

Book Reviews

Architectural Technology up to the Scientific Revolution

ROBERT MARK, EDITOR, 1993

Cambridge Mass. and London, MIT Press

252pp. 206 illust. £35.95

ISBN 0-262-13287-7

Ted Ruddock has already reviewed this book in Construction History Society Newsletter No 36 of March 1994. I am broadly in agreement with what he says. This is a serious, very readable book with a refreshingly new slant, written with authority by a number of authors with Robert Mark of Princeton University as the main contributor as well as editor. It is copiously illustrated with photographs, drawings and diagrams and there are wide-ranging bibliographies at the end of each chapter. It is very handsomely produced and in content well above the "coffee-table" level. The question which Ruddock only touches on is the purpose of the book. It is important enough and unusual enough for the aims to merit some discussion.

The book is part of a series of seminars, lectures and books ("the New Liberal Arts Series") founded by the Albert P Sloan Foundation and designed to "involve undergraduates in meaningful experiences with technology and quantitative approaches to problem solving in a wide range of subjects and fields". The subjects appear to include electronics, medicine, nuclear physics, mathematics, risk analysis and ethics and, in the case of this volume, the development of building technology before we started calculating the performance of our structures. It seems from the format of the volume that it is intended for a much wider market than just the American undergraduate. This may all sound like "science for the citizen" and breaking down the barriers between the arts and technology. There can be no finer aim. Much technology is an art and in the case of architecture the split between art and technology is, or should be, paper thin.

In this book structural principles are dealt with in purely conceptual terms without any equations and hardly a single reference to a numerical stress or load – excellent. A distinction is made between the main text and the more technical sections by printing the latter with a tinted background so that one can read the book without considering the "difficult" bits; for some curious reason these technical parts (sometimes a full page of text) are referred to as figures and numbered in with the references to pictures. Foundations, walls, vaults (and domes) and timber roofs are all considered in separate chapters by different authors or groupings of authors thus taking the reader through Greek, Roman, Byzantine and Gothic architecture and then on to the eighteenth century.

One cannot help returning to the question of intended readership and asking whether the authors have satisfied that market. Who seeing this book in a bookshop would be tempted to buy it? The interleaving of the main and technical text implies two possible levels of readership. Apart from the student, is it aimed at the lawyer, accountant, politician or cleric wishing for a very readable broad sweep of architectural history with a more practical slant than the average glossy volume? Is it for the engineer wishing to enhance his grasp of the history of what he is doing, or architect looking for an understandable exposition of structural principles? Is it also for the serious historian, archaeologist or schoolmaster?

Possibly the historically minded architect or engineer is most likely to find it irresistible, although anyone in each of these groups of potential of readers would gain much from reading it. Nevertheless each would probably find something lacking.

Those looking for broad architectural and structural history might be surprised to find no reference to what the Egyptians did and get the erroneous impression that the Romans were the first to use brick. The types of building covered, almost exclusively religious, limit the scope even of the structural explanations.

Those already interested in engineering history may worry that the connection between present day analysis and what earlier designers thought is not always made clear. It is interesting, as here, to apply finite element analysis to old masonry buildings and, with increasingly sophisticated techniques, it is becoming ever more feasible to follow the redistribution of forces as cracks develop, but such methods are surely of more use to the engineer contemplating remedial work than to the historian wondering what the designers of, say, the Pantheon thought. Also what relevance has photo-elasticity to the behaviour of masonry? These are the thoughts which may well occur to engineer readers while those outside the field may simply be blinded by the science.

There is also a blurring in places of the distinction between fact and conjecture while references to other authors are often vague. We know very little about the original form of most half-ruined buildings, quite apart from the thinking of their designers. For instance the caption to figure 3.32 of the Temple of Olympian Zeus at Agrigento says "note iron reinforcement above figure (after Coulton)". Referring back to Coulton one finds he writes in this connection of cuttings in the under face of some architrave blocks which may have held iron bars, thus admitting the uncertainty. Others have doubted the feasibility of such bars let alone the need for them. Such remarks might be dismissed as pedantry if this was a superficial book but it is a scholarly work and there is a danger of too much certainty based on conjectures. Once an assumption is repeated more than twice it tends to be taken as fact. The danger is even greater when one comes to attributing motives, as Ted Ruddock has already pointed out.

In many ways the structural explanations are the best part of the book. They are clear, well presented and well illustrated. It seems a pity that they have been considered as subsidiary and apparently optional. Of the four main chapters the one on timber roofs and spires by L.T. Courtenay is perhaps the best. The references are more precise than elsewhere, the text is well ordered and there is a greater tendency to qualify statements where facts are uncertain. This chapter goes some way towards filling the gap in our knowledge of timber construction before the seventeenth century, the time when David Yeomans starts in earnest in his recent book *The Trussed Roof* (1992).

I repeat that there is an enormous amount of good material in this book but it seems doubtful whether it will satisfy all the needs of any possible group of readers. Perhaps that is expecting too much. Apart from the irritating lapses of proof reading already referred to by Ted Ruddock, there is a need for some critical editing both of the thought and the presentation. At present it reads like several lectures or essays cobbled together. Perhaps that was its origin. Something as beautifully produced and clearly containing so much scholarship deserves that extra effort to make it excellent.

R J M SUTHERLAND

Technics and Architecture: The Development of Materials and Systems for Buildings

CECIL D. ELLIOTT, 1992

Cambridge Mass. and London, MIT Press

467pp. illust. £58.50

ISBN 0-262-05045-5

It is many years since the history of building technology has been the subject of a broad compendium, providing an introduction for the interested as well as the committed and summarising recent research. The classics of this genre – C.W. Condit's *American Building Art* (1960) and S. Giedion's *Mechanization Takes Command* (1948) are at least a quarter of a century old and take a modernist viewpoint on the technological underpinnings of American skyscrapers and major engineering structures. The only broad-brush texts from Britain work from different starting points, such as regional variations in the use of materials in A. Clifton-Taylor's *The Pattern of English Building* (1972) or the work of builders and contractors in C.G. Powell's *An Economic History of the British Building Industry* (1980).

This new study, taking technology as its central theme, is to be strongly welcomed. Cecil Elliott, researching and writing from the remote location of North Dakota University, is unfettered by the viewpoints of earlier studies and tackles building materials, both traditional and modern, and building systems – from sanitation to acoustics. His perspective is international and embraces the last two hundred years, while also including key innovations in classical and medieval technology. His university inter-library loan service must have worked overtime to enable him to refer to a remarkable diversity of contemporary manuals and journal articles. This weighty volume provides a useful introduction to building technology, and a valuable source of reference especially on the subject of services, so crucial to the evolution of modern building types and the comfort of office workers and theatre-goers.

The seven chapters on building materials give precedence to developments in machinery – band saws, powered planers, rock drills and brick making machines. The problems of particular types of kiln or extruded fireproofing are examined. An emphasis on technological firsts and patented innovations can result in the neglect of all-important adaptations: multi-chamber, intermittent kilns and simple forms of fireproof flooring gained more widespread usage than the Hoffman kilns or the inflexible patented flooring systems from which they were derived. It is extremely valuable to have a chapter on wood but the detailed coverage of the tools of the lumberjack at one extreme and the nuances of veneering at the other allows such crucial points as the American predilection for 'slow-burn' heavy timber construction through the nineteenth century to go unexamined. Even so the value of having an international summary of quarrying techniques and approaches to clayworking should not be underestimated.

Elliott's technological viewpoint proves more effective in the chapters on the more obviously 'modern' materials. The balance between the use of cast and wrought iron for train sheds and exhibition halls and the inadequacies of early Bessemer steel are summarised with the aid of elevations and cross-sections. The orientation of each chapter varies, glass being considered almost entirely in terms of furnace design and the introduction of drawing and float processes. Meanwhile reinforced concrete is examined in terms of eccentric houses and boats, early patents and the work of heroic figures such as François Hennebique and Auguste Perret, rather than drawing upon recent studies of the mainstream adoption of concrete on both sides of the Atlantic.

Technics and Architecture breaks new ground in providing an overview of the key services – sanitation, lighting, heating and air conditioning – and other critical issues such as fire protection, structural engineering, acoustics and protection against lightning. Elliott briefly digs into a tantalising range of subjects such as the balance between English and French efforts to introduce gas lighting and the role of the ice trade in early systems of air conditioning. Work by pioneering industrialists such as William Strutt and Matthew Boulton in developing heating and lighting systems for large factories emerges repeatedly as a precursor of American efforts to provide appropriate services for the skyscraper. The few but valuable studies on lift technology are reworked into an especially informative and well-illustrated chapter, which also introduces the neglected subject of escalators.

The thematic approach of the book is tightly proscribed, key innovations being presented chronologically at the head of each chapter and then worked through paragraph after paragraph. This structure makes for clarity and easy reference but leaves the reader with the task of making crucial links between, for example, issues covered in the chapters on steel framing, ceramic technology, fire protection and structural engineering to permit an understanding of the structural evolution of the skyscraper.

The book is densely illustrated with line drawings reproduced from contemporary journals, manuals or patents. They reward detailed study but can be difficult to comprehend with their fine detail and with their original labelling shorn of its captioning. There are useful footnotes, and a select bibliography, but no conclusion. Elliott hints at the factors that may trigger new innovations and their application to building – earthquakes, fires, the need to span large spaces or build storey upon storey in city centres – but he does not provide any challenging thesis on the role of technological advance in architecture. His text and illustrations show no evidence of having examined extant buildings in the big city. The combination of inventive zeal and financial constraint that guided many shifts in building construction through the collaboration of industrialists, architects and engineers is suppressed rather than highlighted. Cold historical analysis, line drawings and a sombre cover do not make for an instantly appealing book. *Technics and Architecture* is nevertheless an extremely useful reference text and should provide a springboard for numerous future dissertations and research papers.

MICHAEL STRATTON, *The Ironbridge Institute*

The Mansion House

SALLY JEFFERY, 1994

Chichester, Sussex: Phillimore for the Corporation of London

328pp. 275 illust. (50 in colour) £75.00

ISBN 0-85033-890-5

The Mansion House in the City of London, designed by George Dance the Elder, was built by the City Corporation between 1739 and 1752 as a residence for the Lord Mayors of London during their years of office. As well as living accommodation, it provided rooms for large entertainments and a Justice Room where the Lord Mayor sat as Chief Magistrate of the City. It was designed with the traditions of the City in mind but incorporated a fashionable Palladian plan and elevations, and it survives as a remarkably complete example of an eighteenth-century town palace which is still in everyday use.

In the early 1980s the Corporation began to contemplate an extensive programme of structural repairs, improvements or replacement of services, and replanning – the cells on the ground floor, for instance, were no longer in use, and more space for offices was urgently needed. Very early in the planning of the work the Corporation decided that nothing should be done to the house before a full investigation of its history and structure had been carried out. Detailed historical research was therefore commissioned by the Corporation in 1985, and most of it was done by Sally Jeffery of the Corporation's Department of Building and Services. Publication of her work as a permanent record of the house was always intended.

Such a detailed examination of all aspects of the design, and more particularly of the minutiae of the building of a great eighteenth-century house is very rare in itself, but this study must be in a class of its own. In the first place, the Mansion House was one of the grandest town palaces ever built in London, and very few of them now survive. Secondly, and perhaps most importantly, the documentary evidence without which such a study would be impossible is available in great profusion in the City Corporation's own archives in the form of building specifications, craftsmen's tenders, contracts and payments made to them, as well as in the minutes, journals and reports of the Corporation's Committees and Courts of Aldermen and Common Council; and there are also hundreds of architect's drawings from Dance's time onwards. Lastly, the whole enterprise was supported by the Corporation's not inconsiderable resources of money and expertise – certainly far greater than those which any private owner could command. So this book really is a 'one-off'.

Sally Jeffery begins by explaining why a specially designed house for successive Lord Mayors came to be necessary, and goes on to the selection of the site and the architect. (Dance was in the right place at the right time, having only recently been appointed as the Corporation's Clerk of Works, and was certainly lucky to get the job against the competition (of, *inter alia*, Gibbs and Leoni). Then she discusses the evolution of the design, which was heavily influenced by the published designs of Inigo Jones, Kent and Ware, and by the example of several recently built large country houses. But for many readers the real meat of the book will be found in the six chapters on the building of the house, the finishing of the interior, and the furniture and furnishings with which it was equipped. The remainder of the book discusses how the house was used in its early days, the changes of fashion in the way great entertainments were conducted, and sets out the alterations made to the building during the two and a half centuries of its existence, culminating in the great refurbishment of 1991-3.

The Mansion House has in general had a bad press from the architectural critics. Sir John Summerson, for instance, refers to its 'ungenerously shallow portico', and thought that the

building was too large for its site. The interior was 'ungracious', and the whole thing was 'a striking reminder that good taste was not a universal attribute in the eighteenth century and that, in the City of the 1730s, there was a great deal more money than discrimination'.

A Palladian palace conceived on the lines of Wanstead or Houghton Hall, where there were no limitations of space, was, indeed, an impossibility within the City. The Mansion House had no forecourt, the main entrance (on the principal floor through the portico at the north end and approached by an exterior double staircase) was very soon declared to be 'very inconvenient', and a small 'private entrance' at street level was constructed on the west side. Gradually this became in practice the main entrance, and the first-floor north doorway, from which Dance had provided a magnificent vista extending through the whole length of the building, was used less and less. Nowadays it is only used once a year by the out-going Lord Mayor and (very rarely) on state occasions. So Dance's original conception of the house was quickly thrown off balance, and it was not helped in 1795 by the removal of the grand staircase leading up from the principal to the second floor, and by the roofing-in of the central cortile.

But the inadequacy of the site and the short-comings of Dance's design in no way detract from the merits of this book. First and foremost, Sally Jeffery has a profound and rare knowledge of how great houses of the mid-eighteenth century were actually built. As the site of the Mansion House was very near to the Walbrook Stream hundreds of piles averaging eight feet in length had to be sunk, across which 'Riga planking' was laid. The brick walls, some six feet in thickness at the basement level and tapering to about four feet at the top, took four years to build, work having to stop for three or four months every winter. A sectional drawing of one of the exterior walls – one of many specially commissioned drawings of very fine quality – illustrates how the outer stone facing was attached to the brick inner skin by bond stones, iron cramps and chains. A radar survey has shown that chains were used very extensively to hold the fabric together, two, for instance, extending along the top of the main cornice, and numerous others being embedded in internal walls. Altogether over fifty tons of 'best Swedish iron' were used for cramps, chains and the bars which supported the brickwork above the numerous chimneypieces.

The work of John Cordwell, the carpenter, is illustrated by isometric drawings showing the trussed beam construction and the complex system of cross bridging, wedging and bracketing needed for the coved ceilings of the big rooms. Some of the large timbers specified by Dance proved impossible to obtain, despite correspondence with suppliers in Riga and despite searches made by Cordwell and his foreman at timber yards 'at several places on the River Thames from Chelsea down to Limehouse hole'. For the window frames (some still in use) Dance had full-size patterns made, from which tradesmen could tender; for the glazing a local product from Stepney, 'Bowles best Ratcliff Crown Glass' was used. Water was piped in from the London Bridge Waterworks and pumped by an 'Engine' (hand-powered) to reservoirs at the top of the house, whence some of it supplied two water closets (one close to the Lord Mayor's Bedchamber) – 'a relatively new venture', Sally Jeffery tells us, and 'liable to overflow, and to smell'. There was also a privy or 'bog house' on the ground floor, which drained into a cesspit.

The finishing of the interior of the house – the joinery, carving, plasterwork and painting – are all documented in detail. Drawings explain the structure of such things as dados and dovetail joints, and CAD (computer-aided drafting) has been used to show doorway and doorcase methods of construction. The plaster putti which recline so nonchalantly on the pediments over several internal doors were modelled on minimal timber armatures; they have a wooden core to their legs and arms, twisted wire supports their wings, and the plaster was applied and modelled in two or three stages (all illustrated). In the original colour

scheme for the interior stone colour seems to have predominated, and the ceilings were white; but by the 1770s several rooms were painted 'dead white', while blue or green were sometimes being used for mouldings. A coloured photo-micrograph shows a cross-section of the paint applied over many years to the iron railings of the ballroom gallery, the three earliest schemes being in a mid-grey, followed by two in light blue.

This is in all respects a book of outstanding quality, based on fine scholarship supported by much modern technical expertise. It is well organized – despite the great mass of information presented, the reader never fails to see the wood for the trees – and skilfully designed so that in general one can study text, illustrations and footnote source material without having to turn a page; and there is a good index. Lastly, it is a pleasure to note that the printing was all done in England.

F.H.W. SHEPPARD

Pugin's Builder – The Life and Work of George Myers

PATRICIA SPENCER-SILVER, 1993

Hull, University of Hull Press

294pp. 75 illust. £14.95

ISBN 0-859-58611-1

George Myers (1803-1875) was one of the leading building contractors of the Victorian period. Although he is known as Pugin's builder, this important book brings him out of the shadow cast by that brilliant yet short-lived genius and puts him into the wider context of the 19th century building world. We can now see that Myers was a man of stature and significance, involved in a far wider range of activity than the title 'Pugin's Builder' might imply.

Gilbert Scott described Myers as that "strange rough mason from Hull" and Pugin described him as "a rough diamond, but a real diamond, for he is thoroughly acquainted with my branch of ancient construction and detail and a most honourable person in his transactions". Although nine years apart in age, they formed a lasting personal friendship and business relationship in which Myers constructed almost all Pugin's buildings.

The reason for this was, Patricia Spencer-Silver suggests, not so much a shared enthusiasm for the Gothic style, and certainly not for the religious infection that Pugin injected, but more for the knowledge and concern for *construction* in its own right, coupled with a common capacity for hard work. Biographies of Pugin tell how, at the tender age of 14, he was found to be excavating below the walls of Rochester Castle to "ascertain the mode of their construction"; and in this book we hear that Myers, at 13, was already apprenticed as a stonemason at Beverley Minster. It might be said that Pugin developed the theoretical ideas and consequently had less time for the practical interpretation whilst Myers brought the practical experience, but had less theoretical knowledge. So Pugin would sketch the briefest of delicate outlines on tiny scraps of paper knowing that Myers could immediately interpret them in terms of his practical understanding of medieval construction.

Whilst this relationship with Pugin is important, and will intrigue the architectural historian, it rightly occupies less than half this book. Myers was much more than Pugin's builder – he would have been a great builder without Pugin. The rest of the book surely proves this, as it explores in detail the vast range of works he undertook, and in the course of so doing it throws new light on the workings of the Victorian building industry and its business methods, which will particularly interest the construction historian. Contracting 'in gross', as a general contractor, Myers secured over half his work through public tender, not only for buildings, but also for railways, drainage, coastal defences and military projects. There is a detailed description of his workshops, and their equipment, including his patented machines for cutting wood and stone. He had his own brickfarms at Ealing, whilst stone, Myers' favourite material, was largely obtained from the quarries he leased in Wiltshire. He also manufactured an extensive range of furniture, not only ecclesiastical furnishings for Pugin but also the furniture for Colney Hatch Asylum and the Rothschilds' house at Mentmore. Furthermore, there were Myers business methods and his involvement in industrial relations. We hear the familiar story of the break-up of an early partnership because of financial mismanagement by the other partner, and how Myers was caught up in the extraordinary legal battle (described very fully in this book) between the Colney Hatch Asylum authorities and the architect Daukes, a case which vindicated both Myers and Daukes but which shows us the vulnerability and unethical practice of other architects at the time. Against the threat of industrial unrest and with financial insecurity always in the

background, we see the emergence of Myers, as a leading figure in the move towards a nine-hour working day for the industry, his involvement in many trade disputes, his leading of delegations to Parliament and his contribution to the founding of the Central Association of Master Builders in 1859.

Mentmore, designed by Paxton (who would have seen Myers' work for Pugin at the "medieval court" at the Crystal Palace) incorporated advanced building services and Myers' involvement with this scheme, even including details of costs, is fully covered.

His reputation for efficient business methods secured all the Rothschilds' work in England and also in France, where he built their house at Ferrières near Paris. The contract for Mentmore was won in open tender, but the subsequent Rothschild contracts were given directly to Myers, and for that reason he was as much the Rothschilds' builder as Pugin's builder. The range of his work was extensive. He built for the military at Aldershot, the first military hospital at Netley and the Woolwich Herbert Hospital. Other projects included Westminster Palace Hotel, Wyld's Great Globe in Leicester Square, the warehouse that formerly overshadowed the church of All Hallows by the Tower. There was also continuous restoration work at the Guildhall and Tower of London.

Patricia Spencer-Silver paints an attractive portrait of Myers, as a generous and considerate man. He cared for Pugin after his spell in Bethlem (a building Myers was later to extend), gave support to Jane Pugin and her children after Pugin's death, acted as a pall-bearer at the funeral, carved memorials to Pugin and even bought much of his library. He also showed genuine concern and compassion for his own workmen, for example when they lost their tools and thereby their means of livelihood in a fire at his workshops.

An immense amount of fascinating material has been packed into this worthwhile and well organised book. At times, however, it almost overflows with detail because of the understandable reluctance to omit too many of the findings of the extensive research – but almost all of it is of value and it certainly adds colour to the story. The book is fully illustrated and also has two useful appendices, one listing all the major contracts, the other all the architects and their buildings. It will, one hopes, mark the start of further much needed studies of the major contractors of the last century.

ROGER H HARPER, *University of Sheffield*

The Terracotta Revival, Building Innovation and the Image of the Industrial City in Britain and North America

MICHAEL STRATTON, 1993

London, Victor Gollancz

256pp. 236 illust. (38 in colour) £30.00

ISBN 0-575-05433-6

The Terracotta Revival by Michael Stratton examines the ideas, attitudes and reasons behind the developing interest in the use of terracotta that occurred in the 19th century, and explores many themes that are important to the architectural and constructional history of the period. The book is about a single material, or rather a group of similar related materials, some with different applied surface finishes. It is also particularly valuable for the perspective from which it looks at more general subjects of broader significance such as architectural style, design and the search for new materials.

While the book deals primarily with buildings in Britain and North America where the revival of interest in terracotta over the past 150 years or so has been most evident, the debt to the 18th century developments and to early 19th century uses of terracotta is explained, particularly those which occurred in England and Germany.

This account is extremely informative about the technical background, explaining the different compositions and geological locations of the clays used in the manufacturing process. The development of the process is also considered, beginning with the architect's design through working drawing stage, to the technician's role from model stage to mould and finally the pressing of the image before firing. However, some processes did not finish here and some elements were hand finished with further undercutting before firing: in certain cases the blocks were cut to size after firing. Individual processes and methods were unique to certain firms and the book explains the characteristics of work by different firms.

Collaborations between architect, manufacturer and sculptor produced by some very fine examples of architectural sculpture. Terracotta is an excellent medium for sculptural decoration and notable sculptors such as John Bacon and John Rossi in the early 19th century collaborated with the Coade Manufactory, whilst later in the century sculptors such as John Bell, W S Frith, George Tinworth, Harry Bates and George Frampton were employed by firms such as John Blashfield, Doulton and Company and J.C. Edwards.

The rise of interest in the use of terracotta in Britain is connected with the building of the Victoria and Albert Museum, then known as the South Kensington Museum. The block known as the Official Residences (the western range of the main quadrangle), built in 1862, was directly influenced by Henry Cole's interest in the use of terracotta elsewhere in Britain at the time. His travels to Italy in 1858 to study Romanesque and Renaissance architecture fuelled this interest and the new buildings of South Kensington utilised decorative terracotta extensively. The Italianate arcade of the Royal Horticultural Society's Garden, the Victoria and Albert Museum and the Royal Albert Hall were testament to the keen interest in the use of terracotta in South Kensington by the Royal Engineer and architect, Captain Francis Fowke and Henry Cole. The short time between the erection of the South Kensington Museum buildings and the Albert Hall does not disguise a significant change in approach from the use of terracotta as a sculptural decorative material, through to its substitution as a masonry material.

Michael Stratton traces this early development with considerable care whilst acknowledging that at first the collaboration between architect and technician was time consuming and therefore very expensive and not widely applied to commercial buildings.

Of all the 19th century British architects associated with the use of terracotta, Alfred Waterhouse is perhaps most closely associated with notable and significant buildings of the period. The Natural History Museum built between 1873 and 1881 receives due attention as does his subsequent work for the Prudential Insurance Company for whom he created a 'house style' that evolved over time.

To a generation of subsequent architects, designers and critics, the widespread fashion in late 19th century Victorian England for strong rich burnt red terracotta seemed unfortunate, such as used on the many notable civic buildings erected in the 1880s and 1890s during Birmingham's rapid programme of expansion. The Edwardian age found a beige stone-coloured finish imitating stone much more to its liking and this preference was largely accepted through the 1920s and '30s. The book traces the use of terracotta in the 20th century by co-operative societies and commercial firms for stores, factories and cinemas built during the inter-war years.

An important pioneering use of terracotta in North America was at the Boston Museum of Fine Arts. In the same way as with the Victoria and Albert Museum, the use of decorative terracotta was of symbolic importance to the creators. Supplied by the Stamford Terracotta Company in Lincolnshire, the contract was an ambitious attempt by John Blashfield to expand his business across the Atlantic. The venture was not however a commercial success and led to the demise and bankruptcy of the firm. But it introduced to the United States the expertise of former employees, and Blashfield's extended influence in different areas of the country is explained. Interest in the use of terracotta in the late 19th century was quite widespread throughout the eastern and central mid-west States and it was adapted to suit the particular needs, such as its use as a fire-proofing material for covering the iron and steel structural skeletons then being developed in Chicago. Many American architects adeptly exploited the decorative qualities of the material, and Louis Sullivan in particular used the material in a most original way. The account extends up to the present day and considers its use on recent buildings and in conservation work.

The Terracotta Revival is a fascinating account which spans the interests of architectural history and the history of construction and building techniques. Through its particular emphasis, this account explains the ideas, theories, technological developments and roles of individuals and firms of the past 150 years. The book is well illustrated and engagingly written, and because of the many facets upon which it touches, it will be standard source for those particularly interested in buildings of the 19th and early 20th centuries in Britain and in North America.

EDWARD J. DIESTELKAMP, *The National Trust*

Eisenbrückenbau und Unternehmertätigkeit in Süddeutschland.

Heinrich Gerber (1832-1912)

HELMUT HILZ, 1993

Stuttgart, Franz Steiner Verlag.

210pp. 53 illust. DM68

ISBN 3-515-06286-6

Der Badische Ingenieur Willhiem von Traitteur

SERGEJ G. FEDEROV, 1992

Karlsruhe, Institut für Baugeschichte der Universität Karlsruhe.

82pp. 41 illust. no price given

ISBN 0940-578X

These are two outstanding contributions to the history of construction. Although both have a biographical theme, they contain important information on the development of bridge engineering and the use of iron in the nineteenth century.

Hilz's work is a study of the iron bridge industry in Germany in the nineteenth century centred on the career of Heinrich Gerber. Beginning with a brief overview of the early development of bridge building in Bavaria, and the life and work of Pauli, Hilz takes up the story of Gerber's life and works, before concentrating more on the ironworks with which he was involved, finishing with a summary of the activities of the other leading German bridge building firms of the second half of the nineteenth century. There is no equivalent work on British ironwork fabrications of the time, or any of the engineers associated with them, which makes comparison difficult, but one suspects there was nobody with Gerber's educational background in an equivalent position in the UK.

Gerber was born at Hof in 1832, and was educated at polytechnics in Nürnberg and Munich, where he became interested in bridge construction, and his mentor was Bauernfeind. Between 1852 and 1854 he was working on the Neuenmarkt-Bayreuth line on Bavarian State Railways. The first major bridge with which he was associated was the Grosseesselohe Bridge on the Munich-Salzburg line, while he was still in the state service and taking his examinations. On the completion of the bridge he joined the Nürnberg firm owned by Cramer-Klett in 1859, with whom he was associated in one way or another for much of the rest of his career. At Grosseesselohe Gerber had analysed Pauli girders, and in the 1860's he designed a whole series of such bridges in southern Germany.

In 1860 the decision was made to build a specialist bridge fabrication works at Gustavsburg, which was designed by Gerber and Werder. After the Franco-Prussian War the Süddeutsche Brückenbau AG was set up by Cramer-Klett and other associates of Gerber in Munich, and Gerber transferred there. In 1855 the works were taken over by Nürnberg Maschinenbau AG, who merged with the Augsburg Maschinenbau AG in 1898. From 1874 Rieppel was associated with these. As a result of a lifetime in ironworks Gerber was involved in the design of more than 600 bridges. Although his name is often associated with the cantilever system he developed in 1865, and patented the following year, he used many designs, making use of pin joints and various systems of continuous girders. Among his more famous designs are that at Hassfurt on Main – the first Gerber Truss, the Vilshofen road bridge, the Max Joseph Bridge at Munich, including a 47m span, the Brannau Bridge over the Isar where electric lighting was used in the caissons, the Simbach Bridge where compressed air was first used in Bavaria for bridge foundations, and the Königswart Bridge over the Inn – the first bridge where cantilever erection methods were used. The final major bridge design he was involved with was the Friedrichsbrücke at Mannheim (1888-1891).

In addition to bridge designs, Gerber was involved with many other important structures – stations at Zurich, Munich and Mariuz, the Nürnberg exhibition hall plus smaller iron framed buildings. His ironworks were renowned for their quality control. His colleague Werder designed a famous testing machine. Hilz's work does justice to Gerber's career. While he regularly features in German histories, in the English language he has largely been a footnote in the discussions about the Forth Railway Bridge. This publication makes clear that Gerber was much more important than that.

While Gerber's career was concentrated in southern Germany, Traitteur's career was international. Unfortunately, largely as a result of the Cold War, his importance has been overlooked in this country even more than Gerber's. When John James published his seminal paper on ironwork in Russia in the early nineteenth century ten years ago, Traitteur began to emerge from the shadows. James had, however, found it very difficult to obtain biographical information on Traitteur. For Federov the task has been made easier by first hand acquaintance with Traitteur's work in Russia, but before Glasnost the work could not have been completed, as his access to information on Traitteur held in the West would have been severely restricted. Karlsruhe University are to be congratulated in making his researches possible.

Traitteur was born in Mannheim in 1788. After a patchy education from 1807 he worked for four years in France, initially in the department of Mont-Tonne, on land and trigonometric surveys, as well as harbour work at Mainz and bridge and canal works around Strasburg. He was then in Paris for eighteen months, working for the Ponts et Chaussées on harbours, and the St Quentin Canal. In December 1810 he applied to the Baden Government for work, and took their examinations in which he did appallingly badly. To improve his mathematical knowledge he enlisted at the Mannheim Gymnasium, at the same time improving his skills as a draughtsman to the level of a graphic artist as exemplified in his work on the uniforms of the Baden army of 1813, in which year he was finally admitted to government service! This coincided with the triumphant progress of Tsar Alexander I across Europe. In November 1813 Traitteur was granted a private audience, as a result of which he was invited to Russia, to join the international group of engineers then being assembled under Betancourt by the Tsar. The bulk of these engineers were French. Traitteur's early work under Betancourt included various timber bridges, including the pontoon St Isaac bridge, which was the subject of his first bridge book. It was not until 1820 that Traitteur was given a major project himself – the first stage of the proposed new road between St Petersburg and Moscow. A major feature of his design was a series of timber bridges, making use of laminated arches. In 1823 Traitteur was relieved of his responsibilities, and the road was completed by Reichel.

From 1823 to 1826 Traitteur was one of the engineer's involved in the design of a series of suspension bridges in St Petersburg, probably his chief cause of fame today. At the beginning of 1823 he submitted a report recommending the use of such bridges. Although the first Russian suspension bridge was designed by Bazaine, Traitteur appears to have been responsible for the second, the Pantelymon. While other engineers were involved in the bridges – Lamé and Claypeyron on the theoretical side, Baird on testing, Christianovich and Kostin on construction – Traitteur consciously strove for an elegance in design, which makes the bridges which have survived until today a delight to behold. His book on their construction is one of the most beautiful works on civil engineering. Although these are his chief claim to fame, he had earlier (1820) proposed a form of lenticular truss for a 137.25m span.

From the end of 1823 Traitteur was a consultant to the Russian civil engineering corps, mostly on hydraulic engineering projects, such as the aftermath of the November 1824 flood

in St Petersburg, as well as two bridges and a new street in the city. For these cast iron bridge schemes he was promoted to the rank of general in 1830, and a short time later he returned from Russia. On his return he continued to report on engineering developments to the Russian authorities. In the late 1830's he proposed a suspension bridge across the Neckar, some harbour improvements, and a railway line from Mannheim to Basel. He appears to have retired from active engineering by about 1840.

While Traitteur cannot compare with Gerber in importance, his career is of interest for the light it throws on information (and personnel) transfer between Russia and Western Europe in the early nineteenth century, particularly with regard to bridge design. It would have been helpful to have had more detailed analysis of the relative roles of all the engineering personnel in Russian bridge design at the time. Such detailed assessment will not be possible until more work has been done in Russia and the West on the people involved. One suspects that this work will not be done by British researchers.

Production of publications like these by academic institutions in the United Kingdom is almost inconceivable. Their existence reflects the academic prestige attached to the study of the history of civil engineering and construction in Germany. The fact there is no British equivalent to the Institut für Baugeschichte at Karlsruhe will inevitably mean that this country increasingly will be left behind as a centre for serious research into the subject.

MIKE CHRIMES, *Institution of Civil Engineers*

Tower Block

MILES GLENDINNING AND STEFAN MUTHESIUS, 1994
New Haven and London, Yale University Press
420pp. 260 illust. £40.00
ISBN 0-300-05444-0

Built for a Better Future: the Brynmawr Rubber Factory

VICTORIA PERRY, 1994
Oxford, White Cockade Publishing
96pp. 67 illust. £12.99
ISBN 1-873487-04-5

Every generation produces at least some buildings which are failures. Amongst the reasons why such examples never get beyond their earliest years are the fact that they are badly designed and built, or are in the wrong location, or cannot withstand adaptation to new uses. Generally the failures are soon forgotten, and only assiduous historians try to keep their memory alive.

In the light of what has happened in every previous generation it is initially not surprising that some of the buildings put up in the quarter century 1945-70 were destined to fail. The major difference about that period is the degree to which it is now indelibly associated with the idea of failure, to the extent that historians and polemicists feel bound to look at it from that point of view. In part the failure of post-war architecture is simply a matter of changing perspectives, which have led to its fall from favour because it no longer carries the excitement of novelty. But that alone does not explain why so many buildings of those years have not only gone out of fashion but have been systematically discarded; not just individual cases but whole architectural schemes and developments. And this fall from grace is all the more dramatic because of the high ideals under which they were first conceived and built. If more modest claims had been made for them at the outset their demise might not have attracted so much attention.

These two new books discuss two classic cases of post-war architectural failure. Victoria Perry has written the biography of the Brynmawr Rubber Factory, an acutely optimistic and well-intentioned project to revive the life of a Welsh industrial town by introducing a new kind of workplace. Built in 1946-51, the factory was internationally acclaimed, particularly for the brilliance of its shell concrete roofs, yet it was occupied by its intended user for less than a year and its total working life was only thirty years. The campaign to find new uses for the building (which is now listed) has now exhausted almost every possibility.

At the opposite extreme in the size of the subject they have chosen to tackle, Glendinning and Muthesius have set out to chronicle the tower block phenomenon, from its first appearance in Harlow New Town in 1950, via its climax in the mid 1960s, to its eventual rejection about a decade later. The tower block was the ultimate symbol of how modernism could deliver its benefits to everyone; a new kind of living made possible by new kinds of construction. High rise flats never formed more than 25% of local authority house-building, yet they dominate the arguments about the links between modernism and the welfare state. The post-war story of low-rise and ordinary housing will never attract the same attention.

The biography of a single building invites a narrative approach and Victoria Perry tells her story extremely well. She introduces a fascinating cast, led by Lord Forrester, the peer with a conscience, and his adopted design team from Architects' Co-Partnership. Ove Arup gets due attention for having made the shell domes possible, and the contractors are properly

acknowledged. The major performers about whom little is heard are the men from the Board of Trade who, because of the way industrial recovery was financed, found themselves paying for a highly idiosyncratic project which cost twice its original estimate. Generally excellent use is made of oral history, but their testimony goes largely unrecorded.

Similarly Glendinning and Muthesius have spent a great deal of time talking to the leaders of the tower block movement, especially local councillors, designers and contractors. Yet despite these contacts their account is curiously depersonalised, and it lacks a strong sense of narrative. In part it seems that they have been overwhelmed by the amount of information they have gathered, not just through interviews but also by combing through journals and council reports, and by visiting every tower block in the country (including Northern Ireland, which gets a whole section to itself). But they have added to their difficulties by dividing their treatment into two broad sections, first on design and then on production, with the result that the story gets too compartmentalised. There is a case for saying that the tower block saga started with a highly creative phase, led by the younger generation of post-war architects, but that from the early 1960s mass production took over. However the way this book is arranged overstates that distinction, to the detriment of the overall story.

It is impossible to speak or write about tower blocks without taking sides, and Glendinning and Muthesius identify a strand in the high-rise story which they believe others have missed. In particular they aim to counter the interpretation given by Patrick Dunleavy in his work, *The Politics of Mass Housing in Britain 1945-1975* (Oxford, 1981). Previously it has been argued, by Dunleavy and others, that local authorities were persuaded to build high through the system of storey-height subsidies that were made available in 1956-65, and that contractors had leant on the government to introduce such subsidies to ensure that they had enough orders for their industrialised systems. Armed with their detailed knowledge of what local housing committees were thinking, Glendinning and Muthesius turn this explanation on its head. It was the big municipalities, they argue, that felt forced to build high in order to maintain urban densities, and they persuaded the government to help foot the bill. Contractors grabbed hold of system-building (mainly licensed systems from abroad) as a way of satisfying the huge demands of provincial house-building programmes. This stress on the ambitions of local authorities is an excellent corrective to housing history written largely from Whitehall sources.

Tower Block is a truly magisterial work which will be referred to whenever the building history of the post-war years is under discussion. It is so encyclopaedic in scope that it seems churlish to say that there is yet another book on the subject crying out to be written. The gap still waiting to be filled concerns the failure of this heroic episode, as symbolised by the last picture in the book, of the 'blowdown' of Glasgow's Hutchesontown 'C' blocks in 1993. When it comes to analysing the deep unpopularity of high-rise housing Glendinning and Muthesius rely chiefly upon secondary opinions, with little of the kind of grassroots evidence that they use in describing how the blocks got built. Above all, there is virtually no testimony from those who have lived in such blocks, except for a vivid monologue from an Edinburgh steelworker caught in the social decline of a 20-storey point block.

With the benefit of a more manageable subject, Victoria Perry scores much better in the way she follows her story through, devoting almost as much space to the present state of Brynmawr, and the debates about its survival, as to its original construction. Glendinning and Muthesius could usefully have learnt from her approach, but the result would have been a book so large that readers would have been scared away. Let us hope that they are now at work on its successor volume.

ROBERT THORNE

L'Invention de l'Ingénieur Moderne: l'école des Ponts et Chaussées 1747-1851

ANTOINE PICON, 1992

Paris, Presses de l'École Nationale de Ponts et Chaussées

768pp. 136 half-tone illustrations; various diagrams, tables, histograms etc.

FF380.00

ISBN 2-85978-178-1

It need hardly be said, perhaps, but this is a very French book. It addresses the general issue of the birth of the modern engineer, the particular case of the history of the École des Ponts et Chaussées – France's national school of civil and structural engineering – and the influence of the particular case on the general issue. The Frenchness comes across in many ways. First is the fact that it was written at all, and with the support and patronage of the École and two government departments. Secondly, the manner in which the subject is treated could hardly have been conceived by an Anglo-Saxon mind. The argument flows smoothly among ideas that we too often treat separately – philosophy, epistemology, the history and philosophy of both science and technology, economic, social, sociological and political history. Thirdly, the general thesis and the story portrayed confirm that it is not necessary to be surrounded by water to display the characteristics of insularity.

The main title of the book is rather too bold perhaps – there is little consideration of precisely what it is to be a modern engineer, nor whether modern is 1851 or 1991, nor what differences there were between being an engineer in countries other than France; but then that is the reviewer's Anglo-Saxon mind at work, and the book is really about the internal workings of France's leading civil engineering school.

In essence the book is about piloting an academic institution through a time of dramatic upheaval and is centred around events of the year 1794, just five years after the French Revolution. Reading it in 1994, I was more than once reminded of events a little nearer home with unprecedented pressures on teaching in British universities and endless talk of restructuring the construction industry and its institutions: France had Napoleon to help resolve their turmoil.

Part of Picon's story has already been told, both in one of his previous works (now available in English as *French Architects and Engineers in the Age of Enlightenment*, OUP, 1992; reviewed in Vol.9 of this journal) and in various papers which the reader can easily trace via the extensive notes and references in the book. The book is in two parts – Engineers of the Age of Enlightenment and The Period of Adaptation – and its structure takes the form of a comparison of the working of the École des Ponts et Chaussées before the Revolution and in the period of stability which followed during the second quarter of the new century.

We begin in 1508 when the French Government decided that the routes of communication by land and river should be the concern of the state, not one to be left to local authorities. This was the step which set France on such a different path through history from our own. Already in the early 1700s it was realised that the engineer's world was subject to the influence of the dramatic intellectual steps forward being made in mathematics and natural philosophy (what we now loosely call 'science'). The École des Ponts et Chaussées was founded in 1747, under the directorship of the bridge engineer Perronet, with the main aim of providing young engineers with a rational and analytical education. Picon describes the working of the École – the syllabuses, the origin and selection of students, the courses and their assessment, and the conditions of service of the corp of engineers who graduated from the school, and so on. By means of a number of

competitions in different branches of the engineer's art – drawing, road design, bridges, river and maritime projects, architecture and map-making – Perronet sought to instil in his students the intellectual skills of deconstruction and construction.

Ironically it was the very study of mathematics and the physical sciences which began to undermine the traditional and fundamental engineering concept of *solidité*. It was the primary skill of an engineer to deliver this quality to a work – the appropriate balance between correct dimensions, good construction and aesthetic appeal. With more mathematical and rational study of the construction of bridges and buildings it came to be realised that they might be made using less material. The traditional art of the engineer was in crisis.

One outcome of the Revolution in 1789 and the intellectual crisis amongst engineers (indeed, what it was to be an engineer) was a shake-up in the way the state thought it should educate its engineers. New schools were formed with the aim of *polytechnic* education (or *multi-disciplinary* as we now call it!) The new École des Ponts et Chaussées had a broader remit than its predecessor. Courses were to be based on the very latest mathematics and physics and taught by the best possible academics; but, at first, it was not clear just how this tuition would actually achieve the application of science to engineering and work to the benefit of the future engineer – as in much of French life following the Revolution, the idealism of theoretical study seemed to have only an indirect relevance to the real world.

The early success of the École des Ponts et Chaussées under Perronet, followed by the idealism and turmoil of the Revolutionary period under the directorship of Prony, was followed during the next decades by a consolidation, given impetus, no doubt, by the civil engineering opportunities offered by Napoleon's aspirations. Many famous names were to be found on the staff such as Monge and Navier. It was Navier's lecture notes which became the first recognisably modern engineering textbook.

The second part of the book describes the working of the School during the first half of the 19th century and describes how it served the aspirations of the Second Republic across the full range of civil and building engineering projects – roads, bridges, buildings, canals, railways. These achievements are directly attributable to the new education provided by the École and the methods and skills it instilled in its pupils and the new idea of engineer which it helped establish towards the middle of the century.

The contribution to engineering made by the École was considerable and undeniable, especially in directing the attentions of the best mathematical and scientific brains of the day to engineering matters. This success was achieved by direct support and intervention by the state – concepts foreign to the inhabitant of modern Britain. However, Picon tends to overemphasise the influence of the school and its academic qualities. Little mention is made of the part played by practising engineers and the whole issue of just how the new sciences eventually became of use to the designer and executor of engineering works (as opposed to its use in education and the laboratory). There is also a tendency to ignore other cultures – another (French) writer on the history of French engineering education, Antoine Léon, mentions that the new model for the École was set up in 1794 after many fact-finding visits to other European countries and America to learn from their experiences; Picon leaves the reader with a different impression. While there is mention of France's debt to English achievements at home (such as Navier's studies of British bridges), the English engineers who constructed some of the earliest railways in France, such as Brassey and Mackenzie, are not mentioned.

Nevertheless, Picon's work is of great interest and represents a considerable amount of high-quality historical investigation. My Anglo-Saxon mind would have liked more comparison with other nations' engineers and the effect that their education systems had on

engineering, and, indeed, on French engineers. It would be fascinating to read what Picon would make of the history of our Institution of Civil Engineers or of our early teaching institutions: it would be very different from the histories we have from English pens.

For the English reader there are two sub-plots which run through the book which heighten its interest. One is the development and richness of French technical drawing, of which more than a hundred examples are reproduced (in black and white – for colour the reader should see *L'Ingénieur Artiste* by Picon and Michel Yvon from the same publisher [1989]). The other is the development of the modern relationship between the individual and the state in France, which offers considerable illumination of many of the modern political battles in the European Union. For the record, out of 184 foreign students who attended the École between 1825 and 1850, just one was English; I wonder who it was?

BILL ADDIS, *University of Reading*

Histoire des Métiers du Bâtiment aux XIXe et XXe siècles: Bibliographie

JEAN EGLIN, MIREILLE GELY, MARTINE GRIMBERT, ELIETTE TALMON,
1993

Paris, Plan Construction et Architecture, Ministère du Logement.

171pp. Ffr 100

ISBN 2-11-085-491-X

This bibliography, prepared by the 'Laboratoire Théorie des Mutations Urbaines (URA CNRS) de l'Université de Paris VIII' for the French Ministry of Housing under 'Plan Construction et Architecture', has 1369 references to books and periodical articles, mainly in French, relating to the history of building and the building trades in the 19th and 20th centuries. As explained in an introductory section, all the sources consulted were French. They include, beside the Bibliothèque Nationale, the documentation centres of the École Nationale des Ponts et Chaussées and the Centre Scientifique et Technique du Bâtiment.

The bibliography, concentrates in the main, on the building trades and professions, and their apprenticeship and professional training; and on labour migration, mobility and related social issues, including trade unionism rather than construction technologies. But there is a section on employers – the 'patronat du bâtiment'; a number of references to the legal responsibilities and standing of architects and engineers; and some three hundred references to technical aspects of construction and to construction materials, building services and equipment.

Each section is introduced by a one-page review of the literature covered. The first, on building employers, draws mainly on the works of economists and sociologists, and on the law affecting the construction industry, mostly of recent date. There are a number of references to the effects of industrialisation on the structure of the industry, its growth and concentration of financial power since the 1970s. But there are also references to studies of the industry over much longer time spans, for example a history by G Desert covering the period 1815-1913 and two studies by M. Lescure over the period 1820-1920. There are also a number of regional studies, and a history of the largest French contractor, Bouygues, its organisational methods and internal culture.

In the section devoted to the design professions, four major themes have been identified:

- architects, their function and standing;
- the legal responsibilities of the design professions and the development of insurance against Civil Code liabilities;
- the role of engineers in the industry; and
- the 'formation' – education and training of architects and engineers, and that of 'mètreur vérificateur' – roughly to be equated to a British quantity surveyor.

Much of this section is devoted to the changing roles and responsibilities played by architects and engineers: On the one hand, the development of professional organisations – in France there have never been professional institutions – and, on the other, the relation between the design professions and the state.

There are a number of references to the state-sponsored education of architects at the École des Beaux Arts, including 19th century studies like that of T Lachez (1868) *Enseignement de l'Architecture: l'École Impériale et Spéciale des Beaux Arts*, and of civil engineers, like A Picon *L'Invention de l'Ingénieur Moderne: L'École des Ponts et Chaussées 1747-1850* (1992). But there seem to be few references to very different roles played by architects and civil engineer members of the state Corps des Ponts et Chaussées, as in the

Baron Haussmann's 'grands travaux' in the period 1850-70 or, more recently, in the 'grands travaux' of President Mitterand and his immediate predecessors.

Two of the authors of the bibliography, M Grimbert and J Eglin, are from the École des Hautes Études en Sciences Sociales. As one would expect, many of the references, especially in the section dealing with building workers, deal with the social aspects of the industry: trade unions, mobility, immigration and migration of workers within France, working conditions and matters relating to health and safety. There are ten references to strikes and lock-outs, dating from 1845 to 1933.

The second part of the bibliography is devoted to studies on construction technology and materials. They include a useful list of French histories of building and civil engineering, and a few references to English works, as well as number of 19th century textbooks on construction and the building trades like carpentry and masonry. As might be expected, there is a long section on cements and concrete, and a shorter section on prefabrication and industrialised building techniques, the first reference dating from 1872.

The last part is devoted to the training of building workers which, in the words of the introductory notes, had to be looked at in a political-economic context. There are a number of references to the relationship between apprenticeship and technical education. Studies range from that on technical education during the French Revolution to the crisis in apprenticeship in modern France. Both in this section, and that dealing with the mobility of French building workers, there are many references to 'compagnonnage' a term for which there seems to be no simple English translation, other than the 'fellowship of journeymen'. This illustrates, like terms like 'formation' and even 'profession' the difficulty there is in translating a number of French concepts into English.

GEORGE ATKINSON