A GRAPHICAL METHOD FOR SWING-BRIDGES. A RATIONAL AND EASY GRAPHICAL ANALYSIS OF THE STRESSES IN ORDINARY SWING-BRIDGES. WITH AN INTRODUCTION ON THE GENERAL THEORY OF GRAPHICAL STATICS

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BENJ. F. LA RUE

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BY

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1892.

PREFACE.

In the analysis of swing-bridges given in the following pages, no acknowledgment of indebtedness, or other reference, to any work which has appeared upon the subject, is therein made, as no book has been consulted in its preparation, although much of the ground has been previously well explored; except that equation (1), of Case III, was taken without material change from Professor W. H. Burr's able work on the "Stresses in Bridge and Roof Trusses." Otherwise the solution of continuity herein given is entirely the result of independent investigation.

In the Introduction no originality

whatever has been attempted. The principles given are well known and established. The texts of other writers have been liberally drawn upon, where principles were found so well expressed as to warrant such quotation; and due credit has been given in each case.

It may be noticed that among the fundamental principles stated, no mention is made of the "Parallelogram of Forces." This term is thought to be inelegant in both its logic and its application. The Triangle of Forces concisely covers the same ground, without the use of superfluous lines.

The article on the analysis of the stresses in swing-bridges, of which the greater portion of these pages consists, was originally intended for publication in some engineering journal, and for such purpose to be complete in itself; which fact explains why it contains matter which otherwise might have been more consistently embodied in the Introduction, which was not thought of until later.

In the hope that this humble effort may contribute something of value to the constantly increasing knowledge of graphical methods of analysis, it is submitted to the perusal of those interested in the subject.

B. F. La R.

JACKSON, MICH., 1892.

INTRODUCTION.

The General Theory of Graphical Statics.

Before taking up the analysis of the stresses in swing-bridges, which is the principal feature of this work, the general principles of Graphical Statics, or the graphical investigation of static force, will be briefly noticed, in order that those who are not familiar with the subject may understand the solution as given without being obliged to first study the general theory elsewhere. Those readers to whom the subject of graphical statics is familiar may omit these introductory pages and pass directly to the analysis for swing-bridges.

At the beginning it will be well to

repeat a few well-expressed principles of equivalents in

STATIC FORCE.

"The resultant of two or more forces is a force which singly will produce the same mechanical effect as the forces themselves jointly.

"The original forces are called components.

"In all statical investigations the components may be replaced by their resultant, and *vice versa*.

"The resultant of two unequal forces acting in opposite directions is a single force equal to their difference and acting in the direction of the larger.

"The resultant of any number of forces acting in the same right line is their algebraic sum.

"If three forces are in equilibrium, each will be equal to and opposite in direction to the resultant of the other two.

"If three concurring forces are in equilibrium, and a triangle be formed