

HANDBOOK FOR HIGHWAY ENGINEERS

CONTAINING INFORMATION ORDINARILY USED
IN THE DESIGN AND CONSTRUCTION
OF RURAL HIGHWAYS

Part I. Principles of General Planning & Design
Part II. Field & Office Detail Data
Part III. Specifications
Part IV. General Tables & Formulae
Appendix. First Aid (Accidents)

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FORMERLY SUPERVISING ENG., N. Y. STATE DEPT. OF HIGHWAYS

FOURTH EDITION
ENTIRELY REVISED AND ENLARGED
THIRTEENTH IMPRESSION

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PREFACE TO FOURTH EDITION

THIS edition contains the selected data which 14 years use of the older editions indicates as desirable to meet the requirements of the everyday work of Highway Engineers. It includes information ordinarily needed for General Planning and for the detail work of Surveys, Design and Construction.

A Revision is necessary at this time on account of the rapid strides made in Rural Road Practice to meet the increased demands of modern motor traffic. The text has been entirely rewritten. Construction and Reconstruction methods and costs have been brought up to date; General Economics and Railroad Grade Crossing protection data have been added at the request of users and a number of additional convenient design tables have been introduced. The additions total 700 pages.

The discussion of general principles of economics and design illustrated by examples of Current Practice in Part I has been made more thorough as it is our experience that if the younger men have a good understanding of broad general principles they can more readily apply the detail rules to specific problems.

The general character of the second part of the book remains unchanged; namely a concise collection of data ordinarily required for everyday work.

For the convenience of users the book is bound either complete in one volume for office men or students or in two volumes for field men which gives a handy pocket thickness for the volume containing the field data. A full table of contents as well as the regulation index adds to the ease of locating desired information.

Readers are requested to suggest additions or changes in style of presentation which will increase the value of the book. The present edition is the outgrowth of such suggestions.

E. A. Bonney has supplied the data on Contractors Equipment. W. G. Harger has handled the balance of the revision.

W. G. HARGER.

E. A. BONNEY.

ROCHESTER, N. Y., September, 1927.

PREFACE TO THIRD EDITION

THE present revision was undertaken in response to the suggestions and requests of many users of the earlier editions. The practical value of the Handbook is increased by the addition of approximately 350 pages of new material covering mountain road location and design, camp equipment, medical notes, notes on photography, the selected soil and gravel treatment of moderate traffic roads, and the more recent developments of hard surfaced types. There is no change in the general scheme of the publication, which is primarily a compact collection of reference data and time saving tables. For the benefit of men not entirely familiar with the road problem, the discussion of principles has been retained, and in some cases where it has been shown that certain arguments in the previous editions have failed to make the impression warranted by their importance, the discussion has been amplified and illustrated by examples of construction and design. We wish particularly to emphasize gradeline design, which is not at present receiving the attention to which it is entitled, and also point out the practically universal lack of adequate maintenance.

The costs given in the body of the text are for comparative purposes only and are based on labor at from \$0.175 to \$0.20 per hour and material costs of the period 1912 to 1915.

For the improvement of future editions we request your coöperation in the correction of typographical errors, and the addition of any omitted data generally useful in road work.

Very few highway engineers are satisfied with the road legislation or technical practice of today or believe that it can be applied as it stands to solve the highway problem in this country in the next fifty years, but the data that has been collected from experience serves as a basis for future improvement. There is every reason to be optimistic in regard to road development provided the problem is approached with constructive imagination and encouragement is given to departure from methods whose main defense lies in precedent or habit.

The work of revision for this edition is entirely that of W. G. Harger.

W. G. H.
E. A. B.

ROCHESTER, N. Y., January, 1919.

PREFACE TO SECOND EDITION

SINCE the publication of the first edition of this book four years ago, considerable progress has been made in the practice of road design and construction. To meet this advance, this handbook has been revised by bringing the material on top courses up-to-date, and by adding considerable data on tests, designs, costs, maintenance and specifications. Not only has much of the old material been revised, but new material, totaling approximately 100 pages, has been added. The criticisms and suggestions of many who have used the book in the field and office have aided the authors in this revision.

A more complete and systematic index has been prepared by Mr. Percy Waller.

The general arrangement of the book remains untouched.

W. G. H.
E. A. B.

ROCHESTER, N. Y., May, 1916.

PREFACE TO FIRST EDITION

THE purpose of this book is to collect, in a compact and convenient form, information ordinarily required in the field and office practice of road design and construction.

The book is designed to meet the requirements of both experienced and inexperienced road men. The material on the relative importance of the different parts of the design, and the possibilities of economy, without impairing the efficiency of the road, are primarily for the inexperienced engineer. The collection of cost data and the tables will be useful to any one engaged in road work.

As it is difficult to avoid clerical errors and mistakes in proof-reading in first editions, we shall appreciate the coöperation of readers in calling our attention to any errors.

W. G. H.
E. A. B.

ROCHESTER, N. Y., April, 1912.

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HANDBOOK FOR HIGHWAY ENGINEERS

PART I—PRINCIPLES AND PRACTICE

CHAPTER I

GENERAL ADMINISTRATIVE, ENGINEERING, AND ECONOMIC DATA

Introduction.—There is no object in giving an extended discussion of the general highway problem in a handbook of this character. The reader is referred to the many excellent highway books and official government publications for such a discussion. This chapter summarizes briefly the main points to be considered and tabulates basic administrative and economic data.

Public business as well as private business is usually based on the fundamental idea of creating a demand for commodities or services in order that large sums of money may be collected and its expenditure controlled by the constituted authorities. In order to produce a healthy and long-lived business, public or otherwise, it is necessary to follow a line of procedure which is both popular and economically defensible and which raises the living standards of the community and increases its productive capacity. The highway executive must decide what will be popular and at the same time good business. He must distribute rewards for large public expenditures on a reasonable basis between the capitalistic or banker class, by some use of bonds and other interest-bearing methods, and the laboring and active business interests, by utilizing most of his expenditures for human labor and the development of actively productive business enterprises of road material and equipment manufacture.

In the pursuit of the universal and laudable object of public works, highway executives are between two fires: the desire of constituents for perfection in travel comfort, and a reasonable type of road improvement, taking into consideration the economics of highway service and cost. *General policy must usually be a compromise between business utility standards and the natural desire of all individuals and communities to get as much pleasure out of existence as they can regardless of cost or regardless of the business wisdom of expenditure for luxuries.* The main value of highway economics lies in providing a basis for judgment considering the problem from a business standpoint. *The practical use of economics*