

Book Reviews

Building Construction before Mechanisation

JOHN FITCHEN, 1986

Cambridge, Mass., MIT Press

326 pp, illust., £19.95

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The principal problems of the builder in all ages have been those of transporting materials from their source and lifting them into position, supporting those materials until they, or the fabric that supports them, are strong enough to act by themselves, and gaining access to the work. To these must be added the problems of removing spoil and ground water, which are the particular problems for the miner and the well digger but which face the ordinary builder in digging his foundations. The importance of the solutions to these problems need hardly be stressed because upon their efficiency depends the economy of the construction and the methods available will ultimately limit what can be built. How these problems were managed without mechanical aids and what effects this had upon the organisation of construction and the economics of building, even possibly on architectural form, are all legitimate questions and those suggested by the title of this book. Unfortunately its coverage of these questions is disappointing.

The difficulty that I have had in reviewing this book is in deciding just what its intentions were and for this reason have had to attempt to set out what appear to be legitimate questions even though this runs the risk of falling into the reviewer's trap of trying to tell the author what he ought to have written about. Perhaps one cannot tell a book by its jacket but titles do raise expectations of the subject matter. One would, of course, expect the content of the book to be more precisely indicated by the introduction, but here Fitchen says no more than that he is interested in the process of building before mechanisation, i.e. no more than one could deduce from the title. Much of this book does deal with the questions that I have suggested. Such questions have been of particular interest to historians of military architecture, where the scale of work is very large, and to those interested in such major building projects as Brunelleschi's Santa Maria del Fiore or the Gothic cathedrals which Fitchen has looked at in the past. All such projects stretched building construction to its limits and the forms were in turn limited by the technology available and so the problems of their construction have attracted the attention of historians. So far, however, there has been no general discussion of the processes of construction, and to the extent that this book deals with such questions it provides a useful outline to a much neglected subject.

The difficulty facing the historian of this subject is the comparative paucity of evidence. Building accounts may mention special payments to builders for unexpected difficulties, pumps in wet ground for example, but the normal problems of building were the builder's concern and his accounts rarely survive. Temporary works leave little or no trace and materials will be reused wherever possible so that their costs will be a poor representation of the works themselves. Occasionally we may discover the

remnants of a hoist left in a roof space but these were the more substantial parts of the builder's equipment and more often we have to rely upon other evidence. Our sources may be occasional drawings, like those in the sketchbooks of Villard D'Honnecourt or those by Brunelleschi for his Florence dome. Drawings in early manuals or encyclopaedias or paintings, drawings and prints by artists that have illustrated works in progress, (as Piranesi did of Blackfriars Bridge, Bourne did for the building of the railways or more in this century Brangwyn did of bridge building) are all to be examined for the clues that they offer. So limited are our sources that we may even have to look at works where the artists have included building works as incidental features of their views. Often we must use less direct evidence, such as surviving putlog holes, while another useful source is the observation of construction in parts of the world where there is still little mechanisation. Fitchen uses a combination of these together with some sensible imagination but in a rather scattered way throughout the book and a discussion of historical method in this difficult area would have been valuable.

'Before mechanisation' does not define a clear period. The simple pulley and lever are machines so that there has been very little building construction without mechanisation of some sort. It would therefore have been helpful if the reader were told of the basis for selection of the subject matter. Is the significance of mechanisation the introduction of and the ability to transmit mechanical power? If so this has affected the nature of building operations both off as well as on site but there is no discussion of the effect of mechanisation on the preparation of building materials or conversely on the limit that hand work placed upon wood and stone working. However, he does deal with the provision of ventilation in building before the introduction of mechanical plant. Here 'construction' clearly refers to the product as well as the process but it is a subject that cannot be dealt with adequately in the space available.

This is an example of a number of chapters whose inclusion is difficult to understand. 'Jerry building' and the development of building regulations to prevent this are of some importance to the history of building but seem to have little place in this book and again require fuller treatment than Fitchen gives them. Similarly an understanding of structural mechanics and material performance have little to do with mechanisation although an understanding of these subjects was coincidentally developed at the same time as improvements in mechanical handling during the nineteenth century. It would have been better had he not ventured into these areas where he seems out of his depth.

Even chapters on subjects of clear importance to the problems of construction sometimes deal with irrelevant issues while ignoring what seem to this reviewer to be pertinent questions. Wood must be regarded as the most important material before the industrial revolution but although Fitchen provides a chapter on its importance in construction regrettably he fails to identify the crucial issues. Decay, which he discusses, is a problem for timber but obtaining timber supplies, which is not covered, seems to be more important. The availability of different timbers at different times and particularly in different countries would surely have affected both building design and method of construction. Similarly there seems little point in a description of different forms of framing and jointing without some consideration of the methods of woodworking that led to those forms. His discussion of the collaboration between the mason and the carpenter also gives a poor indication of the importance of the carpenter on early building sites where all trades were dependent upon him both for false-work as well as scaffolding.

Fitchen touches on a great number of issues that are of considerable importance

to the process of building. His chapter on ladders, for example, is an unusual subject to see tackled and one of the more interesting and more detailed sections of the book. All too often though such issues are raised only to be dealt with superficially. While their importance is noted nothing of substance is said about them. The text is also marred by a few technical and historical errors. For example there is a confusion between the two different setting processes of lime mortar and concrete, dry rot is mentioned as if it were the only form of fungal attack on timber and British readers will be surprised to be told that there are only two main forms of structural carpentry here, cruck construction and hammerbeam roofs.

It is difficult to be sure who this book has been written for. The author gives the impression that he has set out to provide a scholarly work that seeks to explain some of the methods that were used in the past and the text is heavily footnoted and accompanied by a useful bibliography that at first glance promises to provide historians interested in this aspect of construction with useful information. However, this promise is not fulfilled in the text which reads as if it were addressed to the general rather than the specialist reader; and even then the general reader who is not particularly concerned with historical detail. For the most part the author takes little care to separate different historical periods or even different places nor does he always make explicit which of the different kinds of source material he might be relying on. Had irrelevant chapters been omitted this would have made a useful introduction to an important subject but it lacks depth and will be of little use to the serious historian.

DAVID T. YEOMANS, *University of Liverpool*.

Transitions in Engineering: Guillaume Henri Dufour and Early Nineteenth Century Cable Suspension Bridges

TOM F. PETERS, 1987
Basel, Birkhauser
244pp., Illust., SFr. 80
ISBN 3 7643 1929 1

For those familiar with Professor Peters' paper on Dufour in the 1979 ETH Zurich volume on "The Development of Long-Span Bridge Building" this book has been long awaited. Dufour's work was relatively well-known in the engineering community of the first half of the nineteenth century. Descriptions of his bridges and texts appeared in English in Drewy's book on suspension bridges (1832), Weale's bridges (1839-43), and in several scientific periodicals. Today, however, it is unlikely that many people outside his native Switzerland will have heard of him, and still fewer read his work. This extensively illustrated book will remedy this and the publishers are to be commended, as the title would appear at first glance to have little appeal beyond the specialist circle of civil engineering historians. The decision to publish must have been influenced in part by Dufour's importance in Swiss history.

Dufour was born in Constance in 1787, when his father was in temporary exile from Geneva as a result of his radical political views. The family returned to Geneva in 1789, and Dufour received his early education there. As a result of the French annexation of Geneva in the Napoleonic wars Dufour became eligible to take the entrance examinations to the Ecole Polytechnique in Paris. He scraped in, but through hard work graduated in 1809 as fifth in his class. Thus Dufour met some of the great

scientific teachers of the age, as well as many of his own generation of French civil engineers. Dufour then chose the career of military engineer and served in Corfu, where he developed tremendous mapping skills. In 1817 he returned to Geneva where he became Commandant of the Geneva military engineers and Professor of Mathematics at the Geneva Academy. With a firm base in Geneva he proceeded to play an important role in the development of Switzerland. He co-ordinated the mapping of Switzerland at a scale of 1:100,000, and was three times appointed Commander-in-Chief of the federal forces, preserving Switzerland's independence. His personal friends included Napoleon III, and by the time of his death in 1875 he had gained international honours. With such a distinguished career he makes ideal biographical material and it is puzzling that a comprehensive biography has not yet appeared, although many of his writings were published in a collected edition by Dunod and Griffon in 1951.

Peters' approach is not however a conventional biography. Instead he has chosen to use Dufour's career to provide an insight into the development of engineering thought and practice in the early nineteenth century. Dufour's life coincided with a crucial period in civil engineering history, with the introduction of a "new" structural material (iron), a "new" transport system (locomotive powered railways), and a "new" structural form (level deck suspension bridges). As engineers sought to master new technological problems they were able to use increasingly effective analytical methods, and combined these with detailed tests.

Dufour's work provides an ideal opportunity for investigating this period of transition to modern (i.e. pre-computer) engineering practice, as many of his papers have survived. It was thus possible for Peters to examine many of the drawings, reports and correspondence regarding the early wire suspension bridge schemes with which Dufour was associated between 1822 and c. 1853. Many of the drawings are reproduced in this book.

Although Dufour was not the originator of the first Geneva suspension bridge proposal, as city engineer he was consulted as soon as the idea was first mooted at a time (1822) when wire suspension bridges were still in the experimental stage. He was able, therefore, to play a role in the development of this type of structure to its first maturity, and his collaboration with the Seguins was of mutual benefit.

By using Dufour as a central theme, Peters traces the development of suspension bridges from antiquity to mid-nineteenth century, providing much background on the history of civil engineering education and ideas on the way. There are relatively few general histories providing this information, and the reader unfamiliar with this material will find the book doubly rewarding. Its most interesting section, to those already familiar with the activities of Dufour and his contemporaries, is that which deals with the early Asian suspension bridges. Although Needham (1971) and Fugl-Meyer (1937) discuss the early Chinese bridges there is much that is new to the west here.

One question which his wide-ranging discussion raises is why, given European awareness of suspension bridges in both South America and Asia, so few European examples are known before 1810. One explanation is possibly that engineering historians are not aware of them, indeed little has been added to the information provided by Navier and Stevenson in the 1820s. Clearly a degree of technological development has to coincide with a need for a specific engineering solution, and it may simply be that the increasingly widespread acceptance of iron as a structural material was the crucial factor. Related questions are why did Judge Finlay seize on the idea,

and who built the suspension bridge seen by Latrobe in 1796, and was Finlay aware of it? In the case of Telford one can readily see why the problem of bridging the Runcorn Gap drove him to look for a new structural solution, but this does not explain why suspension bridges were being used for relatively modest spans, or who first suggested to Telford the notion of a suspension bridge. Possibly it was the entrepreneur rather than the engineer who provided the crucial impetus, and rather as Ironbridge can be seen as the flagship of the Coalbrookdale Company, so other ironmasters sought new markets for their products in the form of suspension bridges.

Commercial considerations may have played their role in other ways. An interest in the patents for particular bridge types may help explain the dominance of particular bridge systems in various countries. Did Roebling choose wires partly because patents existed for chain bridges? Did the Seguins prefer wire cables because it was their system and chains seem to have been regarded as part of the public domain in France? While it appears true that the number of wire suspension bridges in the first half of the nineteenth century exceeded that of 'chain' suspension bridges, in much of the globe chains predominated: Britain, Germany, Austria-Hungary, Russia, British India. Dufour himself advocated their use on the Bergues Bridge. Even in France, where the Seguins' system received official blessing, and Vicat was able to identify the inherent advantages of wire cables, one of their most distinguished engineers—Navier—advocated chain bridges. In that sense Dufour's influence was limited, as was that of the Seguins. What is clear, however, is that the engineers working from Finlay's time onwards were aware of each other's work, corresponding with one another, and even visiting each other. Even when they preferred a differing solution, they did so with knowledge rather than in ignorance of their colleagues' work.

Peters work provides much useful information on the development of the wire cable suspension bridge by Dufour, the Seguins, and Vicat. Vicat saw the advantages of aerial spinning of cables, and his ideas were taken up by Chaley from 1840 onwards, and later by Roebling. The importance of the failure of Chaley's Basse-Chaine Bridge in 1850, which was attributed to corrosion on the cable anchorages, is detailed. The anchorages were basically the same as those used for most such bridges since 1831 when Vicat had advocated grouting them on lime mortar as an effective barrier to corrosion, and the shock of the failure basically killed off the development of suspension bridges in France for a generation, by which time the Roeblings had been able to seize the technology initiative.

This book will clearly play a part in the process of enabling us to get a better understanding of the development of engineering thought and practice. On initial reading I felt using Dufour as the 'window' to peruse the evolution of engineering from an art to a technology led at times to the book being rather disjointed. The diversion into early cast iron arches when discussing the Bergues Bridge, and the earlier section on the development of structural theory, were two instances of this. There are also a few silly errors which probably crept in at the typesetting stage, e.g. Gilbert Davies for Davies Gilbert (p. 48). I also believe that Peters is wrong in dating the establishment of analytical status to the publication of the third (St Venant) edition of Navier's lectures. Navier's work was known in England much earlier than this, in part due to the influence of Professor Moseley, and is referred to, for example, in the correspondence on the Britannia and Conway Tubular Bridges. Despite Telford's apparent dislike for the theoretical approach to engineering problems this did not prevent him from using people like Provis who clearly were able to master such methods. (Was Telford's attitude coloured by the confusion of replies he received from the scientists

regarding his London Bridge proposal, and its contrast with the practical advice he received from ironmaster Hazledine and his foreman Stuttle?) By the mid nineteenth century there were probably many engineers in the United Kingdom, of whom perhaps Charles Head Wild was the most notable example, who were able to effectively work as consultants because of their ability to analyse structures.

Such points are not intended to deter people from purchasing the book. It is beautifully presented and deserves to be bought by all interested in the history of civil engineering and technological change.

MICHAEL MARK CHRIMES, *Institution of Civil Engineers*

Innovation and the Rise of the Tunnelling Industry

GRAHAM WEST, 1988

Cambridge University Press

355pp., illust.

ISBN 0 521 33512 4

This book is not a 'history' of tunnelling, nor even an attempt at an overall study of tunnelling innovation. Rather, it is a series of interesting and informative snapshots, with general comment appearing only in the introduction and conclusion. Twelve of the fourteen chapters provide a series of accounts of important technical advances in the industry since 1825, and a major attraction of the book lies in the fact that each of these could stand alone and still appear complete.

In his preface, Dr West states that the book is aimed at civil engineers and others involved in tunnelling, at students of the history of technology, and at a more general readership. However, assumptions made about the readers' prior knowledge of the subject mean that technical material beyond the scope of the general reader is occasionally included, whereas at other times background historical information of a rudimentary nature is supplied. Probably the book best serves those who already have at least passing familiarity with basic civil engineering ideas and vocabulary.

The innovations examined were all significant to the tunnelling industry. A broadly chronological sequence is followed, with the important proviso that problems need to be judged by contemporary rather than present standards. West places each innovation securely in context, so the reader is more able to evaluate its importance. He also provides excellent bibliographic notes, and anyone wishing to embark on further study of tunnelling history would find these an invaluable aid, though it is perhaps unfortunate that ephemeral sources are seldom referenced fully. The book's illustrations are also generally of a high standard, with good use of many contemporary drawings.

Although each chapter could be read in isolation, several common themes emerge, and chapters dealing with these are grouped together. The book starts with hard rock tunnelling. The first innovation examined is the development of compressed air rock drilling machines in the nineteenth century, largely as a result of the demand for railways. Developments took place in both Europe (the Mont Cenis Tunnel) and the United States (the Hoosac Tunnel) at approximately the same time, with engineers travelling extensively to examine contemporary developments elsewhere.

For hard rock tunnelling to proceed further, improved explosives were needed; descriptions are provided of the introduction of first nitroglycerine and then dynamite.

The story of the discovery that frozen nitroglycerine was safe to handle is a better one than most historians of technology are fortunate enough to possess and West tells it well; his work is eminently readable.

The chapter on the development of tungsten carbide drill bits provokes as well as answers questions. Here mention is made of developments in the early 1940s, yet no mention is made of the war. Was the progress of the time purely civilian in origin, or did war—as well as tunnelling—stimulate innovation? Also, have there been any changes since 1960? Normally West satisfies the reader's curiosity as to whether further developments are being made; here, though, no indication is given of events of the last twenty-five years.

This section concludes with an examination of hydraulic rock drilling machines from 1865 to the 1970s, when many parallel developments were occurring. Then follow three chapters on soft rock tunnelling, commencing with an examination of tunnelling shields from a time when the workforce for a tunnel could be as large as 4000 men. Compressed air tunnelling provides an example of one of the most common criticisms levelled at the construction industry: scientific knowledge being in advance of technology.

Immersed tube tunnels suffered from problems relating to finances and people, rather than to technology, as did many of the earlier attempts to tunnel under the Thames. Even after problems were solved, the delay in the use of immersed tube tunnels in Great Britain provides a good example of an innovation being adopted only if there is a need. The use of steel tube units in the USA and of concrete in Holland shows how the comparative cost advantage of one material in a particular country determines the exact nature of the technology employed.

Lastly, tunnelling machines are examined, for both hard and soft rock. Europe and the USA are the scene for most of the innovations described in the book, but for recent developments in machines Japan has been important, and the Japanese tunnelling industry—supported by research laboratories—is investigated.

In the final chapter, which comprises general observations on and the author's classification of technical innovation, an attempt is made to analyse what stimulates innovation. West believes that "The best way to stimulate innovation in an industry is to give that industry plenty of work to do and not to worry about trying to stimulate innovation artificially by other methods". Although in many ways an attractive proposition, this idea exemplifies a bias apparent throughout the book: technical problems and their solutions are discussed with little regard for their economic costs. If British contractors have to rely on the public sector for most of their work, then profit margins may not be sufficient to accommodate the high research costs of technology-based innovation.

This last term is one of six which West puts forward as a classification system for technical innovation, the others being science-based, borrowed technology, accidental, external ideas and composite innovation. These terms are hardly new, though the idea of using them in conjunction with one another as a classification system may prove useful. Borrowed technology and technology-based innovation appear most frequently in this book. However, *Innovation and the Rise of the Tunnelling Industry* uses comparatively few case studies, all selected by the author; it is difficult without an extensive knowledge of tunnelling to know whether other innovations could have been chosen, to show different causation.

It would be a pity to finish on this disparaging note. The book's strengths do not lie in academic theory but in its detailed description and analysis of specific innovations,

and in its overview of developments in a major, if largely unseen, industry. The case studies provide a good introduction to an area of construction history which has probably escaped the attention of many of those with a knowledge of innovations above ground.

KATE DAVISON, *Bristol*

With Our Hands: The Story of Carpenters in Massachusetts

MARK ERLICH 1986

Philadelphia, PA, Temple University Press

239pp., Illust., end-notes and index US \$29.95

ISBN 0 87722 433 1

This is an attractively-produced book, clearly set out, well printed on semi-glossy paper, and extensively illustrated. Though it comes from an academic press and has a good scholarly apparatus, it is not designed for a narrowly academic market. It is a centennial history of the Massachusetts "locals" (branches) of the United Brotherhood of Carpenters and Joiners of America, long established as one of the largest and strongest craft unions in the United States, and at the heart of the construction trades, themselves the enduring core of the American labour movement.

The book is clearly intended to be interesting to present and former members of the union and the trade. It is straightforwardly written and organised, pursuing a story in largely chronological order, with some thematic chapters (e.g. appropriately enough towards the end, "Knocking on the Door: Blacks and Women in Construction"). The text is broken up by photographic sections which do not, however, tie in with the story very usefully. Much use is made of oral history interviews with past and present carpenters. The principal author and researcher is a working carpenter, and his inspiration is the "History Workshop" school from the UK. This is history of, by, and in good measure for, skilled, unionized tradesmen.

Its focus is on the workforce and the industry, rather than simply on the union. There is much conventional labour history narrative, which is well done and very interesting, but there is not a vast amount of either analysis of, or apologetics on behalf of, union leaders' tactics and strategy, which takes up so much of the contrasting histories of the national union by Robert Christie (*Empire in Wood*, 1957) and Walter Galenson (*The United Brotherhood of Carpenters*, 1983). For a fuller understanding of key decisions taken within a highly-centralized union which set much of the context within which the Massachusetts carpenters' local unions operated, the reader will have to refer to those standard accounts.

Erich is very good at explaining the changing organization of the industry's ownership and management, and the complex relations between clients, general- and sub-contractors. He explains also how the economics of large-scale construction, in which labour costs have been a steadily declining proportion of the total and contractors have been sensitive to completion times and to the availability of an adequate skilled workforce, made it a soft target for craftsmen's organizing efforts. This encouraged the union in the post-Second World War period progressively to abandon less remunerative general and residential construction jobs to lower-paid, less-skilled, non-union labour. This allowed a lower-cost sector to grow until it now threatens to swallow what remains of the unionized construction industry.

Erich also does a thorough job of describing carpenters' occupational culture. It was a workforce recruited (often by father-to-son successions) from a relatively few of the white ethnic groups making up the American population, and organized to keep outsiders out and to secure job opportunities for members of the trade community. It took pride in real skill, acquired more by observation and experience than through formal apprenticeship programmes and combined strong loyalty to the union (whose centrality as a social institution in its members' lives has, however, declined since the 1920s) with an equally-powerful commitment to America's ethos of individualism. Its members still can, and do, cross the unstable dividing line from employee to (unionised) supervisor, or "lumper" or small contractor, and back again.

Erich also explains the effects of the industry's unstable product-market on the men and their union. The harsh New England winter imposes even greater seasonality on the American construction trades than on our own. The wide, and wild, fluctuations of the construction cycle from feast to famine, the ever-present threat of a labour market oversupplied by rural, French Canadian, or European migrants, and the effects of technological change in undermining the centrality of on-site woodworking in US construction, have helped determine the union's focus on labour market regulation and the aggressive redefinition and defence of its "jurisdiction". As a result, the union has acquired a bad public image for its exclusive policies and its frequent involvement in demarcation disputes with other organized trades. Erlich's account of these matters might have been strengthened by reference to Robert M. Jackson's *The Formation of Craft Labor Markets* (1984), which explains further another consequence of the industry's organization: the employers' willingness to compromise with the union, recognizing its control of the labour supply and its ability to stabilize, as well as disrupt, on-site labour relations.

There is much for readers of *Construction History* in this book. Though its focus is just on one state, it would serve as a remarkable introduction both to the history of industrial relations in American construction and to changes in technology and work organization. The nearer to the present it comes, the more useful it is as an explanation of the de-skilling and accompanying de-unionization of one of America's largest industries.

HOWELL JOHN HARRIS, *University of Durham/University of California at Davis*

Harry Neal Ltd: A Family of Builders

MARTIN GASKELL, 1989

Cambridge, Granta Editions

xii + 176pp., illust., £14.95

ISBN 0 906782 40 6

Despite the growth in business history as an academic discipline and indeed as a minor industry in itself over the past few years, a good history of a building firm is still a rare commodity. All credit is therefore due to Harry Neal Ltd who had the imagination to commission a work of this kind and entrust its execution to a scholar of repute. The mediating hand of Debrett's Business History Research Ltd is also discernible in the desire to produce an eminently readable general history of a family firm which at the same time addresses some of the wider concerns of historians of the building industry.

The very name, Harry Neal Ltd, which the firm has retained since 1923 through all

kinds of mergers and take-overs, suggests the homespun origins and traditional image which it has carefully nurtured over the decades of expansion. This is not one of the great contracting firms, usually identifiable these days by their adoption of a single name, but one of the medium-sized building concerns which are often said to constitute the backbone of the industry. The book illustrates very clearly how the firm has sought to make a virtue out of a sense of history and continuity by stressing the loyalty of its long-serving workforce and the high quality of its workmanship based largely on the almost unimaginable luxury of its retention of separate craft departments. That such factors can still be influential in a world of highly competitive tendering is very gratifying to the historian.

As is often the case, the origins of the firm are still somewhat obscure. Harry Neal came to London in about 1889—hence the peg on which to hang this history—and after a short period as an apprentice to his older brother, commenced speculative housebuilding on his own account in the Kilburn area. He prospered sufficiently in this to move on to the building of higher-priced housing in the Northwood area, where, after a brief hiatus during the First World War, the firm concentrated its activities in the interwar years.

There is a tantalising reference to financial backing from the Westminster Bank which enabled the firm to branch out on a larger scale in the 1920s, especially on the important Gatehill Estate. This successful development appears to have provided the basis for further expansion, and especially the diversification into contracting in the 1930s. Several major buildings were undertaken, especially large blocks of flats, banks and cinemas, including the lavish Gaumont State in Kilburn, the largest of all the super cinemas, where some account of the organisation of the opulent decorative work would have provided an insight into how the firm handled such complicated contracts. It would also have been useful to know which blocks of flats were built speculatively and which under contract, and indeed how these different types of work were handled organisationally. For the former work the firm seems to have favoured certain architects like Septimus Warwick and it would have been interesting to know if this was indeed the case and why. Despite the size of the firm's jobs in this period, its permanent staff, we learn with some surprise, still numbered only 62 in 1939.

There is a very good chapter showing how some firms, including Harry Neal, could profit from the abnormal conditions of the war and then be in a strong position to take advantage of the relaxation of building controls. The acquisition of the firm of C. R. Price, which, it is strongly suggested, was stagnating because of the adherence of its owners and senior staff to the more socially exclusive tenets of the Plymouth Brethren, provided the management expertise to carry the firm over the boom times of the 1960s and 1970s. Two analytical chapters describing the organisational changes which were a prelude to growth are followed by a somewhat breathless run-through of the major contracts of the past twenty-five years, an exercise rendered slightly less necessary by the useful appendix which lists the 350 or so major projects undertaken by the firm, with the names of clients and architects and the value of the work, most of them from the 1960s and later.

What the book sets out to do it does well, and there was doubtless a conscious desire to avoid too many statistics or dry facts and figures, but the sparse information that is included on turnover, profits, wage rates and the like suggests that more could, and perhaps should, have been provided along these lines. One wishes that the bare bones of the firm's success had been fleshed out just a little more. And were there no

setbacks, no periods of doubt, no boardroom conflicts? Was the upward progression really as smooth as this account suggests?

If then we are still awaiting the in-depth, warts-and-all, study of a building firm, it has to be said that this book manages to pack a lot of information into a text which is probably less than 50,000 words in length. The format is lavish and the photographic coverage generous. There are over 100 black-and-white illustrations, most of them photographs which presumably belong to the firm's own collection, although this does not appear to be stated anywhere, showing buildings just completed or sometimes in course of construction. In addition there are eight plates of colour photographs showing the wide variety of buildings the firm has erected in recent years, and illustrating particularly the fine brickwork for which it has become justly renowned.

If there is a thread running through this history it is the resilience of the tradition of fine craftsmanship which the firm has always upheld. In that as in much else, this book is a testimony to the remarkable achievements of four generations of the Neal family.

VICTOR BELCHER, *English Heritage*