

**THE GLASGOW TEXT
BOOKS.
REINFORCED CONCRETE
RAILWAY STRUCTURES**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649688548

The Glasgow Text Books. Reinforced Concrete Railway Structures by J. D. W. Ball & C. Moncur

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

J. D. W. BALL & C. MONCUR

**THE GLASGOW TEXT
BOOKS.
REINFORCED CONCRETE
RAILWAY STRUCTURES**

THE GLASGOW TEXT BOOKS OF CIVIL
ENGINEERING. EDITED BY G. MONCUR, B.Sc.,
M.I.C.E., *Professor of Civil Engineering at the Royal
Technical College, Glasgow*

REINFORCED CONCRETE RAILWAY
STRUCTURES

Volumes hitherto published of the Glasgow Text
Books of Civil Engineering are:

MODERN SANITARY ENGINEERING.

BY

GILBERT THOMSON, M.A., F.R.S.E., ETC.

Demy 8vo. Cloth. 6s. net.

"The most useful work of its kind we have ever read."—*English Mechanic.*

"Admirable in all respects."—*Building News and Engineering.*

"The author's knowledge is complete down to the minutest detail."—*Architect and Builders Journal.*

**RAILWAY SIGNAL ENGINEERING
(Mechanical).**

BY

L. P. LEWIS.

Demy 8vo. 8s. net.

Details of the volumes to follow are given in
a special prospectus which will be sent, post
free, on application.

CONSEABLE AND COMPANY LTD

THE GLASGOW TEXT BOOKS

Edited by G. MONCUR

REINFORCED CONCRETE RAILWAY STRUCTURES

BY

J. D. W. BALL, ASSOC. M. INST. C. E., A. C. G. I.



NEW YORK

D. VAN NOSTRAND CO.

TWENTY-FIVE PARK PLACE

1914

transpou.

EDITOR'S PREFACE

ALTHOUGH Reinforced Concrete has been hitherto more extensively utilised for railway purposes on the Continent and in America, it has of recent years been more largely adopted in this country for certain classes of structures. It is not claimed in this book that this material is universally applicable or suitable for all kinds of construction, and in many cases the nature of the site or the conditions of erection might render it inadvisable to use it; but, on the other hand, it has many desirable features, more especially durability and economy of maintenance. These advantages and deficiencies have been clearly set forth by the Author in the opening chapter.

The formulæ given are comparatively few in number, are reduced to simple forms for facility of practical application, and by the aid of the curve diagrams calculations can be made with ease and expedition. A considerable number of worked-out examples have been included, covering the great majority of the problems which would occur in practice, and it is hoped that this will simplify the application of the formulæ. For convenience of reference the notation adopted and the formulæ have been collected together in the last chapter, and an explanation is there given of the method of using the diagrams.

G. M.

AUTHOR'S PREFACE

It has been the author's aim to describe in this book the generally accepted principles and processes upon which the design and construction of reinforced concrete structures depend, and more especially those structures which come within the practice of the railway engineer.

The use of complicated formulæ and calculations with which the literature of this subject has so frequently been associated has, as far as possible, been avoided, and attention has been concentrated upon arriving at results as simply as possible and presenting them in a convenient manner for use in the design of the various structures. The reader's attention is drawn to Figs. 10, 11, 14, 15 and 17, and the explanatory notes at the end of Chapter X., which the author has found useful and speedy for proportioning the parts of beams and other members subjected to bending. They are quite sufficiently accurate for all practical purposes, for it must not be forgotten that in applying the theory of bending to reinforced concrete beams in the generally accepted manner, very broad assumptions are made.

On the other hand, the careful determination of reactions and bending moments, in the case of many reinforced concrete structures, is rendered very necessary, and at the same time more difficult, owing to their monolithic character. In this connection, and in determining the stresses in arches, for instance some of the problems presented have necessarily required mathematical treatment, but, where possible, graphic methods of procedure have been adopted.

The method of dealing with flat arches, and the determination of the stresses in sleepers, have been previously described by the author in *The Engineer* and *The Engineering Review* and his thanks are due to the Editors of these periodicals for

permission to reproduce some of the illustrations and descriptive matter here.

Much of the matter relating to materials and labour has been given in the form of extracts from specifications of some of the works described, with a view to making this part of the book of the greatest practical utility.

For the illustrations and descriptions of some of the works described the author is indebted to the engineers or architects of the railways concerned, to the partners of the late Mr. L. G. Mouchel in the case of works carried out in Hennebique ferro concrete and to the Indented Bar and Concrete Engineering Company and the Trussed Concrete Steel Company in the case of structures reinforced with their respective specialities and carried out to their designs.

J. D. W. B.

CONTENTS

CHAPTER I

PRELIMINARY CONSIDERATIONS

	PAGE
Development—Difficulties—Advantages—Encased Steelwork—Reinforced Concrete—Working Stresses—Striking Centres—Specification of Materials	1

CHAPTER II

BENDING STRESSES

Theory—Concrete in Tension—Neutral Axis—Moment of Resistance—Relative Cost—Double Reinforcement—Tee Beams	16
---	----

CHAPTER III

SHEAR STRESS

Formulae—Ultimate Shear Stress—Depth of Beams—Shear Reinforcement—Design—Principal Stresses—Tee Beams—Special Systems—Bond Stress	35
---	----

CHAPTER IV

FLOORS AND BUILDINGS

Scope—Platforms—Continuous Spans—Slabs Supported on Four Sides—Floors of Buildings—Old Rail Reinforcement—Lintels—Columns—Warehouses—Jetties and Gantries	51
---	----

CHAPTER V

FOUNDATIONS AND RAFTS

Piles—Piers—Spread Foundations of Piers—Column Foundations—Rafts—Underground Subways	80
--	----

CHAPTER VI

RETAINING WALLS

Advantages of Reinforced Concrete Construction—Earth Pressure—Walls with Counterforts—Design of Base—Design of Counterfort—Walls without Counterforts—Design of Base—Relative Cost—Combined Wall and Coal Bunkers	99
---	----