ลักษณะทางพลาสติกของตานธรรมดาและโครงสร้างแบบหลังคาเหลี่ยม

นายที เหว้ียน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
แผนกวิชาวิศวกรรมเครื่องกล
บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
พ.ศ. ๒๕๑๓

PLASTIC BEHAVIOUR OF SIMPLY SUPPORTED BEAMS AND PORTAL FRAMES

Mr. Tee Wian

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Engineering

Department of Mechanical

Graduate School

Chulalongkorn University

1969

Accepted by the Graduate School, Chulalongkorn University in partial fulfillment of the requirements for the degree of Master of Engineering.

T. Nitanidhi

.....

Dean of the Graduate School.

Thesis Committe .....P. Pattalongse.....Chairman.

.....W. Chalitchan.....

.....C. Thau.....

Thesis Supervisor .....C. Thau.....

Date 15th May 1961.

ABSTRACT

This thesis involves the plastic behaviour of simply supported beams and single bay portal frames subjected to concentrated load at mid-span.

In the former case emphasis is placed on the relationship between load and transverse deflexion. Rolled black mild steel and rolled brass are chosen for investigation and their characteristics as obtained from a simple tensile test are idealized so that the slope-deflexion equation can be analysed in comparison with that obtained from experiment.

In the latter case, study of the collapse load is the main purpose. The bases of the frames have two different forms, namely pinned-bases with special fittings and fixed-bases. The experimental values of collapse load are compared with values obtained from plastic bending theory and reasons for any divergence are suggested.

ACKNOWLEDGMENT

The author is very grateful to his supervisor, Dr. R.C. Shelton, for his valuable advice and suggestions. He also takes this opportunity to extend thanks to Dr. Vaikun Chalitchan for his suggestions and comments in the improvement of the book. Finally, he wishes to acknowledge his debt to Mr. D.J. Cobb in reading many parts of the manuscript, to Mr. Swai Rodrussra, and to Mr. Thongchai Singsangvong for assistance in making various pieces of apparatus.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

a, b	Distances
A	Cross sectional area, numerical coefficient
B, C, K, Y	Numerical coefficient
b	Width of beam
e	Base of natural logarithm
E, E'	Elastic modulus, plastic modulus
h	Thickness of beam
H	Horizontal load, numerical coefficient
I	Second moment of plane area
L	Length, span
M	Bending moment, couple
M_p, M_w, M_o, M_c	Plastic moment, working moment, moment corresponds to lower yield stress and moment at collapse
M_p^B, M_p^S	Full plastic moment of beam and stanchion
N	Factor of safety
n	Power coefficient
P, P_o	Concentrated load, load corresponds to lower yield stress
R	Radius of curvature
S	Shape factor, the ratio between the plastic moment to the moment at first yield
V	Vertical load

w	Load per unit length
W_W, W_C	Working load, collapse load
x, y	Rectangular coordinates
y_e, y_p	Deflexion in elastic zone and plastic zone
y_o	Distance of elastic core from neutral axis
α	Ratio of depth of elastic core to full depth
β	Ratio of plastic modulus to elastic modulus
γ	Numerical power coefficient
δ	Central deflexion
ϵ	Unit conventional strain
ϵ_n	Natural unit strain
ϵ_o	Unit strain at yield
σ	Unit normal stress
σ_u, σ_l	Upper and lower yield stress
σ_w, σ_o	Working stress and represented lower yield stress
σ_e, σ_p	Unit stress in elastic range and plastic range

ABBREVIATIONS

British Standard Whitworth	B.S.W.
centimetre	cm.
feet, foot	ft., (')
inch	in., (")
minute	min.
neutral axis	N.A.
pound	lb.
pound-inch	lb-in.
pounds per square inch	psi.
kips per square inch	ksi.