



UNIVERSITI PUTRA MALAYSIA

**LIMIT CRITERIA OF POST-TENSIONED
THIN WEB BEAMS**

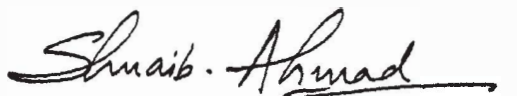
LEE TEANG SHUI

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.....
PETER MONTAGUE, Ph.D.
Professor
Department of Engineering
University of Manchester
(External Examiner)



.....
SHUAIB H. AHMAD, Ph.D.
Associate Professor
North Carolina State University
(External Examiner)




.....
ZOHADIE BARDAIE, Ph.D.
Associate Professor/Dean
Faculty of Engineering
Universiti Pertanian Malaysia
(Internal Examiner)



.....
S. A. SALAM, Ph.D.
Associate Professor
Faculty of Engineering
Universiti Pertanian Malaysia
(Internal Examiner/Supervisor)

I certify that the Board of Examiners have met on October 14, 1989 to conduct the final examination of this candidate on his Doctoral thesis in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981, and recommended that the candidate be awarded the relevant degree.

Date: 22 MAR 1990


.....
AHMAD MAHDZAN AYOB, Ph.D.
Professor/Dean of Graduate Studies
(Chairman, Board of Examiners)

This thesis was submitted to the Senate of Universiti Pertanian Malaysia and was accepted as fulfilment of the requirements for the degree of Doctor of Philosophy.

Date: 12 JUL 1990


.....
AHMAD MAHDZAN AYOB, Ph.D.
Professor/Dean of Graduate Studies

**LIMIT CRITERIA OF POST-TENSIONED
THIN WEB BEAMS**

By

LEE TEANG SHUI

A Thesis Submitted in Partial Fulfilment of the
Requirements for the Degree of Doctor of Philosophy
in the Faculty of Engineering
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October 1989



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Lee, Teang Shui

Universiti Pertanian Malaysia
Serdang, 43400 Selangor Darul Ehsan
Malaysia

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TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF PLATES	xvi
LIST OF SYMBOLS	xix
ABSTRACT	xxii
ABSTRAK	xxiv
CHAPTERS	
I INTRODUCTION	1
General	1
Advantages of Prestressed Concrete Over Reinforced Concrete	5
Pretensioned and Posttensioned Prestressed Concrete	7
Bonded and Unbonded Posttensioned Prestressed Concrete	8
Partially Prestressed Concrete	10
Definition	10
Development of Partial Prestressing	13
Advantages and Disadvantages	16
I and T sections	18
Limit Criteria for Prestressed Concrete	19
Objectives and Scope of Work	24



	PAGE	
II	FLEXURAL STRENGTHS OF PARTIALLY PRESTRESSED CONCRETE MEMBERS	28
	Introduction	28
	Steel Stresses in Prestressed Concrete Beams	32
	Determination of the Neutral Axis Depth	38
	Code Provisions	41
	Flexural Strengths of Partially Prestressed Beams by the Strain Compability Method	43
III	SHEAR STRENGTHS OF PARTIALLY PRESTRESSED CONCRETE MEMBERS	52
	Introduction to Shear in Prestressed Concrete	52
	I and T sections	61
	Shear Strength of Partially Prestressed Concrete Beams	64
	Ultimate Shear Prescribed by Code of Practice BS 8110:1985	66
IV	FLEXURAL CRACKS IN PARTIALLY PRESTRESSED CONCRETE	72
	Introduction	72
	Cracking Load	75
	Predicting Maximum Crack Width	77
V	DEFLECTION OF PARTIALLY PRESTRESSED FLEXURAL MEMBERS	87
	Introduction	87
	Predicting Deflection and Camber	89



	PAGE
VI EXPERIMENTAL PROGRAM	99
General Description of Model Beams	99
Constant and Varying Parameters of the Beams	104
Concrete: Mix Design for Strength	105
Prestressing Steel, Normal Reinforcement and Web Reinforcement	106
Ducts and Grouting for Prestressing Tendons	107
End Blocks	108
Prestressing of Tendons and Measuring of Camber	108
Beam Testing Procedure	109
Beam Testing Errors	110
VII EXPERIMENTAL RESULTS	112
Presentation of Theoretical Calculations and Experimental Data	112
Strain Measurements	113
VIII DISCUSSION	166
Flexure	166
Theoretical Predictions and Observed Ultimate Flexural Failure	166
Effect of Bond on Ultimate Flexural Load	169
Effect of Prestress on Ultimate Flexural Load	170
Effect of Additional Reinforcements on Ultimate Flexural Load	172



	PAGE
Prediction of Ultimate Flexural Moment by Code BS 8110	173
Shear	175
Shear Cracking Resistance of Prestressed Concrete	175
Theoretical and Experimental Shear Cracking Strength	176
Effect of Deformed Bars on the First-shear-cracking Load on Concrete in Prestressed Concrete Beams	179
Effect of Shear Reinforcement on First-shear-cracking Load on Concrete in Prestressed Concrete Beams	180
Effect of Prestress on First-shear-cracking Load on Concrete	182
Combined Effect of Prestress, Additional Reinforcements and Shear Reinforcement on First-shear-cracking Load on Concrete	182
Predicted Ultimate Shear Strength and Experimental Ultimate Shear Strength of Concrete in Prestressed Concrete Beams	184
Effect of Shear Reinforcements on the Ultimate Shear Strength of Prestressed Concrete Beams	185
Combined Effect of Deformed Bars and Shear Reinforcements on the Ultimate Shear Strength of Prestressed Concrete Beams	187
Effect of Bond on Shear Strengths of the Partially Prestressed Beams	187
Serviceability of Beams not Reinforced in Shear	188
Cracking Load, Number of Cracks, Crack Width and Crack Spacing	189
General	189
Cracking Load	191



	PAGE
Number of Cracks	194
Crack Width	209
Crack Spacing	222
Effect of Bond on Cracking Load, Number of Cracks and Crack Width	224
Factors Controlling Serviceability	227
Deflection	229
Effect of Shear Reinforcements on Deflection	229
Effect of Deformed Bars on Deflection	234
Predicting Deflection of the Prestressed Beams	235
Effect of Bond on Deflection	236
IX CONCLUSIONS AND RECOMMENDATIONS	239
Conclusions	239
Ultimate Load	239
Shear Strength	240
Flexural Cracking	241
Deflection	243
Recommendations	243
REFERENCES	245
APPENDICES	256
A End Block in Posttensioned Beams	256
B Design of Normal Concrete Mixes by DOE Method	257



	PAGE
C HP41C Program for Determining Neutral Axis and Calculating Ultimate Moment	258
D HP41C Program for Determining Service Stresses and Cracking Load	263
E HP41C Program for Determining Centroid of T Beams	265
F HP41C Program for Calculating Deflection by Naaman's Method	267
G HP41C Program for Calculating Deflection (after Goode)	270
H HP41C Program for Crack Width	272
I HP41C Program for Students' T Statistical Test for Pair Observations	276
J Analysis of Partially Prestressed Concrete Beams for Testing	278
K Calculation of Crack Widths	285
L Theoretical Calculations, Experimental Data and Observations of Model Beams	288
VITA	306



LIST OF TABLES

TABLE		PAGE
1	Criteria for Serviceability Limits in Prestressed Concrete Beams	22
2	Limit States for Prestressed Concrete (BS 8110 : 1985)	23
3	Comparison of Experimental Ultimate Flexural Load to Theoretical Ultimate Flexural Load for Beams Designed to Fail in Flexure	167
4	Comparison of Experimental Ultimate Flexural Load to Theoretical Ultimate Flexural Load for Beams Designed to Fail in Shear	168
5	Increase in Ultimate Load (experimental) Capacity of Prestressed Beams Due to Prestress or Nonprestress Reinforcements	171
6	Experimental and Code-calculated Ultimate Moment of Prestressed Beams	174
7	Shear Strengths of Experimental Partially Prestressed Concrete Beams	178
8	Combined Effect of Prestress, Additional Reinforcements and Shear Reinforcements on Concrete Shear Cracking Resistance (Loads at Shear Cracking, KN)	183
9	Combined Effect of Additional Deformed Bars and Shear Reinforcements on Experimental Shear Strength of Prestressed Concrete	183
10	Serviceability of Beams Not Reinforced in Shear	190
11	Comparisons of Cracking Loads	193
12	Cracking Load of Beams with 76 mm Web and Various Levels of Prestress and Deformed Bars. (Beam Number in Circle)	195
13	Cracking Load of Beams with 56 mm Web and Various Levels of Prestress and Deformed Bars. (Beam Number in Circle)	196



TABLE		PAGE
14	Summary of Calculations of Crack Width by Various Methods	211
15	Observed and Calculated Average Crack Spacing	223
16	Loads at 12 mm and 20 mm Deflection of 76 mm Web Prestressed Beams With Shear Reinforcements	231
17	Loads at 12 mm and 20 mm Deflection of 76 mm Web Prestressed Beams Without Shear Reinforcements	231
18	Loads at 12 mm and 20 mm Deflection of 56 mm web Prestressed Beams With Shear Reinforcements	232
19	Loads at 12 mm and 20 mm Deflection of 56 mm Web Prestressed Beams Without Shear Reinforcements	232
20	Effect of Shear Reinforcement on Deflection of 76 mm Web and 56 mm Web Prestressed Beams. (Ratio of Loads of Prestressed Beams With and Without Shear Reinforcements at Respective Deflections)	233
21	Calculated and Experimental Total Deflections of Prestressed Beams	237



LIST OF FIGURES

FIGURE		PAGE
1	Classification of Prestressed Concrete (Flexural Members)	4
2	Stress Strain Conditions At Ultimate Load Condition	46
3	Crack Patterns and Idealized Zone Structures (After Moayer and Reagan, 1974)	56
4	Types of Cross Sections of Experimental Beams	100
5	Strain Distribution Along Depth At Mid Span of Beam 4 at Various Loadings	126
6	Strain Distribution Along Depth At Midspan of Beam 9 at Various Loadings	127
7	Strain Distribution Along Depth At Midspan of Beam 14 at Various Loadings	128
8	Strain Distribution Along Depth At Midspan of Beam 25 at Various Loadings	129
9	Strain Distribution Along Depth At Midspan of Beam 27 at Various Loadings	130
10	Strain Distribution Along Depth At Midspan of Beam 32 at Various Loadings	131
11	Strain Distribution Along Depth At Midspan of Beam 37 at Various Loadings	132
12	Load vs Deflection Graphs for Beams 1, 3, 5, 7 and 9.	133
13	Load vs Deflection Graphs for Beams 2, 4, 6, 8 and 10.	134
14	Load vs Deflection Graphs for Beams 11, 12, 13, 14 and 15.	135
15	Load vs Deflection Graphs for Beams 16, 18, 20, 22 and 24.	136
16	Load vs Deflection Graphs for Beams 17, 19, 21, 23 and 25.	137



FIGURE		PAGE
17	Load vs Deflection Graphs for Beams 26, 28, 30 and 32.	138
18	Load vs Deflection Graphs for Beams 27, 29, 31 and 33.	139
19	Load vs Deflection Graphs for Beams 34, 35, 36 and 37.	140
20	Load vs Deflection Graphs for Beams 38, 40, 42 and 44.	141
21	Load vs Deflection Graphs for Beams 39, 41, 43 and 45.	142
22	Comparisons of Load Deflection Behavior for Beams With 76 mm Thick Web and 2 Prestressing Tendons	143
23	Comparisons of Load Deflection Behavior for Beams With 76 mm Thick Web and 4 Prestressing Tendons	144
24	Comparisons of Load Deflection Behavior for Beams With 76 mm Thick Web and 6 Prestressing Tendons	145
25	Comparisons of Load Deflection Behaviour for Beams With 76 mm Thick Web and 8 Prestressing Tendons	146
26	Comparisons of Load Deflection Behaviour for Beams With 56 mm Thick Web and 2 Prestressing Tendons	147
27	Comparisons of Load Deflection Behaviour for Beams With 56 mm Thick Web and 4 Prestressing Tendons	148
28	Comparisons of Load Deflection Behaviour for Beams With 56 mm Thick Web and 6 Prestressing Tendons	149
29	Load vs Total Number of Cracks Graphs for Beams 1, 3, 5, 7 & 9.	150
30	Load vs Total Number of Cracks Graphs for Beams 11, 12, 13, 14 & 15.	151
31	Load vs Total Number of Cracks Graphs for Beams 16, 18, 20, 22 & 24.	152



FIGURE		PAGE
32	Load vs Total Number of Cracks Graphs for Beams 17, 19, 21, 23 & 25.	153
33	Load vs Total Number of Cracks Graphs for Beams 26, 28, 30 and 32.	154
34	Load vs Total Number of Cracks Graphs for Beams 34, 35, 36 & 37.	155
35	Load vs Total Number of Cracks Graphs for Beams 38, 40, 42 & 44.	156
36	Load vs Maximum Crack Width Graphs for Beams 1, 3, 5, 7 & 9.	157
37	Load vs Maximum Crack Width Graphs for Beams 2, 4, 6, 8 & 10.	158
38	Load vs Maximum Crack Width Graphs for Beams 11, 12, 13, 14 & 15.	159
39	Load vs Maximum Crack Width Graphs for Beams 16, 18, 20, 22 & 24.	160
40	Load vs Maximum Crack Width Graphs for Beams 26, 28, 30 & 32.	161
41	Load vs Maximum Crack Width Graphs for Beams 27, 29, 31 & 33.	162
42	Load vs Maximum Crack Width Graphs for Beams 38, 40, 42 & 44	163
43	Load vs Maximum Crack Width Graphs for Beams 34, 35, 36 & 37.	164
44	Load vs Maximum Crack Width Graphs for Beams 17, 19, 21, 23 & 25.	165
45	Load vs Maximum Crack Width Graphs for Beams 39, 41, 43 & 45.	165
46	Flexural Cracking Pattern of 76 mm Web Beams With Shear Reinforcements and 0 Deformed Bars.	198
47	Flexural Cracking Pattern of 76 mm Web Beams Without Shear Reinforcements and With 0 Deformed Bars.	199
48	Flexural Cracking Pattern of 76 mm Web Beams With Shear Reinforcements and 2 Deformed Bars.	200



FIGURE		PAGE
49	Flexural Cracking Pattern of 76 mm Web Beams With Shear Reinforcements and 4 Deformed Bars.	201
50	Flexural Cracking Pattern of 76 mm Web Beams Without Shear Reinforcements and With 4 Deformed Bars.	202
51	Flexural Cracking Pattern of 56 mm Web Beams With Shear Reinforcements and 0 Deformed Bars.	203
52	Flexural Cracking Pattern of 56 mm Web Beams Without Shear Reinforcements and 0 Deformed Bars.	204
53	Flexural Cracking Pattern of 56 mm Web Beams With Shear Reinforcements and 2 Deformed Bars.	205
54	Flexural Cracking Pattern of 56 mm Web Beams With Shear Reinforcements and 4 Deformed Bars.	206
55	Flexural Cracking Pattern of 56 mm Web Beams Without Shear Reinforcements and With 4 Deformed Bars.	207

LIST OF PLATES

PLATE		PAGE
1	Beam 1 (76 mm Web) With Wide Flexural Cracks and No Shear Cracks. Good Recovery on Unloading.	115
2	Diagonal Tension Shear Failure of Lightly Prestressed Beam 2.	115
3	Few and Widely Spaced Cracks With Wide Opening of Lightly Prestressed Beam 3.	115
4	Beam 4 (76 mm Web) Unreinforced in Shear, Failed in Flange Compression in Flexural Span.	116
5	Beam 5 (76 mm Web) Unbonded Failed in Flexure With Wide Cracks. Excellent Recovery Upon Unloading As Shown.	116
6	Beam 6 (76 mm Web) Unbonded With No Shear Reinforcements, Failed in Flange Compression.	116
7	Flexural-shear Failure of Highly Prestressed Beam 7 After Exceeding Theoretical Loads.	116
8	Shear-compression Failure of Very Highly Prestressed Beam 8 Without Shear Reinforcement.	117
9	Beam 9 (76 mm web, On Release of Load) Failed With Flange Compression	117
10	Shear Compression Failure of Beam 10 With Very High Prestress, Without Shear Reinforcement and At Equal Theoretical Flexural Load.	117
11	Beam 11 (76 mm web, With Load Released) Failed in Shear Compression on Left Load Point.	117
12	Flange Compression Flexural Failure of Beam 12 At Equal To Theoretical Flexural Load.	117



PLATE		PAGE
13	Violent Flexural Failure of Unbonded Beam 13 (76 mm Web).	118
14	Flexural Shear Failure After Exceeding Theoretical Loads of Highly Prestressed Beam 14.	118
15	Shear Compression State After Recovery of Very Highly Prestressed Beam 15 With 8 Tendons and 2 Deformed Bars.	118
16	Flexural Failure of Beam 16 With 2 Prestressing Tendons and 4 Deformed Bars. Flange Compression and Flexural Web Disturbance.	119
17	Recovered Diagonal Tension Shear Failure of a Lightly Prestressed Beam With the Aid of 4 Deformed Bars.	119
18	Medium Prestress Beam 18 Just After Exceeding Theoretical Ultimate Flexural Capacity.	119
19	Diagonal Tension and Bar Tension Failure of Beam 19.	119
20	Flange Crushing Flexural Failure of Unbonded Beam 20.	119
21	Well-recovered Shear Failure With the Aid of 4 Deformed Bars, of Beam 21.	120
22	Flange Compression Failure of Beam 22 (76 mm Web, With Load Released).	120
23	Recovery of Beam 23 With High Prestress and Deformed Bars, After Failing in Shear.	120
24	Violent Shear Compression Failure of Highly Prestressed Beam 24 (76 mm Web).	121
25	Very Highly Prestressed Beam 25, Failing in Shear in Tensioned bars, and At Full Recovery.	121
26	Typical Wide Crack of Low Prestressed Beam Failing in Flexure (Beam 26 With 56 mm Web).	121



PLATE		PAGE
27	Fewer Cracks of Beam 27 (56 mm Web) Without Shear Reinforcements.	122
28	Very Thin Beam 28 After Shear Failure.	122
29	Large and Few Cracks of Bonded Beam 29.	122
30	Explosive Web Cum Flange Crushing of High Prestress 56 mm Web Beam 32.	122
31	Flexural Failure of Beam 33.	123
32	Flange Heaving Failure of Beam 34 (56 mm Web)	123
33	Flexural Failure of Beam 35 With 4 Tendons and 2 Deformed Bars (133 kN)	123
34	Shear Compression Failure of Beam 37 (56 mm Web).	123
35	Flexural Failure of Beam 38 With 2 Tendons and 4 Deformed Bars (121 kN)	123
36	Diagonal Shear and Tensioned Bar Failure of Lightly Prestressed Thin Beam 39.	124
37	Flexural Flange Crushing of Bonded Beam 40 After Exceeding Theoretical Ultimate Flexural Load.	124
38	Laterally Explosive Web Crushing Failure With Secondary Failure in Separation of Deformed Bars in Beam 41 (56 mm Web).	124
39	Violent Laterally Explosive Web Crushing of Thin Web (56 mm) Beam 43 With 4 Prestressing Tendons and 4 Deformed Bars.	124
40	Flange Compression Failure of Beam 44 With 56 mm Web, 6 Prestressing Tendons and 4 Deformed Bars.	125
41	Tensioned Bar Shear Failure of Beam 45 With 6 Tendons and 4 Deformed Bars and Without Stirrups.	125



LIST OF SYMBOLS

f_{ci}	Concrete strength at transfer
f_{cu}	Concrete cube compressive strength, N/mm^2
G_k	Dead load
Q_k	Applied load
γ_m	Material partial safety factor
V_{TSR}	Total shear resistance of a section
V_s	Shear resistance of a 45° strut inclination truss analogy
V_c	Ultimate shear cracking resistance of a section of the concrete
V_{co}	Web shear cracking capacity of a section-uncracked in flexure
V_{cr}	Flexural shear cracking capacity of a section cracked in flexure
b_w	Web width of T beam
h	Total depth of T beam
f_t	Maximum principal tensile stress
f_{cp}	Compressive stress at the centroidal axis due to prestress, taken as positive
f_{pe}	Effective prestress in the tendons after all losses have occurred.
f_{pu}	Strength of a prestressing tendon
v_c	Concrete shear stress
d_e	Effective depth of steel reinforcements



M o	Moment necessary to produce zero stress in the concrete at the extreme tension fibre.
M u	Bending moment value at the section due to the particular ultimate load condition
V	Shear force value at the section due to the particular ultimate load condition
A ps	Total area of prestressing tendon section
A nps	Total area of nonprestressed steel section
A sv	Cross-sectional area of two legs of a link/stirrup
S v	Link/stirrup spacing
f y	Strength of a nonprestressed steel bar
f yv	Strength of the shear reinforcement
d t	Depth to the bottom most longitudinal reinforcement
v u	Maximum shear stress of concrete
b we	Effective web width of T beam
f ps	Stress in prestressed tendon
ε ps	Strain in prestressed tendon
x	Depth to neutral axis
m	Modular ratio
E s	Elastic modulus of steel
E c	Elastic modulus of concrete
h f	Flange depth



$f_{c'}$	6 inch diameter x 12 inch cylinder compressive strength at 28 days
f_{pb}	Design tensile stress in the tendons
d_n	Depth to the centroid of the compression zone or $0.45x$ if flange thickness equal or more than $0.9x$
ϵ_{cu}	Concrete strain at extreme compression fibre
σ	Stress

ABSTRACT

Abstract of thesis submitted to the Senate of Universiti Pertanian Malaysia, in partial fulfilment of the requirements for the degree of **Doctor of Philosophy**.

LIMIT CRITERIA OF POST-TENSIONED THIN WEB BEAMS

By

LEE TEANG SHUI

October, 1989

Supervisor : Dr. S.A. Salam
Faculty : Engineering

A total of 45 partially prestressed post-tensioned thin web T-beams were tested to investigate their ultimate shear and flexural strengths and the serviceability limits of deflection and crack width. The varying parameters included in the study are the amount of prestress, amount of supplementary nonprestressed reinforcements, prestressing tendons being bonded or unbonded, absence or presence of shear reinforcements and width of the web. A strain compatibility method with the associated bond factors is presented for the ultimate flexural strength analysis of the beams. For prediction of theoretical loads, material characteristics are taken at their ultimate with no materials safety factor associated. Equilibrium of forces and a trilinear stress strain relationship for

