AMA Association of Metropolitan Authorities

DEFECTS IN HOUSING

PART 2:

INDUSTRIALISED AND SYSTEM BUILT DWELLINGS OF THE 1960s AND 1970s

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SECTION 1

1. INTRODUCTION

1.1 The Association's first publication on this subject "Defects in Housing - Part I: Non-Traditional Dwellings of the 1940s and 1950s" was published in July 1983. That publication described the growth and subsequent decline of 'non-traditional' housebuilding and the enormous problem of defects now faced by local authorities. This publication traces the rise and fall of industrialised building in the 1960s and 1970s and finds a similar pattern of failure, on an equally large scale.

1.2 About 500,000 non-traditional dwellings were built but the programme had largely given way altogether to the traditional methods of the past by about 1955. Indeed, the immediate post war housing programme as a whole quickly declined and priorities changed. There was no longer the imperative to expand beyond the constraints of the traditional building industry. Indeed local authority completions rapidly fell to one-half of the peak 1953 level by 1960. But the decline in housing activity between 1955 and 1963 meant that once again a backlog of housing needs was accumulating and a new 'non-traditional' building phase was already being perceived as the inevitable answer.

1.3 A new period of high activity began in the mid-Sixties and this included the production of up to 1 million industrialised and system built dwellings. There were many similarities to the non-traditional' programme - Government sponsorship and encouragement, a favourable subsidy system, technical advice and guidance and collaboration with the construction industry by central Government and its agencies. There were also some notable differences - in the 1960s the shortage of land, the demands of the building industry, and the apparent design freedom led to new forms of development which not only had an impact upon city skylines, but also the new development forms had a profound effect upon community life. Many social considerations have therefore compounded the problems of physical defects.

1.4 This assessment of past experience is relevant today - with such low levels of new housebuilding currently in the public sector and the mounting disrepair and unfitness in the existing stock, both public and private - we feel that it is inevitable that a sudden growth in housing expenditure will be inescapable in a few years' time. It is to be hoped that in order to cope with any new boom we do not again attempt to supplement tried and tested design and techniques with new methods. Nevertheless, the temptation will be there - the traditional building industry will not have the capacity and skilled labour and traditional materials will not be available in the capacity required. **We must learn the lesson of the past - sudden expansion of the building programme to meet political objectives and deal with new housing crises - have provided short term 'solutions with devastating effects in the longer term. Slump and boom in housing programmes must be avoided and higher levels of investment are now necessary with a long-term (say 10 years) strategy which allows for the gradual expansion of the construction industry.**

1.5 We are naturally most concerned now with our financial position and, since the publication of our first report, the Government have recognised that substantial problems exist with the 'non-traditional' dwelling stock and have made provision for the private owners of these dwellings. Thus, the central role played by Government in the development of these dwellings has been acknowledged. The development of industrialised dwellings also depended upon Government, and we believe that for both these and the earlier types there is a strong case for **some measure of compensation to be made available to the local authority owners concerned. The present discrimination cannot be justified.**

1.6 Unfortunately, the problems of both 'non-traditional' and system built dwellings are emerging now, at the very time when housing investment is being substantially reduced. The Government also proposes that Housing Investment Programmes (HIPs) are further reduced, in real terms, in 1984/85 and 1985/86 (72). Capital receipts, from council house sales and sales of other assets, have not restored the level of housing investment. In fact, as capital receipts have risen HIP allocations have fallen with 'gross provision' declining in real terms very substantially. Local authorities are having great difficulty in funding the cost of remedial works programmes within their HIP provision. Inevitably the demands of existing tenants in existing housing will take priority in most programmes and therefore the proportion of HIP expenditure spent on renovation of the public stock has increased - but at the expense of other programmes, notably new housebuilding.

1.7 Revenue costs are also significant. There are both the effects of maintaining a loan debt for the remaining 40 or 50 years on dwellings demolished, and the annual repayments and interest on new loans for remedial works. In addition, the physical defects and social problems often have to be tackled together and this leads to extra manpower and other revenue charges.

IDENTIFICATION OF DWELLING TYPES AND ASSOCIATED DEFECTS

1.8 In our earlier publication (30) we referred to the difficulty in collating details of the types of 'non-traditional' dwellings, and qualifying their associated defects. Whilst the 1960s and 1970s dwellings are 20 years younger the same difficulties apply. There are few publications which attempt to identify the types, and official statistics are limited. There has been virtually no attempt to record the associated defects in any systematic way and we have therefore had to rely upon research from member authorities and limited published material.

1.9 Our information cannot ever be fully comprehensive, but does represent the experience of metropolitan districts at least. Even so, difficulties in identification of the many systems and the recording of defects associated with each type means that it is no easy task

for authorities to be entirely clear about the exact nature of their own problems. We would hope, however, that the information presented here is taken as a broad expression of the size and nature of the problem and is probably the best estimate yet available. We must, however, reiterate our view from our previous work that a fuller investigation is needed, and that this can only be undertaken by central Government.

BUILDING CONCEPTS

1.10 The concept of traditional building changes over time. In the strictest sense it implies the use of certain materials, such as bricks and blocks, which are established in the building industry; and an organisation of the building works itself with the components or materials being brought to the site and erected in a recognised order.

1.11 Traditional building has, however, become increasingly industrialised. Firstly, prefabricated components such as roof trusses, lintels, and staircases are now common place, and secondly the building process has become far more mechanised. The industrialisation of the building process aims to reproduce the conditions of the factory, by prefabricating components off site in the factory, (or by on 'on-site' factory production), with a mechanised system of assembly. An 'industrial method' would therefore include in-situ casting.

1.12 Traditional building can therefore be industrialised to virtually any degree. The point at which a building becomes 'industrialised' is not clear cut. However, it is usually taken to mean the point at which most of the main structural elements are prefabricated (or cast in situ) and assembled on site as an unskilled or semi-skilled operation employing a high degree of mechanisation.

1.13 Non-traditional building is a narrower concept than industrialised building', and implies the use of unfamiliar building materials (notably for the external walls) which were often prefabricated, or cast in-situ. Whilst some increased mechanisation was often associated with the construction of non-traditional dwellings, it did not attempt (unlike industrialisation) to rationalise the whole design and construction process.

1.14 System building is what we are most concerned with here. In the 1960s and 1970s there was a tremendous growth in industrial methods generally, but the 'system' took this a stage further by producing a combination of materials and methods for a design and construction package. Heavy reliance was usually placed on industrialised methods. The system may have been derived from earlier design concepts or built around one component that a firm had on offer and wished to promote an entire system which took advantage of that product. Systems were either proprietary or non-proprietary, although the majority were associated with one particular builder or developer.

2. THE ORIGINS OF INDUSTRIALISED AND SYSTEM BUILDING

HOUSING NEEDS AND HOUSING CRISIS

2.1 As with the 1940s and 1950s non-traditional expansion, and indeed that of the 1920s, **it was the backlog of housing problems which were again growing to crisis proportions which led to a rapid expansion of the housing programme and necessitated the use of new methods in housebuilding.**

2.2 The immediate post-war period concentrated upon the production of new homes and the repair of war-damaged and other houses in disrepair. By 1954 the Government had achieved a new record level of completions of over 300,000 homes and the worst effects of shortages were beginning to come to an end. But **this programme growth was not sustained** (see Table I), **and public sector activity rapidly declined. Housing need did not, however, decline and difficulties with the deteriorating older housing stock, in particular, became increasingly more evident.**

Housing Progress GB 1950 to 1960 Table 1

Year	Private Sector	Public Sector	Total Completions
1950	27,000	164,000	191,000
1951	22,000	163,000	185,000
1952	34,000	187,000	221,000
1953	63,000	229,000	292,000
1954	91,000	224,000	315,000
1955	113,000	181,000	294,000
1956	124,000	155,000	279,000
1957	126,000	154,000	280,000
1958	128,000	132,000	260,000
1959	151,000	114,000	265,000
1960	169,000	116,000	285,000

Source: Merrett (31) and HSGB (38, 39, 40)

2.3 In 1953 the Government attempted to estimate (1) the number of unfit dwellings. 140,000 slums remained to be dealt with from pre-war programmes. More dwellings had deteriorated since the war and whilst "assessments vary.... the number certainly runs into

hundreds of thousands." The problem was indeed large - "of the 7¼ million houses owned by private landlords over 2¼ million are 100 years old or more; a further 1¾ million are more than 75 years old; a further ¾ million are over 65 years old"(1)

There were also some problems of unfitness in the 3¾ million owner occupied dwellings and the 2½ million rented in the public sector.

2.4 Unfortunately the Government's white Paper 'Houses the Next Step' (1) recognised the problem of older housing that lay ahead, but paid scant regard to the need to continue with a high level of public sector housing output, and as our earlier work has shown (30) and Table I illustrates the housing programme was allowed to decline.

2.5 Turning its attention to the older housing stock the Government introduced the Housing Repairs and Rents Act in 1954. This amended the law relating to clearance and compulsory purchase and local authorities were required to estimate the number of slums within their area against a new standard of fitness which was laid down for the first time. New impetus was also given to house improvement. The local authority estimate of the total unfitness problem was a staggering 847,000 dwellings (32). This compared with a clearance programme of about 30,000 a year, and whilst rising (see Table 2) was clearly unlikely to have much of an impact on the problem.

SLUM CLEARANCE PROGRAMME 1945 TO 1975[a] GB Table 2

Year	No	Year	No
1945-54[b]	77884	1965	72118
1955	29488	1966	78637
1956	39085	1967	85208
1957	49752	1968	85865
1958	59578	1969	82722
1959	64423	1970	81398
1960	62294	1971	87472
1961	67256	1972	81473
1962	69265	1973	77200
1963	68724	1974	51797

1964 71090 1975 56191

a Scottish figures includes houses closed

b England and Wales only

Source: HSGB, HCS (38, 39, 40)

2.6 The older housing position indeed declined still further. A local authority survey of 1965 revealed 824,000 slums, and two years later a Ministry survey, carried out by public health inspectors working to a common standard estimated the number to be 1.8 million (32). The position in 1967 can be contrasted with the optimistic note in the Government's 1961 White Paper (6). The Government believed that the slum problem of 847,000 dwellings in 1955 would be resolved by 1971 at an annual demolition rate of 60,000 dwellings (250,000 had already been demolished by 1961). Clearly the Government had completely failed to appreciate that fit houses were continuing to deteriorate and would have to be reclassified as slums, and that the unfit dwelling problem was not static. In the ten years up to 1963 the public sector-housing programme was allowed to decline, and meanwhile the older housing stock was deteriorating and in fact requiring a faster rate of replacement.

2.7 By 1963 the true position was beginning to emerge and the Government beginning to respond. In May 1963 a new White Paper (10) noted that there were still 600,000 slums (although this subsequently proved to be an underestimate), and also recognised other unmet and growing housing problems, which had perhaps also been overlooked. The white Paper found

"the total shortage of houses is that somewhere between half a million and a million, the worst areas being Greater London, the Birmingham conurbation and central Clydeside"

and

"there are still 600,000 slums to be cleared. The aim is to clear these within the next 10 years."

2.8 From the "brief summary of the housing position" **the Government's White Paper went on to suggest a target for house building "that can be reached and maintained". This was 350,000 dwellings per annum.**

2.9 In addition the Government aimed "to secure the improvement of most of the older houses worth improvement within the next 10 years."

2.10 **In 1964 a Labour Government took office and like its predecessor recognised that housing output had to be increased. The target however was much higher - 500,000 houses a year. This assumed an even higher level of public sector activity.**

2.11 The new Government's White Paper 'The Housing Programme 1965 to 1970' (15) set out the 'broad requirement' for housing over the next few years.

"needs existing now:

i. about 1 million to replace unfit houses already identified as slums;

ii. up to 2 million more to replace old houses not yet slums but not worth improving;

iii. about 700,000 to overcome shortages and provide a margin for mobility needs arising annually;

iv. 30,000 a year to replace the loss caused by demolition - road widening and other forms of redevelopment and;

v. 150,000 a year to keep up with new households being formed in the rising population."

The target of half a million houses a year was felt to be modest in the light of the housing needs."

2.12 The industrialised building programme was inevitable. Housing progress had not been sustained beyond the mid 1950's. **A new housing crisis of housing shortage and deteriorating older housing could only be averted by jacking-up housebuilding targets. This could only be achieved by using industrialised methods to supplement traditional housing activity. Thus, as in the non-traditional era of the l940's, the political imperative was the motor force behind the industrialised building programme.**

2.13 Industrialised methods, then, would be necessary if housebuilding targets were to be met. But the concentration of need, most pressing in urban areas with large slum clearance programmes, meant that it was the public sector which would have to be expanded most quickly. **Implicit in the new targets, therefore, was a new role for the public sector - to provide schemes of redevelopment on a large scale with high densities - for which industrialised building would be most appropriate.**

Land

2.14 The land issue had several important aspects which contributed to the growth of industrialised and system built dwellings, and to high-density developments in particular. Firstly there was a scarcity of urban building land. This being so there was also the concern that the house building programme would eat up valuable agricultural land, and that there would be considerable encroachment into the Green Belt. There was also general fear of 'urban sprawl'.

2.15 In the early 1960s several circulars were issued by the Ministry of Housing and Local Government calling for the allocation of more development land and for the more intensive use of urban land in 1961(6) a White Paper also recognised the land problem:

"The important thing is to make sure that housing progress does not falter for lack of land, even though the land cannot always be where people most want it"

and urged

"The fullest use of land which is developed and that overall enough land is allocated for development"

The preservation of green belt was also stressed, and consultation with the Ministry of Agriculture promised with regard to substantial proposals to use agricultural land

Keith Joseph the Minister for Housing and Local Government, in a foreword to 'Residential Areas - Higher Densities' (8) said

"That it is a formidable problem with two inescapable consequences, we need to allocate more land for housing and we need higher densities especially in pressure areas. We need not one or the other, but both - more land and higher densities."

2.16 The advice contained in the Planning Bulletin (8) was generally sound and pointed out that whilst considerable savings could be made by modest increase in density, as densities continue to increase the land needed for other requirements of open space, schools, parking etc also increases and the land saved becomes increasingly marginal.

The following table from the Bulletin illustrates the point:

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TABLE 3

LAND NEEDED FOR HOUSING 1,000 PEOPLE AT VARIOUS DENSITIES

Net Popn Density ppa	Total Land Requirements * (acres)	Land Saving as Density Increases (acres)
24	50	-
40	33	17
59	25	8
83	20	5
115	16.6	3.4
159	14.3	2.3
222	12.5	1.8

* Assuming 8 acres per 1,000 people for other land uses.

2.17 Subsequent evidence (see Section 3) shows that this advice was ignored or overlooked, largely because many local authorities were asked to use industrialised methods and it was only high rise systems that were initially available. It is easy to understand how the sound advice of this Planning Bulletin could be ‘lost’ amongst the continuous exhortations from the Government and others to maximise land use. However, there were also other pressures to build high and dense.

18. The land gain from higher density development was less important than the movement of people from the city centres. It was already recognised in the late 1940s that overspill developments and new towns would be necessary to cope with the rehousing of city centre slum clearance programme. Building outside city boundaries was inevitable when houses of forty or sixty to the acre

were to be replaced with conventional developments of 14 houses per acre of 30 low rise flats per acre. Nevertheless as Cooney illustrates (33) several larger cities were also prepared to build at maximum densities to retain as many people within their established neighbourhoods so that they could retain existing family and employment links.

2.19 The New Towns and Town Development Programme contributed to meeting the pressing needs of some cities. 14 new towns were in fact designated prior to 1950 and eight more were named between 1961 and 1967. New impetus was also given to the 1952 Town Development Act and in 1961 (6) the Government reported agreements between urban and rural areas. Nevertheless the contribution made by the New Towns to meeting the needs of urban areas should not be overstated. By 1972 the new towns had built only 155,000 dwellings while local authorities and private enterprise had added another 59,000 within their areas (32). House building was therefore concentrated very much in the existing urban areas.

The Building Industry and the Professions

2.20 The major impetus towards industrialised and system building was due to the increase in volume of housing construction. The traditional industry could not cope with demands above a level determined by the availability of traditional materials and building skills. In the 1940's and 1950's, for non-traditional housing and in the 1960's and 1970's all Governments agreed with the need to supplement traditional activity with new methods. Consequently, there was some encouragement given to the building industry to devise and promote new methods, although even without such encouragement it is likely that expansion in this area would still have proved commercially attractive, but perhaps taken longer to develop.

2.21 The building industry was attracted by the prospects of higher profitability but also saw that industrialisation generally could lead to a better product, and a better service. The view that quality was likely to be higher in factory conditions, especially for pre-fabricated components, was very prevalent. The building operation was also less susceptible to the vagaries of the British weather, again leading to higher standards and more consistent quality.

2.22 However, factory production also offered the potential to reduce the skilled labour content, and thereby costs. Prefabrication, on a production line, generally depended on unskilled and repetitive work processes, and generally less skilled erection and fitting on site.

2.23 The degree of mechanisation could also be improved with investment in plant justified by the continuous throughput of standardised parts. The same was also true of research and development:

"Clearly, unless there is a large amount of repetition, it is unlikely to pay to carry out the detailed research and development necessary to rationalise a particular system of construction." (35).

Housing, rather than other building operations, such as schools and hospitals, lent itself to large scale production and "large scale production, and large industrial buildings, and tall buildings with identical floors can be based on repeated units" (35). Nevertheless, as industrialisation progressed, other buildings, notably schools, had other systems more generally applied to them.

2.24 Industrialisation was taken a stage further, however, into system building. The development of unique systems protected the investment of plant and capital in the particular method of technique concerned. It made for a sort of 'brand loyalty', and often pre-supposed not only loyalty but possibly also dependence, by the client:

"The rationalisation involves integration of design and production with the implication that the designer must work from the outset with the contractor who is to erect the building, or that the designer or constructor must be within a single organisation. The first solution is hardly compatible with competitive tendering, and the second implies a limitation on the freedom of the client in his choice of design." (35).

Providing that a number of systems are appropriate to the application required and that they are available to compete brand dependence or loyalty is reduced. However, in the 1960's and 1970's at the height of industrialised building it was very much a seller's market and contractors were in a very strong position.

2.25 The mechanisation of processes on the building site and the trend towards prefabrication off the site of an increasing number of building components were singled out as the two major trends by Cleeve Barr (28). Both trends "involved the substitution of manual labour for machinery", and this was a pre-requisite for expanding housing output.

2.26 Development in cranes was particularly important and by 1963 Cleeve Barr recorded "we have a great variety of cranes including small mobile units and tower cranes "which can straddle a complete building and lift loads of tens of tons" (28). Sites were becoming increasingly mechanised, for example, with the use of crane handled skips for delivering concrete. Whilst power driven machinery was being used to advantage with traditional construction, it was most successful if allied to prefabrication. More ominously, Cleeve Barr (28) stated "site mechanisation and factory production again call for new methods of fixing and of jointing, larger building components, such as panel walls".

2.27 Architects were able to respond to the new demands on the building industry, and the possibilities created by technological change. Le Corbusier's vision of the new townscape, of high buildings set in a parkland, had already been realised on the Continent, and by the early 1950's, the Continental (and North American) influence had already made its mark in Britain. A number of high rise schemes came to fruition in these years. For example, in Roehampton in 1951 a scheme of high slab blocks echoed the L'Unite d'Habitation scheme in Marseilles, though on a smaller scale.

2.28 A number of new schemes, especially where the scale of the operations were large, enabled architectural and aesthetic considerations to assume a new importance, and particularly the prospects of mixed developments using high buildings against a woodland or parkland backdrop. Cooney (33) explains:

"The new architecture encouraged belief that municipal housing could harmonise with such a background rather than affront it, if it was contained in great towers. The result was a striking visual effect such as could not have been achieved by a uniform distribution of lower buildings.".

2.29 Whilst some criticism may be levelled at the architectural profession, it was largely reflecting and responding to changing attitudes. The demands made upon the architectural profession fitted well, however, with the new architectural concepts, enabling new techniques and systems to be rapidly developed. Whilst industrialised building gave architects a new freedom of expression insofar as the whole development could impact on its environment, architects were also more constrained by the need for repetition of house designs which was imposed by the industrialisation process. The architectural expression was therefore forced outward towards the facade and skyline.

2.30 Professionals, in general, accepted the need for change, and new types of housing development. The housing profession, for example, was the client and perhaps should have more vigorously pressed the interest of the tenant, but as a local government service was hardly established as a separate discipline. The job for the housing manager was very much one of ensuring tenant acceptance of their new homes (34). The architect therefore had little feedback from the management process, even if he had been prepared to listen to it, and was not able to anticipate the problems which were to become apparent later.

The Role of the Government

2.31 In the early 1950's the potential of the high rise flat was beginning to be recognised by Government. It was not until the latter part of the decade, however, that encouragement and support became vocal and active. Firstly, **support was given largely because of the economies which, it was perceived, could be made by industrialising building, and later, in the early 1960's, the new methods became an instrument in Government housing policy - the means by which the traditional building industry would be supplemented to meet the new, and much higher, house-building targets.**

2.32 Following the attainment of record levels of housebuilding in the early 1950's, a decline was allowed to occur, and the emphasis changed from public to private sector building. The 1956 Housing Subsidies Act was justified by an accompanying circular (3) which stated:

"rents are being subsidised to a greater extent than the financial circumstances of individual tenants require".

The Act provided for a transitional arrangement for a year or so, after which "no subsidy will be payable on houses built for general needs" (3). However, subsidies for flats, particularly for high flats were raised, and further arrangements were made for expensive sites and for over-spill and town development.

33. The Housing Subsidies Act 1956 played a crucial role in the expansion of the high rise flat. A subsidy was paid for both houses and flats if built for 'special purposes', such as slum clearance replacement, new town and town development schemes, and for rehousing people from camps or temporary accommodation. The rate of subsidy was £22 or £24 per annum for 60 years. **However, flats for 'general needs' qualified for £20 per annum if in a block of four storeys; £26 for five storeys; £38 for six storeys; rising by £l.15s for each storey above six. For flats providing for 'special needs', an extra £12 per annum was payable on all subsidy levels (see Table 4).**

1956 Housing Subsidies Act Table 4

Purpose Dwellings Flats : Subsidy by no. Each

of Scheme other than of storeys additional

flats 3 4 5 6 storey

General nil* nil* £20 £26 £38 £l.15s

Needs

Special £22.ls £22.ls £32 £38 £50 £1.15s

Needs or £24 or £24

* transitional period only : £10 pa.

2.34 Furthermore, under earlier Acts the subsidy for expensive sites had been available only for flats. This qualification was removed and provided a separate subsidy which took more account of the high cost of land. This new subsidy would only be available if some, or all, of the development consisted of flats above 4 storeys. Otherwise land costs above £10,000 per acre (the subsidy was progressive) would be disregarded for calculation of subsidy purposes.

2.35 The Housing Subsidies Act 1956 was therefore a real inducement to build high flats. Presumably, the Government, who were banking upon a reduction in housing subsidies, were assuming a continuing low proportion of dwellings built as flats. However, **the new subsidy system, together with other factors referred to in this section, combined to raise the building of flats to new heights. Moreover, the subsidy system ran entirely counter to the sensible planning considerations referred to earlier in para 2.16, and accounts for part of the reason why 'optimum' lower densities were ignored.**

2.36 In 1958 a circular entitled 'Flats and Houses, Design and Economy' (4) accompanied a new booklet 'Flats and Houses 1958'. The Ministry of Housing and Local Government hoped to encourage good design which would include high densities. It was aimed at mixed developments, especially clearance redevelopment sites and pointed out that "high building was always expensive and should not be used without good reason". The 'usefulness of the practical guidance' in the booklet was to be "supplemented by discussion between technical officers of local authorities and the Ministry' s architects.

2.37 Government interest grew in high rise developments, demonstrated by a Government pamphlet "Housing in Britain" in 1960 (5). This referred to the "greater scope for bold conceptions and architectural use of modern methods" offered by flats. Nevertheless, it was still cautious in approach: "regard has to be paid to prospective tenants and their conception of a desirable residence". The pamphlet pointed to the ongoing work of central government in giving advice and guidance on new methods and design, and particularly to the work of the Building Research Station (BRS), and the Department of Scientific and Industrial Research (DSIR):

"These Government bodies have given much technical advice to the building industry and may be said to have covered the ground fairly thoroughly on most aspects of design and technique.".

2.38 The Housing Act 1961 continued higher subsidy levels for dwellings in tall blocks and provided for two basic rates of subsidy for all dwellings : £24 pa (£28 New Town or Town Development Schemes) and £8 pa if rent levels were considered too low. In addition, a subsidy was payable for high flats as follows:-

Four storey flats £8

Five storey flats £14

Six storey flats £26

Additional storeys £1.15s

Where local authority resources were particularly deficient (in terms of 1d rate yield) a subsidy of up to £40 was paid instead of £24 (or £28). The expensive site subsidy continued unchanged.

2.39 In 1962 "Homes for Today and Tomorrow", produced by the Central Housing Advisory Committee (later known as the Parker Morris Report after its Chairman), was sent 'for information' to local authorities (9). The main changes were in space and heating standards, but there was an all-round improvement in house design thought to be necessary. This would, however, increase costs and subsidies were not being revised to take account of them.

2.40 In Circular 37/60, the Minister had called for a review of density standards and this was greatly reinforced by Residential Areas - Higher Densities published by the Ministry in 1962. This has already been referred to in para 2.15, and whilst pointing out some limitations of high densities, clearly called for more intensive use of housing sites.

2.41 As the growing crisis in housing steadily worsened (see paras 2.1 to 2.13) more importance was attached to the housing programme and a new housebuilding target of 350,000 was announced in Housing, a 1963 White Paper (10). The traditional building industry would not cope with the sudden expansion, so "encouragement" was given to industrialised and system building.

2.42 The White Paper pointed out that a number of specialist pre-cast concrete manufacturers can now offer systems for multi-storey flats. Costs would be competitive if large scale orders were given. Housing authorities were therefore also encouraged to form consortia to let big contracts and plan 5 years ahead. At the same time, the Ministry of Housing and Local Government announced their own new system called 5M. The Ministry of Public Building and Works was also announced to have set up a Directorate General of Research and Development "to help the building industry increase its output by using the most up-to-date methods and techniques".

2.43 "Public authorities", it was said:-

"Will be encouraged to use systems which promise good results, which are competitive in costs, and can usefully supplement existing local labour and contracting resources.".

The interpretation of this section seems to have varied, but in practice, Government regional offices seem to have expected around 25% of local authority output to be in industrialised building. Practical assistance in recommending firms and with design was also given; and tenders could be negotiated. **Housing authorities who seemed to be co-operating were 'rewarded' in terms of enhanced capital allocations, speeding approvals etc.** For example, "five year building programmes have been agreed and the northern authorities, and in total, would double or treble their rate of housebuilding, with those that can go faster encouraged to do so" (10). The Ministry's Manchester office was said to be in "close touch with authorities, settling proposals and giving a lead in the formation of groups" (10).

2.44 The Ministry of Public Buildings and Works (MPBW) was also agreeing preferred dimensions to enable the interchange of components within industrialised building (10) and its activities in this area increased in other directions. Building firms were encouraged to produce and develop new ideas. Cleeve Barr in 1963 (Chief Architect MHLG) (28) said that the Department had interviewed 400 firms in recent months, and were trying to involve manufacturers and contractors in the upsurge in demand.

2.45 In July 1963 the then Minister for Public Building and Works, Geoffrey Rippon MP, expounded the Government's role in developing industrialised building (36).

"My Ministry is now specifically charged with the responsibility for encouraging and developing generally the use of new and rapid methods of construction, standardising the use and production of building components to the greatest possible extent, and securing the widespread dissemination of the best modern practices.".

The Minister firstly explained that building bye laws were to be replaced by a national scheme of building regulations to prevent local impediments to building systems which had regional or national capacities. Greater design standardisation was also called for with the combination of orders. The central theme of his address, however, was on the need for a central building agency to provide local authorities with a safeguard against 'bad buildings' and 'misuse' of system building generally. It would be staffed by "highly qualified architects and other professionals".

2.46 In 1963 "A National Building Agency" was published (11) which led to the creation of the Agency in 1964. The two obstacles to the growth of industrialised building which the Agency could reduce were seen as "the lack of an assured and well organised demand and the limited knowledge and experience of new techniques". **The National Building Agency was to have a wide ranging role to promote industrialised building.** The services were to be as follows:-

(i) To assist clients, both public and private, to pool their building requirements together, and collate them into phased programmes. The responsibility for the contracts and the control of their execution will remain with the clients.

(ii) To advise these clients on the administrative procedures and the professional services which they need in order to use the newer methods of building and to offer a range of professional services to the clients according to the circumstances. A full design and planning service would be provided only exceptionally.

(iii**)** To advise the clients and their professional advisers on particular methods of building which might satisfy their needs and on the procedures for design, contract arrangements and administrative control appropriate to them.

(iv) To make available existing systems of building controlled by local authority consortia to clients who do not belong to the consortia.

(v) In relation to systems of building which are commercially controlled to help clients and their professional advisers to arrange sound working relationships with the firms which control them.

(vi) To encourage educational bodies and other organisations (including any Industrial Training Board set up for the construction industries) to provide more extensive training facilities in the new techniques of building for members of the professions and the staffs of building contractors and component manufacturers; and collaborate in providing these facilities.

(vii) To advise building contractors and component manufacturers, as required, on the development of systems of building and components.

(viii) To assist clients who are using traditional methods of building to order their materials and components in bulk where they are agreed on common specifications.

2.47 The Agency was to be a company limited by guarantee, with a board of directors appointed by the Minister (after consultation). It was financed by Exchequer grant, and would charge fees for services.

2.48 **The new Government elected in 1964 was also enthusiastic about the use of industrialised building** and the National Building Agency. MHLG Circular 21/65 made this abundantly clear, **as might have been expected with new housebuilding targets of 500,000 a year.**

"If the rate of housebuilding is to increase there will have to be a greatly extended use of industrialised methods. Systems are already widely and increasingly used for building high flats. The main need now is to create conditions for a rapid development in the use of these methods for both two and three storey houses, and low and medium rise flats. Unless this can be secured, housebuilding programmes will have to be set lower than they should be."

2.49 Authorities were invited to submit a four year plan for housebuilding (1965 to 1968 inclusive). It was intended to give confidence and certainty to the planning and preparation of new housing schemes - again pre-conditions essential for industrialised building. The Government's 'stick and carrot' approach was once more made obvious.

"In deciding what programmes to approve, the Minister will be influenced by the extent of the proposed use of industrialised methods.

The Ministry's officers will be ready to advise, or will arrange for the National Building Agency to advise, on the range of systems suitable.....and regard will be had to

"The Minister proposes to launch a concentrated drive to increase

and improve the use of industrialised methods in housebuilding for the

public sector.....

The advantages for housing authorities……..

On numbers: this is the only way to build the number of houses we need.

On speed of erection: most industrialised techniques show worthwhile

savings.

On price: for flats, industrialised techniques are already slightly cheaper…

but efficient organisation of supply and demand can bring down promotion

costs.

On design: the use of carefully prepared standard designs will release scarce

professional time to concentrate on raising the quality of layouts.

On construction quality: industrialised methods facilitate quality control."

Ministry of Housing and Local Government 1965 (17)

"The results in some instances have all too clearly been developments which

are inhuman in scale, uniform and repetitive in appearance and inadequately

provided with social and community facilities. An industrialised building system had been employed on 16 of the sample estates and many of these had massive concrete facades of overwhelming severity which sophisticated and generous landscaping (if provided in the first place and if it survived) could do little to mitigate.

In addition to their often unattractive appearance, technical problems such as

water penetration were not uncommon with the system built schemes we

looked at.

Some of the systems had evidently been adopted before being sufficiently tried and tested, or else they had been crudely adapted to specific site conditions or density requirements."

Department of the Environment 1980 (53)

the need to make the fullest use of the productive capacity available in each part of the country, and the need to encourage the development of the most satisfactory systems."

2.50 The role of the National Building Agency (NBA) was once more explained and amplified. In particular, authorities were advised that:

"The Agency has set up an organisation for the technical appraisal of new techniques and systems of building for housing purposes. This organisation has a fully representative professional staff and will advise local authorities, new town corporations and other public authority housing clients, either individually or in groups. Appraisals will cover the technical aspects of the structure and services, design, productivity, labour content, economics and availability. An extensive central pool of information about current building systems is being created.

Local authorities are advised to rely on the appraisals undertaken by the Agency, and not attempt to carry out investigations and make evaluations of their own. This will avoid duplication of effort by public authorities and sponsors of systems, and wasteful use of limited professional resources. where an authority wishes to form a view about the suitability for its purposes of some particular system of which they do not have previous experience the Agency should be asked to advise. The Agency will need to know the location, scope, timing and general characteristics of the development proposed. This service will be free to public authorities and their professional advisers, including private consultants.

In parallel with the work of appraisal, the Ministry will offer sponsors the opportunity of negotiating basic national or regional prices for typical dwellings. These prices would form the basis for further detailed price negotiations for individual or group contracts.".

The NBA also offered project co-ordination and management services, often free of charge.

2.51 **The involvement of the NBA became pervasive, and local authorities encouraged to rely on their judgement**. Indeed, if local authorities wanted something different, or questioned schemes in too much depth they would soon become seen as being difficult and obstructive.

2.52 In November 1965, the Government's 'Housing Programme

1965 to 1970' (15) reaffirmed the need for, and the commitment to, build 500,000 houses a year. Once again, priority would be given to:

"measures to enable local authorities to take full advantage of industrialised building, and to increase the output of the housebuilding industry".

It was announced that the Economic Development Committees had been set up for the civil engineering and building industries - charged with the task of working out ways of meeting the target.

2.53 "Housebuilding must be increasingly industrialised" was the message of the White Paper. The fact that costs were higher than for traditional building was seen to be a result of poorly organised demand and lack of long term planning.

"To develop the potential advantages of industrialised building for flats and houses long runs, continuity, and a reasonable measure of standardisation are necessary."

The target for industrialised building was set at 40% for 1970 - double the 1965 level. The commitment of Government was illustrated thus:

"Industry has put much effort into development work and capital investment and the Government intend to produce conditions for industrialised systems to operate effectively on a growing scale.".

2.54 **The new and direct role of Government in local authority production of houses was consolidated and expanded.** Regional offices of the MHLG were to be opened and would then operate in Birmingham, Bristol, Leeds, Manchester, Newcastle and Nottingham. The NBA had offices in London, Edinburgh and Newcastle, with one opening in Manchester. Both the MHLG and the NBA would now offer the following services, especially to facilitate the growth of industrialised building:

(a) choice of sites;

(b) appraisal of systems (by the Agency);

(c) choice of dwelling type, layout and system;

(d) organisation of serial building programmes;

(e) pre-contract and contract procedures.

2.55 The white Paper also proposed to change housing subsidies. The flat rate of £24 was to be replaced with a contribution towards the loan charges associated with the capital costs. Assuming a borrowing rate of 6½% the basic rate of subsidy (outside London) would be as follows:

Range Medium

Dwellings up to 3 storeys £37 to £89 £64

Dwellings over 3 storeys £66 to £94 £81

To this was added special subsidies for expensive sites, high flats, building in special materials, town development schemes, extra cost of subsidence precautions, and special needs. The subsidies for high flats and expensive sites were to be on the same general lines as previously existed. However, in the event, the 1967 Act abolished progressive subsidies for flats above 6 storeys (para 3.18).

2.56 The Government pressure was maintained in a new MHLG Circular 'Industrialised Housebuilding' (17). The Circular pointed out that if 500,000 houses a year "were all to be built at the present level of productivity 100,000 more men would be needed in housebuilding. They just will not be available.". **Once again, the need for continuous programmes, large and straightforward sites, minimum number of plan types and standardisation was emphasised.**

2.57 The advantages to local authorities were described as:

(i) output - the only way to build the number required;

(ii) speed of erection - saving money;

(iii) price - flats were "slightly cheaper", though houses were not, until output improved;

(iv) design - prepared standard designs meant more time could be spent on layouts;

(v) quality - "industrialised methods facilitate quality control".

2.58 **The Government's part was seen as leading "the drive" towards industrialisation. Systems were agreed with sponsors and were approved by the NBA. Appraisal certificates were only given where that system "is sound and suitable for a 60 year loan sanction"**. When the Circular was issued 25 certificates had been prepared for low rise systems and the NBA were "starting on high rise systems". By 1969, 89 certificates for low rise systems had been issued (37). However, the formal issue of certificates was less important in practice than the continuing advice and guidance on all aspects of industrialisation offered by the MHLG and NBA offices.

2.59 MHLG and the NBA were quite simply arranging the industrialised building programme for local authorities. The Agency kept records of the production capacity for individual systems within their areas of operation and local authorities were advised of what was available. Regional prices were negotiated by the Ministry with some sponsors (developers), and the Ministry also

grouped together the schemes of individual authorities. Systems were selected for authorities and made "available" to them, and help was given with statutory procedures and consultations. The Ministry were even to give priority to the "handling of schemes forming part of the drive".

2.60 Three appendices to Circular 76/65 detailed:

1. The services offered to local authorities.

2. Appraisal certificates and their relationship to architects certificates.

3. Appointing the contractor.

These are included as Appendix I to this report. Certain elements of the advice given to local authorities were in conflict however (see para 2.65 below).

2.61 The drive continued unabated and in 1967 a new Circular 'Progress of the Housing Drive' (22) indicated that the Minister was "anxious to be kept informed about the progress of programmes he had authorised and of the industrialised building drive". Again, the services of MHLG regional offices and the NBA were offered.

2.62 A year later, with the collapse of Ronan Point, the opposition to high rise buildings in particular, and unsatisfactory industrialised (and some traditional buildings), was at last expressed in strong terms. The Government's drive was immediately thrown into a much lower gear and industrialised methods allowed to wane.

The Role of Local Government

2.63 Local government was not blameless, and was generally a compliant partner and, in some cases, an enthusiastic pioneer and developer of the new methods.

2.64 Central government, and particularly the MHLG regional offices and the NBA, were trusted however as far as the technical appraisal of schemes were concerned. Most local authorities did not have the resources to carry out their own evaluation, and this would have been duplication of effort. Indeed, local authorities were asked to rely upon the judgement of the NBA in particular. Local authorities were only nominally in charge of their programmes. Even the determination of housing mix was constrained by the system "available", and would be modified to fit in with the production agreed by MHLG at regional level. Indeed, the choice for local authorities was often to have what was an offer, or nothing at all, at least in the short term.

2.65 Apart from the constraints on the design brief, the role of central government in "arranging" the industrialised building drive was quite simply in conflict with the suggestion that "the authority decide which system they will use" (17).

2.66 Local authorities were charged with meeting housing needs, and in some areas there were grave shortages. Consequently, there was often a rather desperate bid to obtain new housing of any type on offer, particularly bearing in mind that capital programmes were determined according to the willingness of local authorities to adapt industrialised methods. In addition, the use of industrialised methods for high rise building was more established than for low rise and those authorities that had large clearance programmes (and the need to replace high density housing) were under most pressure to redevelop within existing city centre areas. For some authorities there was also a preference for central redevelopment rather than overspill or new town development to ensure the continuance of existing employment and community links.

2.67 Hence, Planning Bulletin No 2 (8) was often ignored with regard to the diminishing gain in terms of land use derived from increasingly dense developments. Industrialised building was on offer; the Ministry gave priority to it; contracts could be negotiated; standard designs were already prepared; and the capital allocations with increasing subsidy for high rise buildings would be paid.

2.68 Local authorities also saw the opportunity to clear their drab rows of slums with bold and exciting new developments which would change the image of the town or city - a modern and progressive look. Architectural conceptions were therefore supported, in some cases enthusiastically, and would become monuments to civic pride.

2.69 Local authority representatives were also pioneering industrialised techniques, and visits were made to Continental and Scandinavian countries (29). Schemes were taken on and adapted, or new schemes developed altogether by the more ambitious authorities.

3. THE INDUSTRIALISED BUILDING PROGRAMME

The Number and Types Built

3.1 There was some experience for the system builders to draw upon in the late 1950's and early 1960's. By 1955 there were, of course, 500,000 non-traditional dwellings built since the war and over 50,000 built in the 1920's (30). However, this experience had not been entirely successful and the programmes had declined once Government support and sponsorship had waned.

3.2 Moreover, most of the earlier non-traditional designs were not simply transferable to the new industrialised housing period that was about to commence, and most were low rise, low density schemes, in which the design and build process was essentially traditional with some 'non-traditional' methods and materials grafted in.

3.3 In the early 1950's the low rise non-traditional programme was complemented by the development of flats in the public sector programme. Redevelopment of war-damaged city centres had by then provided opportunities for some high flats to be developed, and also for office blocks to be built. This was already a perceptible market for which the necessary research and development work was being undertaken by leading building firms. Indeed, by 1953, 15% of all flats in approved tenders in the public sector were in blocks of at least five storeys (31).

3.4 The growth in industrialised methods and system building grew, slowly at first, and then accelerating and reaching a peak in 1970. **We probably now have between ¾ and 1 million dwellings in Great Britain built by system and industrialised methods in the public sector stock in addition to the earlier 500,000 non-traditional dwellings.**

3.5 The industrialised building statistics are not entirely accurate, nor comprehensive. Records of industrialised dwellings were only kept between 1964 and 1979 by the Ministry of Housing and Local Government and Department of the Environment. Table 5 shows that for England and Wales 474,300 industrialised dwellings were built. In addition, high rise dwellings were built between 1953 and 1963, and most of these were built with industrialised methods. High rise dwellings for this period amount to a further 140,316 (see Table 6). Both these figures exclude Scotland, for which, during the period 1960 to 1980, a further 380,000 dwellings were built, of which around 100,000* would have been industrialised. However, recording of statistics was somewhat inaccurate and the perception of what was 'industrialised' varied. Those dwellings that looked traditional (e.g. with a brick skin around a framed building) were not necessarily submitted as industrialised. **In total, therefore, official statistics are probably an understatement of the number actually built and whilst a minimum of ¾ million dwellings were built a more reasonable estimate would be in the region of 1 million.**

* 71,812 were included in tenders approved between 1965 and 1969

- Housing and Building Control Statistics.

TABLE 5

INDUSTRIALISED BUILDING 1960-79: PUBLIC SECTOR: ENGLAND & WALES

Year	Number of completions England & Wales [thousands]	% of Flats 5 storey + in total dwellings approved in England & Wales	Number of industrialised dwellings completed in England & Wales [thousands] [% of all dwellings]
1964	126.1	24.1	17.2 [14.4]
1965	140.9	21.5	25.1 [18.9]
1966	152.0	25.7	37.5 [26.3]
1967	169.9	23	49.0 [30.8]
1968	158.4	19.9	50.6 [34.2]
1969	150.8	13.6	53.1 [38.0]
1970	145.1	9.9	55.7 [41.3]
1971	129.7	8.6	35.3 [32.1]
1972	102.6	7.4	24.5 [26.2]

1973	89.6	3.4	17.7 [22.3]
1974	111.6	2.5	24.5 [24.7]
1975	138.3	1.2	25.8 [21.0]
1976	140.1	1.8	23.8 [19.6]
1977	147.2	1.3	19.7 [16.2]
1978	119.3	2.6	10.3 [10.7]
1979	92.6	-	4.5 [6.3]
1980	98.3	-	-

Source: MHLG – Local Housing Statistics 1960-66

MHLG – Housing Statistics 1966-69

DOE Housing and Construction Statistics

TABLE 6

HIGH RISE BUILDING, PUBLIC SECTOR, 1953 TO 1963, ENGLAND AND WALES

Year	Dwellings over 5 storeys [% of total]	**Nos Built**
1953-9	6.9	67,046
1960	14.2	15,200
1961	16.5	16,236
1962	17.3	19,306
1963	22	22,528

Total =140,316

Source: MHLG – Local Housing Statistics 1960-66

And Cooney [33].

6. Statistics, based on returns by housing authorities to the Ministry, have also been collated (38, 39, 40) for 1964 to 1979 for each individual system type. The 474,300 dwellings for this period, referred to earlier, account for about 150 types. These are listed in Appendix 2. However, these statistics, compared with information supplied by member authorities (which do not constitute all housing authorities), seem to confirm our doubts about the accuracy of industrialised building data. We have been able to check four of the types listed and, in each case, the statistics have been very inaccurate. These are as follows : -

Bison Government Statistics 30,607 (England and Wales)

No. built by Bison Concrete 50,000 (UK)

(Note: This latter figure has been confirmed by Bison Concrete Ltd, and includes 20,000 low rise dwellings which were not listed in Government Statistics at all.)

Rigid Frame System Government Statistics 27

Actually built for one member authority 149

ISEC System Government Statistics 258

Actually built for one member authority 354

Anglia (TWA) Government Statistics 683

Actually built for one member authority 1034

Further, a comparison of official statistics from other publications (65), (67) shows that a considerable number of systems which were used in this country were not included in Government statistics, and some that had been built in much greater numbers than officially recorded.

3.7 Appraisal certificates under Circular 76/65 (17) were issued for 89 low-rise systems (37). These are set out in Appendix 3. These were issued as follows:

Year No. Issued

1966-67 69

1967-68 15

1969 5

Total 89

However, of the 89 issued, 29 did not figure in later Housing Statistics for industrialised building activity. This may be due partly to the inadequacy of the statistics, but also to a decision by the sponsor not to go beyond the design and prototype stage.

3.8 Whilst in terms of absolute numbers there is some considerable reason to doubt the accuracy of official 'industrialised building' statistics, the distribution over the years shown in Table 5 is probably fairly accurate, apart from the first two years of statistics collection when under-reporting was likely to occur. The industrialised building activity did indeed reach its peak in 1970 and overshot the target of 40% (see para 2.53). However, with Ronan Point and the growing expression of doubts there was an immediate decline, with a gradual falling from favour thereafter. Many of the contracts let in the late 1960's would have taken 3 years to come to fruition and explain why industrialised building continued at a high level (i.e. a quarter) until 1974. The final demise came when volume building plunged in the late 1970's.

The Character of Industrialised Building

3.9 In Section 2 the origins of the growth in industrialised building has been analysed. High rise building was established first:

"developments such as Harlow, where the first tall point block was used in a scheme of 1950. Probably the most influential and widely acclaimed mixed development scheme of this period was the LCC's Alton Estate at Roehampton (begun 1951) where a balanced group of eleven-storey point blocks and other types were built" (32).

Not all high rise, however, was industrialised but, as Table 6 demonstrates, the foothold of high rise was being established in the early 1950's. ' The nature of high developments, with repeated floor plans, lent itself to industrialisation - as did the building operation itself. Also, the Continental experience, which had concerned itself less with non-traditional and low rise development, was available for transfer to Britain during the later 1950's.

3.10 In May 1965, Mr P Lederer, the newly appointed adviser to the Minister on industrialised methods (16), produced his first report (18). By this time Mr Lederer felt that high rise industrialised methods were 'already more economic than traditional methods' and were 'proved systems'. For medium rise, and low rise, it was quite another matter however, and Table 7 illustrates the limited success of industrialised methods for the different forms of development.

TABLE 7

INDUSTRIALISED METHODS BY FORM OF DEVELOPMENT 1964

Total Industrialised % Industrialise

Dwellings

High rise

(5 storeys +) 35,450 11,730 33%

Medium rise 44,900 4,080 9%

Low rise 63,100 10,440 16.5%

Source: P Lederer's First Report (18).

3.11 Mr Lederer's report (18), in essence, said that local authorities needed little convincing about the value of industrialised methods for high rise dwellings. However, he felt there was resistance to industrialisation of low and medium rise dwellings because of maintenance and durability considerations. Whilst the NBA's role was:

"To confirm that systems subjected to their examination have a 60 year life, subject to reasonable maintenance work being carried out. I have found that some councillors and officials view such opinions with reserve based on unhappy technical advice given by Government agencies in the past."

Mr Lederer recommended the 'appraisal certificate' system, and this was one of the major means of creating confidence in low and medium rise industrialised methods. (See paras 2.58 and 3.13 and Appendices 1 and 3 for further details.)

3.12 It is interesting to note here that high rise systems were subjected to examination by the NBA (8) though no appraisal certificate was issued (see also para 2.50). The Minister subsequently announced that they would be given for high rise systems (17), but this subsequently proved not to be the case (37). The drive towards industrialising low and medium rise was successful as Table 5 demonstrates by increase in the proportion of industrialised dwellings above the proportion that were in high rise form. Indeed, it had to be successful if industrialised building targets were to be met, given that the proportion of high rise flats had gone about as high as it would ever go. (It, in fact, reached a peak in 1966 when 25.7% of all dwellings in the public sector were 5 storey and above.)

Appraisal Certificates

3.13 The basis on which appraisal certificates were issued was set out in an appendix to Circular 76/65 (17). This appendix is included in Appendix 1 to this report. Appendix 3 lists the appraisal certificates given for 89 low rise systems up to 1969. A typical appraisal certificate gave the following information:

Name and address of sponsor

Location of offices

Licencees (if any)

Description of the system

Range of dwelling types

Layout flexibility and qualifications for use

Compliance with Ministry standards and Building Regulations

Factory location and capacities

Detailed description of a typical dwelling type.

In addition, an assessment was made of the following features on the system with the options deleted as appropriate:

Assessment of Plan Type

Adequate Fair Good Very Good

Likely Maintenance Cost

70-85% 85%-95% 95-105% 105-115% 115-130%

as compared to traditional construction maintenance.

Likely Prices for the System

under 95% 95-105% 105-115%

as compared with the cost of traditional construction with 50-75 mile radius of Iver, Buckinghamshire.

Clearly, local authorities will have been very much influenced by these assessments. However, as pointed out in Section 2, the direct role of central government agencies in organising housebuilding programmes at this time was also very strong, as informal comment and the constraints of what was available may have been the overriding factors. Local authorities are now, no doubt, considering the assessments made by the NBA in the light of actual experience with these systems.

Consortia

3.14 Local authorities were encouraged to form consortia to further standardisation of design and production. Systems could be developed exclusively where the number of authorities could pool their work to ensure sufficient demand collectively. In local authority housing, probably the Yorkshire Development Group and the Midlands Group were the best known. Consortia also existed for schools, where some 15% of school buildings used "advanced systems of construction" by 1963 (28). These included CLASP (Consortium of Local Authority Schools Programmes) and SCOLA (Second Consortium of Local Authorities).

Decline of Industrialised Methods

3.15 The gas explosion in Ronan Point in May 1968 marked the turning point in the fortunes of industrialised housebuilding. High rise building, however and some medium rise had already declined to some extent (see Table 5) and had by then already been criticised, and as the initial 'shine' wore off, the tenant reaction grew stronger. The success of the low rise industrialised programme, which was proving cheaper for the Government (after taking account of subsidies) and the price per unit was reducing.

16. In 1967 the Housing Cost Yardstick was introduced and Parker Morris standards at last became mandatory (20). However, the higher standards, perhaps coupled with the realisation that local authorities could design schemes to maximise subsidies rather than achieve the most economical developments, made the Ministry more cost conscious.

3.17 Housing Standards, Costs and Subsidies MHLG Circular 36/67 (17) announced the introduction of new cost yardsticks for housing schemes. Schemes would not receive loan sanction if their costs exceeded the yardstick by more than a tolerance of 10%. The yardstick level was set so that local authorities would be able to achieve Parker Morris standards without exceeding them. The Circular said: "The Minister therefore considers that housing authorities should only build to these (very high) densities in exceptional circumstances" and then only "in the most congested urban areas where existing densities are even higher and where there is an acute shortage of building land e.g. only in the central parts of conurbations and particularly in inner London". The Circular went on to explain "how wasteful it can be in money terms to build to densities higher than are really necessary". It also states that at high densities, dwellings in high blocks cost some 25% more than those in blocks of 3 to 4 storeys, or 50% more than equivalent houses. It refers to Planning Bulletin No 2 "Residential Areas Higher Densities" (18), first published in 1962 (see para 2.16) which shows that land savings diminish at higher densities, once density is increased beyond about 20 dwellings per acre development above 2 storeys becomes increasingly necessary and building costs begin to rise sharply.

3.18 The Housing Act 1967 abolished the special extra subsidy for flats for each storey above 6 storeys. Subsidies for dwellings in flats over 4 storeys were set out as follows (Section 4): (c.f. 1965 white Paper (15) - see para 2.55).

(a) 4 storeys - £8

(b) 5 storeys - £14

(c) 6 storeys or more - £26.

Arrangements for expensive sites were, however, retained and this helped the transfer from high rise to low rise systems that utilised fairly high density layouts.

3.19 The cost of industrialised methods was probably never much below that for traditional building, and mostly it was higher. In 1965, for example, Mr Lederer reported (18) that the cost of the average high rise industrialised dwelling was £3,047 compared with the traditional cost of £3,152, but other types were less competitive. Costs for industrialised methods were generally acknowledged to be higher except in the most favourable circumstances of volume and standardisation (see, for example, para 2.53).

3.20 For industrialised methods generally, transport costs were higher. In 1962, for the Reema proprietary system based on pre-cast concrete units, the costs of transport was £100 for 100 miles - 5% of the cost of the dwelling (35). Traditional methods were also more flexible and could meet fluctuations in demand. The materials cost for prefabricated units in particular is often higher, and the quality of components and dimensional accuracy of factory made units has to be very high to ensure perfect fitting together on site. Consequently, traditional building was generally able to compete, and had certain widely recognised qualities, better appearance and durability. When more questions were asked about the wisdom of the new methods, the impetus was lost. Subsequent reductions in volume building almost killed industrial methods completely.

Industrialised Housebuilding by Type and System

3.21 This section is based largely on a paper by A W Cleeve Barr to the AMC Conference in September 1963 (29). The systems referred to are not necessarily defective - some have performed well as far as we are aware, although equally, some have proved exceptionally problematic.

3.22 The main types are:

(i) heavy pre-cast concrete systems;

(ii) lightweight pre-cast concrete systems;

(iii) on-site poured concrete systems;

(iv) timber panel and timber framed systems.

3.23 Heavy Pre-cast Concrete Systems

These systems were developed first in France, Scandinavia and the USSR for multi-storey housing. They consist largely of pre-cast concrete walls, floors, and other elements, made in large panels in specialist factories, delivered to building sites by special transporters and lifted into position by cranes. They were mainly systems of rationalising the erection of the structure of multi-storey buildings. Some firms went a good deal further than others in incorporating service pipes, electric’s, and fixings for equipment, in the concrete panels. The units weigh from, say, two to five tons for transport to a radius of 40 or 50 miles from the factory. Some systems used a factory on the building site, for which a large contract was obviously required, and cast units up to ten or twelve tons in weight. Such a unit would be the entire party wall between two flats, one storey height and the full depth of the block from back to front - alternatively, the floor of a flat from wall to wall, and back to front of the block.

In these systems windows and doors are cast in the wall panels in the factory, and may be glazed and painted in the factory as well. The floor finishes and the heating may also be cast in. Plastering was eliminated, and walls, which were brought to a degree of accuracy in the factory, that permitted finishing on the site with wallpaper or plastic paint on to the concrete.

By the use of these systems construction times for multi-storey flats were said to be reduced to under six months for blocks which formerly would have taken two years or more. Productivity in terms of man hours was increased by 40 per cent. Many British contractors took out licences to develop systems on these lines in this country, either by extending existing factories or laying down new ones. They included: -

Gilbert Ash - (Tracoba, of France)

Building & Construction Co - (Cauvet, France)

Crudens (Scotland) - (Skarne, Sweden)

John Laing - (Jesperson, Denmark)

Walter Lawrence - (Sundh, Sweden)

Taylor Woodrow/Anglian - (Larsen and Nielsen, Denmark)

Unit Construction - (Camus, France).

Other British firms who developed similar systems of their own included:-

Concrete Limited (Bison wall frame)

Cubitts (A multi-storey system jointly with specialist concrete manufacturers)

Reema (A system developed early after War for both houses and flats)

Wates (A firm which had a factory-based system for houses and flats early after the War, and which now has a new technique of on-site pre-casting).

Low rise systems were developed by:-

Concrete Limited (with Gregory and other housebuilders)

Selleck Nicholls Williams Limited

Unit Construction (with Camus Great Britain Limited).

3.24 Lightweight Pre-cast Concrete Systems

Lightweight concrete is produced either by using a lightweight aggregate (e.g. clay expanded under great heat) in lieu of gravel, or by generating a gas through a mixture of cement and sand, so that the resulting material consists largely of tiny disconnected hollow bubbles bound together by cement. According to the purpose intended the material can be made very light, a fraction of the weight of ordinary concrete, in which case it has little structural strength but high insulation value, or it can be made, say, one-third or to one-half the weight of ordinary concrete in which case it has both useful strength and useful insulation values. A number of firms produced it in ordinary block sizes, say, 20 in. long by 8 in. panels for storey-height walls or large roof spans requires elaborate steam-curing kilns. Storey-height panels were produced in Britain by Durox Limited, by Costain's and by John Laing -who also acquired patent rights for Scandinavian systems respectively known as Ytong and Siporex (based on materials of the same name).

The material was adequate for the structural walls of two-storey houses, but only for the non-structural walls of blocks of flats. A storey-height panel could be lifted by two men. It took nails or screws direct for fixings. It could be cut with a saw. It could be wallpapered or painted direct. Sound insulation values for party walls was said to be initially a problem, and insulation values were described as good.

3.25 On-site Poured Concrete Systems

This type involved a high degree of site mechanisation, combined with the factory production, not of finished building products, but of the formwork within which the concrete was poured on site. In brief, these systems made maximum use of concrete for all the possible building elements - walls, floors, partitions, roofs - for which concrete in various firms was suitable. The concrete was centrally mixed on site, and either pumped through hoses or lifted by crane to where it is needed. The formwork was made of steel or timber, its facing depending on the degree of precision wanted in the finished face of the work.

The SSHA were amongst the earliest developers of this system and were responsible for much of the early development work.

Firms who used this kind of system included the following. A few notes are necessary because of the variety of techniques within this general classification:-

Wimpey (No-fines)

A system using "no-fines" concrete, that is, concrete with no sand. A "no-fines" concrete does not flow, like water, and therefore builds up less pressure in the formwork, and could be cast more economically. It also contains air gaps and has a small insulating value. The firm developed a dry-lining instead of plaster.

W C French (Bittner)

A similar system, developed jointly with the LCC, using an Austrian method of making the formwork. It used a different aggregate in the concrete to improve the insulation values.

John Laing (Sectra)

A rapid system for tall blocks using dense structural concrete, with highly standardised factory-made formwork, incorporating heating pipes for quick curing of the concrete on site.

Thornton (Prometo)

A system for the structure of tall blocks using dense concrete, poured into formwork, which incorporated hydraulic jacks, and which rose continuously as the concrete was poured.

Mowlem (Stevenage New Town)

A system for two-storey houses using lightweight insulating concrete, which could be wallpapered direct. Traditional external finishes.

3.26 Light Framed Structural Systems

A variety of these systems were developed, including:

5M System

A completely flexible system permitting any detailed planning arrangements to the client's requirements developed by the Ministry's Development Group in collaboration with the Yorkshire Group of authorities. Light steel columns, but all other components timber-framed. Various external walling materials (5M = 5 modules, or five times 4 in., the basic module of the system). This system had an interesting factory-made party wall, consisting of two leaves of thick laminations of plasterboard with a cavity and a lead sheet in between them. (See references 14 and 21 for further details.)

Building Systems Limited, Doncaster

A technically advanced system using a light pre-stressed pre-cast concrete post and beam frame with timber infill panels. External claddings of concrete tiles and timber boarding.

Metal Web Limited

A system, developed initially in association with a City Architect's Department, as clients. It consisted basically of a rigid-jointed light steel frame, with pre-cut timber floors and roof, leaving the party walls, cladding and so on, to be carried out in traditional or pre-fabricated components. This was developed later from a timber core and metal web 'beam' unit into all steel units.

Lowton Cubitt System

Standard steel sections assembled to form a frame infilled with timber and faced with a variety of claddings.

Trusteel

A pressed steel frame at close centres, used for low and medium rise construction.

27. Timber Panel and Timber Framed Systems

These systems included:

Vic Hallam (the Hallamshire House)

A system developed by Messrs Hallam in collaboration with a local authority City Architect. It used factory-made two-storey height timber wall units, floor and roof units, with brick party walls and certain external facing walls in brick. Finishes were described as excellent by Cleeve Barr (28).

Spooner (the Caspon House)

A system developed by Messrs Spooner in collaboration with a local authority City Architect. Large factory-made timber components. Some external facings in brick. Party walls in poured concrete.

Simms Building Systems

A timber framed system developed in collaboration with a Midlands Borough Architect. It has two-storey height factory-made wall units with party walls in blocks.

TRADA

A system devised by the Timber Research and Development Association. It used load-bearing timber panel walls, with intermediate post and beam frames, where needed in wider spans. Timber external walls, with concrete party walls similar to Spooner.

Other examples included Frameform, Riley, Metratrim HSD, ISEC, Quikbuild, Selleck Nicholls and Resiform.

4. COMMON DEFECTS

Introduction

4.1 The following defects have been identified by member authorities in their industrialised housing stock, and also drawn from published material. It must be emphasised that not all the defects referred to are a function of industrialised building. They are defects commonly found in dwellings of this age and type. Nevertheless, in general, the defects referred to **are more prevalent in industrialised building** than in traditional forms, and may **sometimes be attributable to the built form -** which was determined by the possibilities created (and limits imposed) by the industrialisation process. Furthermore, **industrialised building relied heavily upon the use of certain materials and components,** such as asbestos - necessary in the lightweight structures (largely a function of prefabrication, transportation and crane handling) for insulation and fire protection.

4.2 Many of the defects cited by members were related to particular systems, but in view of the consistency of complaints across systems, and relevant to types of construction, and particularly high rise dwellings, the defects have been grouped under the following headings:

High rise systems

Pre-cast Panel Systems

On-site Poured Concrete Systems

Light Framed Structural Systems

Timber Panel and Timber Framed Systems.

4.3 Reference has also been made to the problems of built form associated with industrialised types, and high rise in particular. It has not been our intention to catalogue these problems in a comprehensive and systematic way and the main focus of our work has been on defects problems. Nevertheless, the two problems cannot be viewed separately and we have therefore attempted to explain the relationship between the two.

4.4 We must reiterate the view expressed in our First Report (30) that a more thoroughgoing and comprehensive study of this problem is now necessary. Once again, we have been struck by the difficulty in identifying the systems used, and the adequacy of records and statistics which would have helped us to quantify the scale of the problem involved. We have also been struck by the lack of central advice and guidance to identify defects and devise schemes of remedial works. Local authorities are having to solve problems virtually unaided.

Ronan Point

4.5 No mention has been made of the specific problem highlighted by the collapse of Ronan Point in 1968 which, it is assumed, has long since been completed. It was found (25) that blocks of this type could be liable to progressive collapse in the event of an explosion, or fire, or other forms of accidental damage, including wind damage.

Appraisal was required of all blocks over 6 storeys "in height built of large pre-cast concrete panels to form load bearing walls or floors, or both" (26). Existing buildings were subsequently strengthened by making joints more continuous and tougher, and so disposing the load bearing walls that alternative paths are provided in the event of local failure. The new standards also applied to new buildings of this type. Grants were paid for this work, and this extended to tenants' expenses and loss of rental income (27). Geoff Scott (46) estimated the total cost of this work at £l00m.

4.6 High Rise Systems

A number of defects seem common to high rise (and indeed to some medium rise) Systems, but built by a variety of industrialised methods. Whilst the 'system' designs have suffered heavily from defects, they were built in greater numbers than 'individual' or 'local'

designs. However, the 'one-off' industrialised dwelling may not have fared any better, and they are well represented in the listed defects.

Rain penetration has been a major problem. This has occurred through parapet walls, through brickwork panels, around and through other claddings, and particularly through panel joints, and at the junction of the frame with cladding. It is also prevalent around window frames, and has occurred in unusual spots such as through lift motor rooms.

Naturally, rain penetration has contributed to the discomfort of tenants, but has also contributed fundamentally to the deterioration of the structure of the building itself.

The exposure conditions in the upper floors of high rise dwellings was not generally appreciated and accounted for in the design. This is clear from the Ronan Point investigations (25) which emphasised the stress created by strong winds at those heights. Similarly, standards of water-tightness applied previously to low rise dwellings were not adequate for multi-storey blocks. Any hairline crack could permit rain into the cavity and wind pressure was such that it could be blown across to the inner leaf, or driven into unprotected areas of window frames, behind claddings, decorative facings and so on. Cavity trays which were slightly defective (and would give rise to no problems in a low rise application) would not perform their task adequately.

The cracking of decorative panels, delamination of finishes, rotting window frames have all become major problems.

The problem of watertightness has been made worse by the use of different materials together, for which no adequate allowance has been made for differential movement. A serious example, of which many authorities have complained, is the differential movement between a concrete frame and brickwork infill panels, and other cladding materials. In the case of brickwork, cracking of the bricks or concrete frame, or both, has resulted with spalling and possible structural failure.

Differential movement has also occurred on parapet walls, and between cladding panels and window frames. Another example is between in-situ concrete and pre-cast units which have a different composition. A significant problem has also been the dislodging and cracking of cavity trays.

Condensation has been a major difficulty too, with the structure being exposed to very much colder conditions at higher levels. Coupled with rain penetration problems, and cold bridging at floor and ceiling junctions of external walls, condensation has proved difficult for tenants to control. Authorities have attempted to improve insulation by dry lining techniques, externally applied insulation, and by cavity filling. However, these are expensive and usually imply some additional structural work and not generally simple to introduce.

Condensation has also been reported as a cause of electrical failure, and deterioration of insulation boards and surface finishes.

Roofs - flat and low pitched roofs are more often to be found in industrialised and system built dwellings. This is because they could more easily be prefabricated, and because weight could be kept to a minimum. (Reducing the weight of the structure, largely for handling, was a major objective of the industrialised building programme - see Cleeve Barr, Chief Architect MHLG (28)).

Flat and low pitched roofs have (typically) performed badly. Water penetration is a common complaint, and poor insulation values added to condensation problems. Performance has, however, been worse than for traditional construction due to the high exposure conditions, and their inability to cope with differential movement, settlement, and thermal expansion and contraction.

Replacement with conventional roofs has in some cases been prevented by the difficulty that the existing structure would have in coping with the extra weight imposed.

Sound insulation has been a noticeable problem, though perhaps particular to some dwellings. It has been a special problem where deck access ways have been positioned above dwellings.

Noise has been transmitted through gaps between dwellings and there have been several examples of the isolation of dwelling units being far from complete. This, of course, gives rise to other problems, such as smell and smoke (in the case of fire) transference and a through route for vermin.

Spalling concrete has been evident from a wide range of systems, and generally caused by the presence of chlorides or the lack of cover to steel reinforcement. Again, the process of deterioration is accelerated in higher exposure conditions.

Concrete which is exposed, (floor slabs, parapets. balconies etc) has been most affected. The lack of cover to reinforcing and the porosity of the concrete has provided inadequate protection for the reinforcement. A separate, but related problem has been the use of calcium chloride which was widely used to accelerate concrete setting times up to the mid 1970s. Deterioration is precipitated by the weather. Both problems result in thereduction of alkalinity of the concrete and weaken weather resistance. However spalling concrete due to lack of cover to reinforcement and concrete porosity may be localised (although often widespread in any structure) whereas the use of calcium chloride produces a chemical change throughout the exposed concrete areas. This is difficult, if not impossible, to arrest.

Localised damage is itself expensive and difficult to treat; calcium chloride problems threaten the whole structure, and a far more difficult and complex. It is also clear that some of the problems are yet to manifest themselves due to the comparatively recent completion of buildings using these materials.

Calcium chloride was also used on a pre-cast units, particularly panels, and ‘patch’ repairs might be undertaken initially but are unlikely to be appropriate in the longer term.

Asbestos products are not confined to industrialised building systems. Nevertheless they are for more prevalent. This is largely due to the use of prefabricated components and the emphasis placed on light weight structures. Asbestos was used to give fire protection to structural components such as metal beams, and to prevent fire spread from heating ducts and flues. It was also used in claddings, and with other materials in external and internal panels.

The Association has found that most of the problems of asbestos in housing which members now face are indeed concentrated on the post-war non-traditional and industrialised stock.

High alumina cement has featured in public campaigns in the past, and many difficulties have been dealt with. However, deterioration is progressive, and it is not always easy to identify. It is therefore anticipated that this will continue to manifest itself as a problem in various situations.

External staircases, walls, and link bridges have also suffered from a combination of thermal and differential movement and weather damage, including spalling of concrete. Asphalt coverings have also had to be replaced to walkways as a result.

One frequent complaint has been deterioration to balconies, and particularly balustrades guard rails, and asphalt surfaces. Again, it seems that the weather and higher exposure conditions have caused rapid deterioration, together with poor workmanship and inadequate detailing.

Drainage problems have also occurred and proved particularly difficult to remedy. Drainage runs may have been cast within the structure, and the source of leaks difficult to establish, and rodding eyes inaccessible or not provided.

4.7 Pre-cast Concrete Systems

Insufficient ties between inner and outer leaves of external walls (panels), resulting in movement and, in some cases, falling out of panels.

Water penetration through horizontal and vertical panel joints.

Cold bridging from concrete floor and panel junction causing condensation.

Bowing of pre-cast concrete panels causing cracks between floors and the external wall - permitting noise, smell, and smoke (in the case of fire) transferred between flats.

Cracks developing between in-situ and pre-cast units.

Inadequate fixing of stud partitions and exacerbated by doors fixed to partitions which are too flimsy - or where it is difficult to obtain adequate fixing.

Parapets not effectively tied back.

Inadequate mechanical connection between load bearing wall and floor panels, and lack of restraints between buttress walls (and spandrel panels) and load bearing walls.

Pre-cast panels spalling or chipping with corners proving particularly vulnerable. Largely due to presence of chloride or inadequate cover to reinforcement.

4.8 On-site Poured Concrete Systems

Condensation: A widespread and general problem associated with poured concrete and no-fines construction. Particularly exacerbated by cracking and spalling of render cover, and rain cooling the structure from the external face.

Spalling of Concrete: Again, fairly widespread, from exposed areas, associated with the corrosion of reinforcement due to the presence of chlorides or inadequate cover.

4.9 Light Framed Structural Systems

Numerous problems have arisen, but these are difficult to categorise because of the variations and unusual nature of the systems.

Rain penetration has been a problem between the junction of the house frame and various claddings, and particularly around doors and windows. Door and window frames have had to be renewed after only 10 years.

Claddings have also provided problematic and not only failed to keep out the elements but have deteriorated due to lack of watertightness. This has resulted in bowing and corrosion of cladding and delamination of the external finishes.

Roofs have been a special problem, with several authorities replacing corrugated metal sheet roofings. Low pitched roofs have been especially difficult and condensation in the roof space hard to avoid. The fixing of roofs to house frames has also been inadequate in some cases, with one authority reporting 16 house roofs blowing completely off in one night of gales. To re-roof in a traditional form, however, adds considerable weight, and the existing structure may not be capable of supporting this.

Differential movement has also proved a major problem with the house frame, cladding, and components expanding and contracting at different rates. In some cases, this has caused severe structural problems.

With the emphasis on lightweight materials, the rigidity and robustness of the structure has been in doubt with, for example, flexing of entire pre-fabricated floor units, and constant movement cracking surface finishes.

The linking of traditional heating appliances to prefabricated flues has also created problems, and the flues in particular proving to be insufficiently durable and inadequately protected against the possibility of fire spread.

Asbestos has also been used in some of the systems using composite pre-fabricated panels for external walls, and also to line flues, in lieu of brickwork, and for heating ducts, etc.

Upgrading thermal insulation has also proved difficult, and in some cases impossible in roof spaces with limited space.

4.10 Timber Panel and Timber Framed Systems

Fire barriers in the cavity of external walls have been omitted. This has permitted fire spread in houses via the cavity, and also between dwellings where cavity barriers have also been found to be inadequate or omitted altogether.

Roofs have proved to be a particular problem, with extensive roof leaks, especially to flat roofs, being reported, condensation in the roof space, and roof coverings being susceptible to differential and thermal movement. In one case, there has also been differential movement between the roof and rainwater stacks, allowing rain to stand in pools.

Differential movement between the cladding and the frame has led to cracking of the structure, gaps around window and door frames, and cracking and rotting of those frames resulting. Rotting structural timbers have also been evident. Some problems have been found where the timber frame (and windows) have shrunk downwards causing the external timber cills to force down the back of tiled cills so that joints are broken and back fall created allowing water penetration.

In the external walls, insulation has been found to be missing or insufficient, and vapour barriers have not been continuous in some cases. Cold bridging at ground floor panel level has also been found.

Asbestos has also been used in the external walls of some systems, and also for ducting and protection to heating appliances.

Problems Arising from the Built Form

4.11 Industrialised building dictated the built form and estate layout. Initially, at least, industrialised building was only available in high rise forms and in 1964 twice as many units were still built in high rise forms compared with low rise (see Table 7). Industrialised building found it difficult to compete with traditional forms in low rise development whereas high rise and, to a large extent, medium rise could rely on repetition of standard units vertically and with higher densities were able to bring down unit costs.

4.12 Repetition of standard units imposed considerable constraints upon the built form - point blocks, large slab blocks, deck access terraces, etc. However, their position on site and proximity to each other could also be determined by other physical factors such as crainage. Barry Russell (63), for example, shows how for one LCC development blocks were located in such a way so that they could be served by one crane.

13. If built form, then, was dictated fundamentally by the methods used, this was certainly not the impression conveyed by promotional material at the time. The impression was given that the new forms were designed to create traditional street patterns and would allow community life to continue in the old way. For example, promotional material from the Yorkshire Development Group (49):-

"The community is socially more closely integrated the decks are protected from the weather and provide a convenient route for household deliveries, and are a natural meeting place for young and old alike.".

4.14 Little was known, however, about how the occupiers would react to their new environments and there was little design knowledge which would ensure that the schemes actually worked in practice. The fundamental problems, especially for families, of having play space and drying areas many floors below were foreseen to some extent and views varied as to whether families should be housed only on lower floors etc. However, more detailed points, and especially, coming to terms with the concept of 'defensible space' were not well understood. Vandalism, insecurity, cyclists on walkways - and a host of problems not experienced in traditional layouts were simply not catered for.

4.15 It is not our intention to discuss in detail all the problems which have arisen from the layout and built form of industrialised building. Much good work has already been done on this aspect elsewhere and we would draw attention to the Government's own work on 'Priority Estates' and similar projects (53), (54), (55), (56), (57), (58), (60), and the recent publication by the Institute of Housing "Trends in High Places" (52). New entryphone systems, floodlighting, redesigned communal areas, extra security staff/caretakers/resident managers, blocking off secondary accessways and perimeter fences are now fairly commonplace in an attempt to deal with the unforeseen problems that arose from the new layout arrangement and built forms.

4.16 Certainly, the Department of the Environment now recognise these problems and there is an appreciation of the relationship between physical defects and built form:-

"Many authorities began their programmes short of land and assuming a continued growth in population. Hence, metropolitan authorities particularly resorted to high density, multi-storey schemes on both redeveloped and peripheral overspill sites. An adjunct to this approach was the use of industrialised building systems. Although central government never set out a clear policy advocating high rise or development at high densities, its subsidies at least facilitated these practices; it also promoted industrialised building systems as a means to speed housing production and overcome labour shortages.

The results in some instances have all too clearly been developments which are inhuman in scale, uniform and repetitive in appearance and inadequately provided with social and community facilities. An industrialised building system had been employed on 16 of the sample estates and many of these had massive concrete facades of overwhelming severity which sophisticated and generous landscaping (if provided in the first place and if it survived) could do little to mitigate.

In addition to their often unattractive appearance, technical problems such as water penetration were not uncommon with the system built schemes we looked at.

Some of the systems had evidently been adopted before being sufficiently tried and tested, or else they had been crudely adapted to specific site conditions or density requirements.". (53)

Now, with the benefit of hindsight, the Government is prepared to recognise at least some of our difficulties and the above quotation by the Department of the Environment represents a complete change of direction to that advocated by their predecessors only 15 years ago.

5. RECENT GOVERNMENT ACTION

HIP Allocations

5.1 The Association is disappointed with the recognition that Government has been prepared to give to the problem of defective dwellings generally. The cost of remedying defects is escalating all the time as faults are becoming manifest, and local authorities are having to devise programmes to safeguard the structure, protect the tenant, or both. However, Housing Investment Programme allocations have been reduced in real terms by around 50% since 1979. An increasing proportion of HIP allocations is also being found by the local authorities themselves by way of capital receipts. In addition, pressure to tackle the increasing unfitness and

disrepair in the private sector has meant a much greater proportion of HIP allocations have had to be devoted to this activity. New housebuilding has suffered most, but even the dramatic reductions here have not allowed local authorities' expenditure on repair and renovation of their own stock to keep pace with, and certainly not rise to, the level required.

5.2 In the current round of HIP negotiations for 1984/85, the Department of the Environment did show some willingness to redistribute resources between authorities and to direct them to those authorities with the greatest defects problems. Consequently, regional officers' discretion was increased from 40% to 50% outside London, but our preliminary analysis of HIP allocations indicate that authorities with known large defects problems actually received a decrease in allocations. This may also be affected by other factors, but it is clear that whatever the final explanation, the measures have had no meaningful effect, and are quite inadequate, and will have no impact on the problem at all. The Department of the Environment have shown a willingness to find an indicator within the General Needs Index which can take account of defects in a mechanical way. The Association remains sceptical about this proposal, and continues to argue for more resources, outside the existing framework and to fully reflect the magnitude of the problem.

Prefabricated Reinforced Concrete Dwellings

5.3 The Government firstly accepted that some provision should be made for Airey dwellings, and repair grants were made available to private owners (50). The vast majority of these dwellings remain in public ownership, and no additional finance has been forthcoming for remedial works, nor seemingly, to reflect the additional capital to meet the repair grants given to private owners.

5.4 The scale of the problem has begun to dawn gradually upon the Government and the Association has recently been consulted on some new proposals to assist private owners of other types of prefabricated reinforced concrete (PRC) dwellings. In the response to these proposals, the Association drew attention to the unsatisfactory piecemeal approach: -

"Local authorities are being asked to tackle, firstly, the problems of Airey dwellings; secondly, six more PRC dwelling types; thirdly, the Smith houses (arrangements to be announced); and fourthly, six more types of PRC houses are being studied. Individually, the problems are large enough, but the cumulative effect is far more serious, and if presented together, would undoubtedly have affected the local authority response. Moreover, the Association has identified many further types of non-traditional houses, which are not of the PRC type, which the Government have yet to agree to examine.".

We then went on to outline the likely result of this report and the fact that there were already known to be many defective types of industrialised dwellings from this period.

5.5 The Government proposals to safeguard the position of private owners is discriminatory and unsatisfactory in many respects. We do, of course$_1$ wish to see sufficient resources devoted to disrepair in the private sector as the long term consequences of under-investment in this area would in any case fall upon local authorities. However, the imposition of statutory rights to a repair grant, or repurchase of defective dwellings by local authorities in some cases, merely pre-empts resources from other areas which may be every bit as needy; and adjacent public sector dwellings receive nothing at all.

5.6 The 'proposals for assistance' in respect of PRC dwellings do, at least, represent Government recognition that defective types do exist (something that was resisted apart from Airey dwellings for a long time). As yet, we have been unable to persuade the

Government to take comprehensive research into defective types of 'non-traditional' and industrialised dwellings. There are certainly known defects in many non-PRC 'non-traditional' dwellings, and many defective types of industrialised dwellings apart from Bison which the Government have now acted upon.

Bison Dwellings

5.7 The DOE wrote in October 1983 (51) to advise local authorities which own flats and houses built in the Bison Wall Frame system that they should take steps to satisfy themselves, if they have not done so already, that these buildings do not have certain specific defects which may present a safety risk. The letter had been sent as a result of the recent public concern about the safety of these buildings. In the letter, the DOE state that in the light of this concern, and as a precautionary measure, they are collating and reviewing reports of failures in flats and houses of this type.

5.8 The DOE's work "suggests that certain defects, although they may be infrequent, could lead to failures which, in exceptional circumstances, could present a safety risk.... Such failures could occur, in particular, where, because of shortcomings in the original specification, or the manner in which it was executed in manufacture or on site:

(a) no effective mechanical connection is made between load bearing wall and floor panels, and/or the bearing of floor and bedding of wall panels is inadequate, and/or the load bearing walls are not effectively restrained by buttress walls or spandrel panels;

(b) parapets are not effectively tied back;

(c) ties between the inner and outer leaves of external wall panels are lacking altogether, are insufficient in number per panel, or are of unsuitable material;

(d) inadequate cover or the presence of chloride has led to corrosion of the reinforcement and consequent spalling of pieces of concrete, in particular from external wall panels;

(e) pieces of exposed aggregate, used as a wall finish, are not adequately secure.

5.9 The DOE have asked local authorities to let them have details of appraisals of Bison dwellings which they have undertaken or have in mind, and details of any steps taken or proposed to eliminate safety risks. The DOE have also requested local authorities to make available the results of any appraisals to those who have bought, or may consider buying, from them flats or houses of the Bison design; and, where practical, to include their properties in any appraisal made by the authority. The DOE have also suggested to local authorities that they might find it useful to consult with other authorities that own buildings of this type so that information on methods of inspection and repair can be exchanged, and have offered to assist in the exchange of this information.

5.10 It is not yet clear what action might be proposed by the DOE in respect of Bison dwellings, nor if any assistance will be given to owners. Nevertheless, the DOE letter puts the onus for assessment largely upon the local authorities themselves and indicates, once again, a special concern for any private owners.

6. COST IMPLICATIONS

6.1 The cost of remedial works is extremely difficult to quantify. The variety of systems and associated problems means that it is very difficult to give more than a few 'pointers' to the type of work being undertaken and the costs involved with that work. For our First Report (30) we were better able to construct an average unit cost as whilst there were a similar number of systems, problems were more uniform, and being all low rise housing were not complicated by high and medium rise built forms.

6.2 There have been attempts to aggregate costs for one or two aspects of the problem. In 'Roof' (61), Roger Critchley, apparently drawing on experience from the National Association of Bison Tenants (NABT), estimated the cost of dealing with Bison flats at "over £1.4 billion". However, we feel, in the short or medium term, that this estimate is too high. Certainly, there are examples of refurbishment costing up to £20,000, and in some cases the cost of demolition and replacement (where the decision has taken other factors into account) is much higher. However, some authorities have managed to carry out a series of minor repair works, some of which are financed by revenue budgets, and more difficult to quantify.

6.3 The cost of asbestos removal from dwellings (mainly) and other industrialised building has been put at £1 billion by Building Design (62). This gave details of expenditure on asbestos of over £100m by just four London boroughs. Member authorities have also confirmed to us that the cost of dealing with this problem alone is running into hundreds of millions of pounds and it is fairly common to find the cost of tackling one scheme alone exceeding £1million. One London Borough which has carried out the most extensive surveys has found asbestos in 10,728 dwellings in half of its housing stock. The average cost of removal has been £1000 per dwelling. The likely cost for this London Borough so far is therefore £10m, and if the total dwellings affected rises to 20,000, as might be expected when the survey is complete, the cost could rise to £20m.

6.4 Perhaps the easiest identifiable single element is the cost of demolition and replacement. We estimate that there are already 10,000 units of accommodation demolished or scheduled for demolition. Assuming an average cost for this work, and attendant costs of 'home loss' and other payments of £30,000 per unit, this alone produces a sum of £300 million.

6.5 Remedial costs for the various works are more difficult to estimate, but it is possible to construct some average or typical costs based on responses from member authorities:

High Rise

Cladding failures £1,000 per flat

Spalling concrete £100,000 to £300,000 per block*

* assuming repair is possible see para 4.6.

Expansion joints and retying infill panels £250,000 per block

Balcony repair/replacement £50,000 per block

Replacement window frames £1,500 to £2,500 per flat

(premature deterioration)

High alumina cement replacement £50,000 per block

Rain penetration through walls £100-£1,000 per flat

Rain penetration through flat roofs and £50,000 per block

parapets (renewal of covering)

Improving thermal insulation and/or

remedying cold bridging and condensation £1,000 per flat

A number of other costs, such as re-asphalting walkways, repairs to external staircases and walls following differential movement, settlement to floor slabs, roof slab shrinkage, concrete lintel failure, are more difficult to average.

Some of these costs, such as repointing of sealant around window frames, which has to be redone at intervals, due to the action of the weather and differential movement, is seen as a revenue cost and not separately budgeted.

Low Rise

Improving thermal insulation £2,500 to £3000 per house

Rain penetration to cladding/ cladding repairs £500 to £1,000 per house

Replacing defective cladding £2,500 to £3,500 per house

Water penetration through flat roofs £1,000 per house

Replacement of flat or sheet roof with pitch roof £5,000 to £10,000 per house

New flue/flue protection works £1,200 per house

Improving fire barriers in cavities/ between £300 to £1000 per house

dwellings in framed construction

Again, some items are difficult poses. These include, stiffening the structure, or elements of it like the floors; improving roof fixings to the framed structure; roof wind bracing; and dealing with premature rotting of timbers due to water ingress over a period of time. Indeed, one member reported a cost of £2,000 per house for treatment and renewal of structural timbers, but there is a wide range of

problems affecting window frames, door frames, porches, and spandrel panels, largely due to poor detailing and lack of watertightness due to differential movement.

6.6 In many cases a high or low rise system suffers from more than one of the above problems, though not necessarily at the same time. It therefore seems reasonable to assume an average cost of around £5,000 per unit, bearing in mind that for some types the cost of replacement will be much higher, whereas there are others as yet performing quite well. Assuming 750,000 to 1,000,000 industrialised dwellings (see para 3.5), it is possible that the total cost of repair and replacement in the medium term will be £3,750 to £5,000 million. In the longer term, the potential life expectancy must still be in doubt and further works, perhaps more drastic, may yet be needed.

Revenue Costs

6.7 Revenue costs are even more difficult to estimate and generalise about. However, consideration of several factors leads us to believe that the assumption of an average cost of £5,000 per unit is not unreasonable, and may even be an underestimate when revenue costs are added, bearing in mind that they are continuous.

6.8 Revenue costs associated with demolition are very high indeed. Firstly, the debt has to be repaid long after the dwellings are demolished and rent income has ceased. An example illustrates the point.

Yorkshire authority demolishing 1,249 dwellings 15 years old approx:-

Debt outstanding £4.76 million

Remaining period of loan 45 years

Loan charges pa (at current rates) £710,000 pa

Cost of demolition £400,000

Additional debt charges £57,000 pa

Compensation costs £250,000

Additional debt charges £36,000 pa

However, the cost must then be added of building new dwellings to rehouse those displaced. A further substantial loss is then incurred as the income from rent is (for, say, at least the first 10 years) much lower than the cost of repaying the loan on rebuilding costs.

6.9 It must be borne in mind that about 80% of housing authorities no longer receive any form of subsidy towards existing or new loan repayments.

6.10 A further (unsubsidised) revenue burden is the higher maintenance cost associated with industrialised dwellings and high rise developments in particular. However, even greater costs flow from the social consequences of these forms of development, and these will include additional management costs, lighting and security measures, clearing and refuse disposal.

6.11 The Association therefore believes that the Government should accept more responsibility for the schemes which it helped to appraise and design, and to promote and impose upon local authorities.

In particular the Government should:-

- increase HIP allocations to enable housing authorities to finance remedial and replacement schemes, and not at the expense of other necessary housing activity

- provide an adequate subsidy to offset the burden of loan charges on the capital costs of remedial works; demolition costs; compensation costs

- take over the existing loan debt on dwellings demolished

- provide a subsidy for dwellings erected to replace those demolished

- consider a special subsidy arrangement for additional management and maintenance costs associated with this form of development.

7. SUMMARY AND CONCLUSIONS

7.1 Industrialised methods were developed to supplement the traditional building industry to meet new and higher levels of demand. This phase was similar to the late 1940's when non-traditional' housing was developed to meet the post-war needs. That led to record completions and especially high output in the public sector (see earlier report "Defects in Housing Part 1 - Non-Traditional Dwellings of the 1940's and 1950's"). The housing progress was not sustained, however, and a **new backlog of housing problems, particularly unfitness and disrepair in the older housing stock which necessitated large scale slum clearance activity, was beginning to emerge.**

7.2 In the early 1960's, the scale of the new housing problems became all too apparent and **Government launched housing programmes with exceptionally high housebuilding targets.** The public sector was seen as the main vehicle for this drive and would provide the rehousing for the occupiers of houses in slum clearance programmes. **Industrialised methods were therefore promoted by Government to rapidly expand the housebuilding industry and meet targets of up to 500,000 new homes a year. The public sector, which would be meeting basic housing needs, often with large scale redevelopment and high density schemes, would be especially suited to use of the new methods.**

7.3 The 1956 Housing Subsidies Act provided the financial framework for the development of high rise and high-density schemes. The 1961 Housing Act continued with this subsidy system and **local authorities were encouraged to design schemes with financial advantage in mind.** This continued until 1967 when a new Subsidies Act abolished extra subsidy for high rise developments.

7.4 The Government gradually increased pressure upon local authorities to adopt industrialised methods. This was done in a number of ways:-

(i) housing authorities had to agree housing programmes and additional allocations were given to those co-operating with the "drive" towards industrialising housebuilding;

(ii) a target of 40% of housebuilding to be industrialised (by 1970) was introduced and individual contributions agreed with authorities;

(iii) authorities using industrialised methods to the full were promised special arrangements, such as fast approval of schemes and priority treatment, with no need for competitive tendering;

(iv) the system of local bye laws was replaced by a national scheme removing 'irritating impediments' being put in the way of schemes by some 'over zealous' authorities. Local authorities were urged not to make changes to standard plans and layout arrangements;

(v) **the Government set up the National Building Agency and established MHLG regional offices to provide a series of local authority advisers to promote industrialised methods and provide help and guidance in the choice of sites, system, dwelling type, contract organisation and procedures;**

(vi) **local authorities were advised not to appraise the systems and methods they used, but to rely upon the Ministry and NBA, who later introduced formal appraisal mechanisms.**

7.5 **Government influence in housebuilding, through its departments and agencies, was direct and pervasive.** Programmes were agreed, not only in terms of the numbers to be built, but the methods to be employed, the type of scheme adopted, and contractors lined up with agreed prices. Authorities 'co-operating' received higher allocations and were given priority. Essentially, if local authorities wanted a substantial housing programme, they had to accept what was determined for them and relied on the judgement of Ministry and NBA officials. Local authorities were, of course, not blameless and were generally compliant partners and, in some cases, enthusiastic pioneers of new methods.

7.6 Appraisal certificates were issued in respect of 89 systems, although all systems in general use were also appraised by the NBA. **The issuing of a certificate, however, whilst intended as a guarantee that the system was "sound and suitable for a 60 year loan sanction", has now been found to be deficient** and some 'appraised' schemes are now known to be very defective. This raises very important questions as to the liability, not only of the NBA (now wound up), but the Government itself.

7.7 **The building industry had to use industrialised methods to extend output beyond the limitations of traditional building.** New materials could be used and both on-site and off-site prefabrication enabled greater use of unskilled labour. Mechanisation was developing coincidentally and the new schemes were also well suited to new architectural conceptions.

7.8 **The Government departments also collaborated with builders and manufacturers,** encouraging them to produce systems and components, and suggesting alterations etc. Developers were also able to agree levels of output and be put in touch with

authorities requiring schemes of the type offered. National and regional prices were also negotiated.

7.9 Government statistics for industrialised building were inaccurate and unreliable. From those statistics, it would appear that about 3/4 million dwellings of this type were built. However, we think a more realistic figure is nearer 1 million.

7.10 **Industrialised building was generally not cheaper than traditional construction except in the most favourable circumstances** of high levels of output with a continuous programme. Decline of industrialised building was inevitable when the housebuilding programme was reduced by Government and special subsidies removed. By the later 1960's, disaffection was already growing, especially with high rise forms and the disaster at Ronan Point sealed the fate.

7.11 **The defects problem is very widespread and has affected low, medium, and high rise forms of construction.** The defects described in section 4 are not necessarily a function of industrialised methods but are certainly more prevalent in this type of construction and may also be attributable to the built form - which is determined by the method employed.

7.12 Dealing with virtually all of the problems has been very expensive, but their nature is varied. Cutting new expansion joints, or dealing with spalling concrete are obviously major structural problems, whereas, replacing mastic sealants may be necessary as a continuous maintenance operation. In our assessment, we have largely ignored the continuing maintenance burden, which is generally accepted as being much higher for this form of construction and concentrated on remedial works schemes, which are generally capitalised. Nevertheless$_1$ in deciding the future of schemes, local authorities will obviously have regard to longer term maintenance costs as well as other problems which determine whether the schemes are acceptable places to live, including associated management costs.

7.13 This study is of necessity limited and cannot hope to be fully comprehensive. **We therefore believe that a more thoroughgoing study is necessary** which cannot only quantify the problem of defects in greater depth and detail, but can also assist local authorities to determine appropriate schemes of remedial works. **Bearing in mind Government involvement with these schemes in the first place, we believe they now have a responsibility to assist in this way.** It is quite possible that remedial works schemes, which are often costing more than the original building works, may themselves prove defective in years to come unless a co-ordinated programme of evaluation is set up.

7.14 It is quite apparent that **the initial appraisal was inadequate, prepared in haste to avoid slowing down the progress of political initiatives, and with no follow up assessment in use.** Indeed, records of the various types, including construction details are extremely difficult to obtain and there was evidently no intention of any post-assessment. Experimentation was therefore boundless, with no attempt to control, monitor, and learn from that experience.

7.15 The cost of dealing with the defects problem is obviously difficult to quantify. Nevertheless, judging from the regularity of which certain items appear for different types and systems, it seems that the average unit cost will be around £5,000. This allows for the fact that some schemes are, as yet, performing well whereas others have been the subject of most extreme and drastic action. The **total cost could therefore be up to £5,000m. Bearing** in mind that **10,000 dwellings have already been demolished at a cost of £300 million,** and the number of authorities with current remedial works programmes of between £10 million and £50 million, our estimate is thought to be fairly sound.

7.16 Capital expenditure must obviously be accommodated within **housing capital allocations (HIPs), but these have been substantially reduced by Government in real terms since 1979. Further reductions are also planned for 1984/85 and 1985/86 (72**). It seems to us, however, that **expenditure should be geared to enable the deterioration of the public stock to be effectively dealt with** and to prevent further, and more costly, decline. It should be borne in mind that the older private housing stock condition which also has to be accommodated within HIPs is also in need of increased provision and the provision of new public sector housing is at an extremely low level.

7.17 **The cost of industrialised building problems is also high in revenue terms. Increased management** and maintenance costs are very significant, but considerable extra costs are increased in loan charges on the cost of remedial works, demolition costs, and compensation payments. Where houses are demolished, loan charges will, in general, continue to be met for a further 45 years or so without the benefit of rent income. It should be borne in mind that around 80% of authorities no longer receive an Exchequer Subsidy to their Housing Revenue Account.

7.18 The Association welcomes the fact that provision is to be made for private owners of non-traditional dwellings, but believes the **Government should recognise its responsibility for all dwellings which are now defective, and were produced as a direct result of previous Governments' actions, and compensate public owners accordingly. Local authorities should not be expected, nor can they afford, to meet the additional capital and revenue expenditure** within existing resources.

7.19 The Association is concerned that the possibility of successful legal action to secure redress in respect of design errors and bad workmanship has, if anything, become more limited recently. It is hoped that the present review of the law in this area will lead to an improvement of the client's position.

7.20 Previous experience in both the 1940's/1950's period of 'non-traditional' construction and the 'industrialised building' of the 1960's and 1970's has demonstrated the **grave weaknesses of stop-go investment patterns** in housing and construction. In both cases, a backlog of housing need has had to be catered for by new untried designs, materials and techniques. This was essential, as the traditional industry was constrained by limits on the availability of skilled manpower, traditional materials, and existing patterns of organisation. Expansion of this order can never hope to be successful, and can only hope to succeed where it is gradual and controlled and development monitored and evaluated, in use, over a substantial period of time. With the current decline in housing investment, and the emergence of new and growing housing needs, **we again seem to be moving towards another period when the same choice will face us - sudden expansion of output with new untried methods and materials, or unacceptable housing conditions. That can only be avoided if our problems are recognised now.**

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TABLES

APPENDIX 1 APPENDICES TO CIRCULAR NO 76/65

Appendix 1

SERVICES OFFERED TO LOCAL AUTHORITIES

1. The Headquarters of the Ministry are responsible for the overall determination of the priorities for the deployment of these services in support of the Government's housing policy. In respect of those services in which both the Ministry and the National Building Agency are involved the Ministry's regional offices* will be responsible for the co-ordination of action. In general, in order to avoid overlapping, local authorities are asked in the first instance to consult the Ministry's regional offices* before seeking the advice of the Agency or of the Ministry's Headquarters.

2. The services available will be : -

(a) choice of sites: consultation on the suitability of individual sites for industrialised building (Ministry/Agency);

(b) choice of system: advice will be offered on systems available and suitable for the authorities' requirements of density, range of family sizes, etc. (Agency);

(c) advice on dwelling-types, layouts etc.: the usual Ministry Regional Architect service to groups and individual local authorities will concentrate particularly on schemes in the drive; this will be done in consultation with the Agency so that choice of system, plan types and layout are effectively related (Ministry/Agency);

(d) organising phased programmes: the Ministry will be continuing and expanding their services to consortia, and will also be ensuring that schemes of individual authorities are grouped *ad hoc* into co-ordinated programmes (Ministry);

(e) the Ministry and the Agency will co-operate to secure a satisfactory flow of work for each successful system. In addition, specialist help will be forthcoming from the Agency’s project planning engineers, who will also be available to advise authorities on methods of programme control (critical path, network analysis etc.). They will provide a full or partial service on a fee basis where required (Ministry/Agency)

(f) statutory procedures: advice will be available on the choice of statutory procedures for land acquisition etc. Priority will be given to the Ministry's handling of schemes forming part of the drive. Stickers will be supplied to identify letters relating to these schemes (Ministry HQ);

(g) other procedures and consultations: the Ministry will help where appropriate on consultations with local planning authorities, statutory undertakings etc. (Ministry):

(h) in a number of cases where authorities are extremely short of staff or pending the recruitment of staff for working parties about to bc established by consortia, the Agency can provide full or partial architectural services, if required. Where these are provided on a scale beyond normal advisory services professional fees will be charged (Agency);

(i) in special cases the Ministry or the Agency will carry out demonstration or pilot projects (Ministry/Agency).

Appendix 2

APPRAISAL CERTIFICATES AND THEIR RELATIONSHIP TO THE

ARCHITECTS CERTIFICATE

The National Building Agency's appraisal certificates

I. Before adopting an industrialised system of building, a local authority will wish to be satisfied that the construction techniques used are sound, that maintenance costs will not be excessive, and that the initial capital cost will be comparable with that of a similar dwelling built by traditional methods. The certificates being issued by the National Building Agency in respect of individual systems will appraise these, and other aspects of the system. (For further advice on comparative costs see also para. 10 of the Circular, and Appendix 3).

• In the south-east, where the Ministry has no regional offices, all references to such offices should he understood as referring to the branch at Ministry Headquarters dealing with housing matters for the authority's area.

2. With most currently available systems it is possible to produce a wide variety of dwellings. In order to obtain comparable examples on which to comment, the Agency has invited sponsor; to provide a detailed specification and plan for a 5-person house to Parker Morris standards, on the basis of a performance specification produced by the Agency. This dwelling is known as the "offered dwelling".

3. The issue of an appraisal certificate by the Agency indicates that the building system to which it relates has been examined by the Agency, and is considered by them to be suitable for local authority use and 60-year loan sanction. In particular, the certificate confirms that dwellings can be produced at a reasonable initial cost, and in compliance with the necessary technical and space standards. For two-storey houses and flats or maisonettes up to four storeys, the certificates will cover all performance standards, including structural stability. For higher buildings all performance standards will be covered, except structural stability, in respect of which calculations must be done individually because of the many variable factors.

4. The certificates are intended for use by local authorities, their professional advisers and other *bona fide* building clients. They may be obtained from the National Building Agency, *35-38* Portman Square, London W.1. They will not be available to the public at large, and will be copyright so that reproduction in whole or part is forbidden except by permission of the National Building Agency.

5. The certificates will be charged for at a fee of one guinea per copy to defray cost of printing and distribution. Each copy will be numbered and the distribution will be registered so that any subsequent amendments may be automatically distributed to holders of certificates.

Approval of system-builders' type plans and prices

6. In addition to the appraisal of **systems** described above, arrangements are being made to approve type plans submitted by sponsors, as set out in para. 8 of the Circular. Where the sponsor wishes a price will be agreed for the design as described in Appendix 3.

The local authority's responsibilities

7. The issue of an appraisal certificate does not, of course, relieve a local authority of the need to obtain loan sanction from the Ministry. There will therefore be no change in the present certification procedure in T.C.1. Where plan types approved under the arrangements mentioned in para. 6 above are used without modification the certificate in para. 5(a)(i) of Form T.C.1. will be appropriate. Apart from this the local authority must ensure that -

(a) they use the system in accordance with any conditions set out in the appraisal certificate;

(b) they make application for any necessary relaxations of Building Byelaws or Building Regulations (the appraisal certificate will specify these);

(c) they nominate a professional officer or adviser to take full responsibility for site supervision;

(d) in the case of buildings above four storeys, they check structural calculations as necessary under the Building Byelaws or Building Regulations.

Appendix 3

APPOINTING THE CONTRACTOR

Nationally agreed prices

1. As part of the assistance which it is offering to local authorities in the industrialised building drive the Ministry intends to enter into price agreements with system sponsors for a range of the various types of standard dwellings they are offering. These prices should not only speed up negotiations on individual schemes, but should help to ensure that the financial benefits of large-scale production in long runs are passed on to authorities. These price agreements, which will also cover preliminaries, external and site works, will represent a firm commitment on the part of the sponsors to enter into contracts with local authorities on the basis of the prices and conditions set out in the agreements. When several systems are recommended to an authority by the National Building Agency, information will be given on the agreed prices by the Ministry, thus enabling the authority to select a system suitable to their needs with the prior knowledge of the level of cost involved. The local authority can then, in agreement with the sponsor they select, apply the agreed prices to their own scheme in the confidence that the resulting contract sum is likely to be acceptable for loan sanction when application is made to the Ministry. In medium and high density schemes the principles set out in Circular No.40/63 for ensuring that the building heights and block forms selected give value for money will continue to apply.

2. This procedure provides a basis which enables sponsors to compete with one another both in the quality of the dwellings offered and in price, not on individual contracts, but on a national basis. It is sufficiently flexible to enable them to quote their most favourable rates for the localities in which they are best able to work. All firms offering a sound system at a competitive price may expect to attract a share of the market in the localities most suitable to themselves, and those systems having the best combination of quality, price and productivity should be able to secure continuous production under optimum conditions. Sponsors will have opportunity to revise their quoted prices at reasonable intervals.

The way to use nationally agreed prices

3. If full benefit is to be derived from this approach, authorities should avoid having a succession of small schemes each using a different system. Wherever possible, each contract should be for 100 dwellings or more. Nor should authorities regard the nationally agreed prices merely as a first sieve in selecting firms whom they will invite to tender on a competitive basis. If authorities are in any doubt about the application of the agreed prices to a particular site or contract, the Ministry's officers will advise.

The Interim period

4. It will be some months before nationally agreed prices are available and in the interim period while agreements are being negotiated by the Ministry, or where firms are not covered by these arrangements, the Ministry's officers will be prepared, if required, to assist authorities in any separate competitive tender arrangements, or price negotiations with an individual firm, that may be necessary.

Briefing the contractor

5. Many advantages flow from the appointment of a contractor for industrialised building at the earliest stage (see para. 6 below). The availability of information on prices and supply from the Ministry and the Agency should help authorities to do this.

The following procedure is recommended :-

(a) The local authority, on the advice of their own architect, or a consultant employed by them, prepare a design brief.*

(b) The architect prepares a preliminary layout.

(c) The architect studies a short list of systems on offer to ascertain how far each can meet the main points of the brief, and what the comparative costs are likely to be (on the basis of the agreed prices).

(d) The authority decide which system they will use.

* The main points to be included in a design brief are as follows:-

(a) the total number of dwellings, and the approximate proportion of dwellings of different sizes;

(b) the general form of development i.e. whether in flats, maisonettes, houses, or a mixture in certain proportions;

(c) the way in which the layout will fit in with the general road pattern and development form of the town ; and the method of providing for segregation of vehicles and pedestrians;

(d) the standards of provision of children's play-space;

(e) the standards of provision for car storage, and for parking of visitors' vehicles;

(f) the standards of space, fittings, equipment, and heating in the dwellings;

(g) any special requirements for multi-storey buildings, with regard to lifts, refuse chutes, plumbing, drying areas and similar matters;

(h) details of site conditions, including levels, nature of subsoil and liability of subsidence, site investigation report (in the case of multi-storey buildings), trees to be retained, services available, etc.;

(i) the constructional standards and widths of roads;

(j) building byelaws or building regulations, relevant B.S.S.'s and C.P.'s to be complied with, etc.

(e) The sponsor collaborates with the local authority's architect on the application of his system to the particular scheme.

6. The aim should be to set up, right from the preliminary layout stage, a close and effective liaison between the local authority's architect, with his knowledge of user needs and environmental requirements, and the sponsor, whose knowledge and experience of production and erection techniques can be brought to bear on the financial effects of particular design solutions. To this end, it is essential that the selected sponsor should be given a design brief and full weight should be attached to his contribution to the planning of the job, subject to the final responsibility of the local authority's own adviser.

APPENDIX 2

INDUSTRIALISED DWELLINGS BY SYSTEM

STATISTICS FOR NUMBER COMPLETED DURING PERIOD 1964-1979 FOR LOCAL AUTHORITIES AND NEW TOWNS IN ENGLAND AND WALES

System Number

Anglia (Taylor Woodrow Anglian) 683

Anvil 831

Arcal (G.80 Developments) 1125

Arrowtrim 42

Arrowhead Housing (ex Rigid Frame) 588

Balency 3529

T Bates & Son 826

Beal & Son 360

Belfry 1425

Bison High Wall Frame 30607

Blyth 186

Boro 82

British Housing 74

Bryant Low Rise and Wall Frame 12058

B R S (Battery Casting) 3425

Building Systems 310

Burt Boulton 49

Calder Homes 563

Camus 6090

Canadian Timber 143

Carlton 347

Cebus 621

C M (Calverley Industrialised Buildings) 923

Cornish Unit 219

Cosmos 154

Crux 422

Dorran 639

Discus 74

Drury System 3 3026

Dudley Coles Ltd 116

Easiform (Laing) 12318

Engineered Homes 778

Eurodean 581

Faculty (Dudley Coles) 117

F & J Halliwell 33

Fram/BRS 2447

Fram Components 879

Framecourt 82

Frameform (James Riley & Partners) 12773

Fredericks 59

Gerrard 88

Gerrard Incon 254

Gerrard Intrad 504

GLE System 3237

Gray Holme 163

Gregory Housing 1301

Guildway 3133

Hales Rationalised Traditional 139

Hawthorne Leslie 2021

Homeville Industrialised 710

Housing Development & Construction Ltd 524

H S S B (SLP Industrialised Buildings) 847

Howard Mersham Housing 58

Isec 258

Jesperson 12m 8184

Kenkast 966

Kier BDC 36

Laings Rationalised Traditional 70

Larsen & Neilson (Taylor Woodrow & Anglian) 7951

Lawrence Weaver Rationalised Traditional 6

Lecaplan 1542

Lesser 4480

Lift Slab 607

Lilleshall 384

Local Authorities Own Systems 10247

Lowton Cubitt 8448

Lovell 2001

Mac Trad 2273

Martin Construction 39

Matthews & Mumby (M2) 1286

McLean Rationalised Traditional 582

McLean (Wolverhampton) 100

Medway 420

Metracon (Selleck Nicholls) 38

Metratim (Selleck Nicholls) 6163

MFC Moss & Sons 821

Middleton Rationalised Traditional 732

Midland Housing Consortium 10868

Minox 2225

M L Meyer 235

Modus 278

Mowlem 14250

Multiflex H12 (Swiftplan) 108

Mucklow 92

Multilite 422

Multi-storey Construction Ltd 294

MWM (Stanley Miller) 2150

NEMA Rationalised Traditional 88

Norwest 384

Open System Building 92

Others 1576

PAC 246

Parkwall 3018

Peak Homes 1878

Plus 3 (contracts) 49

Prometo 144

Quikbild 12467

Reema 8517

Resiform 1441

Ridgeway 69

Rigid Frame 27

Rileyform 2882

Rofton 563

Rowcon 1976

SB2 164

Scan 225

Sectra 2535

Selleck Nicholls Rationalised Traditional 5466

Selleck Nicholls Timber Frame 564

SF1 (Indulex) 199

Shadow Wall 90

Shaneley Rationalised Traditional 622

Shepherds Rationalised Traditional 1780

Simmcast 628

Simms CDA 1772

Siporex (Costain) 869

Skarne (Crudens) 6948

Spacemaker (Shepherd) 2752

Spaceway 48

Spooner 213

Spooner (Caspon) 5300

Spooner/Urban 574

Storifirm (Laing) 3118

Stubbings Industrialised Low Rise 76

Stubbings Rationalised Traditional 1349

Sundh 386

Sunley Allbetong 1164

Surebuilt 1203

Tracoba 673

Trada 1716

Trim (Dudley Coles) 61

Truscon 694

Trusteel MK II 1761

Trusteel 3M 3951

Trygon Rationalised Traditional 1466

Unit System 66 2097

Vic Hallam MKs I & II 2445

Vic Hallam Home-pac 372

Wates 6144

Wates (Midlands) 2060

Wates : Low Rise 3013

Wates : High Rise 8731

Well Built (A Halliwell & Sons) 146

W G West & Sons 1257

Weir 590

Wimpey 6M 3053

Wimpey No Fines 128, 145

X W (Selleck Nicholls Williams) 3683

YDGH MK1 (Yorkshire Development Group) 3435

C M Yuill 460

4H/7 (H A Holmes) 148

5M (MHLG) 3151

TOTAL 453853

Source: Housing and Construction Statistics (38), (39), (40).

APPENDIX 3

NBA APPRAISAL CERTIFICATES ISSUED TO SPONSORS OF LOW-RISE HOUSING SYSTEMS IN ENGLAND AND WALES

1966-67

Belfry

Bison

Bryant

Carlton

Dorran

*GLC Anglia (TWA)

Tracoba

*Gregory

HSSB

*Industricon

Easiform

Calder

Calverley

Eng. Homes

*Fontaberry

Frame Form

Guildway

Hallam

Arcal

Arrowhead

British Housing

Building Systems

*Cornes

5M

*HLB

Homeville

*Ideal Industrialised

Jesperson

Lecaplan

Modus

*MOSS MFC

Reema

Mowlem

Parkwall

Lawrence

Mactrad

Medway

Mucklow

Multiflex (Swiftplan)

*purpose Built

Quickbuild

Resiform

Lowton Cubitt

*Mark

*Nuttal

Kier BDC

Lesser

MHC

*page Johnson Peak

RT (SNW)

*Ratra

*Sawston SB2

Skarne

Spacemaker

XW

Wimpey

Rowcon

Sherwood

Spooner

Rofton

*Roy

Trusteel

Simms

Surebuilt

*Tybuilt

Unit 66

WG

Crux

1967-68

*A McK

*Federated

Fram

Lovell

Minox

OSB

Stubbings

*Transitional

Trim

*T & N

Wates

*Gale

Fredericks

*Token

*System 3

1969

*Humphreys

*Jansel

*Gart

*Trendsetter

*Willett-Industricon

* Not appearing in Housing Statistics as 'Industrialised Building' activity.