the *total* cost by spreading interest charges over a greater number of years. The lower down payments, if "lending values" are not set too low, will certainly help. However, homes in Canada will still cost the average owner about 1 per cent of their value per month, when amortization, taxes, maintenance and repairs, insurance, and interest (including interest lost on down-payment and closing fees as well as mortgage interest) are added together.

As demonstrated in a recent publication of the U. S. National Housing Agency,[6] only reductions in land and construction costs will make truly significant decreases in costs of home-ownership. The Act does little to reduce such capital costs. The stimulation of research is highly desirable; but without power to undertake experimental housing projects of the sort recently conducted by the British Ministry of Works,[7] and without an attaek on monopolistic elements in the construction industry, such research will be of limited effectiveness.

The assistance provided by the Act to tenants in the middle and upper income groups is limited by the same factors, *unless* the provisions regarding "low-rental housing" are so administered as to make the special privileges granted to limited dividend corporations available even if they build for middle and upper income groups. In that event, however, assistance to middle and upper income tenants would be at the expense of slum dwellers, who would be forced out of their present houses without any new accommodations being provided.[8] For urban and rural families in the lowest income-third, whose substandard homes constitute the true "housing problem," the Act provides no real relief.[9]

6. *Housing Costs*, National Housing Bulletin 2, Washington, 1944.

7. Vide U. K. Ministry of Works, *Demonstration Houses*, London, His Majesty's Stationery Office, 1944.

8. Why can't slum-dwellers move into houses vacated by middle- and upper-income tenants moving into new projects? This "seeping-down process" is a notoriously ineffective means of providing low-rental housing. Some of the reasons are: The vacated houses are often improperly located and designed for people in the lowest income-third; they remain too expensive until they in turn have degenerated into slums; zoning restrictions often prevent proper adaptation of those dwellings that might be usable; costs of maintenance and repairs are often excessive relative to tenants' incomes, and consequently landlords allow such properties to run down. Indeed, the "seeping-down process" is precisely the manner in which our existing slums developed.

9. There are, of course, a few landlords who think that the Report of the Sub-committee goes too far. This group is represented by Messrs. W. H. Bosley and H. E. Manning, in their recent pamphlet *This Housing Problem*. The author of the present article was sorely tempted to reply to this collection of unsupported (and unsupportable) statements point by point; but their argument really boils down to the declaration, "We are large-scale real-estate operators; consequently, we are opposed to any significant increase in the housing supply, and we favour higher rents and lower real estate taxes." Since this is the attitude to be expected from "practical" landlords, there seems little reason to quarrel with it.

Bringing Down Building Costs

By D. P. Reay

EVERY family wants and needs a decent home to live in. The demand for good homes is the most widespread and insistent in our society, and yet the most cursory of surveys shows that it is the one demand which has never been supplied. Why?

The basic reason is because under normal conditions the cost of what is considered to be a minimum standard dwelling is beyond the financial resources of about two-thirds of the population. If the standard minimum were to be lowered, this proportion would be lowered: and of course if everyone received the same income, differences in the standard of housing accommodation would depend only on geographical location.

This inability of the greater part of the population to be able to afford what is considered a minimum standard of accommodation is a world wide phenomenon; it is no respector of geography or political systems, and its root cause is the low output per operative in the building industry.

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Attempts to provide good new housing for the middle and lower income groups can be made on three levels:—

(1) The money necessary to pay the high cost of the new dwellings can be lent by the government (or the government can guarantee a private loan) on easy terms over a long amortization period. The state is normally the only organization in a position to adopt this role of providing cheap housing money.

(2) The necessary money can be given outright by the state as a direct subsidy in one form or another. In this way the wealthier part of the population is helping to pay for the housing of the lower income groups.

(3) More efficient construction methods can be encouraged in an attempt to lower the number of man hours required to construct and equip a dwelling, thus lowering its cost.

(1) and (2) are necessary only because of the high relative cost of the standard dwelling. If this cost can be sufficiently lowered, they become unnecessary, unless the minimum standard is subsequently forced up as a result of income differences. For example, sudden technological advances might double the amount of house available for an expenditure of say $2,500.00. This would of course materially help to solve the housing problem, but it would also double the amount of house available for $10,000, and thus, as the idea of what is a minimum is conditioned by what is possible, the public idea of what constituted minimum accommodation would rise as well. It is not so very long ago since bathrooms were considered unnecessary luxuries.

Although it is perfectly true that a considerable reduction can be made in the monthly cost of a dwelling by providing cheap money and long amortization periods, the amount of the mortgage is still a function of the construction cost of the building; if this is reduced, an all round reduction in cost automatically occurs.

An Analysis of Costs

The United States National Housing Agency recently produced figures proving a little known and largely undocumented fact:[1] that the structural shell of a house represents the biggest single item in the cost of home ownership. 60 per cent of the total cost of an average single family dwelling is taken up by the foundation, walls, floors and roof. For example, a reduction of $1,000 in the construction costs of a $5000 house cuts monthly payments by 16.4 per cent. In no other major cost item would a 20 per cent reduction cut monthly payments by more than 5.4. per cent.

Figure (1) shows where the housing dollar goes in the construction of an average house.

Figure 1

Cost of House and Land

(Each item expressed as a per cent of total cost of house and land.)

Materials	Cost (delivered at site)
Lumber	11.85%
Masonry	3.45
Concrete and mortar	3.33
Plaster, wallboard	4.27
Insulation	0.24
Roofing	1.25
Flooring	2.95
Millwork	7.36
Paint	1 41
Finish Hardware	0.71
Plumbing	5.48
Heating	1.41
Electrical	0.98
Miscellaneous	1.00
TOTAL MATERIALS	45.70%
Site construction labour	29.50
Contractors' O. H. and profit	12.30
TOTAL COST OF HOUSE	87.50
Value of land (including profit)	7.00
Land improvements (including profit)	5.50
CAPITAL COST	100.00%

Figure (2) breaks down the monthly cost of owning the house.

1 Housing Costs, National Housing Bulletin No. 2, National Housing Agency, Washington.

Figure 2

Monthly Cost to Own

(Cost of house and land assumed $5,000.00)

Initial cash payments

Down payment (90% mortgage)	$500.00
Closing fees and commissions	100.00
TOTAL CASH PAYMENTS	$600.00

Monthly Cost For:	25 yrs.	15 yrs.
Interest (5%)	$11.31	.....
Amortization (25 yrs.)	15.00	.....
Loss of interest on cash payments (3%)	1.50	$ 1.50
Taxes (2½%)	10.41	10.42
Hazard insurance (2/10 of 1%)	.83	.83
Maintenance ($100 per annum)	8.33	8.33
TOTAL MONTHLY COST	$47.39	$21.08

Average for 40 years $37.52

Figure (3) shows the effect on the monthly cost of reductions in various items.

Figure 3

Effect on Monthly Cost of Reductions in Various Items

Monthly cost of housing can be cut by reducing any one of the following items: interest, amortization, taxes, maintenance, or cost of house and land. The relative effect on monthly costs of a 20% reduction in each of these items separately, with all other items remaining unchanged, is shown below.

	Reduction in Monthly Cost	
	25 yrs.	15 yrs.
Interest (from 5% to 4%)	5.4%	....
Amortization (from 25 yrs to 31 yrs.)	4.5%	....
Taxes (from 2½% to 2%)	4.4%	9.9%
Maintenance (from $100 to $80 p.a.)	3.5%	7.9%
Capital cost (from $5,000 to $4,000)	16.4%	11.9%

A 20% reduction in capital cost gives a reduction of monthly cost of 15.4% over a period of 40 years.

These figures go far to prove that lengthened amortization periods or revamped distribution systems cannot in themselves prove panaceas for the problem of providing more good housing for more people. Most housing legislation concentrates primarily on the financial angle of providing the money and on regulations designed to ensure that the value of projects will remain as high as possible for as long as possible, instead of tackling the problem of trying to reduce the first cost of projects, which is, as is shown above, the most effective method of reducing monthly costs. This is not to say that loans and subsidies are unnecessary by any means: but it is evident that not nearly enough emphasis has been placed by government on the desirability of introducing new methods to reduce first costs, which, instead of showing over the years a tendency to fall, show a very strong tendency to rise.

Why are building costs so high?

The Construction Industry

It is a common observation that the construction industry, particularly the residential construction industry, hardly merits the name of industry at all, consisting as it does of a disintegrated mass of contractors, sub contractors, material dealers, trade unions, speculative builders and so on, where mass production and assembly line methods have hardly even begun to make their presence felt.

It is a complicated industry and many of its inefficiencies can be laid down to sheer lack of organization. A general over-simplified picture of its pattern is shown at Figure (4). The flaws become obvious at once. They result mainly from the large number of alternative paths available for the flow of goods and services from their point of origin as raw material to the finished product. They are apt to pass through a number of hands, and profits, sales costs and distribution costs are often duplicated and triplicated.

Apart from raw material producers, fabricators, financiers, distributors, transportation workers, designers and retailers, the construction industry proper is composed of general contractors carrying out work in accordance with detailed instructions received, trade contractors who are usually engaged in repair work

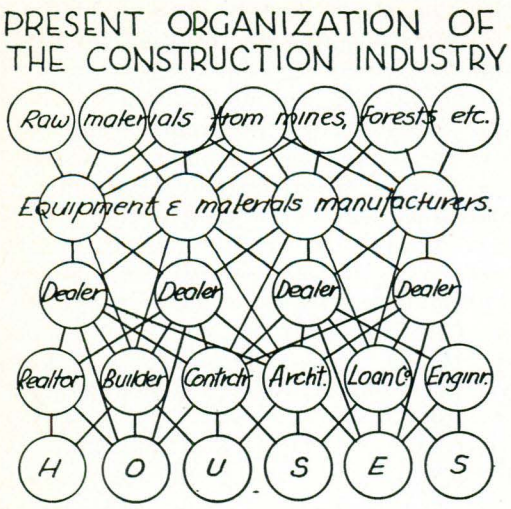

Figure 4

and remodelling, speculative builders who construct residential buildings on their own account in order to sell them during or after construction, and sub contractors who undertake certain sections of work for general contractors or speculative builders.

The irresponsible element is largely restricted to the speculative builders who have done considerable harm to the good repute of the construction industry as a whole. They cut wages and try to sell substandard houses at high prices. Bankruptcy is no hindrance for continuing in the business, and many operators are not activated by principles of fairness to either labour or customers. The small scale and spotty nature of their operations are major factors in keeping costs high. Yet they construct the bulk of our housing. It is noteworthy that this field of residential construction is comparatively unorganized. The overwhelming strength of the speculative builders in the house building field has made the organization of firms engaged in residential construction impossible. A central organization is needed, not only to co-ordinate the interests of contractors and builders, but also to give medium and small builders an opportunity to make a contribution to the industry by a co-operative pooling of their resources.

Construction Methods

Apart from organizational problems, a major source of waste in the building industry is its continued use of "cut and fit" methods. Diverse materials are assembled on the site in all sorts of shapes and sizes, from bricks to carpets, and have to be cut and shaped to fit in with each other. A recent survey in England showed that bathtubs were being manufactured in over 120 different sets of dimensions, the bulk of them differing only by inches and fractions of an inch. Bathroom tiles being made in sizes which bear no relation at all to the bathtubs around which they are to be eventually installed, it can be seen what waste of time and energy is involved on the job when the two have to be fitted together. This waste is repeated in scores of other instances during the construction of a house, and is duplicated in the drafting offices where the plans are drawn up, and in the plants where frequently an unnecessarily large variety of sizes have to be manufactured and kept in stock. The accusation that standardization of dimensions and performance characteristics will standardize design simply will not hold water. Musical notes and instruments have been standardized for generations, and music is anything but dull.

Another potent influence keeping costs higher, at least before the war, is the prevalence of various forms of restrictive practices in sections of the industry. Broadly they are of three types.

(a) Building unions and interested manufacturers have been known to see to it that municipal building codes effectively block the introduction of new materials and methods, or otherwise ensure that their interests are served. Codes tend to be written specifying the use of particular materials or methods of stress calculation, instead of setting up definite performance standards which have to be met and leaving it to the ingenuity of the designer to meet these standards as economically as possible.

(b) Craft building unions have a strong tendency to set up regulations to ensure

that work is done in the traditional manner, in some cases without the use of labour saving equipment. The protective urge to do this kind of thing is of course very strong, but is fundamentally short sighted and against the long term interests of the industry as a whole which are to provide more product to the public at lower cost, and not the other way around. It also leads frequently to wasteful disputes on the job as to the installation of new types of material which may not belong to the field of any of the craft unions at all.

(c) Material dealers and manufacturers are apt to impose restrictions which require that materials be distributed through traditional channels, including both wholesaler and retailer, rather than being shipped direct from manufacturer to contractor.

The cumulative effect of restrictions such as these is to create friction in the movement of materials through the industry and also to create a standing pressure against the introduction of new materials and new methods. There would appear to be no opposition to the adoption of standardized dimensions, which would in themselves eliminate "cut and fit" and generate considerable economies, but the adoption of this simple and obvious step towards cost cutting has not yet been even considered by the industry.

There are two other factors tending to increase construction costs which should be mentioned before we can describe possible methods for increasing the efficiency of the building process and the influence full use of such methods would have on the organization of the building industry as a whole.

The prices of building materials have a tendency to rise higher than the prices of other commodities during periods of prosperity and to remain higher during depressions. This feature seems to be peculiar to building materials. It is not true of building equipment of example, where prices have fallen with increased volume of sales. In the case of building materials increases in price have tended to accompany increases in the volume of building and seem to resist any downward movement.

Finally wages in the building trades have tended to rise more rapidly than in many other types of work. Wage rates are high but seasonal unemployment is serious so that annual earnings are low. There is no doubt but that wage rates could be lowered if continuous employment could be guaranteed over the year.

Largely as a result of the continuance of these practices the cost of building has tended to rise rather than fall during the last decade. Most of the new materials and methods introduced in house construction in recent years have improved the quality of houses only by increasing their cost, and low costs, when they have been achieved, have been made possible only by reducing the size and quality of houses. In view of demonstrated inefficiencies in the structure, methods, and materials of the building industry, this is a serious state of affairs, and existing housing legislation does little to correct it: indeed a convincing case can be made out to show that existing legislation encourages and perpetuates the continuance of obsolete construction organization and methods.

The Industry Reorganized

Really sizeable reductions in the monthly cost of housing can be achieved only by bringing about changes in distribution methods, construction methods, land development, financing, taxation, and maintenance, but only to the extent that all these elements cooperate. No one item in itself is capable of effecting a really startling reduction of housing costs, although, as has been demonstrated above, construction costs are easily the most potent factor, with financing arrangements next in order of importance, and not the other way around as is usually supposed.

Factors involved in the reduction of construction costs are so interdependent that it is not easy to give a simple picture

of suggested coordinated improvements without distortion of some aspects. However, Figures (5) and (6) respectively show two possible arrangements both superior to the conditions now obtaining (shown at Figure (4)) and together demonstrate many of the relevant issues.

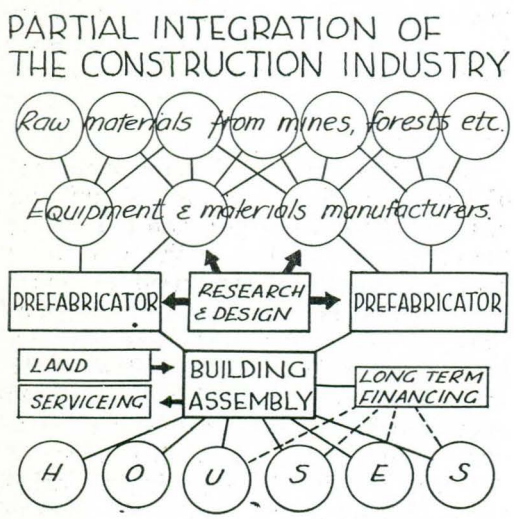

Figure 5

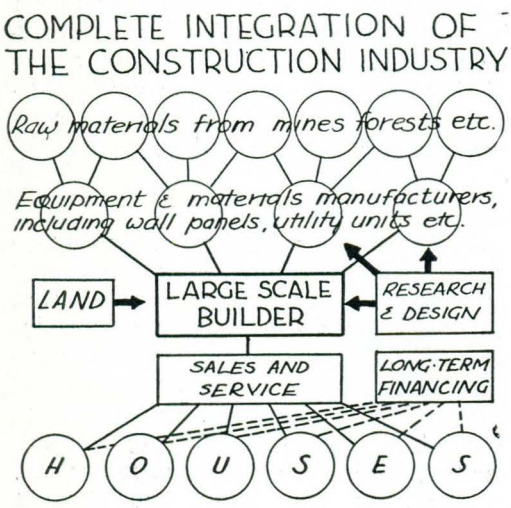

Figure 6

Figure (5) may be called the partial rationalization of the industry. It shows the possible effect that widespread prefabrication and standardization might have. The arrangement is far simpler than that shown at Figure (4). All the materials which go into the construction of a house are subject to some form of coordination: for some parts, for instance, floors, roofs, furniture and fittings, this coordination may be restricted to standardization of dimensions of the components only, in order to speed up the rate of assembly; other sections such as kitchens, bathrooms, heating units, and external wall panels, may be completely prefabricated and shipped to the builder in one piece. In general the major characteristics of this form of organization can be demonstrated at Figure (7) where the mechanical core of the house has been totally prefabricated, shipped to the site on a trailer and the remainder of the house assembled around it; the assembly is tremendously simplified in that no wet processes are involved and that although the individual pieces may be of all shapes, sizes, and degrees of factory prefabrication, they fit together like pieces of a jigsaw puzzle due to their being dimensioned to a standard module.

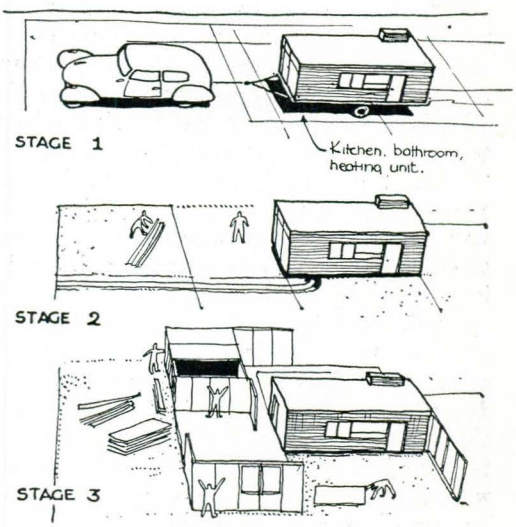

Figure 7

The point to emphasize however, is that all the component parts may be made by different manufacturers who concentrate research on their particular unit—wall panels for instance. Under present conditions a wall may consist of as many as sixteen layers each erected by hand by as many as five different trades belonging to five different unions, arriving on the job at five different periods, all

of which have to be carefully scheduled to ensure that time is not wasted sitting around waiting for the previous trade to finish its section. Carpenters erect studs and sheeting and apply waterproof paper, masons apply a brick veneer, electricians cut holes in the studs for their wiring, tinsmiths cut more holes for their heating ducts, plasterers apply their lath and plaster, and painters finish the whole job with two or three coats of laboriously applied paint.

In the prefabricated wall panel, the whole unit is produced by one set of operatives on an assembly line, with the number of stages cut to a minimum, and subject to intensive research directed towards producing a composite material which will reduce these stages to one only—the moulding of the panel. Apply this process to roofs, floors, furniture, fittings such as cupboards and storage closets, kitchens, bathrooms, and so on, and it can be seen that, as in other industries, very considerable economies can be effected. It can also be seen that the craft structure of the building trade unions is completely ignored, and that the fixed capital equipment required is very considerable. Everything has been mass produced except the sites on which the houses are to be built and the price at which these sites are to be bought. And this final requirement has to be satisfied otherwise the whole structure falls to the ground.

In Figure (5) distribution is left in the hands of a builder who takes care of final assembly and who is also responsible for site development, servicing, and long term financing. It is highly probable that the price of the most important raw material with which the dealer is concerned—building lots—will have to be controlled by government action, if the advantages incurred by more economical construction are not to be offset by inflationary increases in urban land prices, caused by the stimulated expansion of the housing market due to lowered costs.

The Industry Integrated

Figure (6) has carried the integration process to its logical conclusion. All raw and partially fabricated materials are brought together by the large scale builder, who fabricates and assembles them in the most economical manner, and lays his products out in whole neighbourhoods at a time. Henry Kaiser has recently announced his intention of entering the housing field in precisely this manner. Control of all the relevant raw materials has been brought under one head. Areas of land big enough to contain whole neighbourhoods, available at a constant price, are as much raw materials in the housing process as are, say, bulk supplies of lumber at a constant price.

The whole industry has now been integrated around its real product,—a good house, on a good site, in a good community,—and the key factor is the large scale builder. The prefabricator producing sub-assemblies sells his products to the builder rather than to the individual consumer, when his function is not taken over by the builder himself. Assembly of lots and liquidation of obsolete housing occupying blighted areas could be a valuable function of the builder, and indeed would be essential from a town planning point of view to ensure both satisfactory and continuous replacement of residential dwellings and to direct reconstruction into areas where it is most needed—in the blighted belts of our towns. This would provide some assurance that municipal services would not be over-extended in order to supply peripheral development of a city unless such expansion is part of a master plan. Existing, land acquisition and compensation legislation is at present quite inadequate to enable such a procedure to be carried out.

Once the large organization has got under way producing the low cost housing to fill the demand, operations can be planned to a far greater extent than they are at present to ensure even and constant employment to building operatives over the whole year,

even in such a country as Canada with its sharply defined building season, and this in itself will bring costs down further.

Consequences of Integration

This brings us to the influence such an integrated building industry would have on the organizations composing the industry to-day, many of which constitute obstacles to such a reorganization. The speculative builder and the craft building union stand squarely in the way, together with a host of middlemen and retailers.

It is true that the various craftsmen, contractors, carpenters, plasterers, plumbers, painters, steamfitters and so on would be little affected and indeed in some cases assisted by the adoption by the industry as a whole of a modular system of standardization, which would effect considerable economies. But as soon as integration passes beyond this point the building crafts become obsolete, and the building worker tends to become either an assembly line mechanic or a site erection mechanic. It is hard to see how this transition can be made without making the training of the new construction craftsmen the joint responsibility of the industry, labour and government, and ensuring that some kind of permanent board be charged with the introduction, maintenance and supervision of a nation wide training programme.

As for the other specialists filling their own niches in the present construction picture, economists, real estate men, architects, engineers, small scale developers, etc., all these can find more efficient places as logical parts of the large scale builders' organizations which need teams of specialists to plan their work, and all sorts of other technicians to carry it out. Government will probably take a more active interest in construction than it has in the past and will need a staff of its own to coordinate the plans of the various large scale building companies as well as to carry out projects of its own. For the first time a really integrated building profession will be created, not composed as at present of often warring elements, but united in a singleness of purpose and a clear understanding of its place and part in the reconstruction activity of the whole country.

It is difficult to see how the ball can be started rolling in this direction except on government initiative. The problems are old ones and the suggestions put forward here are neither new or original, but that does not decrease their validity, as they have never been wholeheartedly applied. The Labour Unions have shown little interest in the problem, and the National Construction Council, which was formed in 1933 to help the industry overcome the depression, and which could take a positive line, has done little during the last decade and appears to receive insufficient support from its members to enable it to carry out even limited objectives.

One cannot escape the conclusion that a clear directive from the Government as to the extent and characteristics of the reconstruction job which has to be done, with particular regard to residential work, together with a clear formulation of the organizational and technical problems which the industry has to face and solve, would do much to contribute to the advancement of one of the most important industries in this country. Indeed, recommendations along these lines were made to the Government some time ago by a sub-committee of the Advisory Committee on Reconstruction. We would then undoubtedly stand a far better chance of success in our attempt to rehouse our people and rejuvenate our towns and cities in harmony with our geography and climate and the potentialities of modern life.