experimentally on 47 numbers of short CFT columns, when subjected to axial concentric load. The stiffness rigidity, different cross-section shape and different loading conditions are the main parameters studied in this project. The stiffening system was observed to contribute largely to the load bearing capacity of concrete filled thin walled steel short column. The effect of increasing the stiffness rigidity has a significant influence in square specimens but only moderate effect on octagonal specimens. It was also found that the highest ultimate strength obtained when the CFT column was loaded on entire sections. Generally, the proposed stiffening method can improve the ultimate strength capacity of concrete filled thin walled tubes provided the stiffeners are adequately designed.