

9
5+

**Analytical Investigation and the Design of the
Compressive Strength of Steel Gusset Plate Connections**

by

Sheng Ni

A Thesis submitted in partial fulfillment
of the requirements for the Degree of

MASTER OF SCIENCE

in

CIVIL ENGINEERING

Faculty of Science and Technology

UNIVERSITY OF MACAU

August 1998

TABLE OF CONTENTS

Chapter	Page
1. INTRODUCTION.....	1
1.1 General.....	1
1.2 Literature Review.....	2
1.3 Current Design Methods	10
1.4 Objective and Scope	12
2. FINITE ELEMENT ANALYSIS.....	20
2.1 Introduction.....	20
2.2 Updated Lagrangian Formulation	22
2.3 Finite Element Formulation	25
2.4 Incremental and Iterative Methods for Nonlinear Analysis.....	25
2.4.1 Newton-Raphson Method.....	26
2.4.2 Modified Riks Method.....	28
3. FINITE ELEMENT MODEL.....	34
3.1 General.....	34
3.2 Finite Element Model.....	34
3.3 Material Modeling.....	35
3.3.1 The von Mises Yield Criterion.....	36
3.3.2 Associate Flow Rule	36
3.3.3 Isotropic Hardening Rule.....	37
3.4 Finite Element Analysis Results.....	38
3.4.1 GP and SP Type Specimens.....	38
3.4.2 AP Type Specimens	41
3.4.3 MP Type Specimens	42
3.4.4 Buckling Shapes of Specimens.....	43
3.5 Discussion.....	44
4. PARAMETRIC STUDY.....	58

4.1	Introduction.....	58
4.2	Beam and Column Moment.....	59
4.3	Length of Long Unsupported Edge of Gusset Plate.....	60
4.4	Gusset Plate Shapes	63
4.5	Types of Connection between the Splice Member and the Gusset Plate	65
4.6	Rotational Restraint at Conjunction of Bracing Member and Gusset Plate.....	67
4.7	Splice Member Stiffness.....	68
4.8	Splice Member Length.....	71
4.9	Stiffener.....	73
5.	PROPOSED DESIGN GUIDELINES AND METHODS.....	100
5.1	Introduction.....	100
5.2	General Design Guidelines.....	100
5.3	Proposed Design Method.....	102
5.3.1	General.....	102
5.3.2	Proposed Design Method.....	104
5.3.3	Design Example.....	109
6.	SUMMARY AND RECOMMENDATIONS.....	119
6.1	Summary.....	119
6.2	Design Recommendations.....	121
6.3	Recommendations for Future Research.....	122
	REFERENCES.....	124