
The Design of Highway Bridges of Steel, Timber and Concrete

Ketchum Milo Smith

Title: The Design of Highway Bridges of Steel, Timber and Concrete

Author: Ketchum Milo Smith

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THE DESIGN OF HIGHWAY BRIDGES OF STEEL, TIMBER AND CONCRETE

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TO WHOM
IT MAY COME

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PREFACE TO SECOND EDITION

The increase in live loads due to the extensive use of heavy motor trucks, tractors and traction engines, and the increased use of reinforced concrete in building highway bridges have made it necessary to rewrite this book. The scope of the work has been extended so that the book now covers the design of concrete and timber highway bridges as well as steel highway bridges. The design of both the superstructure and the substructure of highway bridges is discussed in detail. The discussion covers all the details of constructing highway bridges, including the calculation of the stresses, the design, the estimate, the contract and the erection and construction.

The same size of type page and size of type as are used in the author's "Structural Engineers' Handbook" are used in this book.

The book is divided into four parts and in addition has three appendices.

Part I covers the calculation of the stresses in bridge trusses and in bridge portals and other details. Both algebraic and graphic methods of calculating stresses in bridge trusses are described in detail. Stresses are calculated in bridge trusses for both equal joint loads and for wheel concentrations. Chapter VII contains the solutions of 27 problems in the calculation of stresses in bridge trusses. Influence diagrams are developed for girders and trusses in this chapter. Part I covers the first course in the calculation of stresses in bridges given in the author's classes.

Part II covers the design of steel and timber highway bridges. The design of steel highway bridges is divided into beam bridges, low truss bridges, plate girder bridges and high truss bridges. The design of bridge floors is considered in detail, and data are given for the design of steel highway bridges. The chapter on timber bridges includes timber trestles as well as timber truss bridges. The design of a beam bridge, a plate girder bridge, a low truss bridge and a high truss bridge are worked out in detail.

Part III covers the design of reinforced concrete highway bridges and foundations. The formulas for calculating the stresses in reinforced concrete structures are developed. The different types of reinforced concrete beam, girder, arch and reinforced concrete trestle bridges are discussed, and working plans are given for all types. Designs of the different types of bridge are worked out in detail. Algebraic and graphic solutions are given for the elastic arch. An influence diagram solution is also given for the elastic arch. Abutments and piers for steel and concrete bridges are discussed and many examples of structures are given. The different types of culverts are described in detail with examples of plans. The overflow bridge, which has been developed to meet a special need in localities subject to excessive flood flow, is described and examples are given.

Part IV covers the details of bridge design, bridge contracting, estimates and costs, and bridge erection and construction. The discussion in Part IV together with Appendix I, "General Specifications for Steel Highway Bridges," and Appendix II, "General Specifications for Concrete Bridges and Foundations," covers in detail the design and erection of steel and concrete highway bridges. Structural tables of especial value in the design of steel highway bridges are given in Appendix III.

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The very rapid advance in the design of highway bridges is mainly due to the excellent work done by the various state highway commissions, and more recently the work done by the U. S. Bureau of Public Roads. The author wishes to express his appreciation for the uniform courtesy of the various commissions and bureaus in furnishing plans and specifications. The author is under especial obligations to Mr. Clifford Older, bridge engineer of the Illinois Highway Commission; Mr. M. W. Torkelson, bridge engineer of the Wisconsin Highway Commission; Mr. J. H. Ames, and Mr. E. F. Kelly, bridge engineers of the Iowa Highway Commission; and Mr. C. V. Dewart, bridge engineer of the Michigan State Highway Department, for furnishing plans, specifications and data, without which this book could not have been written. The writer also wishes to thank the U. S. Bureau of Public Roads for furnishing the blue prints of their standard plans, which are reproduced in this book.

Credit is due Professor W. C. Huntington, University of Colorado, for assistance in preparing drawings and making calculations, to Professor R. S. Wallis, Missouri School of Mines, for assistance in preparing drawings; to H. C. Ford, for assistance in preparing drawings, and to C. L. Eckel, Assistant Professor of Civil Engineering in the University of Pennsylvania, for assistance in making calculations, preparing drawings and reading proof.

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