

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	ABSTRACT	v
	LIST OF TABLES	xv
	LIST OF FIGURES	xvi
	LIST OF SYMBOLS AND ABBREVIATIONS	xix
1	INTRODUCTION	1
	1.1 GENERAL	1
	1.2 BEAMS WITH CORRUGATED WEBS	1
	1.3 BEAMS WITH ENCASED CORRUGATED WEB	2
	1.4 NEED FOR THE STUDY	3
	1.5 SCOPE OF THE STUDY	4
	1.6 OBJECTIVES OF THE STUDY	5
	1.7 ORGANISATION OF THE THESIS	5
2	REVIEW OF LITERATURE	7
	2.1 GENERAL	7
	2.2 OVERVIEW OF LITERATURE	7
	2.2.1 Studies on Hot-Rolled Steel Beams with Trapezoidally Corrugated Web	7
	2.2.2 Studies on Composite Hot-Rolled Steel Beams with Trapezoidally Corrugated Web	18
	2.3 SUMMARY	20

CHAPTER NO.	TITLE	PAGE NO.
3	EXPERIMENTAL INVESTIGATION	21
3.1	INTRODUCTION	21
3.2	MATERIAL PROPERTIES	21
3.2.1	Cold-Formed Steel	21
3.2.2	Concrete	23
	3.2.2.1 Materials used	23
	3.2.2.2 Compression strength of concrete	24
	3.2.2.3 Split tension strength of concrete	25
3.3	TEST PROGRAM ON BEAMS	26
3.4	FABRICATION OF THE SPECIMENS	31
3.4.1	Beams without Concrete Encased Web	31
3.4.2	Beams with Concrete Encased Web	33
3.5	TEST SET-UP	34
3.6	SUMMARY	36
4	FINITE ELEMENT ANALYSIS OF COLD-FORMED STEEL BEAMS	37
4.1	GENERAL	37
4.2	ABOUT ANSYS WORKBENCH	37
4.3	MODELING OF COLD-FORMED STEEL BEAMS	38
4.3.1	ANSYS Workbench Element Shapes	38
	4.3.1.1 3D solid bodies	39
4.3.2	Material Properties	39
4.3.3	Modelling and Meshing the Geometry	40
4.4	APPLICATION OF LOADS AND BOUNDARY CONDITION	41
4.5	SUMMARY	43

CHAPTER NO.	TITLE	PAGE NO.
5	RESULTS AND DISCUSSION	44
5.1	GENERAL	44
5.2	LOAD DEFLECTION BEHAVIOUR OF THE SPECIMENS	44
5.2.1	General	44
5.2.2	Cold-Formed Steel Beams with Plain and Trapezoidally Corrugated Web	45
5.2.2.1	Specimens with 150 mm depth	45
5.2.2.2	Specimens with 200 mm depth	48
5.2.2.3	Comparison of strength capacity of the specimens with plain and trapezoidally corrugated web	52
5.2.3	Encased Beams with Plain and Trapezoidally Corrugated Web	54
5.2.3.1	Specimens with 150 mm depth	54
5.2.3.2	Specimens with 200 mm depth	58
5.2.3.3	Comparison of strength capacity of the specimens with plain and trapezoidally corrugated web	61
5.3	LOAD VERSUS STRAIN BEHAVIOUR OF THE SPECIMENS	63
5.3.1	General	63
5.3.2	Cold-Formed Steel Beams with Plain and Trapezoidally Corrugated Web	63
5.3.2.1	Specimens with 150 mm depth	63
5.3.2.2	Specimens with 200 mm depth	67
5.3.2.3	Comparison of load-strain for the beam specimens with plain and trapezoidally corrugated web	70

CHAPTER NO.	TITLE	PAGE NO.
5.3.3	Encased Beams with Plain and Trapezoidally Corrugated Web	72
5.3.3.1	Specimens with 150 mm depth	72
5.3.3.2	Specimens with 200 mm depth	76
5.3.3.3	Comparison of load-strain for the concrete encased beam specimens with plain and trapezoidally corrugated web	79
5.4	MOMENT-CURVATURE BEHAVIOUR OF THE SPECIMENS	81
5.4.1	General	81
5.4.2	Cold-Formed Steel Beams with Plain and Trapezoidally Corrugated Web	82
5.4.2.1	Specimens with 150 mm depth	82
5.4.2.2	Specimens with 200 mm depth	83
5.4.3	Encased Beams with Plain and Trapezoidally Corrugated Web	83
5.4.3.1	Specimens with 150 mm depth	83
5.4.3.2	Specimens with 200 mm depth	84
5.5	LATERAL BUCKLING BEHAVIOUR OF THE SPECIMENS	85
5.5.1	General	85
5.5.2	Cold-Formed Steel Beams with Plain and Trapezoidally Corrugated Web	86
5.5.2.1	Specimens with 150 mm depth	86
5.5.2.2	Specimens with 200 mm depth	89
5.5.2.3	Comparison of lateral buckling moment of steel beams	91

CHAPTER NO.	TITLE	PAGE NO.
5.5.3	Encased Beams with Plain and Trapezoidally Corrugated Web	93
5.5.3.1	Specimens with 150 mm depth	93
5.5.3.2	Specimens with 200 mm depth	96
5.5.3.3	Comparison of lateral buckling moment of concrete encased beams	100
5.6	DISPLACEMENT DUCTILITY	101
5.7	GENERAL BEHAVIOUR AND FAILURE MECHANISM	103
5.7.1	General	103
5.7.2	Failure Modes of Steel Beams with Plain and Trapezoidally Corrugated Web	103
5.7.2.1	Specimens with 150 mm depth	103
5.7.2.2	Specimens with 200 mm depth	106
5.7.3	Failure Modes of Encased Beams with Plain and Trapezoidally Corrugated Web	110
5.7.3.1	Specimens with 150 mm depth	110
5.7.3.2	Specimens with 200 mm depth	113
5.8	COMPARISON OF EXPERIMENTAL RESULTS WITH ANALYTICAL RESULTS	117
5.8.1	Deflection Shape of Specimens	117
5.8.1.1	Specimens with 150 mm depth	117
5.8.1.2	Specimens with 200 mm depth	120
5.8.2	Load-Deflection Behaviour of Beams	124
5.8.2.1	Specimens with 150 mm depth	124
5.8.2.2	Specimens with 200 mm depth	127
5.9	SUMMARY	132

CHAPTER NO.	TITLE	PAGE NO.
6	CONCLUSIONS	133
6.1	GENERAL	133
6.2	CONCLUSIONS	133
6.2.1	Effect of Web Corrugation Angle in the Steel Beams with Plain and Trapezoidally Corrugated Web	133
6.2.2	Effect of Concrete Encased Web in the Beam with Plain and Trapezoidally Corrugated Web	135
6.3	CONTRIBUTIONS	136
6.4	SCOPE FOR FURTHER WORK	136
	APPENDIX 1	137
	REFERENCES	142
	LIST OF PUBLICATIONS	146
	VITAE	148