UNIVERSITI PUTRA MALAYSIA

LIMIT CRITERIA OF POST-TENSIONED THIN WEB BEAMS

LEE TEANG SHUI

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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 Universiti Pertanian Malaysia

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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/strirrup
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 inprestressed tendon
x	Depth to neutral axis
m	Modular ratio
E_s	Elastic modulus of steel
E_c	Elastic moudlus 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

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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