The increasing market for steel in U.K. multi-storey building

The Increasing Market for Steel in U.K. Multi-Storey Building

Le marché en pleine croissance du bâtiment à étages en acier

Der Aufschwung des Stahlmarktes bei Mehrgeschossbauten in Grossbritannien

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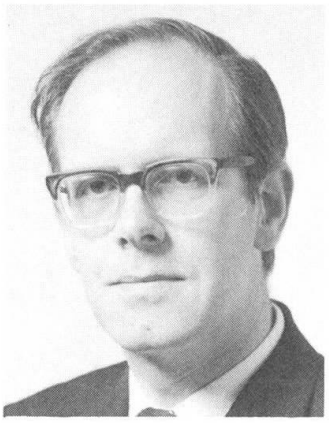


Robert Latter, born 1937, joined the Steel Construction Industry in 1962. Initially in market research, since 1979 he has formed and led BSC Sections Structural Advisory Service.

SUMMARY

The presentation illustrates with appropriate statistics, the resurgence of steel in multi-storey building in the UK. It goes on to outline the reasons including statistical information on the price relationship of steel and concrete and the productivity increases achieved in British Steel Corporation and the UK Fabrication Industry. The second half of the presentation illustrates the market development strategies employed to realise the market opportunity presented by the new competitiveness of steel in building.

RÉSUMÉ

La présentation, accompagnée de statistiques, démontre l'utilisation renaissante de l'acier dans les bâtiments de plusieurs étages en Grande Bretagne. Elle en explique aussi les causes, en donnant les renseignements statistiques sur les prix relatifs de l'acier et du béton, sur la productivité croissante de la BSC et de l'industrie de la construction métallique. La seconde partie de l'exposé démontre la stratégie développée par le service commercial pour profiter des nouveaux marchés qui se présentent actuellement en construction, grâce au prix avantageux de l'acier.

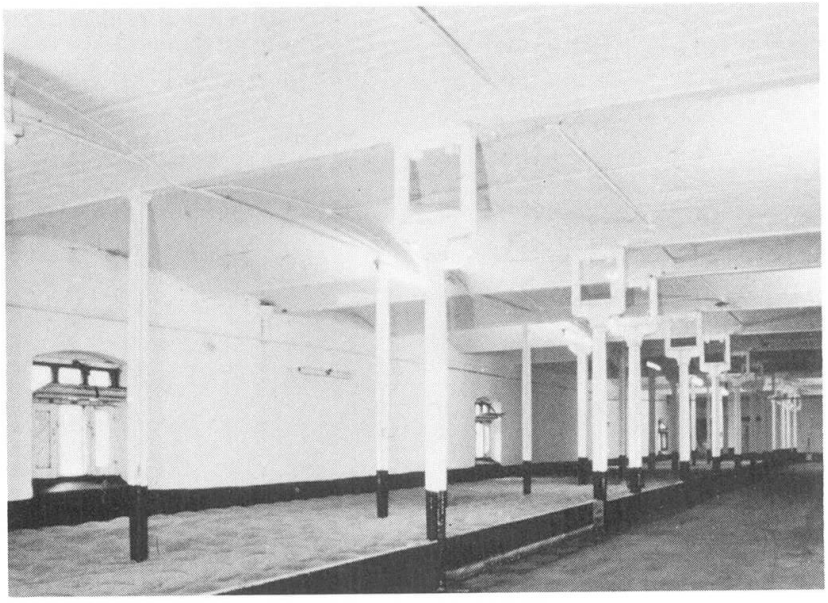
ZUSAMMENFASSUNG

Der Vortrag erläutert mit entsprechenden Statistiken den Wiederaufschwung von Stahl im Mehrgeschossbau in Grossbritannien. Gründe dafür werden dargestellt, wobei statistische Informationen betreffend das Preisverhältnis von Stahl zu Beton sowie die in British Steel Corporation und in der britischen Fabrikationsindustrie erreichten Produktivitätssteigerung miteinbezogen werden. Die zweite Hälfte des Vortrages erläutert die Marktentwicklungsstrategien, die angewendet werden, um die Marktchancen auszunützen, die von der neuen Konkurrenzfähigkeit des Stahls im Bauwesen geboten werden.

1. INTRODUCTION

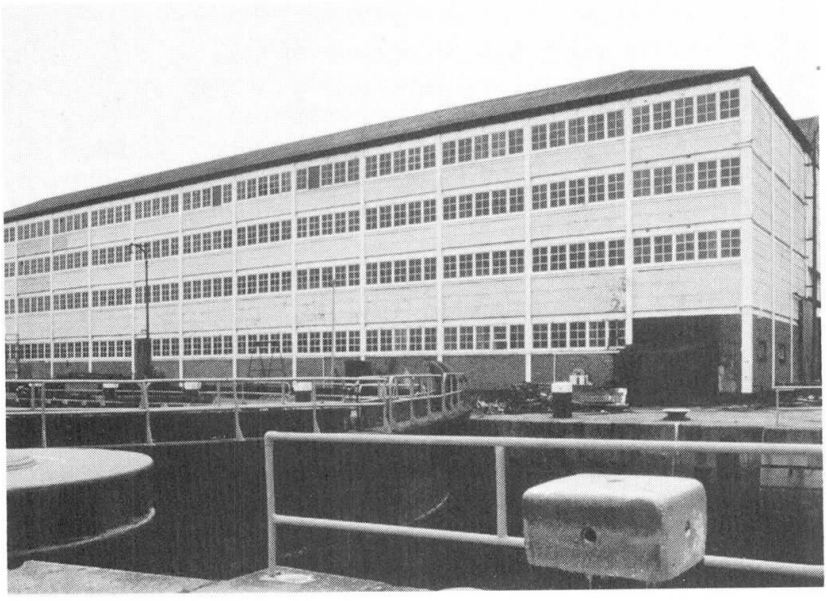
The leading building publication - CONTRACT JOURNAL - recently said "Clearly structural steel is emerging in the 1980's with a bright new image. The old material has become the new material".

Multi-storey iron and steel framed structures have a long and successful history in Britain. The first iron framed multi-storey structure was built in 1797 in Shrewsbury near the birth-place of the Iron Industry at Coalbrookdale.



Mill building at Shrewsbury 1797

The building, a five storey 9,500m^2 mill still stands and is used today as a maltings. Construction is load bearing brick walls, cast iron columns and 11 inch cast iron inverted T beams.



Boat Shed at Sheerness 1859

Another revolutionary structure was the four storey boat shed for the Royal Naval Dockyard at Sheerness. This was the first fully framed multi-storey iron structure, the first to use 'I' section (cast and wrought iron) beams and 'hollow' section columns at gable ends serving as down pipes. Built in 1859 it is still in remarkable condition.

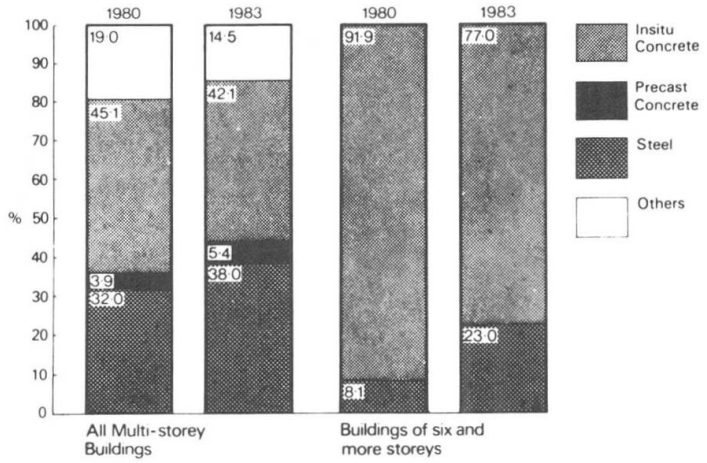
The first major steel framed building in Britain was Cesar Ritz's grand hotel completed in 1906. From that point until the beginning of the second world war, nearly all major and most medium sized multi-storey projects were steel framed. In the period of re-construction after the war steel was in short supply and the less steel intensive reinforced concrete construction became the normal method of construction for multi-storey building.

2. THE RESURGENCE OF STEEL

The dominance of concrete continued until the end of the 1970's but since then there has been a striking resurgence of steel.

Market research by the independent "Construction Markets" organisation, based on a very substantial sample, shows this clearly in Fig 1.

Fig. 1. **The Market for Structures**
Number of Storeys by Type of Structure
UK m²Floor Area



Two factors emerge clearly from these bar charts.

Total penetration of steel has risen from 32% of floor area in 1980 to 38% in 1983. More striking has been the growth in higher rise buildings - six storeys and over - where the share of steel has increased from just 8% to 23%.

The 1984 survey is not yet completed but preliminary results for office buildings - the weakest area for steel - shows the trend continuing with the share of steel rising from 25.5% in 1982; 31.5% in 1983 to 38% of floor area in 1984.

Why has this resurgence occurred? Will it continue? This paper sets out to answer these two questions.

3. THE COST FACTOR

The most significant factor underpinning the resurgence has been the change in basic material prices. Fig 2 shows the basic price of structural steel (sections and plates weighted) v. price of ready mix concrete and precast concrete 1976 - 1984 taken from official price indices.

The reason for increased competitiveness of structural steel is the dramatic productivity gains made by the British Steel Corporation. Fig. 3 shows that at BSC Teesside, which produces about 60% of structural sections, man hours per tonne of finished steel has fallen from 17 in 1978 to just 4½ in 1984. Figures in other plants are similar.

FIG. 2.

Steel and Concrete Costs 1976 - 1984

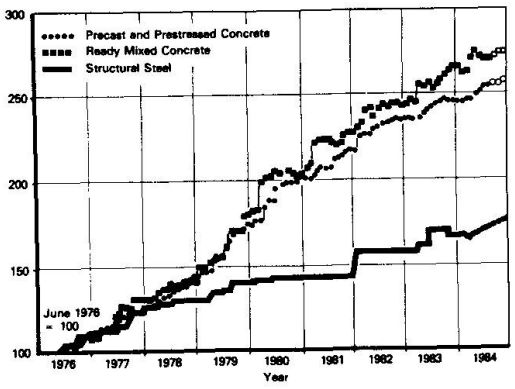


FIG. 3.

Productivity of BSC Teesside

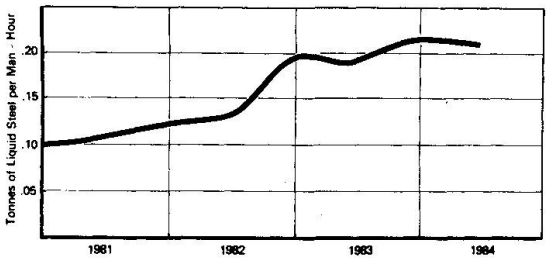


FIG. 4.

Increases in Efficiency in the Steel Construction Industry (1980-1983)

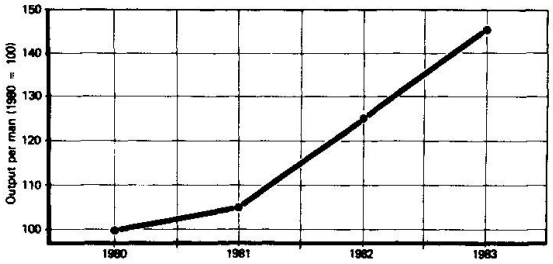
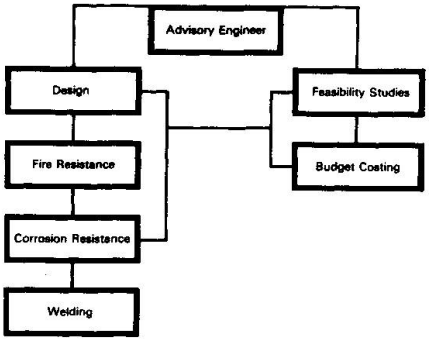


FIG. 5.

BSC Structural Advisory Service



The position for fabricated steel is almost as dramatic with official figures showing a 45% growth in £ Output per man between 1980 and 1983. (Fig 4).

This drive towards increased productivity has enabled the Steel Construction Industry to keep prices at very competitive levels.

4. MARKET DEVELOPMENT PROGRAMME FOR STEEL

Four years ago British Steel, BSC Sections and Commercial Steels Division, initiated a market development programme to take advantage of the market opportunity created by the new competitiveness of structural steel. This was undertaken in close liaison with the Fabrication Industry, particularly British Constructional Steelworks Association; Constructional Steel Research and Development Organisation and BSC Sheffield Laboratories.

It was recognised that the change in relative material prices would not alone be enough to ensure a resurgence of steel in multi-storey building. Many Architects, Engineers and Quantity Surveyors have had no experience of designing with steel and inertia towards change and to learning new techniques were bound to be powerful forces against the adoption of steel frame construction.

5. BSC SECTIONS STRUCTURAL ADVISORY TEAM

A key initiative was the establishment of a regionally based team of eight structural advisory engineers backed by specialists at Constrado and BSC Laboratories on design, fire and corrosion protection, welding and metallurgy.

Each BSC Advisory Engineer aims to become an extension to the professional expertise of the specifiers in his area. He assists in the preparation of outline steel alternatives and budget costs for particular projects, helps specifiers with general problems involving structural steels and their availability, and provides a channel for disseminating research and development in steelwork and related matters.

In budget costing, the BSC Advisory Engineer works closely with fabricators, flooring and fire protection contractors in order to provide a like-for-like comparison with concrete. Advisory Engineers are always "on call" to help when required, and to help sustain their relationship with the specifiers in each area, they are responsible for organising a programme of seminars and lectures. During the last three years there has been an average of one seminar or teach in every working day from mid-September to end June. While some seminars feature notable cost effective but innovative multi-storey buildings, the majority of presentations concentrate on how to achieve economic steel construction and the cost implications of alternative approaches to design, fire and corrosion protection.

Guidance starts with the choice of steel grade. Where deflection is not critical, as is usual in multi-storey structures, the use of Grade 50B steel will give savings of about 10%. Grade 50B steel is readily obtainable from BSC Sections but there are often cost penalties when buying small quantities from stockists. Specifiers are given advice on using Price Lists to best effect.

6. THE ARGUMENT FOR STEEL

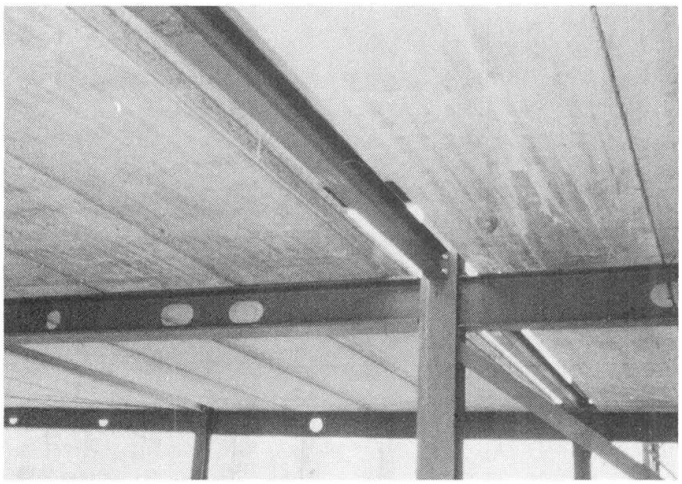
6.1 CONSTRUCTIONAL STEEL RESEARCH AND DEVELOPMENT ORGANISATION - COST COMPARISON

A major input to the seminars and, indeed to the market development programme as a whole, has been made by the Constructional Steel Research and Development Organisation. Particularly important was their publication in October 1982 of a study establishing the comparative prices of steel and concrete solutions for a range of multi-storey buildings. Essentially, the study translates the charge in basic materials prices into construction costs immediately recognisable to specifiers. It shows the steel frames are now competitive on basic cost and invariably cheaper when the financial effect of speed of construction is taken into account.

Both this study - recently updated - and important development work aimed at increasing the use of composite metal deck floor construction are covered in a separate paper by Mr H B Walker of the Constructional Steel Research and Development Organisation.

6.2 BSC SEMINARS

Much emphasis is given by BSC Advisory Engineers to the practical aspects of putting a steel framed building together using the example of recent contracts. For example, precast concrete floors remain an attractive alternative for the smaller projects which account for a large proportion of the total steel framed floor area built. Uninterrupted service zones can be achieved by the simple expedient of supporting the units on the longitudinal steel beams and raising tie beams into the depth of the floor.



Pre-cast concrete floor design giving uninterrupted service zone

Equal attention is paid to attachment of cladding systems, particularly detailing brick work which has become increasingly popular among architects but which sits less easily with a steel frame than curtain walling.

The essential message is that steel construction is a kit of parts, factory made but assembled on site. The overall effect is to drastically reduce construction times. Problems with bad weather are eliminated. The most dramatic argument is performance on real projects. Two suffice. At Wallington, Surrey, a four storey steel framed building (with precast floors) was started two weeks after a similar sized concrete building. The photograph below leaves no doubt as to which is quicker.

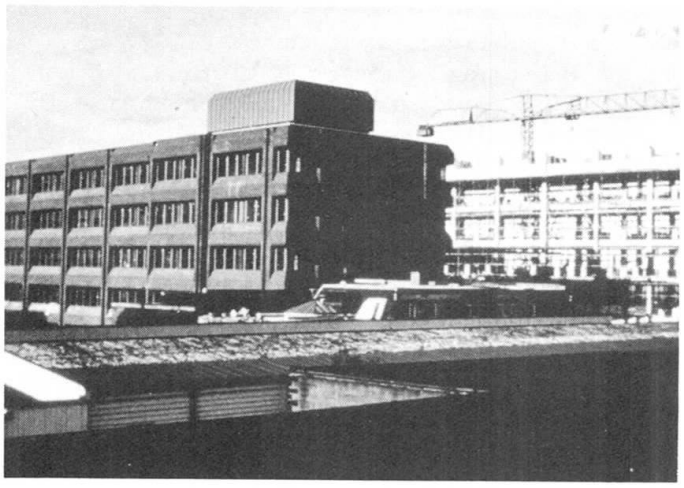
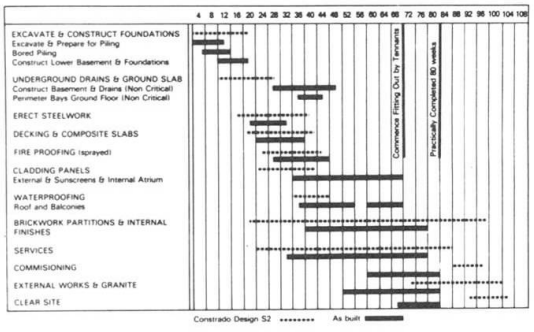


FIG. 6.

Progress Schedule - No. 1 Finsbury Avenue London EC2.



Equally striking is the progress schedule achieved on the nine storey Finsbury Avenue Development in the City of London. Using composite metal deck floors the project was completed four months ahead of the schedule for a comparably sized steel framed/metal deck building, included in the first edition of the Constrado cost study referred to earlier. (Fig. 6)

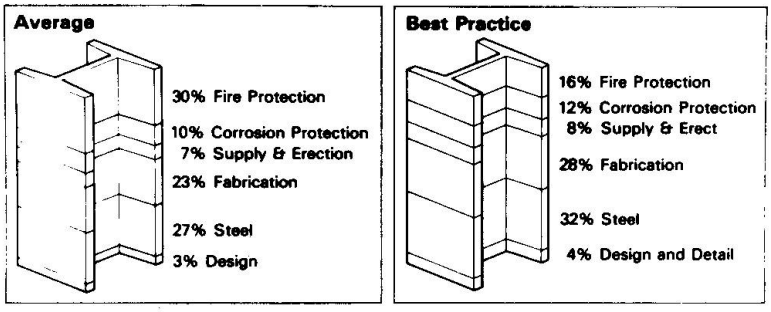
6. FIRE RESISTANCE AND FIRE PROTECTION

It would be impossible to cover the resurgence of steel in multi-storey building without consideration of fire protection - or, more precisely, the extra cost on the basic steel frame necessary in meeting the fire resistance requirements of Building Regulations. Market research carried out in 1982 by an independent consultant on specifiers attitudes towards steel structures showed that the cost and inconvenience of fire protection was perceived as the major disadvantage of steel frames.

Market research also showed that cost of fire protection for multi-storey frames commonly amounted to 30% of the total cost of the fire protected steel frame compared with less than 20% using best practice.

FIG. 7.

Multi Storey Steel Frame Cost Breakdown



Data from "Steel Framed Multi Storey Buildings - Economics" and other sources.

For this reason BSC Advisory Engineers have concentrated on informing specifiers of the cheapest effective systems. For multi-storey buildings this is generally a mineral fibre spray to beams and lightweight asbestos free boards to columns.

Table 1. Costs of Fire Protection

Based on supply and fix of 3000m^2 of fire protection: One hour rating.

Cost per metre run of 203 x 203 x 60 column:

Sprays	from £ 8.40 metre	Preformed Casing	from £19 metre
Boards	from £ 9.00 metre	100mm Blockwork	from £12 metre
Intumescents	from £10.00 metre	In Situ Concrete	from £17.60 metre

Costs, particularly for spray applied materials are reduced on larger contracts, eg., Mineral Fibre - £4.60 metre.

Concurrently, a research programme has been directed to examine alternative ways of achieving fire resistance than conventional "passive" protection systems. This would constitute a paper on its own, but essentially comprises temperature studies of steel in real and standard fires to facilitate fire engineering assessments ranging from whole buildings to partially exposed elements.

7. CORROSION PROTECTION

In the area of corrosion protection, the emphasis is again on education to prevent the over enthusiastic specification of costly proprietary systems. In modern multi-storey steel framed buildings the need for paint systems on interior steelwork is minimal - a fact often not fully realised by specifiers.

The photograph below shows unpainted steelwork at Finsbury Avenue.

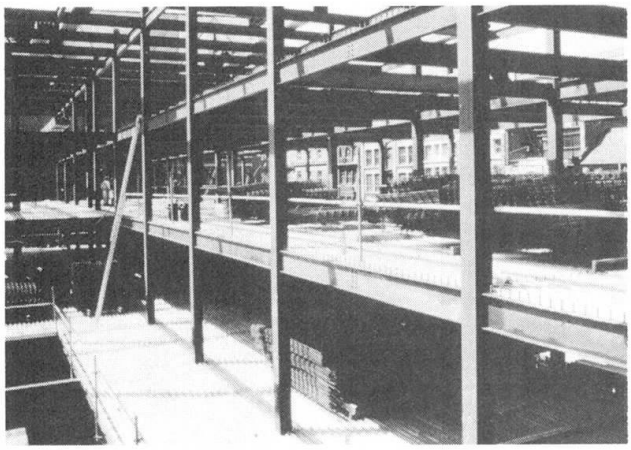


FIG. 8.

Comparison of Common Paint Types

BINDER	WATER RESISTANCE	SYSTEM COST	TOLERANCE OF POOR SURFACE	OVERCOATING AFTER AGING	COMMENTS
Black Coatings (based on tar products	Good	Low	Fair	v. good with coatings of the same type	May soften in hot conditions
Alkyds	Fair	Low	Fair	v. good	
Chlorinated Rubber	v. good	Moderate	Poor	Good	Use travel coat to prevent sticking in transport
Vinyl	v. good	Moderate	Poor	Good	
Epoxy	v. good	Moderate	v. poor	Poor	'Chalks' in U.V. light
Polyurethane	v. good	High	v. poor	Poor	

General guidance is given on the selection of cost effective systems and their various attributes and characteristics. (See Fig. 8).

FUTURE TRENDS

Making forecasts is always a hazardous trade. However, the leading article in the most recent Special Steel Issue of the Architects' Journal finished with the encouraging statement that "It is likely that in ten years' time steel frames in multi-storey building will be the rule....". There is much to support such a view. The pressure for even greater productivity continues within Europes Steel and Fabrication Industries. Partly in response to this, UK cement prices have not increased since 1982 but this has had only a moderating effect on concrete prices which have, as shown in Figure 3, risen steadily. There seems little likelihood of a reversal in price trends of sufficient magnitude to undermine the resurgence of steel in multi-storey building.

In the market development area it is the Steel Interest which is innovative, both in product application development and composite metal deck floors and fire engineering and in marketing. The UK technical press has carried several reports of the Cement and Concrete Industries need to counter "the very aggressive and to some extent effective efforts of their competitors".