1918 BPCF 1968

British Precast Concrete Federation, 9 Catherine Place, London SW1


WIMPEY

Precast concrete

a review of the industry to celebrate

the fiftieth anniversary

of the British Precast Concrete Federation

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Frontispiece: Centre Point, St Giles Circus, London. Each 2½ ton I-shaped structural unit was precast and transported from Dorset. Architects: R. Seifert and Partners.

Page 3 of cover: A water tower at Cockfosters, London; it is 80 ft high and the tank is 60 ft in diameter. It is supported partly by a 9 ft diameter central shaft of reinforced concrete and partly by a hyperboloid lattice frame, the members of which were precast in lengths up to 28 ft. Precast panels are also used for external facing of the tank.

The text was keyboarded in 11pt Monotype Bembo 1pt leaded.
Printed on Henleigh White artpaper supplied by Rotaprint Ltd.
The prelims are printed on Tosa Butten supplied by Robert Horne & Co. Ltd.

Contents

Message from the President

The British Precast Concrete Federation is 50 years old. I think that we can look back with a good deal of pride on the quite remarkable development of precast concrete in those years and, especially, on its spectacular development during the past decade.

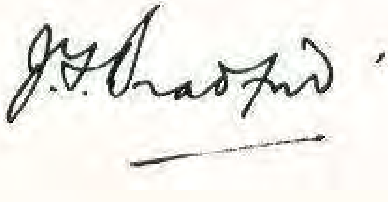
There is hardly a building or civil engineering job that does not use precast concrete in some form or other and the successful completion of many of them has been almost totally dependent upon the specific merits of precast products and on the benefits that are to be gained from their use.

No doubt the progress of many sections of the industry has been greatly helped by the shortage of other materials; but the days of precast concrete as a substitute are over. Now it stands in its own right as one of the most useful and versatile materials in the world—as many fine building and civil engineering projects bear witness.

In fact, I think we can safely say that without the use of precast concrete in industrialized housing systems it would be impossible to overcome the housing shortage both in this country and the world generally.

In this anniversary survey we have tried to give a picture of the industry as it is now and of some of the factors and circumstances that have contributed to its present situation and, at the same time, to indicate something of the variety of products and the processes now available.

We have not tried to foresee what the next 50 years will bring—but of one thing we are confident; the industry will meet whatever demands are made upon it—the progress of precast concrete is not going to be outpaced by technological developments in any other field.



1918 Interim Industrial Reconstruction Committee formed

1931 CCPA Co-operative Research Scheme with Building Research Station (DSIR)—continued until outbreak of Second World War

1937 NJIC for the Cast Stone and Cast Concrete Products Industry formed

1939 British Concrete Corporation Ltd. formed as an emergency measure to harness, by means of bulk contracts, members depleted production capacity for Government requirements; total value exceeded £5¼ million

1942 Scottish Precast Concrete Manufacturers' Association (SPCMA) affiliated to BCCF

Scottish Joint Industrial Council formed

1945 Joint Co-ordinating Committee for the Cast Stone and Cast Concrete Products Industry formed to assist the Government in the operation of voluntary ceiling price control in the post-war period and to assist the Board of Trade in the provision of data for the purpose of a Wholesale Price Index

1948 Joint Study visit with MOW to France to assess the applications of precast prestressed concrete

1950 Joint Research Committee for the Cast Stone and Cast Concrete Products Industry formed (comprising BCCF plus SPCMA, CS and CF and Cement and Concrete Association

Inauguration of official Study Tours

1954 First of Triennial Congresses (Brussels) and formation of the International Bureau of Precast Concrete, viz: Bureau International du Béton Manufacturé (BIBM)

1957 BCCF series of data sheets inaugurated

1958 Concrete Products Development Committee formed (BCCF and C&CA)

1966 Fifth BIBM International Congress of the Precast Concrete Industry, London

1968 Fiftieth Anniversary
First issue of the Directory of Precast Concrete
New issue of Data Sheets
Fiftieth Anniversary Review

Dates from the fifty year diary

1918

Federation of Manufacturers of Artificial Stone (FMAS) formed
First Chairman: W. Campbell Sharman
First Secretary: W. H. Curtis

1928

Cast Concrete Products Association Ltd. (CCPA) formed primarily to create and uphold a standard of excellence in manufacture by research, standards of quality and design
First Chairman: F. G. P. Gedge
First Secretary: A. S. Windsor
(Asst. R. W. Parks)

1936

National Association of Cast Concrete Products Manufacturers (NACCPM) formed to complement CCPA in dealing with labour matters
First Chairman: A. C. James
First Secretary: A. S. Windsor

1938

Name changed to Cast Stone and Concrete Federation (CS & CF)

1939

British Concrete Federation (BCF) formed for the purpose of advising the Government on the use of concrete for war purposes and to organise the industry for mass production of Government requirements
First Chairman: E. L. Cotterell
First Secretary: A. S. Windsor

1942

CCPA, NACCPM and BCF merged to form British Cast Concrete Federation (BCCF)
First Chairman: N. F. Spence
First Secretary: A. S. Windsor

Scottish Precast Concrete Manufacturers' Association (SPCMA) affiliated to BCCF

1964

BCCF, CS and CF merge to form BPCF
First Chairman: J. W. Panton
First Secretary: R. W. Parks

1968 Fiftieth Anniversary

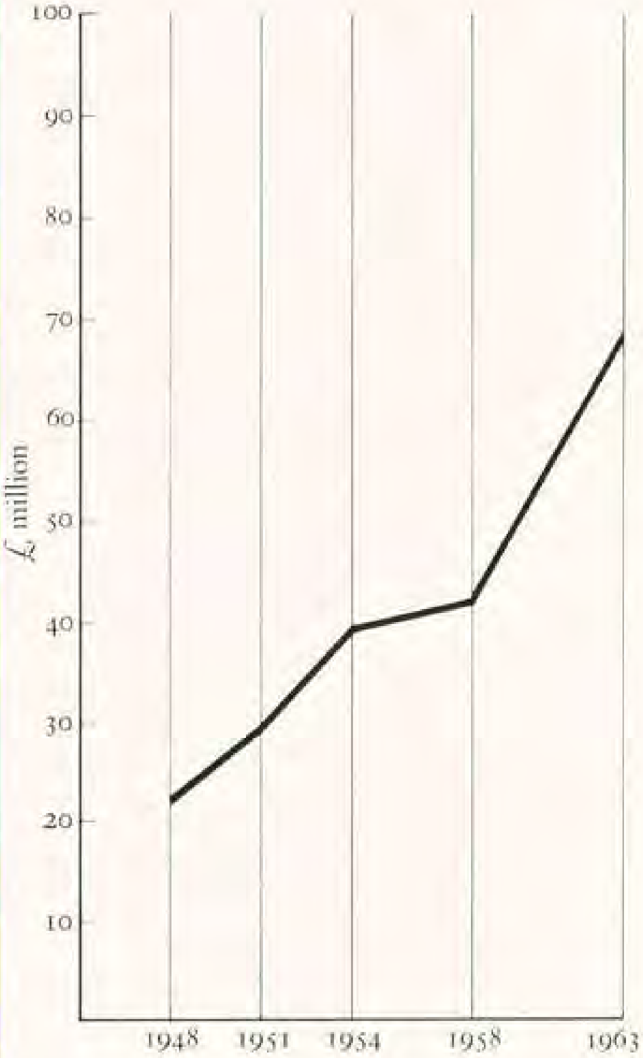
I he industry today

'he precast concrete industry is as forward-thrusting oday as it has been throughout the past half century. In ts representation of this industry, the BPCF at the resent is, in fact, more involved with national issues, nore concerned with technological advancement, conributes more to international industrial co-operation—nd is better able to serve its members, than at any other ime in its history. The organizations which comprise he Federation as it is today have, from their earliest days, eographically represented the whole of the United Kingdom and, from the production point of view, they epresent all precast concrete components made in facories. Moreover, they have concerned themselves with ll matters affecting the industry—with the sole excepion of price fixing.

To refer to 'the precast concrete industry' is to use an omnibus phrase covering many different industries with liverse attitudes and problems. But first, why 'precast'? Precast concrete offers what is not feasible with in situ concrete—components made under factory conditions; controlled, inspected and tested before being built into he structure, delivered ready to take whatever design oads are demanded and, in the majority of cases, covered by British Standards. These are the advantages which, contributing as they do to this country's building and civil engineering programme, have caused producion figures to improve with such spectacular speed over he past decade. The trend is clearly shown in the accompanying graph. Progress has been great in all espects. For some components the most noticeable change is in design—this is so, for example, in the development of roofing tiles for flatter pitches; for others, it s in techniques—such as the application of prestressing to ighting columns, or the incorporation of insulation into loor and wall slabs. But many developments are of universal benefit; in the manufacture of all products here is now a high degree of mechanization and automation which covers materials handling and batching, mixing, compaction, internal handling and loading of components. The current search is for earlier and quicker testing procedures for easier quality control.

Another factor that is important to the growth rate of the precast industry is the ancillary advantage of faster building construction. For example, while there may not appear, from a comparison of tenders, to be a worthwhile saving between precast and in situ concrete—or

Post-war growth of the precast concrete industry



1948: £22 million

1951: £29 million

1954: £39 million

1958: £46 million

1963: £73 million

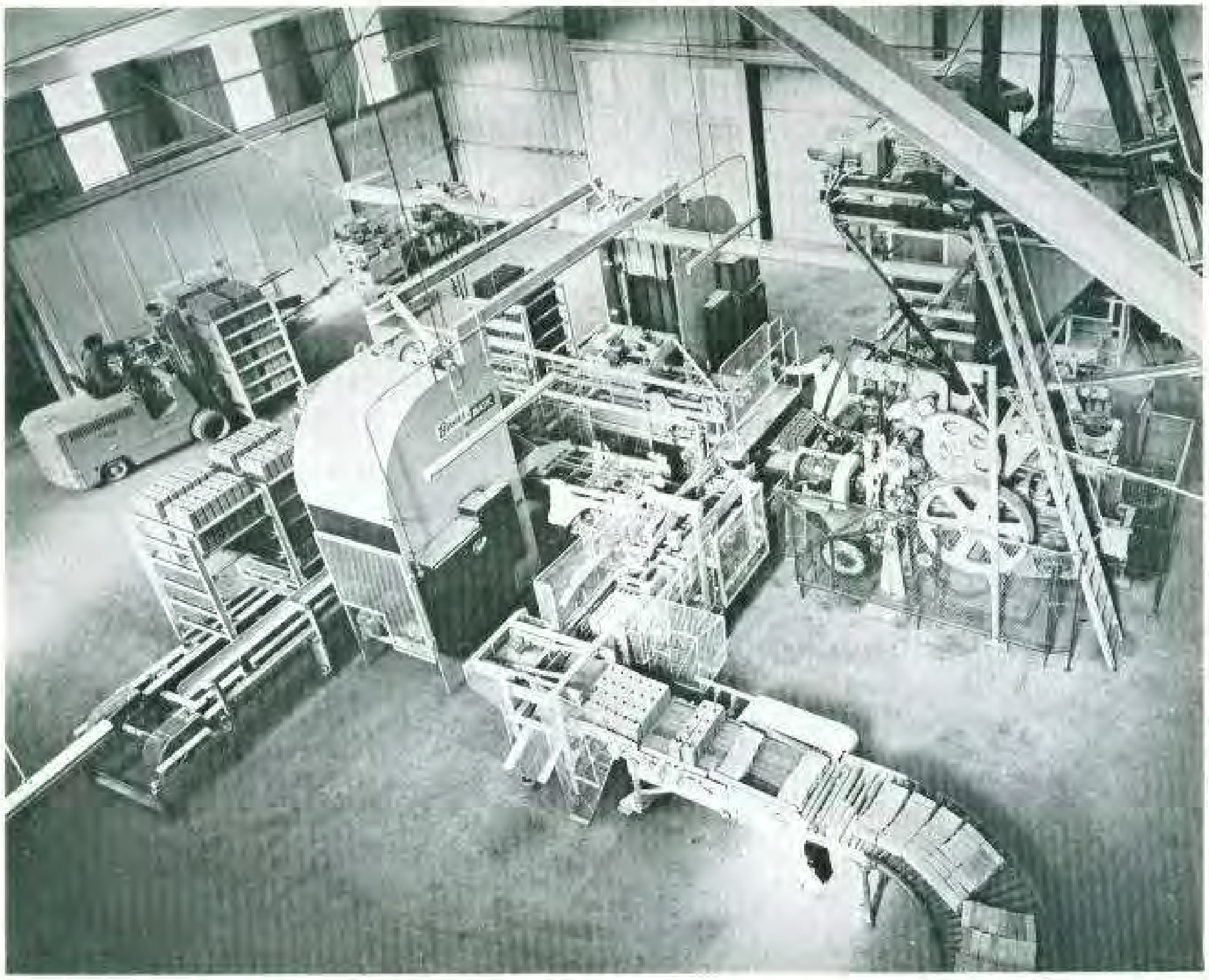
other wet construction—the use of precast concrete in housing schemes can lead to earlier occupation for the homeless and to a more immediate return in rents or purchase money for the building owner.

With the use of precast concrete in highways, subways, under-passes and elevated roads there is minimal disturbance to traffic—this is another reason why this method of construction is desirable for social as well as for economic reasons.

In a review of this size, it is not possible to attempt a detailed survey of the past fifty years—even to deal in detail with the past ten years would require a vast volume. Nevertheless, an attempt has been made to highlight some of the Federation's history and to report on developments in the various building and consumer product fields as well as in labour, training and welfare matters.

One thorny issue is very much of the last decade—at any rate so far as the precast industry in this country is concerned—this is the change to the metric system and all that this implies. The Federation is very actively involved in this question and has been, from the earliest days, working with the British Standards Institution and the National Council of Building Materials Producers. Federation members, or the Director, serve on BSI committees and Functional Group Panels and draw

HRH The Duke of Edinburgh examines the console of a batching and mixing plant.



Automation in the precast concrete industry. Quality-controlled concrete blocks being automatically moulded and stacked ready for curing.

much help for this work from the Product Sections. In particular, the Federation is very much concerned with the possibilities of variety reduction and, of course, with the economic aspects of the change—while, at the same time, maintaining the forward-looking attitude it has held from the start.

Structural precast concrete

In filling the need for rapidly erected buildings for housing, industry, agriculture, hospitals, education and other social services, the precast concrete industry has made great strides during the last ten years.

Prefabricated structural concrete components—which can be erected quickly—have provided the obvious answer to an urgent problem.

Flooring and roofing units

Precast concrete floor and roof beams and slabs—reinforced or prestressed—are now being produced in a very wide range of sections and dimensions. The range of spans available is increasing in length—to provide clear floor areas; this, in itself, has had effect on both structural design and the organization of the space provided.

The units fall into approximately five categories—each suitable for particular structural requirements:

1 Reinforced or prestressed elements including hollow box beams, I-beams and wide-slab hollow planks (up to 9 ft wide) and hollow purlins.

2 Close-spaced units such as inverted channel sections and double-T elements.

3 Precast beams spaced apart to accommodate hollow or lightweight infilling slabs to form a flat soffit; these include inverted T-beams, and also channel-section beams.

4 Prestressed I-beams spaced apart to support wide, precast concrete panels.

5 Close-spaced prestressed concrete planks.

These numerous types of floor and roof units possess the following advantages:

(a) Long span range.

(b) Shallow depth of construction.

(c) High-speed construction—wide slabs and double-T types providing a large area in one unit (some units comprise 200 ft²).

(d) Low construction costs.

(e) Accommodation of services in hollow units.

(f) Fire resistance.

The range of types available, and their advantages, are likely to be increased as further research work takes place in this field.

Precast prestressed double-T beams used in the construction of Watford College of Further Education. Architects: Geoffrey Fardell, MBE, ARIBA, County Architect, Herts County Council.

Precast prestressed inverted T-beams and Y-beams span 55 ft of floor at the Portsmouth Evening News building. Architects: A. E. Cogswell and Sons. Consulting engineers: Jan Bobrowski and Partners.

Point Royal flats for Bracknell Development Corporation were constructed with precast concrete structural framing members. Architects and Engineers: Arup Associates.

Structural frames

The manufacturers of framed concrete structures for public buildings, industry and agriculture have, particularly during the last decade, gained ground because precast concrete frames are acknowledged to possess specific advantages—such as loadbearing strength, speedy erection, freedom from maintenance, fire resistance and low cost.

Public buildings. Several precast concrete systems are now available for building hospitals, educational establishments, hostels, offices and the like.

These systems are generally planned on a modular grid which permits maximum flexibility for the layout of bays in lateral directions—yet, at the same time, allows for future extensions of the building. Precast columns (which can be spaced at various specified increments) are provided with fixing holes for windows and cladding. There are edge beams, primary and secondary beams carrying the precast floor slabs or planks.

Roofs generally consist of precast planks or slabs (sometimes of lightweight or aerated concrete) carried on solid or hollow purlins.

Precast mullions can be erected between the external beams to receive various types of wall cladding.

The National Building Frame. In 1965 a structural system, similar in general principle to the above, was designed on proposals initiated by the Ministry of Public Building and Works and was evolved with the co-operation of the BPCF and the Cement and Concrete Association. This system is controlled by the National Building Frame Manufacturers—an association of about twenty independent specialist manufacturers and erectors of precast concrete frame components. The resources of any required number of the member companies can be called upon to produce the standardized components.

The Public Building Frame. This system was developed in 1966 by a team of architects, engineers and quantity surveyors at the Ministry of Public Building and Works; it also consists of assemblies of precast concrete frame components and is intended for multi-storey buildings. The individual elements are particularly suitable for production by precast concrete manufacturers as sub-contractors; a particular advantage for the industry is that the PB Frame system makes use of proprietary precast floor units. Cost appraisals have shown that the basic units in the Public Building Frame can be used economically as an alternative to in situ construction.

Industrial buildings. In modern manufacturing methods generally, where site conditions permit, the processes are carried out on the ground floor to minimize lifting and handling—so that although multi-storey factories are still in demand, the general trend is towards single-storey buildings; these are generally simple precast framed buildings with bay spans ranging from 20 ft to 100 ft.

The structure for this type of building frequently comprises portal frames or columns supporting clear span roof members or trusses for flat, pitched, north-light or monitor roofs; thermal insulation is provided by lightweight concrete roofing and cladding—according to the standard designs available from any one of approximately 70 member companies of the BPCF.

The precast industry also specializes in the production of architect-designed components—columns, beams, purlins, roof trusses and cladding—for large factories. Roof members for very large spans are often precast in sections for subsequent post-tensioning on site.

Agricultural buildings. Livestock farming, a traditionally outdoor industry, has tended during the last decade to operate more and more under cover and the precast industry is becoming involved in every aspect of this agricultural revolution on a larger scale each year.

Among the structures for which precast concrete-framed buildings are in increasing demand are the following:

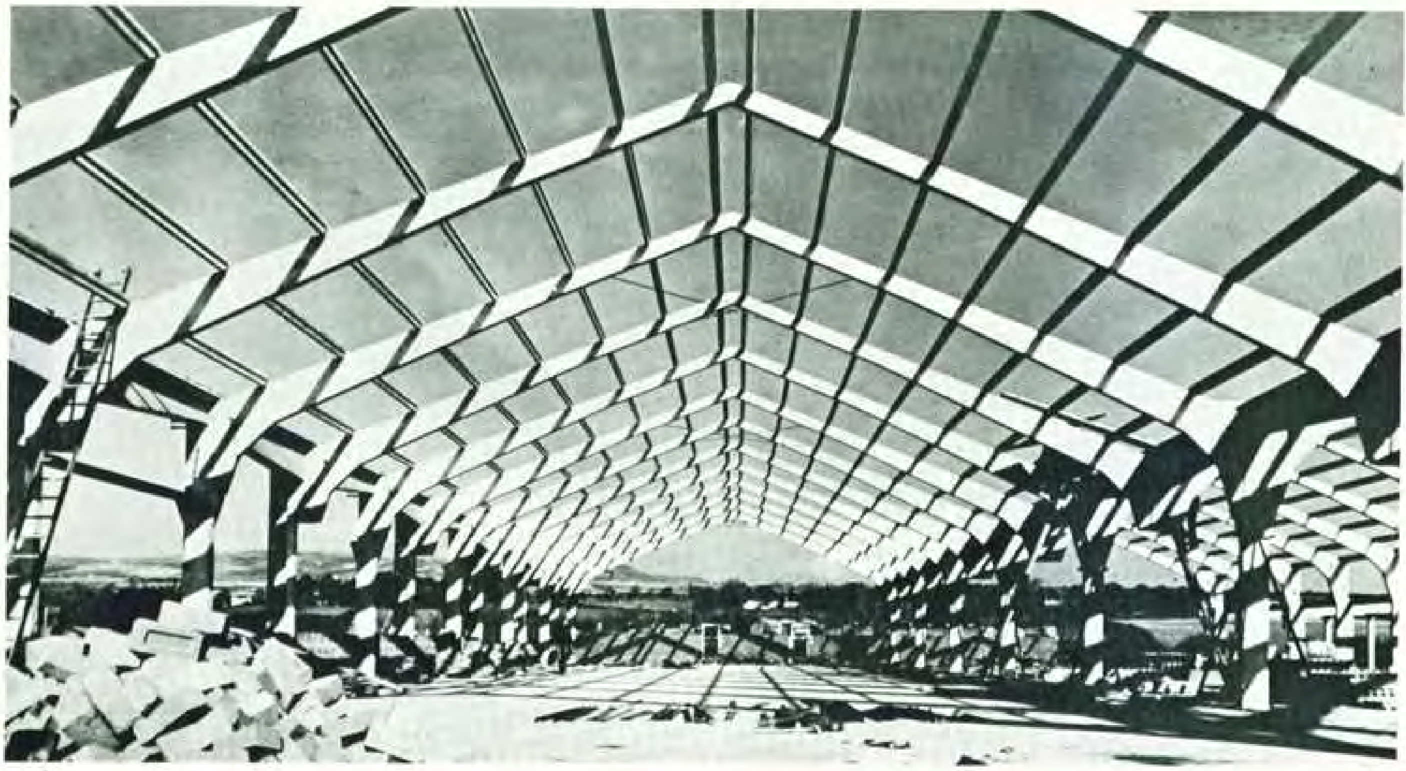
Dutch barns, covered yards, cowhouses, milking parlours, intensive beef units, calf-rearing houses, potato stores, grain storage and drying buildings, fertilizer stores, implement and machinery sheds, poultry units and piggeries.

These buildings are relatively simple in design—generally comprising portal frames clad with concrete block walls and roofed with asbestos-cement sheeting. They can, consequently, be rapidly erected by the mobile teams of specialists provided by the manufacturers of the buildings.

Improvements in the design of these standard, ex-

at the Isle of Man.

Bottom: The Medical and Paediatric block at Isleworth Hospital built with the Intergrid frame system for the Northwest Metropolitan Regional Hospital Board.



Southampton City Centre.

stock precast concrete-framed buildings are taking place each year, so that this branch of the precast industry (of which there are about 60 member companies of the BPCF) is in considerable demand.

Housing

The Government has stated that it is aiming at a target of 500,000 dwellings per year by 1970 and is consequently pledged to assist the expansion and modernization of the construction industry.

As traditional building methods could not possibly cope with these annual requirements a serious effort has been made—and continues to be made—to provide homes faster by 'dry' production of complete building components in factories—for rapid assembly and erection on site.

Fifteen years ago, there were some—but relatively few—precast concrete housing systems in an advanced stage of production; during the last decade, however, a multiplicity of prefabricated systems have been developed in Great Britain—in addition to those Scandinavian and French systems operated under licence by British contractors. In 1962, therefore, the Cement and Concrete Association thought it advisable to review the situation and organized a conference in London on

A precast external wall element for the industrialized building system for flats at Pollokshaws for the Corporation of Glasgow. Architects: Boswell, Mitchell and Johnston in association with Archibald G. Jury, CBE, FRIBA, FRIAS. City Architect for the Corporation of Glasgow.

Precast concrete is used for the cross walls, beams, floor slabs and roof in this low-rise industrialized housing system. Architects: Fry, Drew and Partners.

'Housing from the factory'. Conclusions drawn from this symposium were that the British precast concrete industry was already well established in operating industrialized housing systems.

System-built housing in precast concrete falls into two main categories: low-rise and high-rise. Low-rise housing has been generally defined as including dwellings from single-storey up to four storeys in height; high-rise is, of course, the multi-storey housing above this range.

The components of precast concrete building systems conform with the British Standard Code of Practice CP.116 *The structural use of precast concrete*.

Low-rise housing

The types of precast concrete low-rise dwellings available include single- and two-storey houses, flats and maisonettes, although the whole range is not covered by every system.

Most of the systems offer a complete range of designs —based on the re-defined Parker Morris Standards— which are intended to meet all dimensional requirements.

The majority of the low-rise system designs are based on the use of large, precast, loadbearing cross-wall panels (sometimes connected by beams) and flank wall sections, supporting precast floor slabs.

The walls are generally of dense concrete and are usually of 'sandwich' composition—incorporating a lamination of thermal insulation material. Windows (already glazed) and doors, with their frames, are incorporated in the precast walls; electrical and other services are already laid within the wall panels. External walls are supplied in a variety of surface finishes—such as tooled concrete or exposed aggregates; other types of external wall cladding can, if desired, be incorporated.

In addition to the low-rise systems based on the use of dense concrete elements, other manufacturers specialize in structures rapidly erected with lightweight, autoclaved, aerated structural concrete wall and roof units.

Many of the low-rise systems have now been granted the Appraisal Certificate of the Government's National Building Agency. These certificates were, in fact, introduced as a means of encouraging the use of industrialized methods of building as part of the Government's housing drive. A certificate indicates that the system has been examined by the NBA and is suitable for use by Local Authorities on the basis of a 60-year loan period.

High-rise housing

For those multi-storey housing systems licensed from the Continent or developed and operated by British civil engineering contractors the precast concrete industry plays an important part as associated contractors or sub-contractors for the supply of components.

With regard to the high-rise systems manufactured and erected by members of the precast industry, a number of these are also based on the use of structural frames but, as previously stated, the majority are basically similar to the systems also used in low-rise construction—i.e. loadbearing crosswall and flank wall elements erected to support precast floor and roof units. Precast concrete lift wells and staircases are integrated with the structures and increase the fire-resistance of these buildings.

The individual precast elements have equal attributes to those mentioned in low-rise systems—services built-in and joinery already incorporated and glazed. Construction is accordingly competitive—relative to the slower, traditional methods of building high-rise structures.

Building blocks

Precast concrete blocks were first made in the United Kingdom in about 1850. They were hollow and were produced in imitation of masonry—being moulded to resemble the dressed stone facing of the period.

The architectural possibilities of concrete blocks were, however, neglected in favour of their purely utilitarian purposes when, coinciding with the growth of the cement industry around 1910, single-pallet moulding machines were put into service—in fact, the development of blockmaking plant also dates from this period, when some of the present manufacturers of machines started in business.

The twenties and thirties saw the establishment of the 'breeze' block industry as there was a considerable demand for this type of block for partition walling during the housing boom of that period. For external walls, however, traditional materials were well established and it was mainly for industrial and farm buildings that the first dense, loadbearing, concrete blocks were used.

Concrete blocks manufactured with cement and natural aggregates (particularly in those areas of the country remote from brickworks) gradually became recognized as economic building units which, by reason of their greater dimensions, enabled walls to be built in less time than with clay bricks.

During this period a considerable number of variants—dense and lightweight—were developed and British Standard specifications (492, 728 and 834 in 1944 and 2028 in 1953) were issued to cover materials, dimensions, methods of manufacture and testing. By 1955, annual production had reached approximately 5 million square yards of 4 in. blocks, the majority of which were produced by the 'egg-laying' type of machine, which moves over a prepared concrete bed depositing blocks as it progresses.

But, during the ensuing ten years, concrete blocks definitely began to gain favour, and the yearly output increased at an annual rate of 25%. Their many advantages—size (speed of laying), strength, thermal insulation and fire resistance—began to be appreciated. Close quality control by manufacturers resulted in concrete blocks becoming generally accepted as first-class loadbearing building units in their own right, so that by 1965 production reached over 60 million square yards per annum—more than 20% of the annual total area of walls built in Great Britain. This period saw the introduction of sophisticated automated plants which, besides having high outputs, were able to produce dense, high-strength, high-quality facing blocks—which had not been previously available.

As architects and designers came to appreciate the aesthetic potentialities inherent in the plasticity of precast concrete, which could be utilized in its precast form as a facing material for walls, blocks with a variety of geometric and other profiles to enhance the play of light and shade on wall surfaces were manufactured. Other types of block were given facings of exposed aggregates

Riven blockwork, made with light grey granite aggregate, faces the walls of a lecture hall at Birmingham University.
Architects: Howell, Killick, Partridge and Amis.

Roofing tiles

It is reckoned that at the turn of the century the production of concrete roofing tiles in this country was approximately 1% of the total production of roofing units—when compared with slates and clay tiles.

By the end of 1967 the percentages were as follows:

concrete	91·4% —	2,957,690 squares of roofing
clay	5·2% —	167,108 squares of roofing
slates	3·4% —	109,568 squares of roofing

The factors contributing to this achievement by concrete roofing tile manufacturers must, clearly, include competitive pricing made possible by efficient production methods and the adaptability of the raw materials to automated processes. The low cost of concrete and its greater durability than clay inevitably increased the demand for these tiles, but an imaginative approach has undoubtedly stimulated sales by producing a continually widening range of new shapes, sizes, colours and textures.

Another factor in establishing the national preference for concrete tiles is that—in addition to their regularity in shape, close tolerances in manufacture and closeness of fit when laid—their low permeability makes them perfectly suitable for roofs of lower pitch than the 35°–40° specified in the appropriate BS Code of Practice—CP142:1958 *Tiling and slating*.

This low permeability of concrete tiles has, of course, been the main consideration and in the first British Standard—473: *Concrete plain roofing tiles and fittings*—the requirement for impermeability was specified as four times that of clay tiles; this stringent requirement is also considered as a means of ensuring frost resistance and durability in general.

The revolution in production methods occurred in the thirties, when the extrusion principle was applied to tile-making machines. Larger manufacturers have developed their own machines and now there are only four main types which produce practically the whole output for Great Britain—as well as a large share of world production. Two of these machines have been perfected and operated by the two tile manufacturing undertakings who, between them, account for about 80% of total output in Great Britain.

A further essential factor contributing to the success of concrete tiles has been colour endurance. The original basic grey colour was a negative feature and it was realized that if concrete was to compete, it would need not only to emulate the warm tones of clay tiles but to provide equally pleasing alternatives.

The introduction of colour only developed after years of experiment with pigments and salts, coupled with heat treatment, in efforts to overcome fading. The present methods include fusing the pigment on to granules used for facing, by a process of vitrification. Colours in popular demand today include red, antique red, brown, straw-yellow, green, gold, silver grey, 'Cotswold' and dark slate—although almost any colour can be produced at an appropriate cost.

In recent years new types of concrete tiles have been introduced which, by virtue of their pleasing designs, ease of laying and economical coverage have found favour with architects and building owners. These include various shapes of Roman tiles, Pantiles, interlocking and ridge tiles in a wide range of sizes and designs.

All designs, before being marketed are tested in exposed site conditions and most are also performance tested in wind tunnels in which natural wind and rain conditions are simulated—in order to ensure stability after fixing and that the tiles perform adequately under the worst weather conditions. Another object of wind tunnel tests is to ensure adequate resistance to water penetration and to capillary attraction for those tiles designed for use at low pitches.

In view of these achievements, manufacturers of concrete tiles appear to be well able to maintain their position as main suppliers of roofing units in this country. It is, therefore, not surprising that British designed and owned factories are now also in production throughout Europe and in parts of the Commonwealth, where they command a large share of the tile market.

Precast concrete tiles for low-pitch roofs on a mixed housing project.

Transverse strength testing of a roofing tile.

Concrete tiles on a low-pitch roof blend into the background of Vazon Bay, Guernsey.

Facing slabs

So much prominence is given to the precast concrete units which form part of the system building sector of the industry that purpose-made products, usually described as cladding, are not always fully appreciated. Even the word cladding itself now inadequately describes the product. At one time cladding units were almost invariably small facing slabs similar to those of natural stone, fixed to an existing building structure in order to enhance its appearance. Modern cladding slabs do far more than this; they are often structural members themselves, in which case they would be more correctly described as facing slabs; sometimes they provide not merely a facing but a complete wall. Moreover, not only panels are supplied; the same attractive finishes are used for such units as fascia beams, columns, mullions, window wall units, to name only a few. Out of the once simple cladding slab has grown a complex of units infinitely varied in size, shape, finish and design detail.

Despite the wealth of new materials which has been introduced into the building industry, there is every sign that concrete remains a firm favourite with the majority of architects. This is probably due to the great improvement in surface finish which has taken place in recent years, and the fact that, as a material, it readily adapts to the numerous applications demanded of it. Not least, its price remains as competitive as ever, despite improvements in quality and the wider design possibilities it offers.

Concrete cladding is found on every kind of building and in innumerable roles. While offices, shops, flats and large public buildings perhaps continue to be the most frequent users of concrete facing slabs, the number of other applications is very great and continues to grow. Churches, power stations, places of entertainment and multi-storey car parks are some of the other types of building which use cladding. In the field of civil engineering, cladding is supplied for such diverse applications as bridge abutments, parapet walls, subway linings and dock-side structures.

Development of the industry

Precast concrete facing slabs evolved from the thin facings of natural stone fixed to building structures by means of cramps and corbels. They seldom exceeded 6 ft² in area and could be handled on site by two men. Only when cranes on site became commonplace did cladding slabs begin to grow beyond this size. Today 5-ton units and over are quite common.

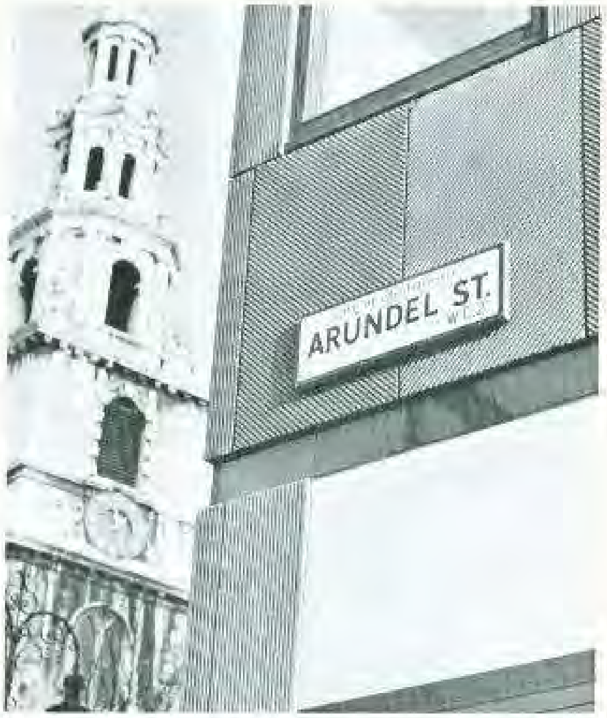
With the growth in size, design has developed dramatically. Cladding panels used to be plain flat slabs slotted along the edges to house the fixing cramps. Today they exploit to the full the flexibility of precast concrete.

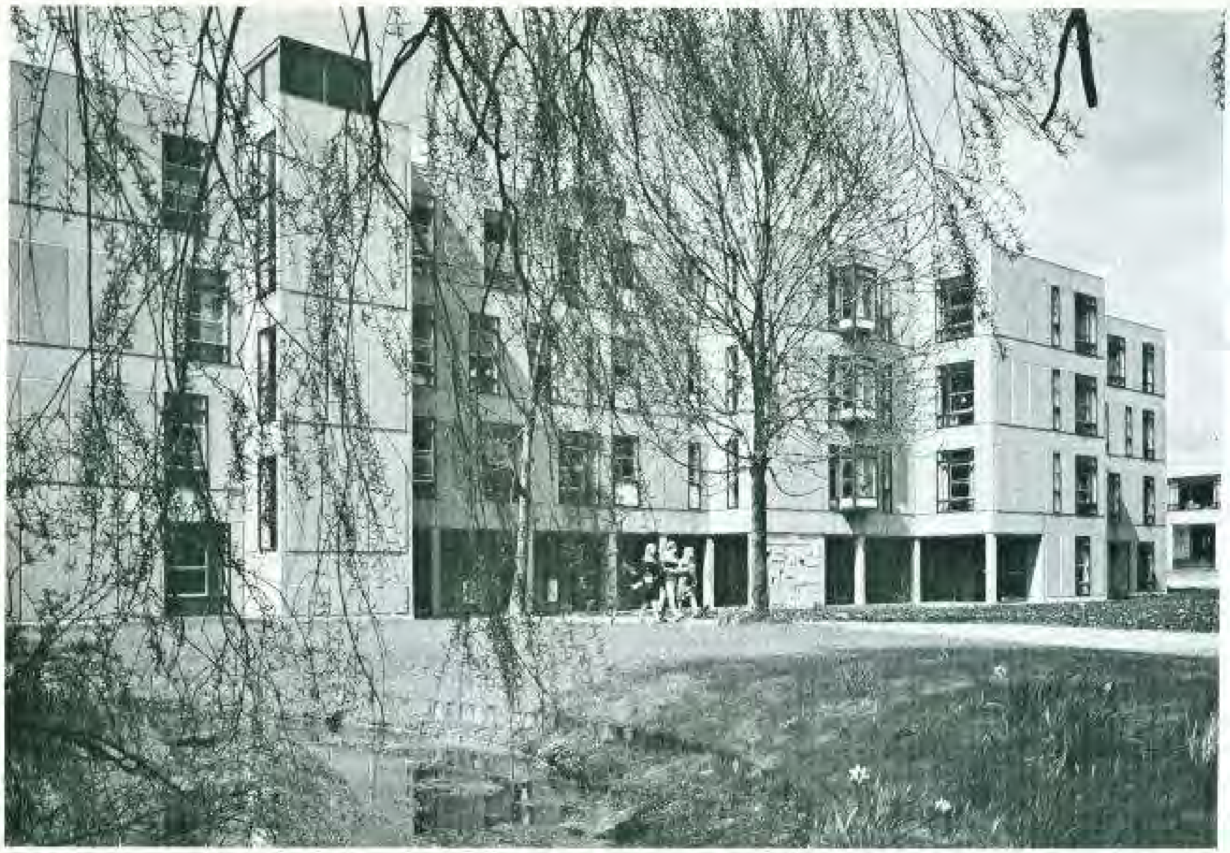
Precast concrete external cladding to the Main Station Control Building at West Burto[n] Power Station for the Northern Project Group of the Central Electricity Generating B[oard]. Architects: Architects Design Group in collaboration with Gelsthorpe and Savidge. Consulting engineers: Merz and McLellan.

Left: Insulated gable cladding panels precast for a multi-storey project.

Below: Dark grey concrete cladding panels with a diagonal grooved pattern used on offices at Arundel Street, Strand. Architects: Arthur Swift and Partners.

Bottom: Robust precast panels faced with an exposed aggregate of knapped flints used internally as well as externally at the University of Sussex. Architect: Sir Basil Spence, R.A.





Storey-height cladding panels facing a college and residential block at York University. Architects: Robert Matthew, Johnson-Marshall and Partners.

Precast cladding panels used in the CLASP system at the Tupton Hall Comprehensive School. Architects: Grey Goodman and Associates in collaboration with D. S. Davies, ARIBA, County Architect, Derbyshire County Council.

Exposed aggregate cladding panels on buildings at New Ash Green Development.

Larger units are seldom uniform in thickness; they are coffered to reduce their weight wherever possible, they often incorporate a supporting corbel, and they frequently provide whatever returns and fair-faced soffits the designer may require them to have in order to exploit the three-dimensional possibilities of modern cladding design.

The units are reinforced, not merely to enable them to withstand the stresses they undergo when fixed to the structure, but also those caused by stacking, loading, and erecting, which are often much more rigorous than the structural stress.

The technique of fixing slabs to a building always called for a sound understanding of structural principles even when cladding was relatively small and light. To design a safe and reliable fixing required a knowledge of fixing materials as well as an appreciation of expansion coefficients and thermal movement of both the structure and the slabs. With the larger and more intricate units the problems are even more complex: the cardinal factors are still safety, simplicity and speed. A good deal more is now known about shrinkage of in situ structures to which facing slabs are fixed. This knowledge, together with the precision with which modern cladding units are manufactured, ensures perfect co-ordination between the structure and the units attached to it.

The joints between slabs have been the subject of much research. Earlier joint-filling materials such as cement mortar or oil-bound mastics have largely been superseded by new materials of greater durability, flexibility, and tenacity such as butyl rubber and polysulphide. Lately there has been a tendency towards the open-type joint with a baffle towards the rear of the slab and a draining cavity behind. The interplay between accuracy in manufacture, accuracy in fixing and the structural requirements of the building has been the subject of much study both in this country and overseas and there has been considerable exchange of information.

Much has been written about the many aspects of surface treatment for concrete. Cladding manufacturers have played a big part in many of the recent developments in this field with the result that there is more variety in external finish than ever before.

While the technique of exposing the aggregate by water spray during manufacture is still quite popular,

A striking sculptured design of profiled panels clad the gable wall of Cater's Supermarket at Chelmsford.

many new techniques are now used. One of them is known as 'striating'. It consists of casting the units with vertical V-shaped ribs on the face. After the concrete has hardened, the tips of the ribs are removed with a club hammer to produce striations of moulded concrete alternating with the roughly exposed interior matrix. Grit-blasting produces exposure effects which vary according to the degree of hardness attained by the concrete when this operation is carried out. This technique has made much progress in recent years.

Different forms of patterned and profiled concrete have continued to develop, much assisted by the availability of new materials from which to make the moulds.

A successful cladding job is the outcome of collaboration between designer, producer and builder, and success is more likely if collaboration begins at the early design stages when architect and supplier can pool their expertise. Interchange of information about cladding technology between manufacturers and architects is constantly increasing and this is one of the main reasons why such rapid progress has been made. The design service is a very important part of a cladding manufacturer's business.

The inauguration of the products committees provided BPCF's cladding manufacturing members with the first forum for jointly promoting their product and for the exchange of technical information. Since it was formed in 1965, the Cast Stone and Facing Slabs Products Section has produced data sheets giving information on cladding design, fixing, ordering and finishes. It ran a very successful forum at the RIBA in 1966, its members have provided lecturers for the architects' training courses held at the C&CA's training centre, and it is represented on the BSI committee which is currently preparing the publication of a Code of Practice for Stone and Concrete Cladding. The committee, working with C&CA and BRS, has studied the jointing of cladding slabs, the use of galvanized reinforcement, and it is at present studying the future of cladding in the light of the present trends towards dimensional co-ordination of building components.

Towards the future

The change to metric is seen by many as not merely the adoption of new units of measurement but as an opportunity to bring dimensional co-ordination closer to reality. Cladding manufacturers are actively co-operating with the Ministries and other authorities in the vital task of establishing the framework within which building construction of the future will fit.

There has been much talk about interchangeability of units, and this will undoubtedly occur in a limited way, although many believe that freedom of choice must always remain the architects' prerogative if dull uniformity is to be avoided.

There is no doubt that precast concrete cladding will continue to evolve and will be able to meet the new demands brought about by changes in building technology. There is also likely to be even more variety with still greater choice of surface finish and better correlation with the structure itself, while manufacturers will be able to offer their clients an even higher standard of design advice.

Understanding between the architect and the manufacturers has grown rapidly and will continue to grow. This is the key factor in the future of cladding.

Prestressed precast concrete

Above: Prestressed concrete double-T beams spanning 122 ft in a factory at Stockton-on-Tees. Architect: W. H. Marmorek, FRIBA. Consulting engineers: Jan Bobrowski and Partners.

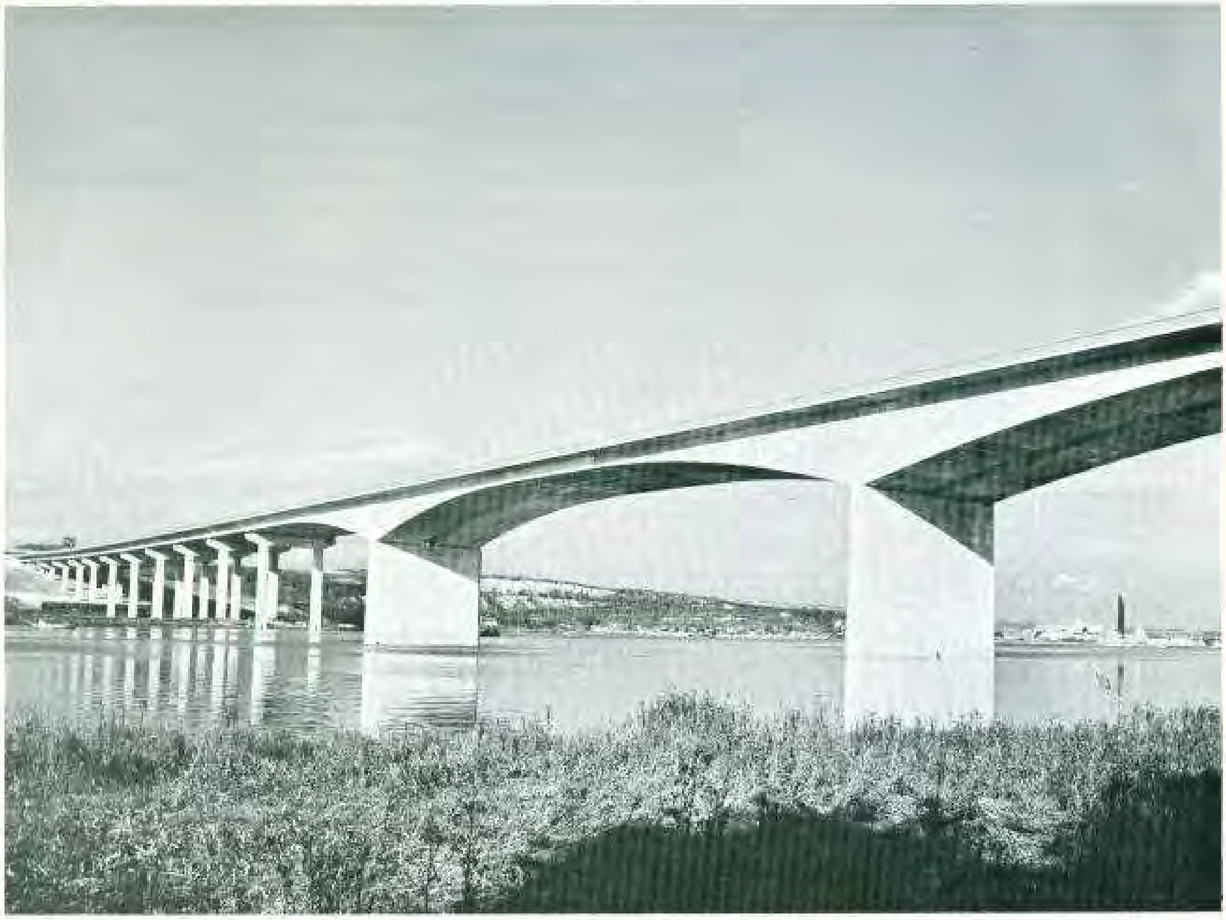
Below: Long-span prestressed T beams provide the uncluttered floor areas for Croydon's multi-storey car park. Consulting architect: D. H. Beaty-Pownall, FRIBA.

Prestressed standard bridge beams were used for the deck of the elevated section of M4 motorway. Consulting engineers: Sir Alexander Gibb and Partners.

Prestressing, as applied to precast elements, is prestressing in its earliest form. M. Freyssinet, in his first applications of prestressing in the early thirties, pre-tensioned precast units by anchoring wires by bond with the concrete. Today there are many variations in the technique of prestressing—all of which can be applied as easily to precast as to site work—and all of them are, in fact, used as the need dictates.

While individual pre-tensioning of units in the factory has persisted as a method in common use, the 'long-line' method of pre-tensioning has also been developed. This method, because it allows for multiples of units to be treated together in one tensioning process, is very well suited to the economic mass-production of standard units and is, perhaps, the most extensively used of all the precast prestressed methods—it was certainly the first form of prestressing to be used commercially in this country.

Sectional precasting—the casting of untensioned sections of a member which are subsequently prestressed



Prestressed beams in the imposing spans of the Medway Bridge for the M2 motorway. Consulting engineers: Freeman, Fox and Partners.

together on the site by one of the post-tensioning methods—is another development which has greatly widened the scope of precast prestressed concrete. Where it is difficult and expensive to transport large prestressed members from factory to site, post-tensioning provides the contractor with all the advantages of factory-controlled concrete and the elimination of site casting; it also reduces many of the handling problems that arise when large units are entirely factory-produced. Post-tensioning is not, however, used only for sectional work, but it is also an accepted method of tensioning individual factory-made members.

It is believed that the first practical application of prestressing in this country was the production, during the war, of precast pre-tensioned sleepers on the long line system. Between M Freyssinet's publication of his new principles in the late twenties and their adoption in England early in the war, prestressing had been tried out on the continent for the construction of bridge beams and high-pressure pipes, so that when, early in the war, the supply of timber virtually ceased, there was some experience of precast prestressed concrete to refer to.

During 1940 experiments in the casting of prestressed sleepers were made in this country and from 1941 the development continued at the first casting yard to be established—near Malvern. The Ministry of Works gave stringent trials to the products of this experimental works and, as a result, the first precast prestressed concrete sleeper factory to operate on a commercial scale was opened at Tallington in Lincolnshire in 1943. Other factories were later set up and, between then and now, over ten million sleepers have been made—not only for use on British Railways but also for export to Holland, Eire, Egypt, India, South Africa, the Sudan and Canada.

After the prestressing of sleepers, all the other applications of the long-line method of pre-tensioning followed, and the needs of the building industry were given particular attention. More than 80 different firms are now manufacturing precast prestressed concrete—pre-tensioned or post-tensioned—either as standard units (for floors, for example) or as special units, precast to order. Components for the construction industry—beams, joists, purlins, columns, fence posts, piles—are all currently made on the long-line system, which, although it is usually applied to smaller units, has produced members up to 130 feet in length. It was in 1959 that CP 115, the British Standard Code of Practice for the use of prestressed concrete in buildings was issued. Meanwhile, the early method of pre-tensioning in individual moulds has not only been continuously employed in a great number of factory-cast products, but has also been applied to spun concrete products—such as lighting columns and transmission line poles.

The principle of sectional construction is not new; it was used by the ancients in the construction of columns and, as used in arch construction, it already contained an element of prestressing. It is the mechanical methods of prestressing, however, which made possible its application to beams. The method first received wide notice when it was used by Freyssinet to form the beams for a series of bridges over the Marne and elsewhere in France between 1946 and 1948; their first appearance in this country was in a factory at Newport, Mon., for the South Wales Board Mills.

In civil engineering, precast concrete units for bridge works and viaducts had made quite startling progress in recent years. The motorway programme and dualling of other trunk roads has provided a large outlet for prestressed factory-produced bridge beams, both pre-tensioned and post-tensioned, and also for precast segments post-tensioned together on site. From jobs of the largest magnitude down to the small bridge jobs for minor roads, the use of prestressed concrete beams has become common practice. The development of prestressed standard bridge beams by the Prestressed Concrete Development Group also gave great impetus to this movement and the flow of orders which followed encouraged manufacturers to embark on the capital expense of laying down production lines for the standardized form of inverted-T beams and hollow box beams for bridge works.

In addition to the production of standard bridge beams there is still a vast amount of work carried out to individual designs to suit special requirements. Prestressed beams of up to 130 feet in length and over 80 tons in weight have been manufactured and transported in one unit.

Also, for viaducts and elevated roads for urban traffic in all parts of the country some impressive structures have been designed and constructed during the last decade with the use of large precast elements post-tensioned on site or precast pre-tensioned beams or a combination of both. In the London area, Hammersmith Flyover, the elevated section of M4 and Western Avenue Extension have been constructed with precast units—in the latter instance, precast sections weighing over 100 tons each are being used. In the construction of the elevated Mancunian Way, in Manchester, complete precast segments of dual carriageway were lifted into position and post-tensioned.

On the technical side, acknowledgement should be made to the extensive use of strand which has replaced wire very considerably in both pre-tensioned and post-tensioned work, and also to deflected strand and debonding techniques which provide better stress conditions. Developments for the use of lightweight concrete for prestressed work are also under way.

The original impetus given to prestressed concrete techniques arose from the shortage of steel and timber during and after the war, but their present—and growing—use is no longer merely a matter of providing a convenient substitute but, in fact, the provision of a

Prestressed sleepers improve the permanent way on British Rail's Western Region—where long welded rails are installed.

25-ton precast prestressed deck sections of Mancunian Way elevated road. Consulting engineers: G. Maunsell and Partners.

superior form of construction for civil engineering works and buildings.

Clearly, the future of prestressing and that of precasting are intimately linked; the technique of prestressing has greatly increased the range and usefulness of precast products and precasting has greatly increased the applications of prestressed concrete. Precasting gives to the prestressed member the advantages of controlled quality and of standardized production and, with the prestressing of precast units, it has been possible to reduce their section and their weight, ease transport and handling problems and produce, where necessary, a product with a strength of an altogether different category. Indeed, research is showing that precast concrete of quite exceptional strength—even greater than it is today—is more than a probability in the future and this will surely create even wider fields of opportunity.

Products for sewerage and drainage

Concrete pipes were first made commercially in Great Britain about 90 years ago, but initially the industry developed fairly slowly and, even 50 years later, output was extremely small when compared with production levels today. The earliest method of manufacture was by the tamping process in which concrete was fed into metal moulds in layers and compacted by hand—and later by mechanical tamping; this was the only method in use for many years.

Since the late twenties the growth of the concrete pipe industry has increased considerably and there is little doubt that this has been due to improved methods of manufacture, which have resulted in a much higher standard of quality of concrete; it is now universally recognized that concrete pipes are ideal for the construction of main and subsidiary sewers and other purposes. These new production techniques include centrifugal spinning, vibration (or vibration and pressure) and rotary compaction; they are all used in one form or another at the present time.

During the period of growth of the concrete pipe industry marked improvements were made in the joints used with concrete pipes. Originally, pipes were manufactured either with plain ends or ogee joints. The first development was a socketed joint, which was made by caulking the annular space between the outside of the pipe and the internal bore of the socket. This joint was improved by making what is termed a 'self-centring socket and spigot' joint. In this type of joint the ogee shape was incorporated, which lined up the pipe, making the caulking of the joint a good deal easier.

In 1936 a major step forward was made in jointing by the introduction of the Cornelius joint, which employed a rolling rubber ring. This joint, in addition to being watertight was also flexible and, as such, was available for use in conditions where ground movement was liable to be expected. The majority of concrete pipelines are connected with this type of joint today. Another flexible joint, termed the 'finned' flexible joint, was introduced in 1957.

Extra-strength pipes

Before the 1950's almost all pipes needed to be supported in the trench by in situ concrete to enable them to carry the loading imposed by the dead and live loads which a pipeline has to withstand. This method of support proved adequate for the small and medium diameter pipes but was found to be somewhat lacking in the case of large diameter pipes, and a number of failures in these sizes occurred. These failures were not due to any deficiencies in the pipes themselves, but rather to the difficulty of ensuring adequate support on site.

The Building Research Station was asked to investigate the problems of large diameter pipelines and came out strongly in favour of producing a factory-made pipe capable of withstanding the dead and live loads without any in situ support other than proper bedding of the pipe itself.

During the late 1950's this factory-made pipe—termed an 'extra strength' pipe—was introduced as a standard product, initially being tailor-made to suit site conditions. This pipe was generally heavily reinforced and, to enable full advantage to be taken of this reinforcement

Extra-strength, flexibly jointed precast pipes—63 in. diameter —being laid at Widnes, Lancs.

Opposite: Jacking an 84-in. diameter concrete pipe under an embankment.

a 1/100 in. crack at the proof test load was allowed, as tests had indicated that cracks up to this width were not detrimental to the life of this type of pipe.

Extra-strength pipes are generally laid on a granular bed to ensure continuous support along the barrel—although occasionally, where exceptional loads have to be considered, concrete support may have to be used.

It was recognized that flexibility of the pipeline could be more readily achieved with extra strength pipes, and all such pipes are supplied with flexible joints. It was also appreciated that to provide the extra-strength, wall thicknesses of pipes would, in many cases, have to be increased; to achieve this with existing processes, a substantial variation in nominal internal diameter was needed.

A full range of concrete manholes for use with these pipes is supplied. Improved joints between sections have been introduced to make manholes water-tight; with the new type of joint there is no need to surround the manhole with in situ concrete, which used to be the practice in the past.

Manhole cover slabs are now designed for specific loads and two types are available; one is termed 'heavy duty' and the other 'light duty'. The heavy-duty type is suitable for main roads where, sometimes, abnormal loads are experienced, whereas the light type has a general application in fields and similar locations.

House inspection chambers are also manufactured in precast concrete and can ensure speedy construction on site.

Other products for use in connection with sewerage and drainage are made in large quantities—these include concrete road gullies, egg-shaped pipes for the purpose of accelerating dry weather flow and box culverts for use in shallow ground. These culverts are generally of rectangular section; they are useful for carrying foul or surface water where headroom is restricted, and have considerably larger carrying capacity than twin or triple lines of circular pipes. To enable Ministry of Transport traffic loads to be carried, they are generally reinforced.

To incorporate the latest changes in practice the British Standard 556 was revised in 1966. The main changes in this revision were the inclusion of reinforced pipes and the provision of four extra-strength classes, proof and ultimate load tests, permissible deviation of internal diameters and the inclusion of a test for manhole cover slabs.

The new type of pipe demanded even more stringent quality control and this was recognized in this new Standard. However, there was a demand for pipes for the conveyance of surface water in conditions where the stricter requirements of British Standard 556 were considered unnecessary. A new Standard was introduced (BS 4101) which covers this type of pipe, with ogee joints for surface water drainage, with a size range up to and including 24 in. diameter.

These changes in practice also demanded a revision of the existing regulations and Codes of Practice. The regulations were amended and revisions have been made to the Codes of Practice, although they have not yet been issued.

Porous pipes

For many years concrete porous pipes for drainage have been manufactured. A British Standard for this type of pipe, BS 1194 *Concrete porous pipes for under-drainage*, was introduced in 1944 and revised in September 1955, at which revision a porosity test was included together with a provision to use sulphate-resisting Portland cement in the manufacture. The Standard for this type of pipe is at present undergoing a further revision. This type of pipe is specially designed for the purpose of sub-soil drainage and the removal of surface water. It is ideal for the drainage of agricultural land as it requires virtually no maintenance as compared with open-ditch drainage; it is extensively used under road verges, aerodromes and railway tracks to prevent flooding. These pipes are manufactured either wholly porous or with an impervious invert.

During the past few years there have been radical changes in the whole concept of pipeline design which have called for continuous efforts on the part of the industry to meet the changed conditions. Recently, thrust bore pipes have been introduced; these are particularly useful in situations where excavation of the ground could cause considerable inconvenience, or high

Left: Precast box culverts being laid at Colne Way, Watford.

Far Left: Design possibilities revealed in a precast concrete inspection chamber base.

Right: Precast concrete pipes at Pevensey Bay.

costs of reinstatement would be incurred. The technique is to jack these pipes through the ground, simultaneously excavating the inside to enable the pipe to move forward. This demands a special design of pipe with the joints made within the pipe wall.

Research

BPCF members, assisted by the Federation's Research Engineer have contributed to the progress of pipeline engineering in numerous ways over the last decade. There has been continuous study of the effects of impact upon buried pipelines, partly carried out at the Cement and Concrete Association's research station at Wexham Springs, and later at the Road Research Laboratory—where full-scale vehicle impact tests were conducted. The BPCF was also represented at the tests sponsored by the Ministry of Housing and Local Government at Christchurch in 1967, where static loads on pipelines formed the subject of extensive experiments.

In a study of flexible joints for concrete pipes, the characteristics of rubber rings in varying grades and diameters were investigated. The evolution of the new British Standard *Cover slabs for concrete manholes* also began at Wexham Springs; extensive tests were carried out to examine loading conditions and subsequently to verify the performance of the new designs.

Further innovations are expected in the immediate future, as it is considered that the loading on pipelines due to superimposed loads, impact factors and weight of fill are excessive. These factors, it is expected, will result in the design of a whole new range of pipes to suit the new conditions.

The use of concrete pipes continues to increase, production methods become more sophisticated, and, with continued research, the designer's task becomes simpler and more precise. The introduction of metric sizes is already being planned, and further rationalization of the present range of pipe strength classes is also in prospect.

The future presents a challenge to the concrete pipe industry; its members who have responded to this challenge in the past will continue to do so in the future—thereby retaining their vital role in the civil engineering industry.

Piling

Concrete has now almost entirely replaced other materials for foundation piling in Britain; for driven piling the use of precast concrete piles is now normal practice.

Precast concrete driven piles are virtually self-testing: designed to resist handling stresses, reinforcement is always adequate for end-loading conditions, while the driving process itself is a stringent test of quality. Every precast pile can be thoroughly inspected before driving, and piles are driven to a specified set using well-known formulae such as Hiley's or Faber's.

The majority of solid precast piles are square in section with chamfered corners; round and octagonal piles are also used but the square section is the simplest and most economical to produce and requires, weight for weight, the least amount of handling reinforcement.

Although on large piling contracts piles may be cast in temporary facilities near the site, for most large contracts, and on virtually all small or medium-sized contracts, piles are purchased from specialist manufacturers equipped to produce them under factory conditions. Over 40 BPCF member companies manufacture and normally hold stocks of standard-section piles in a variety of lengths, enabling deliveries to begin after driving of test piles. It has been found that the majority of site conditions can be met with standard designs without the need for 'specials'.

Ordinary reinforced concrete driven piles are suitable for a wide range of applications; prestressed concrete piles, however, offer many advantages. Where long lengths of piling are required a prestressed pile can be of considerably smaller section than the equivalent reinforced concrete unit, producing important savings in materials, labour and transport costs.

Where appreciable lengths of piling are without continuous lateral support—in jetties, for example, and other marine work—prestressed piles will deflect less for a given load, and any cracks resulting from excessive loading are self-closing.

For lengths greater than 80 ft, hollow piles are frequently used; the saving in weight and material will often more than exceed the added cost of forming the cavity and the necessary additional links, stirrups and binding required. Hollow precast piles are commonly of circular or octagonal section.

Precast concrete shell piling combines the advantages of piling positively driven to a firm set with those of an unstressed cast-in-situ pile core otherwise obtainable only with bored piles. An advantage of shell piling using a number of relatively short cylindrical precast sections is that the number of units can be varied during the driving to meet the constantly varying length requirements imposed by undulations of the load-bearing strata. The interior of the shell can be inspected throughout after driving and before concreting of the core.

In addition to the reliability provided by its 'self-testing' feature and the advantage of being driven to a positive set, precast concrete piling eliminates all risk of contamination of the concrete by ground-water impurities. Compared with other materials used for driven piling, precast concrete piles are virtually immune from chemical attack and corrosion and damage produced by borers and other marine life; special cements can be used where aggressive conditions are encountered.

Continuing research, both with regard to production standards and methods and with regard to application, will ensure that the precast driven pile will not only maintain its already predominant position but will extend it in the years to come.

Precast octagonal piles being stacked at a British factory.

Precast prestressed concrete piling used for bridge piers.

Paving flags and kerbs

With the increase in momentum of the national house-building programme with its attendant roadworks the precast industry over the last ten years has been called upon to supply an increasing volume of street paving flags and kerbs.

These items were traditionally produced from natural stone, but precast concrete is now generally in greater demand than natural stone because of its lower cost, due to mass-production.

Paving flags

In 1956 British Standard 368 (first published in 1929) was again revised; this specifies materials, dimensions and methods of testing precast concrete paving flags. British manufacturers produce flags to meet this specification and also to meet purchasers' special requirements.

The flags are generally hydraulically pressed to a minimum of 1000 lbf/in². The pressing process gives the surface of the flags a non-slip wear-resistant surface. Colour can be introduced into the concrete mix and, in recent years, there has grown a demand for coloured paving slabs laid in decorative patterns for pedestrian precincts of the New Towns—such as Basildon and Crawley. Plain precast flags had already established themselves in Trafalgar Square, Westminster Embankment, Kensington High Street and other famous thoroughfares.

An interesting laying pattern of hydraulically pressed flags in Crawley New Town.

Colour and texture (not obtainable in traditional paving) have already created a preference for precast paving slabs for seaside or river esplanades, swimming pool surrounds, playgrounds, gardens and in the fore-courts and terraces of public buildings, so that the demand increases step by step with the growth of public building projects.

Kerbs

Kerbs and channels are also hydraulically pressed. The British Standard 340, (first published in 1928) after revision in 1936 and 1950 was again revised in 1963. The demand for the profiles specified in the Standard continues to increase, but 'special' improved types of kerbs, channels and edgings are also being introduced to assist the solution of road traffic safety problems.

These include 'safety' kerbs—where the ramped and bulged profile is designed to slow down and direct a vehicle (on impact) back into its proper path—without 'bouncing' it back into the traffic. Marginal strips, bevelled recesses or projections cast in the vertical faces of recently designed kerbs reflect the lights of oncoming vehicles at night; glass reflectors have been cast into the vertical faces of some kerbs and developments are in hand to incorporate strip lighting.

Serrated channels are now in production. The drumming of the wheels on the serrations warns drivers that the vehicle is running off the highway. Non-standard channels are also in production, precast with dished or fluted top surfaces to incorporate gutters; some channels have hollow cores into which surface water drains.

These new designs provide a greater variety of choice for the engineer and it is expected that the demand for all types will increase in the future.

For some roads—particularly in private development—special kerbs are precast in visually pleasing colours and textures—including exposed aggregates.

At night or in fog the drumming of tyres on serrated precast panels warns drivers nearing the edge of the road.

Standard precast street paving flags used on the Thames embankment, London.

Precast concrete safety kerbs help to prevent vehicles from running into dangerous areas.

Lighting columns

Concrete street lighting columns have been used in Great Britain since 1924, but it was not until just before the second world war that any truly large-scale production began. The early designs were rather short, heavy, fluted columns with base and cap mouldings and they were confined to post top mountings. Local Authority engineers and their committees soon began to demand much slimmer, taller columns with concrete brackets of various outreaches—and it was to meet these requirements that much of the precast concrete industry's research was directed.

Initially, all lighting columns were manufactured in vertical moulds; these were filled with concrete and subjected to intense vibration. In 1937, however, the spinning method of manufacture was introduced; the moulds were still filled with concrete and subjected to vibration, but now in the horizontal position; they were then transferred to a spinning machine and centrifugated at high speed.

Spinning has two main advantages; firstly, owing to the centrifugal compaction of the concrete a circular hole is automatically formed through the length of the column. This provides a convenient duct for the power supply to the lantern (in columns manufactured by the old method this duct had to be made by casting a metal tube into the concrete) and, secondly, a much denser concrete is obtained which makes the product much more durable.

In 1938 a British Standard Specification was being drawn up for reinforced concrete lighting columns, but the war interrupted the committee's work and the specification was not issued until 1946.

The shortage of steel at that particular time stimulated the demand for concrete columns and it was not long before many thousands of these were being supplied for use throughout the country. It was also appreciated that, in using concrete instead of the normal steel or cast iron columns, the purchaser acquired a unit which would require no maintenance for many years—a most significant saving in costs.

As the production of concrete lighting columns increased, concern was expressed in various quarters as to their visual design and the Royal Fine Art Commission was appointed as an approving authority for designs used in trunk road lighting schemes. Later, this body was superseded by the Council of Industrial Design, which is now the approving authority. These two organizations have had much influence on the design of street lighting and there is little doubt that it is because of their efforts that designs in the United Kingdom are generally superior to those in other countries.

Up to 1949, all concrete lighting columns were of reinforced concrete, but in that year 'Group B' 15-ft columns were introduced which were manufactured in prestressed concrete ('Group B' lighting is for all roads other than traffic routes). These prestressed concrete columns had two advantages: owing to the small diameter of the prestressing wires used and the much greater strength of the concrete, it was possible to design columns a good deal slimmer than those manufactured to conventional reinforced concrete design. Also, this type of column could withstand a high degree of rigorous handling without cracking. By 1951, 'Group A' 25-ft columns—for traffic routes—were being manufactured in prestressed concrete.

It was about this time that concern was being expressed about the impact resistance of prestressed concrete lighting columns. A performance test was requested by the Ministry of Transport and this was carried out in the presence of senior members of the Ministry. It was proved, without any doubt, that a properly designed prestressed concrete lighting column was at least as resistant to impact as one of reinforced concrete.

The introduction of prestressed concrete columns called for a revision of British Standard Specification 1308 *Concrete street lighting columns* and this was completed and issued in 1957.

Spinning was now generally adopted as the standard method of manufacture—the moulds being filled in the horizontal position (generally by means of a concrete pump). Meanwhile, there were constant efforts to improve the appearance of lighting columns; grinding the surface to expose the aggregate had become almost universal.

It was also during the 1950's that major advances were made in basic design. The Council of Industrial Design were asking for slimmer and less obtrusive designs, but designers could make little progress until the control gear for the lantern was reduced in size as this determined dimensions of the base compartment of the column.

When, after discussions between the various industries concerned, smaller control gear was introduced, it be-

came possible for slimmer columns to be produced. The improvement was most marked and was welcomed by lighting engineers; there had been such criticism of the old, bulky designs. To give some idea of the degree of improvement, it can be said that in many cases the weight of columns has been reduced by more than 50% compared with pre-war designs.

It may seem that the design of a lighting column is a comparatively simple matter. This is not so. In addition to meeting normal requirements—providing adequate support for the lantern and withstanding wind loading and impact, for example—the lighting column must be sufficiently robust to prevent damage during the production processes and transport and handling on site. Strength could not be sacrificed to aesthetic appeal in the new designs. Fragility has no place in this sort of work and a good deal of research and development was needed to ensure that the new designs were at least as good as and, if possible, better than the old.

In the 1960's further improvements in lantern design called for columns of greater height. Mounting heights had hitherto been restricted largely to 25 ft, but the higher-powered lanterns demanded columns with mounting heights of 30 ft to be used. The improvement in lantern design has continued and heights in excess of 35 ft are now required.

The street lighting column industry has responded to the challenge of metrication and was one of the first to introduce metric sizes. Today a full range of metric sizes are available up to 12 metres (approximately 40 ft).

These developments have called for a new Draft British Standard for street lighting columns which, in addition to increasing mounting heights, also provides for greater outreaches than previously envisaged. At the same time an attempt has been made to rationalize requirements by reducing the number of mounting heights and bracket outreaches.

Lighting engineers have appreciated that when

30-ft concrete lighting columns with slender brackets in use at Hackney, London.

choosing concrete columns they are buying a product that is virtually everlasting and requires no maintenance. This, coupled with the major improvements in design, accounts for the rise in demand from a mere 7,000 in 1938 to the present-day annual demand for over 150,000 columns.

Above Left: 33-ft columns provide lighting for dual carriageways at Findern, Derby.

Above: Post lighting columns in harmony with traditional surroundings.

Street furniture and footbridges

Many factors during the past decade have contributed to an increased demand for the wide range of components coming within the above categories; these include the road-building programme, the creation of new towns and general urban redevelopment. In addition, there has been a desire on the part of local authorities to improve visual amenities (not forgetting the Civic Trust anti-litter campaigns) and there has also been an increasing general awareness of the merits of landscape treatment along highways and in parks to employ shape, colour and texture to eliminate monotony.

The originality of modern designs which are now available, the strength and durability of concrete and its maintenance-free characteristics have made precast concrete street furniture the natural choice for many Local Authorities. Seats and benches, litter bins, bollards, bus shelters, plant containers, and indicator posts are some of the many items which the industry is designing and producing.

In addition, precast concrete footbridges are being made by BPCF member companies to conform with Local Authority engineers' designs and specifications. These footbridges have come to be specified during the past 15 years because of the speed with which they can be erected and on account of the large spans which are possible with this method of construction. Pedestrian underpasses constructed with precast rectangular box sections and ramp wall units (often with aggregate-faced finishes) have both speeded construction and minimized dislocation to traffic.

The Council of Industrial Design has made recommendations for the design and held exhibitions of all types of street furniture, and many of the products of precast concrete manufacturers have received the Council's approval. Precast concrete street lighting columns—described in a separate section of the review—have also won COID approval.

Decorative paving slabs, also mentioned elsewhere in this review are, of course, also widely used in the new pedestrian precincts and, with bollards and cobblestone areas, have become a familiar sight in the new shopping areas and in urban redevelopments.

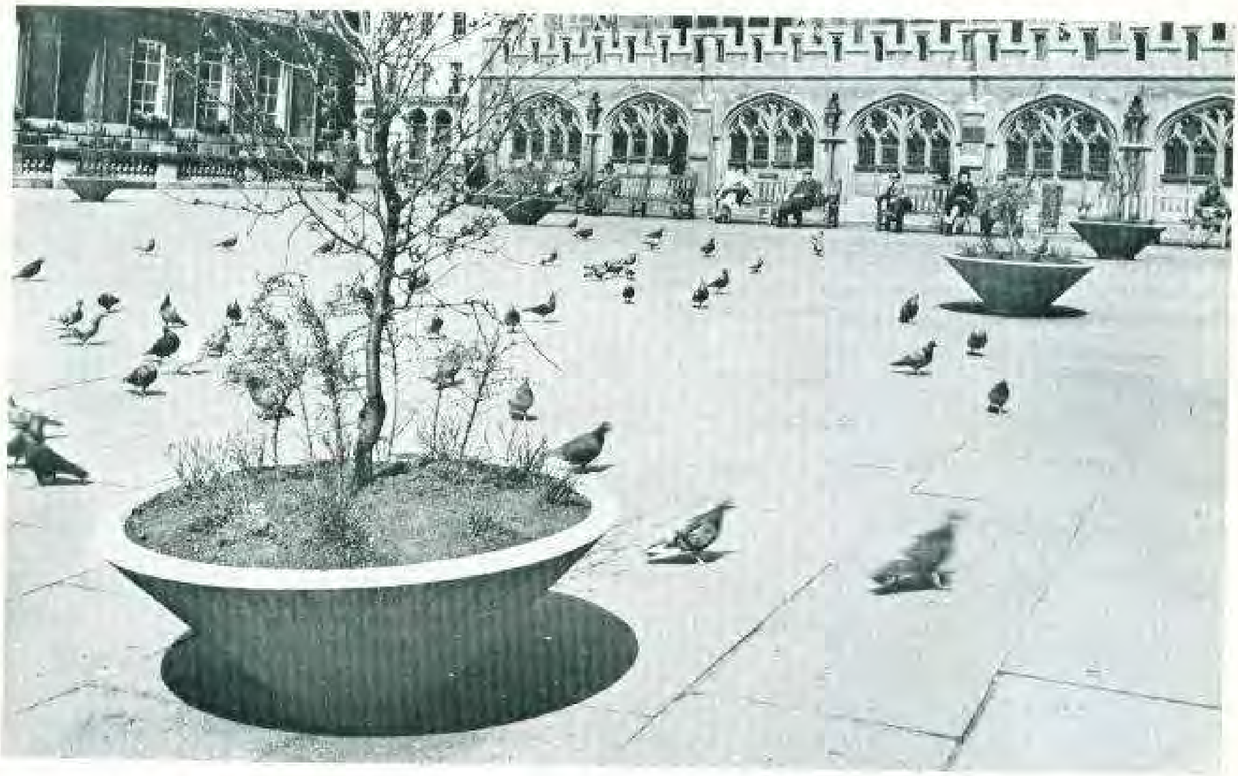
An elegant concrete seat as installed at Crawley New Town.

A precast concrete bowl fountain at Gloucester—pleasing in its simplicity.

Below: Concrete plant containers are a feature of this pedestrian precinct at Bath.

Bottom Left: 'The Martlets', Crawley New Town, paved with a pattern of standard flags in grey, red, black and white.

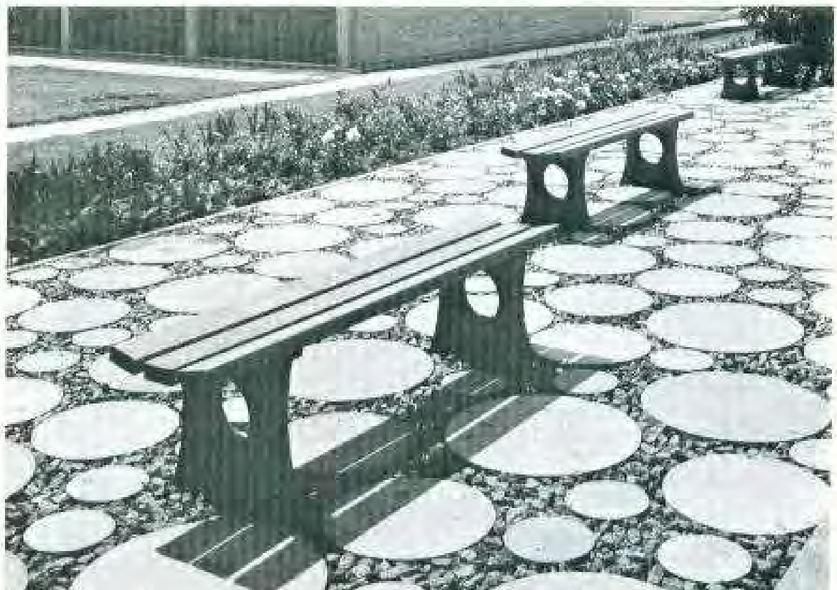
Bottom right: Precast bollards, paving and plant containers enhance the amenities of Stag Place, Victoria.



A clear-cut road sign in precast concrete.

Below: Burlesdon Road footbridge in the City of Southampton. A typical example of the lightness and elegance of structure obtainable with precast concrete footbridges.

Bottom: The design of the concrete seat supports is complementary to the circular precast paving slabs.



Agricultural products

The general trend towards improvement in the efficiency and economics of the agricultural industry has, particularly in the last decade, caused farmers to think in terms of stronger, cleaner and more durable materials for every agricultural application—in addition to the actual farm buildings described elsewhere in this review.

Concrete has been the obvious answer and there are now approximately 90 member-companies of the BPCF catering for the increasing demand for precast units of all types. The following are among the many agricultural units in constant production:

Storage

In recent years more and more precast concrete tower silos are appearing on farms. These cylindrical silos are produced in a wide range of dimensions and capacities—varying from 12 ft diameter by 20 ft high (holding 100 tons) to 30 ft diameter by 70 ft high (holding 2,200 tons).

They are adaptable for the storage of many types of produce from silage to grain and, accordingly, are fire- and moisture-resistant. Construction is rapidly achieved by building up the domed, cylindrical vessels with walls of interlocking vertical staves of precast concrete—tongued and grooved and with cavities for lightness and insulation. The assembled staves are circumferentially prestressed with bands of steel rods, so that they can withstand considerable internal pressure and also wind loads of gale force.

Precast concrete components have been developed to provide other methods of providing storage capacity, e.g. within dutch barns, or to form clamp silos, or as free-standing walls. Prestressed and reinforced concrete panels are also available to form floors to barns.

A precast concrete store silo 60 ft high by 24 ft diameter erected on a farm near Carlisle.

Fencing

The range of British Standards for fences has been augmented by a British Standard specifically for farm stock fences.

Accessories

A wide range of components has been developed, including slatted floors, cattle grids, cowstalls, feeding troughs and mangers, and pig-sties. Another application is in the provision of units which can be readily assembled by farm labour to form footbridges for the passage of pedestrians and livestock over streams and declivities.

The components are manufactured in various designs. A typical form of bridge is built by laying two I-section beams between abutments and laying thereon, side by side, a series of shaped transverse precast planks—rebated on their undersides to fit the tops of the beams. Precast balustrade units also fit on the beams and these comprise posts bored to receive tubular handrails.

A typical precast portal frame cattle shed—providing a wide and clear floor area.

Precast concrete used for the sheds, milking parlour and fencing of this farmyard.

Domestic products

With the rapid increase in the number of home-owners during the past ten years, the demand for precast concrete products for domestic use has gathered momentum. Householders recognize the economic advantages which concrete offers, in addition to strength, durability, easily maintained surfaces, fire resistance and a steadily improving standard of design. Many of these products can be erected or installed by the purchaser himself.

Garden products

The number and range of precast concrete products in this field has grown steadily over the past years. Not only is there a demand for 'pierced' concrete blocks for screen walls—as indicated in another section of this review—but also for small walling blocks, garden seats, plant containers of various sizes and types, fountain units, sundials and garden edgings.

A number of these garden products have been designed by prominent architects commissioned by the precast industry and the Cement and Concrete Association and have received the approval of the Council of Industrial Design.

Paving slabs in precast concrete are now being manufactured in a wide range. The variety available extends not only to shape—square, rectangular, circular, pentagonal and hexagonal—but also to size, weight, colour and texture. Smooth or slightly textured finishes are available in white, all gradations of grey, buff, and various stronger colours. A greater depth of texture is also provided in slabs faced with granites and other aggregates ranging from black granite to white Derbyshire spar. Various shades of muted red, brown, green, and grey are also available in natural aggregate finishes. In addition, some manufacturers produce decorative slabs which have a surface simulating the strata of natural weathered stone.

Many manufacturers of precast concrete decorative paving slabs provide detailed specimen designs and suggestions for laying patterns.

Fencing

During the past ten years improvements in the design of precast concrete fencing, as well as the arrival of the panel walling systems, have contributed between them to securing a larger share of the fencing market for the precast concrete products industry.

Pierced concrete blocks form a screen wall to a garden paved with decorative hexagonal precast flags. A concrete fountain and plant container complete the scene.

Circular plant containers are complementar
to the rectangular paving patter

The range of types offered by manufacturers is wide and includes post and panel, post and rail and palisade; picket fencing is also precast in sections for quick assembly.

Precast concrete garages

Concrete garages are no longer considered as temporary buildings but as permanent, visually pleasing additions to house property. Precast concrete garages, supplied in sections, including joinery and rainwater goods, can be quickly erected by teams employed by the manufacturer; if preferred, they can be erected by the purchasers themselves. Single, double and triple garages are designed for all sizes and types of car while multiple garages provide car accommodation for blocks of flats. A wide range of exterior finishes are available, including exposed aggregate wall panels in various colours and textures.

Precast garden walling units blend with the ashlar walls of this house.

Domestic store buildings

The Parker Morris Committee's report *Homes for today and tomorrow* urges builders and local authorities to provide storage space for items not in constant use indoors. The sale of domestic store buildings has grown markedly as a result. Specialist manufacturers are supplying a range which are erected in single or double units, as well as in batteries for housing schemes; they are supplied complete with joinery and rainwater goods. The attractive external finishes contribute to the popularity of these buildings.

Solid fuel bunkers

This is another type of precast concrete consumer product which has proved popular for its strength and durability and for ease of assembly. At least one make of fuel bunker has been approved by the Council of Industrial Design. Concrete fuel bunkers are also installed by builders and estate developers as standard accessory fixtures.

The precast wall panel fence is particularly suitable for sloping sites.

Multiple garages suitable for flats or as lock-ups.

An interesting laying pattern for precast paving slabs.

A garage of pleasant design to accommodate two cars.

A concrete pipe makes an amusing play tunnel.

Cast stone

Before the war and during the early post-war years cast stone was extensively used for ashlar cladding, decorative architectural items such as cornices, and dressings to buildings of every description. Cast stone lent itself very well to the classical style of architecture.

In the early 1950's, mechanical handling on building sites was becoming increasingly efficient and, coupled with a shortage of experienced labour that was expensive even if it could be obtained, it became necessary for cast stone units to become much larger and, in consequence, to weigh many tons.

Today, arising from that development, many units are composite—embracing mullions, head, transome and panel—and are structurally reinforced.

The term 'cast stone' has lately come to be applied to items which are relatively small in size and are used for dressings to buildings, extensions to existing premises and new projects where it is desired to have a more traditional design and method of construction. Nevertheless, many structural components and cladding panels are produced with cast stone finishes and this country has a wealth of natural aggregates which can be used singly or in combination to provide a durable and pleasing building material.

Below: The restoration of Chester Terrace, Regents Park, for the Crown Estate Commissioners is a notable example of the craftsmanship possible with cast stone. Note the under-cutting on the column capitals.

Left: A window with cast stone tracery at Leatherhead County Secondary School—a good example of modern cast stone detailing.

Research into precast concrete

The sound growth of the precast concrete industry owes much to the initiative of the Building Research Station (DSIR) in offering—and to the wisdom of members in 1932 in implementing—a scheme of co-operative research. This is particularly true in the case of roofing tiles, blocks and pigments, and the research has materially contributed to the original British Standards and Codes of Practice for these products.

In addition, the Associated Portland Cement Manufacturers Limited helped by making laboratory facilities available at Portland House and Rosherville Court. Valuable data was obtained on many items such as crazing of cast stone and effects of carbonation, long-term effect of calcium chloride admixture on corrosion of steel in precast reinforced concrete, properties of dolerite aggregate, grading of aggregates and facing of coloured concrete. The investigations were preceded by a survey of representative manufacturers' production and experience.

At the end of the war, consideration was given to the possibility of increasing the participation of members while still maintaining the benefit of substantial laboratory facilities and the collateral knowledge which had been of such value in the eight years of co-operative research with BRS. With the full co-operation of the cement industry, a solution was found whereby, under the aegis of a Joint Research Committee for the Cast Stone and Cast Concrete Products Industry, the Cement and Concrete Association would make available the services of collateral specialists and laboratory facilities and would also provide separate laboratories for a small staff, to be engaged by the Joint Committee, who could also more readily take advantage of the industry's full-scale production and laboratory resources. The new arrangement operated from October 1950, and has enjoyed recognition by the Department of Scientific and Industrial Research (now the Ministry of Technology).

In the past 18 years, investigations have covered properties of materials and products, manufacturing processes and testing methods which have affected most of the major components of the industry, including the use of new materials such as plastics, silicones and pulverized fuel ash and the fire, frost and sulphate resistance of products. It has also encompassed moulding and curing methods and the development of test procedures and techniques for controlling the quality of products. This work has contributed a great deal to improved product design and performance.

Current work is extremely varied: there are, for example, the long-term exposure studies for corrosion in reinforcement and prestressing steel, investigations of possible applications of fibres for reinforcing precast concrete and research into techniques for accelerated curing. In addition, there is much research into non-destructive testing and alternative methods are being examined for permeability and attrition tests. Work is continuing on thermal insulation, sulphate resistance and retarders. Many reports have been published and research findings have been communicated at international congresses. Members have also been kept fully informed of developments by means of Progress Notes, Interim Reports, Open Days and Training Courses.

Labour

Up to the year 1918 manufacturers of concrete products had dealt individually with employees on all questions of wages and conditions, and the main thought that occupied the minds of manufacturers was how to deal with the increasing unrest that was taking place in the ranks of labour throughout the country at that time.

A meeting of the industry was held at the Ministry of Reconstruction and from this the Interim Industrial Reconstruction Committee comprising equal numbers from employers and labour was formed in 1919 to deal with the question of wages and working conditions. This started the effort to deal with labour collectively and gradually resulted in the feeling on the Trade Union side that the employers in the cast stone and precast concrete industry were actuated by the desire to do the best they could for their employees. This was manifest by the fact that there occurred only one case when a lack of agreement on wages threatened to bring about a lock-out.

In the year 1929, the title of the Interim Reconstruction Committee was changed to the Joint Industrial Council for the Cast Stone Industry. By this change the Council took its proper place alongside those of other industries as a permanent body for operating the Whitley principles of conducting negotiations with labour. Towards the end of 1933 some members of the Cast Concrete Products Association which as a body was not constituted to deal with labour questions, sought to obtain representation on the Joint Industrial Council for the Cast Stone Industry and approached the Federation of Manufacturers of Artificial Stone which, up to this time, alone represented any body of manufacturers on the Joint Industrial Council. But agreement could not be reached on a number of policy decisions and it was not until 1937 that the title of the Joint Industrial Council was changed to the National Joint Industrial Council for the Cast Stone and Cast Concrete Products Industry and embodied members from the Federation of Manufacturers of Artificial Stone and the National Association of Cast Concrete Products Manufacturers. Throughout the period since its inception there has never been a national strike, and the conciliation procedure has resolved a number of Company and Area disputes. There are at present eight Area Joint Industrial Councils, which have representatives on the National Joint Industrial Council, and the National Council of the British Precast Concrete Federation appoint the other eight representatives to the employers' side. The Unions represented on the NJIC are the Transport and General Workers' Union and the General and Municipal Workers' Union (name recently altered from National Union of General and Municipal Workers).

Since 1942 there has been a separate Joint Industrial Council for Scotland comprising the same two Trade Unions.

For a large number of plants the industry can operate bonus, incentive or piece-work schemes and, with the investment in modern plant and automation that has been a feature of recent development, advances in productivity have been achieved without the obstructive resistance encountered in some other industries.

Safety and welfare

Members have improved employees' working conditions, introduced safety measures (and included safety instruction in training courses) and have provided welfare arrangements appropriate to the size of the undertaking. Many companies have employees who have followed their fathers into the industry and have themselves been with the same company the whole of their working lives.

Training

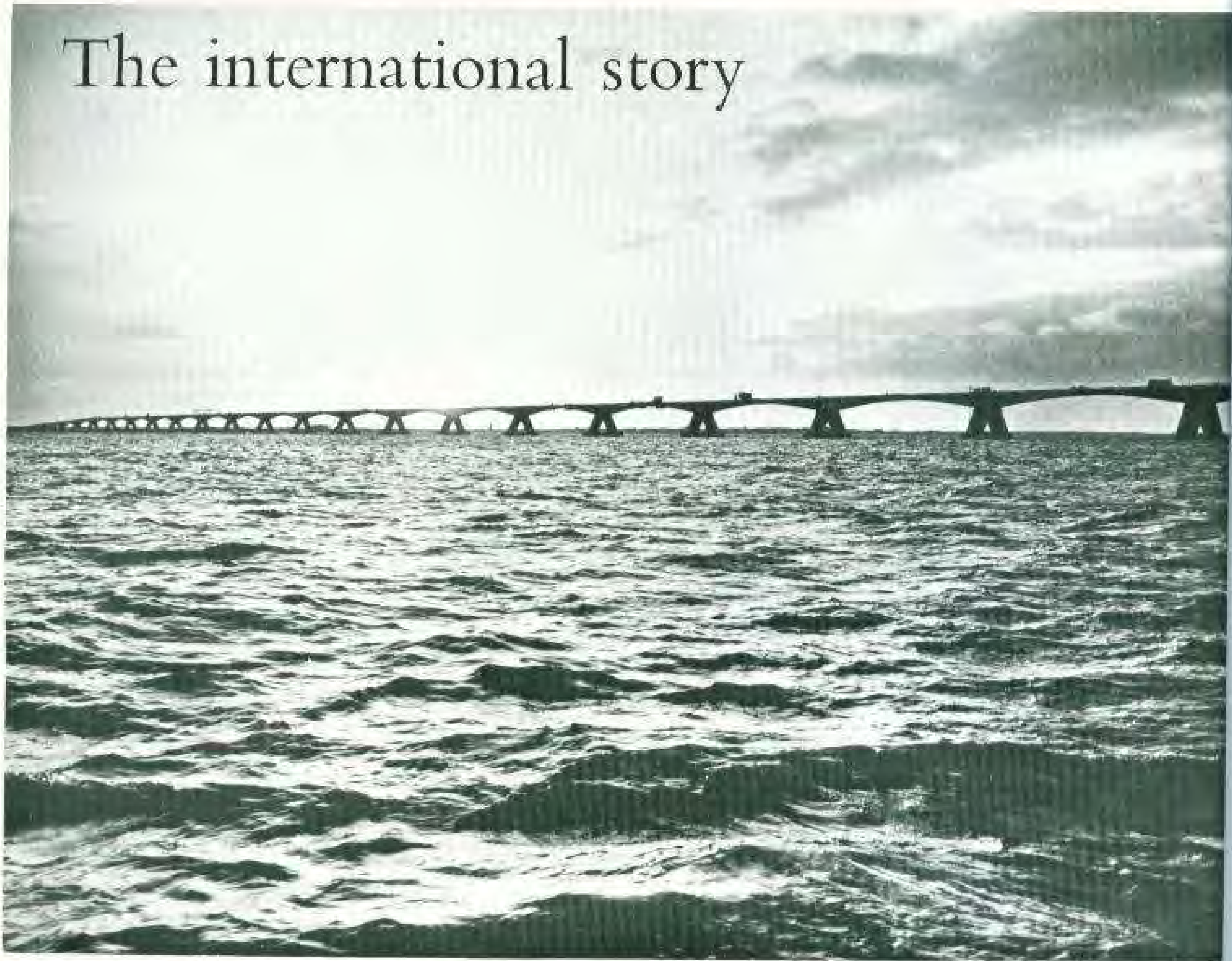
Historically, training has largely been carried out at plant operative level and the main weight of training must continue there. Because of the special needs of different sections of the industry there have been difficulties in devising any national schemes of training. The Federation, however, with the former Reinforced Concrete Association, approached the City and Guilds of London Institute to introduce courses for concrete practice at supervisory level. These were instituted in 1954 and have continued ever since, with a parallel course on concrete technology.

In 1954 the two forerunners of the BPCF combined in establishing a scheme of training for draughtsmen and potential managers. Because of the developments in management training, the original scheme has been modified and is now limited to draughtsmen. Thought is being given to a scheme for estimators.

With the passage of the Industrial Training Act in 1964 the industry came under the aegis of the Ceramics, Glass and Mineral Products Industry Training Board, an interesting progeny of the Act which uniquely embraces a wide range of heterogeneous industries—cement, concrete products, the extractive industry, pottery and glass.

Mr Sidney Browning, a former Federation Chairman and currently a member of the BPCF Council, is a member of the Ceramics ITB main board. Under a sub-board for the precast concrete industry progress has been made towards a scheme for operative training, but it is too early to assess the impact of change in the training field.

The international story



Precast concrete is a world-wide industry. Most countries have local sources of raw materials for concrete production, and there is much similarity in many of the products currently manufactured. There are, however, differences which can arise from standards of quality, codes of usage, acceptable standards of finish, the degrees of mechanization, and the relative production and selling costs. These factors sometimes facilitate export of components, plant or know-how, and can also help home developments.

In the past two decades there has been an increasing interchange of basic and applied knowledge, augmented by reciprocal study tours and international congresses. In 1954 a major step was taken for the precast concrete industry in the establishment of an International Bureau for the Precast Concrete Industry (BIBM), and it was agreed that a principal activity would be the organizing of triennial congresses. The BPCF was a founder-member and has been represented throughout the fourteen-year period to date by Mr George R. Saunders, who was President of BIBM, 1963–1966. The Fifth International Congress, held in London in May 1966, was an outstanding success and was attended by more than 1,300 delegates from over forty countries.

The international relationships which have grown over the years provide channels for obtaining informed opinions on general questions or specialized items—research, technical, economic, new inventions, etc.

Study tours have been of particular value to BPCF members, and have afforded opportunities for members to meet their 'opposite numbers' in other countries, as well as enabling them to observe interesting developments in a world-wide industry. Particular items of study have included mechanization of production processes, new products, conditions of employment, quality control methods and research projects.

Countries visited in post-war years include Belgium, Denmark, France, Germany, Holland, Italy, Spain, Sweden and Switzerland and all but two of these, as well as Finland, Norway, Russia and the USA, have visited this country for study tours. No fewer than ten factories and some sites received visits from delegates as part of the 1966 Congress.

Some of the notable precast concrete work that has appeared in overseas countries in recent years is illustrated here.

Over three miles long, the Oosterschelde bridge in southern Holland was constructed entirely of precast concrete sections.

Precast concrete frame for a factory in Switzerland.

Load-bearing precast elements form the striking façade of the United States Embassy in Dublin. Architects: J. M. Johansen, U.S.A., in association with Michael Scott and Partners, Dublin.

A sports stadium in Romania constructed with precast prestressed folded plate elements.

An imposing water tower at Helsinki, Finland, constructed with precast units.

The Director

To write about a man who has true dedication is to court journalistic disaster. The prose looms purple; the superlatives fall thick and fast. Nevertheless, if this review aims to say something of the history of the industry and of its present place in this country's economy, it must also say something of Raymond Parks, Director of the Federation, and its mentor and guide, for most of his working life.

The total score is, in fact, 43 years. In the early days he was assistant to the late Mr A. S. Windsor; he joined him at the time when the Concrete Utilities Bureau was being reborn as the British Portland Cement Association, under the direction of the dynamic Brigadier-General A. C. Critchley. Some three years later, in 1928, a new association for precast concrete (and one of the forerunners of the BPCF) was formed—this was the Cast Concrete Products Association. Mr Windsor was secretary and Mr Parks was his assistant; he attended all council and committee meetings and was involved in the formation and administration of all the subsequent organizations.

Committees, sub-committees, dry-as-dust minutes? Not so; these early years were exciting and the opportunities for development were immense. There had been, for example, the early promotion of housing (even with plans and information on the means for financing house purchase) and campaigns for more roads and bridges. There was much to be done in many directions. Total production of precast concrete roofing tiles in 1925, for example, was a mere 50 million. Blocks were in bad grace because of the activities of the backyard breeze block makers. There were no British Standards for either of these products.

Came the war years, and he was then deeply involved in the administration of bulk government contracts of more than £5½ million—a new departure for the Federation and one which meant the recruitment of administrative and accountancy staff. All the sub-contracts, production records, delivery instructions and payments were handled by this one emergency organization.

There is little wonder that one member warmly writes that all his life he has been able to "ask Mr Parks" and, what's more, get an answer.

Mr Parks says of his 40 years' term with the Federation that he "progressively knows less and less about more and more". Currently, he serves on more than seventy British Standard and Code Committees. He has represented the Federation and its forerunners on the Committee for Modular Co-ordination since its beginnings and also on its sub-committees and, more recently, on metrication committees. He is also a member of the BSI Building Divisional Council. It is not surprising that his working day far exceeds what most of us, however diligent, consider to be the norm. What else? He is a music-lover. He enjoys walking. He has a nice old dog. He hates having his photograph taken. He suffers fools, if not gladly, at least with patience. He has the most enviable ability to see good.

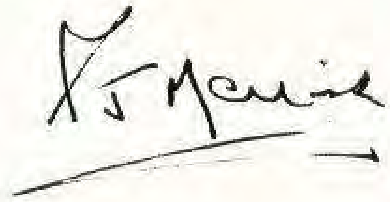
But mostly he *is* the Federation and, with all its office-bearers, the administrative organization set up deals daily with issues national, international and parochial. The climax of his career (to date, at any rate) was the success of the fifth BIBM congress in London in 1966. The most that he will say is that he was "gratified" at its success and is thankful that it will not be Great Britain's turn to be the host again during his working life. Those who know him well know what outstanding and very personal effort went into its organization.

A very, very quiet man, he is apt to snatch desperately at a graph of production or a file of statistics when asked about his long term as a servant to the industry—and one is reminded, shamefacedly, of the honour there is in service. Dedication is a big word and it was not used carelessly; his—and his integrity—are absolute.

Anniversary messages

From: The Rt. Hon. Robert Mellish, MP
Minister of Public Building and Works

I send to the British Precast Concrete Federation my best wishes on the occasion of its fiftieth anniversary. The Federation has played a leading part in the important changes which have taken place in the construction industry during these momentous years, and in the technological advances of our time. I send you my warmest congratulations on your past achievements and wish you all good fortune and success in the future.



From: Sir Hugh Wilson, OBE, FRIBA, MTPI
President of the Royal Institute of British Architects

Reinforced concrete is a comparative newcomer among materials used by the construction industry and it is only in the last twenty or so years that we have seen the development of structural prefabrication as a construction technique. This has given a new design potential to the architect and the engineer; and those designers who have recognised this potential have given us some of the most remarkable architectural structures of this century.

The past fifty years must have been an exciting time for your Federation and to see the results today of all the pioneer work during those years must be very rewarding for those concerned. I feel sure that your Federation will go on to accept the challenges which will inevitably come in this important sector of the construction industry during the next fifty years.

Hugh Wilson

From: J. H. Jellett, OBE, DSC, MA, FICE
President of The Institution of Civil Engineers

It gives me great pleasure to extend, on behalf of the Institution of Civil Engineers, our congratulations and best wishes to the British Precast Concrete Federation on the occasion of their fiftieth anniversary.

The contribution to the improvement of concrete quality control originating in the development of the techniques of precast manufacture has been of quite inestimable value in many applications in Civil Engineering. The use of these techniques themselves for the production of ever larger components of special design has often made possible the completion of structures which would have been both more costly and more cumbersome, and have involved longer site occupations if carried out in any other way.

I am sure we can look forward over the next fifty years to developments as fruitful and exciting as those which have marked the first half century of the British Precast Concrete Federation and its origins, to be carried out under its energetic sponsorship.

J H Jellett

From: A. R. Collins, MBE, DSC, FICE
President of The Institution of Structural Engineers

I have learned with considerable pleasure that your Federation is this year celebrating its fiftieth anniversary. I have, as you know, been concerned personally with your work on many occasions during the last twenty years and I have always been impressed by what your Federation has done in developing precast concrete and in establishing the high standard that now exists in the industry.

Since the foundation of your Federation the uses of precast concrete have been expanded from minor building components into almost every field of construction ranging from footpaths to sky-scrapers and large bridges.

On behalf of the Institution of Structural Engineers I congratulate you on your anniversary and wish you success in the future.

AR Collins

From: A. C. Little, TD, BSC, MICE, AIOB, MSOCCE
President of The Concrete Society

I should like to send the congratulations of The Concrete Society to you and your members on the occasion of your Federation's fiftieth anniversary.

Our organisations have together grown up with concrete, and have seen it progress to become the principal construction material. This publication bears witness to the vital role of the precast concrete industry, and the focus for its special interests which is provided by the British Precast Concrete Federation.

The Concrete Society, and the bodies which came together in its formation, have always enjoyed most friendly relations with the BPCF and its predecessors, and look forward to the continuance of this happy relationship.

We wish the Federation a most successful future.

From: The Hon. Leo Russell, OBE, TD
Director-General of the Cement and Concrete Association

On this, the fiftieth anniversary of the British Precast Concrete Federation, it gives me great pleasure to look back on the many years of productive collaboration between the British Precast Concrete Federation and the Cement and Concrete Association. Since before the last war our two organizations have worked closely together for the progress of precast concrete.

In that time we have seen many advances made by the precast concrete products industry—in the technological field, in the scope of the applications of precast concrete, and in demand for the industry's products.

Among the technological advances, the Federation is to be congratulated on the increasing use of automated methods of production, the continual development of prestressing in all its forms and the development of lightweight concrete.

The flexibility that structural precast concrete has acquired through these developments has been a major factor in the ever-increasing demand for its application in all forms of construction—whether for housing, industry, agriculture, hospitals, education or other public services.

The enormous demand for British concrete roofing tiles—once almost a Continental monopoly—is one of the big success stories of BPCF members. Production, which stood at the high figure of 1,600 million tiles in 1963, has shown a still further increase of 33⅓ per cent in the last four years. The ever-growing use by architects of the precast concrete facing slab indicates a similar success for the BPCF in another field.

Improvements in the surface treatment of precast concrete have also made a strong impact with the architectural profession in the last few years and this has particular relevance as regards concrete blocks. The recent advances in this latter sector of the industry seem likely to lead to a great potential market for the concrete block—already a highly successful product.

It has been gratifying to be associated with the BPCF in these major developments of recent years. I look forward to continuing fruitful collaboration and wish the Federation all success in its future efforts.

Leo Russell

From: C. H. van Waning
President of the Bureau International du Béton Manufacturé

It is a great pleasure for me to congratulate—once again—the BPCF on its fiftieth anniversary.

As President of the BIBM (Bureau International du Béton Manufacturé) I already had the honour last spring to convey the feelings of joy and esteem from all members of our International Organisation to the Board and the Members of your National Federation during the festivities in the Dorchester Hotel, London. I then again was very much impressed by the dignified and friendly way in which our British colleagues look after their common interests. And a good many talks with your countrymen convinced me again of the great value the BPCF attaches to international contacts. After all, as Past Chairman of the BFBN (Bond van Fabrikanten van Betonwaren in Nederland) this was well known to me for many years!

The successful fifth International Congress of the Precast Concrete Industry, held in 1966 in your capital proved this too.

The International Bureau for Precast Concrete gladly joins in with the doubtless innumerable many good wishes for a prosperous future of one of its most loyal members.

From: Ian M. Leslie, OBE, HON ARIBA, HON FIOB
Editor of 'Building'

Most of us who remember the excitement of the Armistice in 1918 would at the time have known nothing of the formation of the Interim Industrial Reconstruction Committee, established to guide the steps of what was to become the Precast Industry of today. Today the men who formed that committee would be surprised—or would they?—to find the extent to which the concrete products industry has grown, and the extent too of the linked activities such as research, training, technical services and contract matters, to say nothing of the participation in development of the industry in the international field.

In all these matters, and more, the British Precast Concrete Federation, which gains additional strength through the affiliated Scottish Precast Concrete Manufacturers Association, has played the leading part. The Federation is represented on more than 90 BSI committees and currently is concerned with metric co-ordinated dimensioning and consideration of tolerances and jointing; it works with the industry's NJIC in the negotiation of wages and working conditions; and plays its part, through representation on the CBI council, in the wider industrial field.

As Editor of a newspaper which has watched with interest these many developments, it gives me great pleasure to add my congratulations to those many others which, I am sure, will reach you on this memorable occasion, and to wish the Federation and its members every success for the next fifty years.