

# Housing—An Industrial Opportunity

by

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The housing shortage from which many countries were suffering even in 1939, and which the war has rendered much more acute, will be one of the first problems to be tackled when peace is restored. One solution may lie in the direction of the mass production of houses. What the possibilities are of progress in this direction and what effect such technological change would have on employment in the building industry are discussed in the following article by Mr. Miles L. Colean, an American architect who was formerly Assistant Federal Housing Administrator, and in 1940-42 Director of the Housing Survey of the Twentieth Century Fund.

THE American construction industry has ample cause to be proud of its achievements. In its skyscrapers, its industrial plants, its intricately equipped hotels and hospitals, its great dams and bridges and highways, it has produced prodigies that may well awe observers unfamiliar with what in the United States have become commonplaces.

In the production of such wonders, the construction industry has developed supervisory organisations of great capacity, boldness, and resourcefulness; it has assembled a host of workmen and special trades contractors capable of handling all the diverse requirements of large structures; it has fostered manufacturing enterprises to supply its various demands for materials; it has introduced into its operations the use of machinery and mechanised processes to an extent found nowhere else in the world.

These are indeed notable achievements. But, in the whole range of a nation's need for construction services, they are achievements of a partial and particular sort. They have been greatest where a special—even a spectacular—purpose was involved and where a challenge to ingenuity and time existed. They have been less notable in the supposedly simpler and certainly less showy types of buildings that make up the body of the urban picture. In providing shelter for the ordinary citizen, the achievement by contrast has been notable for its deficiencies.

# THE SPECIAL CHARACTER OF HOUSE PRODUCTION

There are rather obvious reasons why house building has not shared in the triumphs which the construction industry has elsewhere attained. The most patent of these is that the best talent in the industry, until fairly recently, has not paid much attention to housing. The rewards both in dollars and acclaim were in other fields, and these lures attracted not only contracting organisations but the best designers and workmen as well. Because of this concentration of effort on special-purpose structures, the whole organisation of the construction industry has been built up around their requirements.

The complex subdivision of trades, the great responsibility resting on subcontractors, and the dependence on a variety of personal skills, all reflect the need encountered on such buildings for an assemblage of specialists, the exact composition of which is dictated by the character of the particular building. In other words, construction organisations (in the complete sense of general contractor, subcontractors, and artisans) are specially created for the particular job. These organisations rarely perform a task of an identical nature and they rarely reappear in an identical combination. Workmen move freely from subcontractor to subcontractor; subcontractors shift their allegiance to general contractors as opportunities appear; while the general contractor selects from the group of subcontractors those who are best accommodated to his present purposes, without any sense of responsibility for their future employment.

This kind of organisation is well—and perhaps ideally—suited to the erection of a large structure more or less unique of its kind. The variety in such structures makes a more permanent and less flexible type of organisation impracticable. The question may be asked, however, whether this one method of organisation is as adaptable to all types of construction operation as we have attempted to make it. This question may be most emphatically raised in connection with operations which, however small they may be, consist of units that might be substantially duplicated in subsequent operations, or, however large they may be, are made up of units among which there is much similarity.

The distinction I am trying to make may not be altogether clear to readers unfamiliar with construction. In fact, it has, apparently not always been evident even to some of the most expert builders, who often have undertaken large groups of dwellings in exactly the same manner as they would undertake a huge hospital or university or industrial plant, in which the same repetition of small, similar elements does not exist. Failure to make this distinction—failure, that is, to realise the full advantage of the possibilities of structural standardisation and repetition in house building has been largely responsible for the fact that the so-called big construction firms have not generally been effective and economical house builders.

A type of organisation and a method of operation that are efficient and flexible so far as large, special-purpose structures are concerned has proved cumbersome, unwieldy, and extravagant when undertaking the production of houses. Because of this, we have had a situation where the best equipped organisations have frequently found themselves unable to compete with smaller and certainly more primitive types of organisation, in which even the principal himself may work with tools on the job.

# Scale of Operations

Illustrative of the character of the house building industry as late as 1938 is a study made by the Bureau of Labor Statistics.<sup>1</sup> This indicates that as much as 36 per cent. of the new single-family houses built in urban United States were constructed by builders who built less than 5 houses per year, while only 11 per cent. of the total houses were built by builders who produced 100 houses or more. The average production per builder was 3.4 houses. Thus the single-family house—the staple of the American house building industry—has clearly been a very small-scale sort of business.

In the construction of rental housing (almost always in apartment or flat buildings) the size of the operation was somewhat larger. A special tabulation made from the Bureau of Labor Statistics data indicates that for the year 1939 the average production of builders constructing multi-family houses (3 or more family units) was around 48 family units per builder. This figure is deceptively large, however, since in that year, as a notable variation from type, three builders, two of them in New York City, built over 1,000 units each. It is, moreover, significant to note that in 1939 only 16.9 per cent. of total housing production was in multi-family structures, and that of this proportion, 24 per cent. was done under public rather than private auspices.

#### PROGRESS OF STANDARDISATION BEFORE THE WAR

Prior to the present war, there was increasing recognition of the fact that any continued expansion of the volume of house pro-

<sup>&</sup>lt;sup>1</sup> Builders of 1-Family Houses in 72 Cities, Serial No. R 1151 (Government Printing Office, Washington, D.C.).

duction would necessitate the development of techniques particularly suitable to a mass market. This attitude was stimulated by the availability of mortgage credit with extended payment periods and low interest rates, largely the result of the activity of the Federal Housing Administration; and it permeated every level of the industry from the builder to the manufacturer of materials.

In spite of many surface contradictions, there was a surprising amount of underlying unity not only as to the objective but as to the ways in which the objective might be reached. First, it was widely recognised that the small house, whether built as a detached dwelling or in groups or rows, was an article in which the basic variations were few and in which, therefore, a considerable amount of standardisation of parts was possible. Then, on one side, we find experiment in processes of assembly aimed at taking advantage of this important quality, while from the other we note a search for materials better adapted than those of traditional construction to mass production processes.

As a direct result of these movements, the middle and late thirties saw a continued, if slow, progress in the reduction of the number of shapes and sizes of many building materials and equipment items, and in some cases in the co-ordination of sizes among materials frequently used together. Marked advances were made in the production of heating and refrigerating equipment suitable to small, inexpensive houses, the previous lack of which had been a strong deterrent to small-house construction. Such developments as copper tubing, insulation, plywood, and other synthetic wall and floor covering materials greatly increased the amenity and permitted savings in the cost of maintenance, if not always in the original cost, of housing.

The use of mechanised processes was increasingly evident in the work of operative builders developing large tracts of land. In many instances this was carried to the extent of precutting lumber and of assembling wall, floor, and partition sections before erection. Since the gains to be achieved from mechanisation were directly dependent upon the amount of repetition, there evolved a trend towards larger-scale operations and greater typification of the dwellings or parts of dwellings within the project. Progress in the art of land planning as well as an increased appreciation of design helped to prevent an appearance of monotony.

Early in the decade, numerous, but largely ill-fated, experiments were made with new structural systems using concrete, steel or other metals, or synthetic materials of many kinds, all designed to convert a handicraft system of production at the site to a system involving more or less complete assembly of the house or its parts in a factory.

It was not, however, until improvements had been made in the manufacture of plywood and new principles had been developed for its use<sup>1</sup>, that prefabrication groped its way out of dream and theory into practicable production. By 1941 there were a number of companies successfully engaged in house prefabrication. Most of these companies used systems composed of wall, partition, and sometimes floor, ceiling, and roof panels made by gluing sheets of plywood to light wood frames. Although the volume of prefabricated production was small, the promise of expansion was good.

There was still, of course, much to be done before full advantage could be taken of the evolving techniques. Local organisations, still dominating the picture, were often effectively hostile to the intrusion of more integrated, non-local enterprises. Labour rules and customs remained resistant to mechanisation, particularly where the operation was removed from the site to the shop. Building codes in great measure also acted as bulwarks against change. Such obstacles had, however, to be brought to light, and here and there inroads were beginning to be made against them.

### IMPACT OF THE WAR ON HOUSE BUILDING

# Immediate Effects

In the midst of this mounting industrial ferment the war struck. The impact of war upon house building has produced mixed effects. On the one hand, shortages of materials have called a halt to improvements in amenity and to much of the technical advance that was well under way. Costs have gradually crept upward, and quality has, more precipitately, declined. Prefabricators have been hit especially hard, since, generally speaking, the materials available as substitutes for the now precious plywood have served their purposes less well. It is not unfair to say that prefabricating techniques have been temporarily forced backward to those of a preframed conventional house rather than permitted to go forward with systems based on new structural principles capable of being applied best under factory conditions.

As against such retarding influences, war conditions, through the imposition of limits on prices and the use of materials, led to increased standardisation, simplification, and the use of cost-saving, mechanised processes in both private and public housing construction. The greater use of power tools and the precutting, prefitting,

<sup>&</sup>lt;sup>1</sup> The result of experiments made in the Forest Products Laboratory of the U.S. Department of Agriculture, Madison, Wisconsin.

and preassembly of materials was further advanced by the necessity of using fewer and less efficient labourers as the man-power situation grew progressively tighter. Since, again, advantages from all such means are greater on a fairly large project than in a house-byhouse type of business, the war speeded the trend towards larger building enterprises. This trend was affected also by the difficulties encountered in dealing with the several wartime governmental agencies that shared control over house construction-a situation more readily coped with by the large than the small operator. Numerous small firms for one reason or another found it advisable to retire from business. Thus by 1943, according to the Bureau of Foreign and Domestic Commerce<sup>1</sup>, nearly 20 per cent. of all contract construction firms existing in 1939 had been liquidated, and of these probably as many as 90 per cent. were firms that had employed less than eight persons. It is safe to say that house builders figured prominently among the small firms liquidated.

Under war pressures, there was occasional evidence of relaxation of some of the more restrictive trade union rules. When called for on war-related jobs, labour accepted prefabrication, and in some cases even permitted the preassembly of the plumbing system and the installation of wiring in the structural panels while still in the shop. By 1943, there were probably more than 30,000 union workers employed in prefabricating shops. At the same time, the refusal of the controlling Federal agencies to permit an excessive use of materials, even though required by local codes, brought the building code problem to the fore by clearly revealing the wastefulness and rigidity of many of these ordinances.

# Permanent Effects

It is, of course, too early to evaluate the permanent effects of the war upon either the organisation or the methods of the house building industry. Certain things, however, stand out as definitely promising. For instance, it should prove of lasting importance that (as compared with the past) a considerable number of large and resourceful organisations have found it possible, even under the difficulties imposed by wartime restrictions, to operate profitably in the low-priced field. It is also important that, in the production of their war housing projects, many of these organisations have recognised and applied some of the principles of repetitive operations that have made mass production successful in other industries.

Furthermore, stripping the house to its barest essentials, while resulting in a parellel loss in amenity, has served the purpose of

<sup>&</sup>lt;sup>1</sup> Survey of Current Business, Nov. 1943, pp. 16-18.

revealing the points where waste and inefficiency have been present and taken for granted in the traditional pre-war house. It may be recalled that progress in the evolution of low-priced automobiles was not made until Ford had undertaken a similar process of stripping the then expensive, hand-made motor car, reducing the number of its parts, simplifying the parts that remained, and applying to them with ever-increasing thoroughness the methods of mass production.

In housing, such drastic simplification would never have been permitted by the prejudices and sentiments of peacetime. Manufacturers, builders, financiers, and brokers alike would have been afraid of it; social workers would have cried out against it; and the public would not improbably have refused to accept it. Yet any student of industrial processes will recognise that stripping is an essential step in the development of mass production, and will thank the war for having brought it about. To be sure, the results have often been, in appearance and comfort, not much better than the original Model T, but we may take encouragement from the memory that, in the course of time, the Model T became something easier both to ride in and to look at.

### POST-WAR PROSPECTS

Assuming such changes to be of lasting importance, where are they likely to take us in the first years after peace? Or, in other words, what sort of house building industry is likely to emerge from the war situation, and what sort of houses is this industry likely to give us?

It is a safe prediction that no revolutionary changes either in organisation or output will come full-panoplied from the war. While it is true, that we have gone far in developing a new industrial approach, we have by no means yet established a new industry or created a new product. We shall find ourselves lacking sufficient quantities of many important materials, while plumbing and heating equipment, at the very outset of any non-war construction period, are likely to be available only in small quantities. The striking new designs and the startling new materials will not be there at all. The means at hand for undertaking peacetime building will, for a while at least, certainly be less than adequate to meet the potential demand.

The first post-war houses, consequently, are not likely to differ greatly in structure or appearance from those of 1940-1941. Although they will be better than the dwellings built under wartime restrictions, they may nevertheless in some ways be of poorer quality than their pre-war models. Because of scarcities and of pent-up demand, they are also likely to cost more than their predecessors.

The first post-war houses will probably in large proportion be built by the same operative builders who have been building the privately financed part of the war housing programme. Many of them, as has been pointed out, have gone far under war pressure in reducing their costs and mechanising their processes, and may be expected to go on in the same directions seeking the same broad market. Not a few of these builders, however, have uncompleted projects laid out for relatively high-priced houses which they will have carried over from the pre-priority era and which they will be anxious to resume. Moreover, the fact that no house construction above a \$6,000-limit has been permitted during the war is bound to direct a considerable portion of builders' interest at least temporarily to the market for higher priced houses.

# Prefabricated Houses

Another group likely to figure in the early post-war period are the prefabricators, some few of whom at least have been able to build up substantial businesses during the war. These firms and doubtless many new ones venturing into the field for the first time will endeavour to supply the demand for a moderately priced small house. But this group has many serious obstacles to overcome before its proportion of the total house production is likely to be substantial. Aside from the difficulties to be met from obsolete building ordinances and local prejudices, the most serious problem facing the prefabricator is that of marketing his product.

Unlike the operative builder, whose whole operation from assembly of materials to sale of the complete house is carried on in one location, the prefabricator must maintain separate sales and erection organisations to absorb the production of a central factory. Most prefabricators recognise the seriousness of this problem, but I believe few will claim to have solved it. Various plans have been put forward: sales through special dealer-erectors or established lumber yards, sales to operative builders, sales through department stores.

In almost all these schemes, it is evident that the prefabricator tends to place himself in the category not of the builder but of the manufacturer of materials, the principal difference between him and other materials manufacturers lying in the greater completeness of the product he offers. Few, if any, of those now actively engaged in prefabrication are prepared or expect to perform a completely integrated operation, including purchase and preparation of the land, installation of utilities, and erection of the houses. In some respects they have reserved for themselves the simplest part of the house building process. Their success will depend upon the effectiveness of the means they are able to evolve for handling the other parts. There is much more to prefabrication than the mere performing of certain site operations in a factory.

#### Technological Change

The early post-war period is thus likely to be one of reorientation and perhaps somewhat painful transition from the stringencies of wartime. As the industrial system of the country gets back to a peacetime stride, we may expect a gradual introduction into building of many new products, and many old products made of new materials. What these will be, no one can say definitely now, since the manufacturers of plastics and light metals, who are most likely to be involved, are still fully employed in war work and will not for some time yet have much surplus energy or material to devote to peacetime experiment.

Another trend that we are almost certain to witness is the continued shift of more and more of the processes of dwelling construction from the open to the shop. Whether the shop is the central factory of the prefabricator or a temporary set-up on the site of a single large-scale operation does not make very much difference with respect to the techniques used. We are also likely to see a trend towards the displacement in small low-priced dwellings of several of the trades associated with wet materials—bricklaying, lathing, plastering, tile-setting—since these are the ones most likely to be affected by the new methods and materials.

In other words, the advancing mechanisation and simplification which we noticed in both the pre-war and the war periods promise to continue with renewed force. But even with the impetus of renewed industrial life, the movement will probably come gradually, rather than with the impact of revolution. This appears true not only because of the process of infiltration through which most of the changes will be introduced but also because of the fact that new production in any one year is not likely to exceed 3 to 4 per cent. of the total existing supply of housing. Thus even if all the new housing were characterised by novel features—a most unlikely eventuality—it would take a considerable period of time before the market as a whole would be seriously influenced.

This is not to imply that a problem in adjustment will not exist, since it is obvious that such a problem will to a greater or less extent concern all groups in the industry from labourer to manufacturer to property owner. Of all these groups, none is more wholly and vitally affected than labour, since it has an important stake both as producer and consumer. On the one hand, as consumers, working men have an interest in obtaining the finished house at as low a cost as possible, while on the other, as producers, their interest is to maintain the maximum amount of employment at the highest possible wages. The possible contradiction in this must be resolved if labour is to play its fullest part and to obtain the greatest benefit from the evolution of a housing industry.

#### Effects on Employment.

The talk of increased mechanisation, elimination of site operations, displacement of skills naturally raises the old bugbear of technological unemployment. The likelihood of such disruptions should be measured against several mitigating factors. Beside the fact that, in an industry which is still relatively local and smallscale, technological change inevitably comes slowly, is the more important assurance that a very considerable part of normal building operations lie outside the field where drastic change is likely to take place within any foreseeable time. Thus the whole range of special-purpose buildings, high-priced, custom-built houses, and heavy construction are not likely to be affected by the kind of change discussed here. In addition, repair and alteration work, so long as the traditional buildings exist, must be carried on largely along traditional lines. This proportionately large body of work should constitute a cushion against adverse results of technological change in house production.

The most important fact of all, however, is that the field in which technological progress promises to be most evident is the one in which production has always lagged behind the potentialities of demand—the small, low-priced house. In this field labour has rarely been able to maintain effective union organisations or to secure wages comparable to those paid for other kinds of construction. In this field, therefore, technological change, if it does occur (as is possible), means an expanded market and the substitution of responsible firms for the insubstantial little builder of yesterday. Technological change under such circumstances does not necessarily mean even temporary hardship for labour. On the contrary, it may very well improve labour's position in a field where it has often been weak.

In other words, we are talking about what in effect is a new product designed for a market that, considering its vast potentialities, has never been adequately served. It cannot be served except with lowered final costs, and the necessary cost reduction can come only from technological advances that eliminate the waste and inefficiency in traditional methods. This is quite a different thing from the introduction of technological change into an industry where the total volume of production is more or less limited and where consequently the change threatens the amount of employment that the industry can sustain.

That it is possible for labour to take an expansionist point of view and show a willingness to adapt its demands to the realities of the market is evidenced in a forward-looking report published by the Labor-Management Planning Committee of the electrical construction industry.<sup>1</sup> The report examines the post-war situation with a view to the possibility of enlarging the demand for the electrician's services. To improve the position of the industry as a whole, and the total volume of its production, the union expresses its readiness to provide workers in adequate numbers to meet the estimated post-war demands, to consider an annual wage at a smaller hourly rate than the current scale, which is based on the assumption of intermittent employment, as well as a lower wage rate for small-house construction than for more complex installations, and to "function in all matters so as to promote the efficient conduct of work". The report has as its objective the creation of more employment through the creation of more jobs and greater continuity of employment, in contrast to the depression-bred determination to make as much work as possible out of each separate job. The old attitude was a heavy drag on the development of new techniques, the increase of efficiency, and the lowering of cost. The new one places the industry in a position to take advantage of the opportunities that peacetime may bring.

How great these opportunities may be will depend much upon the extent to which, not only labour, but every other element in the house building industry can adopt the point of view of the electricians. Sufficient progress in simplification and in repetitive production has been made to indicate the possibility of a new industry. The problem ahead is, working from these beginnings, to reduce cost and to improve quality so that a vast new market can be brought into existence. In no other way can a substantial industry be built and the curse of uncertain and intermittent employment be overcome. In house building the post-war period is one of great opportunity and great promise. American industry has rarely before faced so provocative a challenge.

<sup>&</sup>lt;sup>1</sup> First Report of the Labor-Management Planning Committee on Post-War Problems of the National Electrical Contractors' Association and the International Brotherhood of Electrical Workers (Chicago, 10 Oct. 1943). See also the Preliminary Report of the same committee.