ECONOMICS OF CONSTRUCTION IN RELATION TO FRAMED STRUCTURES; PRELIMINARY PARTS: PART I. - CLASSIFICATION OF STRUCTURES; PART II. - DIAGRAMS OF FORCES

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649568154

Economics of Construction in Relation to Framed Structures; Preliminary Parts: Part I. - Classification of Structures; Part II. - Diagrams of Forces by Robert H. Bow

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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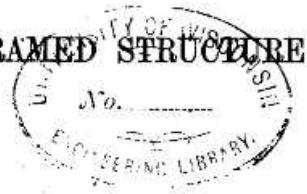
ECONOMICS OF CONSTRUCTION

IN RELATION TO

FRAMED STRUCTURES



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PRELIMINARY PARTS

PART I.—CLASSIFICATION OF STRUCTURES

PART II.—DIAGRAMS OF FORCES

LONDON: E. & F. N. SPON, 48 CHARING CROSS
NEW YORK: 446 BROOME STREET
EDINBURGH: ADAM & CHARLES BLACK
1873

PREFACE.

THE two Parts now published are calculated to form a useful Manual in themselves. And as they are almost altogether of a preliminary character in relation to *Economics of Construction*, no introduction to that subject need here be attempted. But as touching upon the neglect of that branch of Engineering Science, I may quote the following passage with reference to British Engineering from *Applied Mechanics* by the late eminent Professor W. J. Macquorn Rankine :—"In too many cases we see the strength and the stability which ought to be given by the skilful arrangement of the parts of a structure, supplied by means of clumsy massiveness, and of lavish expenditure of material, labour, and money; and the evil is increased by a perversion of the public taste, which causes works to be admired, not in proportion to their fitness for their purposes, or to the skill evinced in attaining that fitness, but in proportion to their size and cost."

Part I. is devoted to the Classification of Structures, but the illustrations are, in the meantime, confined to Roof and Bridge Trusses. Many previous attempts have been made by others and myself in this direction, but not one of those that I am acquainted with is at all satisfactory. I trust that the classification now given, although no doubt open to some objections, will commend itself as based for the most part upon scientific distinctions.

A considerable number of the designs supplied to illustrate the classification are original.

Part II. gives the application of the recently expanded method of arriving at the stresses in structures by drawing diagrams of the forces. The importance to which this method has attained is almost altogether due to Professor J. Clerk Maxwell, who has shown how surprisingly general its application is, and who has placed it in quite a new aspect by his discovery or detection of those diagrams of forces which bear a reciprocal relationship to the relative framed structures.

When I first gave particular attention to the method, it was with a view to preparing an appendix to the general work I projected; but having devised an improvement in the mode of lettering the diagrams, I was led on to devote a considerable amount of time to the subject; and the notes and particulars of its application accumulating on my hands, I have thought them deserving of separate publication.

Some novelty may also be claimed for the application of the method to the imperfect structures constituting Class II.

7 South Gray Street, Edinburgh,
October 1873.

ECONOMICS OF CONSTRUCTION

IN RELATION TO

FRAMED STRUCTURES

PART I.

CLASSIFICATION

OF

FRAMED STRUCTURES OR TRUSSES.

NOTE.—In my Treatise on Bracing (1851), the term "Truss" was applied to any framed girder with a triangular outline, or which did not require any of the struts or ties to change their characters under irregular loadings; but this restriction of its meaning has not been adopted by subsequent writers, and now the term may be used to designate any form of framed structure employed to support a pressure or load over a void.

CLASSIFICATION OF TRUSSES.

DISTINCTIONS BETWEEN ROOF AND BRIDGE TRUSSES.

In roof trusses the line or surface on which the loading is chiefly imposed is, from its office of discharging rain and snow, necessarily a more or less inclined one. In ordinary bridge trusses, on the contrary, the line of the roadway at which the principal part of the loading is situated approximates to a perfect level. This important distinction leads to another very marked difference—a roof truss and its loading, if treated as *inverted*, has no practical value, whereas any good bridge truss becomes, when inverted, another useful design, the natures of the parts becoming simply reversed as regards their strut or tie action. Another distinction between roofs and bridges is that the former have to withstand important oblique forces arising from the action of the wind blowing in the direction of the plane of the truss against the inclined surfaces, whereas the action of the wind in the same plane in the case of bridge trusses is of no account.

TIED AND ABUTTING STRUCTURES.

An abutting truss is to be regarded as nearly in the same condition as the same structure supplied with a tie-bar and resting vertically upon the supports, the chief difference being that in the abutting arrangement the distance between the abutments, sometimes assumed theoretically as invariable, is practically liable to uncertain, and it may be important, changes; whereas, when the horizontal thrust or spreading tendency of the feet is resisted by a tie-bar, the change of span may be calculated with some certainty.