RAILWAY ENGINEERING: OR, FIELD WORK PREPARATORY TO THE CONSTRUCTION OF RAILWAYS

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Railway Engineering: Or, Field Work Preparatory to the Construction of railways by T. Baker

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T. BAKER

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Trieste

RAILWAY ENGINEERING;

AND

GENERAL TABLE

FOR THE

CALCULATION OF EARTHWORKS.

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412

RAILWAY ENGINEERING;

OR,

FIELD WORK

PREPARATORY TO THE CONSTRUCTION OF RAILWAYS.

CONTAINING

THE ORIGINAL AND MOST APPROVED METHODS OF LAYING OUT RAILWAY CURVES, AND OF SETTING OUT THE WIDTHS OF THE CUTTINGS AND EMBANKMENTS, ETC.;

A

General Table

FOR THE

CALCULATION OF EARTHWORKS

OF

RAILWAY CANALS, ETC.

WITH TWO AUXILIARY TABLES;

ALSO,

TUNNELLING, AND INVESTIGATION OF THE FORMULA FOR THE SUPER-ELEVATION OF THE EXTERIOR RAIL IN CURVES.

BY

T. Jeperis BAKER, C.E.

AUTHOR OF

"A System of Surveying by the Theodolite," and "Railway Engineering," in the Ninth Edition of Nesbit's Surveying; "Integration of Differentials;" &c. &c.

LONDON:

PRINTED FOR

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PATERNOSTER-ROW.

1848.

TO

PETER BARLOW, ESQ.

F.R.S., M. INST. C. E., ETC. ETC.

LATE PROFESSOR OF MATHEMATICS IN THE ROYAL MILITARY ACADEMY, WOOLWICH,
AND ONE OF THE COMMISSIONERS OF THE RAILWAY GAUGES,

AS

A MARK OF ESTEEM

FOR HIS DISINTERESTED KINDNESS,

AND

IN ADMIRATION OF HIS TALENTS

AS AN ORIGINAL MATHEMATICIAN AND PHILOSOPHER,

This Work is Dedicated,

WITH THE HONOUR OF HIS PERMISSION,

BY HIS MOST DEVOTED SERVANT,

THE AUTHOR.

PREFACE.

THE matter contained in the following pages, with the exception of a few additions and improvements, was drawn up about twenty-five years ago for private use; its publication, at the present time, having been delayed at least two years, for reasons, which it will be unnecessary here to state.

The chief part of SECTION I., On the Different Methods of laying out Railway Curves on the ground, was communicated to my friend the late professor Leybourn, of the R. M. College, Sandhurst, in 1824, and afterwards published by him in the "Gentleman's Diary;" these Methods being adapted to all cases that can occur in practice, as well as to the different degrees of scientific skill possessed by surveyors and engineers. The Constructions, Formulæ, and Methods of laying out Compound, Serpentine, and Deviation Curves, with Tables of Offsets for Railway Curves, were also placed in his hands; but his death prevented their publication.

As these Methods of laying out Railway Curves, especially two of them, have been generally adopted in practice, from the commencement of the Stockton and Darlington Railway to the present time, and as several other gentlemen, during the last two or three years, have published on the same subject, most of whom have given either all or part of my methods, I think it right to claim the Invention of them. See Remarks on the Invention of the Methods of laying out Railway Curves, p. 29.

The gentlemen that have published on this subject are, Law, Castle, Rankine, and Hill (see page 31). I have lately seen similar publications by Heald, Brodie, Gardner, May, and others. Almost all these authors give their formulæ and rules for laying out curves without investigation; some of them have given an unnecessary profusion of formulæ, which involve the subject they pretend to explain, in such a degree of obscurity as must be very perplexing to students, and repulsive to those engineers who have been accustomed to use my methods, *in which I anticipated, above twenty years ago, all that has since been done by these authors, at least as far as real practical utility is concerned.*

In SECTION II. I have given Methods of setting out the widths of ground for Railway Cuttings, on horizontal, laterally sloping, and uneven ground, with original Formulæ connected therewith; superseding, in most cases, the unscientific methods of approximation given for the same purpose used by many engineers. This Section concludes with methods of calculating the quantity of land required for projected and intended Railways.

In SECTION III. I have treated extensively on finding the Con-

tents of Railway Cuttings, both for preliminary Estimates from the depths, and for actual Cuttings from Sectional Areas, by means of a General and two Auxiliary Tables, on one folding sheet at the end of the work. — ***The Method here given of finding the Contents of Cuttings from Sectional Areas is, as far as I know, the only one mathematically correct, yet published,*** having been prepared for private use, many years ago.

The authors who have published Tables on this subject are Sir John M'Neill, Mr. Bidder, Mr. Bashforth, Messrs. Sibley and Rutherford, Mr. Huntingdon, Mr. Law, and others; some of whose Tables are voluminous, and most of them well adapted for finding the Contents of Cuttings for preliminary Estimates; but none of them are accompanied with directions for finding the Contents from Sectional Areas, which is the most important part of the use of such Tables, except Mr. Bashforth's: ***but his method of applying them is erroneous.*** See pages 41 and 54. This Section contains Investigations of the Methods of constructing the Tables, and of using them for finding the Contents of Cuttings; and concludes with investigating and pointing out the errors of Mr. Bashforth and others.

In SECTION IV. I have given Methods of setting out the Earthwork of Tunnels, with a Table of the Dimensions of several existing Tunnels.

In SECTION V. I have given the Investigation and Application of the celebrated Formula for the Superelevation of the Exterior Rail in Railway Curves, which is, I believe, due to *Pambour*.

The matter contained in this Work is drawn up in a manner which, I trust, will be easily understood by any surveyor or engineer; Examples, wrought out at length, being given in every case, the mathematical Investigations of the Problems, &c. being kept separate from the practical parts of the Work, the whole of which, except a few trifling alterations, form part of a System of Railway Engineering, which I added to the ninth edition of Nesbit's Surveying, lately published.

In conclusion, I can truly say that the whole of the matter contained in this small volume, with some few trifling exceptions, was originally drawn up by me; the most essential parts of which have either been published or communicated to my friends for periods varying from ten to twenty-five years: no author, on the subjects here treated of, having preceded me, whose results appeared to be of a character adapted to this work, excepting one of *Pambour's* as already noticed; and a small part of the investigation of the rules for finding the contents of earthworks which has been given, as is well known, by various authors.

T. BAKER.

Vauxhall Street, London, 1848.

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