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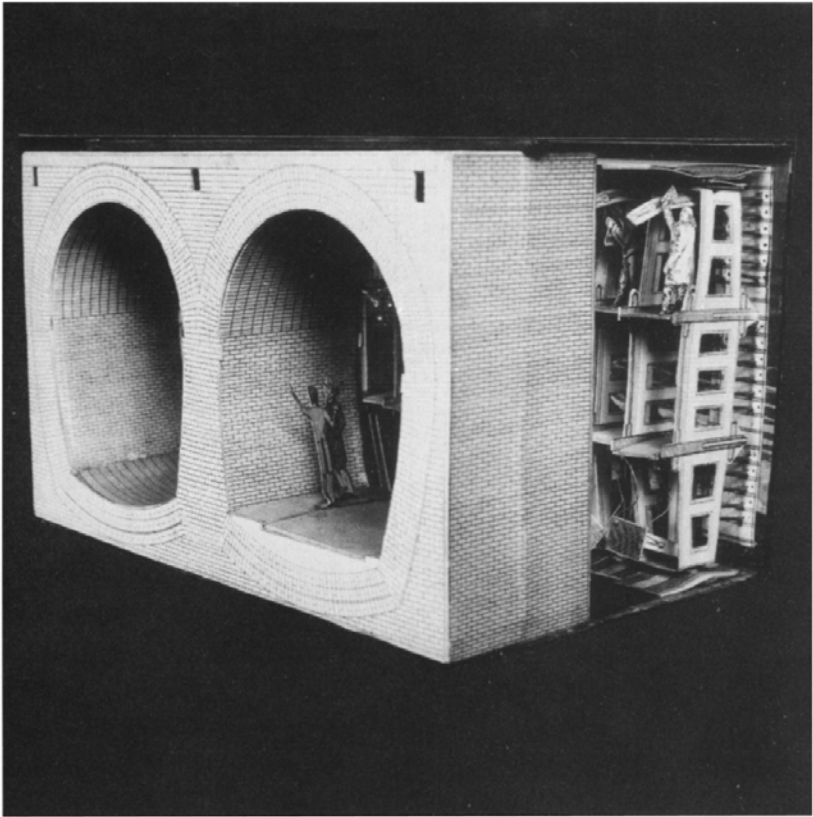
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Frontispiece – Thames Tunnel and shield (1826 or 1836)

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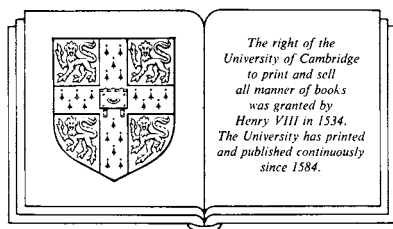
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**Innovation
and the rise of the
tunnelling industry**

GRAHAM WEST



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CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 2RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521335126

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First published 1988
This digitally printed first paperback version 2005

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data
West, Graham.

Innovation and the rise of the tunnelling industry.

Includes bibliographies and index.

1. Tunnelling – History. 2. Tunnels – History.

I. Title.

TA803.W47 1987 624.1'93'09 87-8089

ISBN-13 978-0-521-33512-6 hardback

ISBN-10 0-521-33512-4 hardback

ISBN-13 978-0-521-67335-8 paperback

ISBN-10 0-521-67335-6 paperback

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For Sheila, Caroline and Jonathan

Now among all the benefits that could be conferred upon mankind, I found none so great as the discovery of new arts, endowments, and commodities for the bettering of man's life. For I saw that among the rude people in the primitive times the authors of rude inventions and discoveries were consecrated and numbered among the Gods. And it was plain that the good effects wrought by founders of cities, law-givers, fathers of the people, extirpers of tyrants, and heroes of that class, extend but over narrow spaces and last but for short times; whereas the work of the Inventor, though a thing of less pomp and show, is felt everywhere and lasts for ever.

Francis Bacon (1603)

From the preface to *On the Interpretation of Nature*

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Preface

It is a truism that everyone is interested in holes in the ground, but for me an original interest in holes in the ground has developed into a further interest, namely an interest in how holes in the ground are made. For a decade I was fortunate in being associated with the tunnelling industry, albeit as a research worker, and this gave me the opportunity to find out about tunnelling technology and its fascinating history of development. This book is the outcome of that endeavour.

The book has been written with the interests of three kinds of reader in mind. Firstly, civil and mechanical engineers, engineering geologists and others who are involved in present-day tunnelling, but who wish to know something of the history of the technical development of the tunnelling industry. Secondly, students of the history of technology who will find in the book a case history with important lessons that can be seen to have a relevance beyond the confines of the tunnelling industry. And thirdly, a more general and growing readership consisting of those who see in the history of technology a subject which is not only interesting and worthy of study in its own right, but one which can be properly regarded as part of the culture of our civilisation.

I would like to express my gratitude to two particular colleagues and friends: Dr Noel G. Coley of the Open University, for guidance and advice on research in the history of technology and on historical writing, and Dr Myles P. O'Reilly of the Transport and Road Research Laboratory, for support and encouragement and for reading through the whole of the book in draft form and commenting on the technical matters. However, I hasten to add, any shortcomings and errors in the work are entirely my own.

Colleagues in the tunnelling industry are thanked for their help with information and for their forbearance in setting aside present concerns to answer historical questions. The following libraries are thanked for access to their collections: Institution of Civil Engineers, Science Museum, Lyon Playfair (Imperial College), Institution of Mechanical Engineers, Transport and Road Research Laboratory, and Reading University.

My employer, the Transport and Road Research Laboratory, is thanked for assistance towards the higher degree studies that eventually led to this book; however, any views expressed in the book are entirely my own and not those of the Laboratory or of the Department of Transport, of which the Laboratory is a part.

Much of the book is based on a thesis submitted to the Open University with whom I am proud to have been a part-time postgraduate student.

Dr Richard L. Ziemacki and the editorial staff of the Cambridge University Press are thanked for their help in preparing the book for publication.

October 1986

Graham West