

**NOTES ON CYLINDER BRIDGE PIERS AND  
THE WELL SYSTEM OF FOUNDATIONS.  
ESPECIALLY WRITTEN  
TO ASSIST THOSE ENGAGED IN THE  
CONSTRUCTION OF BRIDGES, QUAYS,  
DOCKS, RIVER-WALLS, WEIRS**

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**JOHN NEWMAN**

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*Epecially written to assist those engaged in the  
construction of*

**Bridges, Quays, Docks, River-Walls, Weirs, etc.**

BY

**JOHN NEWMAN,**  
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*"Earthwork Slips and Subsidences upon Public Works";*  
*"Scampering Tricks and Odd Knowledge occasionally Practised upon  
Public Works"; etc., etc., etc.*

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1893.

## P R E F A C E .

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THIS book has been especially written to assist those engaged in designing or erecting Cylinder Bridge Piers and Abutments, and Concrete, Brick, or Masonry Wells, as applied to Bridges, Quay-, Dock-, and River-Walls, etc. Many of the chapters have recently appeared as serial articles in *THE ENGINEERING REVIEW*.

It will be seen, by reference to the Table of Contents and the Index, that most of the chief points requiring attention in the design, sinking, or erection of Cylinder Piers or Wells, either by compressed air, dredging, or open-air excavation, from the first sketch and calculation to the completion of the work, are examined. The strains caused by wind-pressure on bridge piers, or the lateral thrust of earth on abutments and walls, are only very cursorily referred to, as there are many excellent treatises and papers on those subjects, whereas information on the matters herein mentioned is only to be fragmentarily obtained, and after considerable research in the various engineering journals, books, and reports of this and other countries, and especially in the engineering press.

In 1873 a Miller prize was awarded to the author by the Council of the Institution of Civil Engineers, for a

short paper upon the calculations necessary in designing Iron Cylinder Bridge Piers, it being afterwards published by permission. The pamphlet having been many years out of print, and several engineers and bridge-builders, here and abroad, having unsolicitedly testified to their having received "much help" from it, the whole subject has been considered *de novo*; and although this is by no means an exhaustive treatise, it being a kind of miniature cyclopædia on "Cylinder Bridge Piers and the Well System of Foundations," and as the application of cylinder and well foundations has since been much extended, the hope is cherished that the book may be equally useful to the Engineer, Bridge-Builder, Contractor, and Student.

J. N.

LONDON, 1893.

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# CYLINDER BRIDGE PIERS.

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## CHAPTER I.

### GENERAL DESIGN.

In this book purely theoretical questions will not be specially examined, the object being to practically explain the chief points requiring consideration in the correct design of cylinder bridge piers and the well system of foundations, and in the prosecution of the sinking operations connected therewith. Reference will also be made to the load upon the base, surface friction, methods of sinking, and the general operations necessary in the design and erection of bridge piers or wells constructed according to the methods herein mentioned.

First, it may be stated as an axiom that no system of bridge piers or foundations can be universally recommended, because of the varying nature and condition of the ground and the different general circumstances. The cylinder pier system is usually employed where great lateral stability is not required; it is especially adapted for an insistent weight, and where a heavy load has to be supported without materially obstructing a river or waterway. It is obviously safer and cheaper to give too much waterway than too little; but economy of space in navigable rivers and rapid tideways is generally absolutely imperative in piers, both during erection and when erected; therefore, apart from other questions, the advantage of the cylinder method of foundations is apparent.

In deciding whether to use well foundations instead of iron cylinders filled with concrete, brickwork, or masonry, several questions must be taken into consideration, and among others may be named the following: The character of the soil, which should be sand or loose strata not firmer than sand; the probability of *débris*, and boulders, and other obstructions such as a hard stratum being encountered, in which case it may be advisable to adopt iron cylinders or the caisson system; the relative cost of the various types of bridge pier, as it may so happen that iron is cheap when bricks or Portland cement are dear; the length of the season during which operations can be carried on; and the assured