NATIONAL CO-ORDINATION OF HOUSING
by
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(1956)

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NATIONAL CO-ORDINATION OF HOUSING

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ABSTRACT

NATIONAL CO-ORDINATION OF HOUSING

By Cordell William Hull

Submitted to the Department of Civil Engineering on May 20, 1957 in partial fulfillment of the requirements for the degree of Master of Science.

The need for housing, particularly in the lower and middle income groups of the population of the United States, is continually increasing. For many years there have been serious doubts as to the ability of the housing industry to satisfy this ever-growing need for housing. In fact, there is positive evidence to indicate that the housing contractors are neglecting the lower and middle income groups by constructing houses too costly for these groups to afford. One of the major reasons that the existing system fails to provide adequate housing at reasonable costs to a larger segment of the population is the disorganized and unco-ordinated nature of many of the methods employed by the industry. This thesis suggests a plan whereby the various elements of the housing industry might be co-ordinated at a national level, thereby permitting modern technological and mass production techniques to be more readily applied to the industry. However, these technological innovations should replace existing methods through a gradual evolutionary manner instead of any immediate revolutionary process.

One of the essential features of the plan is the provision which vests control in existing elements of the housing industry. Co-ordination will take place at a national level but control will remain the responsibility of groups at the community or regional level. In this manner maximum use could be made of local resources thereby promoting the prosperity of the community while at the same time improving the community's housing standards.

Thesis Supervisor: Walter Charles Voss
Professor of Building Construction, Emeritus.
ACKNOWLEDGEMENTS

Walter C. Voss, Professor of Building Construction, Emeritus, at the Massachusetts Institute of Technology, has been deeply interested for many years in the problems confronting the housing industry. Professor Voss has collected data and performed studies pertaining to the various concepts that might logically be applied to the housing industry in order to achieve effective co-ordination at a national level. These preliminary studies served to inspire this thesis.

Some of the material for this thesis was drawn from the files of the Housing Research Corporation of which Professor Voss is President. It is interesting to note that these files indicated that the idea for some type of co-ordination of housing at a national level was under consideration by Professor Voss almost thirty years ago.

The author is deeply indebted to Professor Voss for his helpful suggestions and criticisms during the writing of this thesis.

P. H. Lopatnikov, Manager-Commercial Research of United States Steel Homes, presented valuable information on housing markets and existing prefabrication techniques.

John C. Pollock, Advertising Manager of American Housing, presented data pertaining to prefabrication costs and techniques.

Helen Irene Minton prepared the typescript and aided in editing the thesis.
# TABLE OF CONTENTS

I. Introduction........................................page 6

II. Philosophical Ideals................................. 13
   Cost Reduction of Housing..................... 14
   Improved Architectural Standards........ 15
   Flexibility........................................ 18
   Use of Local Enterprise...................... 19
   Stabilization of the Housing Industry.... 20
   Reasonable Choice of Location............ 26

III. The National Housing Corporation.............. 28
   Objectives........................................ 29
   Capital.......................................... 29
   Management..................................... 30
   Design.......................................... 30
   Plant Operation................................ 31
   Legal............................................ 31
   Material Distribution....................... 31
   Purchasing...................................... 31
   Advertising...................................... 32
   Inspection...................................... 32
   Research......................................... 33

IV. The Local Housing Corporation.................... 35
   Objectives........................................ 36
   Capital.......................................... 37
   Architect....................................... 38
V. Detailed Operations

- Design Features
- Land Planning
- Material Requisition
- Manufacturing by National Corporation
- Distribution by National Corporation
- Manufacturing and Distribution by Local Corporation
- Used Panels
- Technical Assistance
- Insurance
- Homeowner's Funds
- Financing
- Building Codes
- Inspection
- Utilization of Existing Contractors

VI. Achievement of Philosophical Ideals

- Cost Reductions
- Improved Architectural Standards
- Flexibility
Use of Local Enterprise.................page 93
Reasonable Choice of Location............ 94
Protection of Owner's Equity............. 95
Obstacles................................. 95
Appendix................................ 96
Bibliography.............................. 105
Introduction

As a means of providing considerations that may promote the welfare of the public of the United States, this thesis will evolve a plan designed to provide a large segment of the population with adequate, well designed housing at reasonable prices.

Figure 1
Cost of New Houses to Consumer

<table>
<thead>
<tr>
<th>Price Range</th>
<th>1954</th>
<th>'55</th>
<th>'56</th>
<th>'57</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20,000 and over</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>$15,000-$20,000</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$12,000-$15,000</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>$10,000-$12,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$7,000-$10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under $7,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It seems almost a paradox that the United States with its wealth and vast resources should be unable to provide its citizens with adequate housing. Instead of approaching the ideal of adequate housing for all, this country has not managed to provide even half of its citizens with decent shelter at reasonable prices. This problem is not a new one. As early as 1934 a Committee on the Housing Exhibition in New York stated:

"The most prosperous third of our population, nearly 10,000,000 families live in comfortable modern homes. The next 10,000,000 families cannot buy or rent a new home. Meanwhile the lowest economic third of the population occupy obsolete, inadequate, neglected shelter, damaging in degree to health and self respect." ¹

It might well be expected that technological advances together with increasing social awareness would have provided solutions to the problem of housing costs in the years to follow. Yet, the only solution that has met with the least degree of success is public housing. However, public housing provides for only a very small segment of the population. This program certainly has not won widespread social approval, nor is it likely to gain this approval in the years to come. Even if public housing were desirable and acceptable to the low income groups, which it

¹ Aronovici, Carol, America Can't Have Housing, Museum of Modern Art, New York, 1934, p.24.
is not, we would still have to revise the housing program in order to provide housing for the middle income group. Housing at reasonable prices is not available to most of this group. The fact must remain that the existing housing industry is pricing itself out of the market. In the latest staff report to the Senate Subcommittee on housing (January 14, 1957), it was concluded that:

"less than one-fourth of the homes produced were within the means of the medium income families".

This can only mean that three-quarters of the medium income group and most of the low income groups cannot afford the housing that is being produced by today's housing industry. Coupled with these problems, the housing industry is building fewer and fewer homes in the low income and middle income groups and shifting operations to fit only the needs of the wealthier groups. (See Figure 1)

"In 1950, some 4 percent of families earning more than $7500 bought new homes; in 1955, while rising income had increased the number of families in this income group, the percentage of this larger total that were home buyers had climbed to 8 percent (on the basis of the reasonably representative statistics on FHA purchases) In absolute figures, this upper income group in 1950 bought about 180,000 new homes out of a total of 1,100,000; in 1955 out of a total of 1,200,000 new homes, this group accounted for the purchase of 470,000 units. Stated in another way: while prosperity

1 Straus, Nathan, Two Thirds of a Nation, Alfred A. Knopf Incorporated, 1952, p.98.
increased the number of families in this upper income group by about 22 percent, the group's number of home buyers soared more than 150 percent. And finally, stated most bluntly: well before the shortage of mortgage money, the building industry began abandoning the low-income market."

Undoubtedly, much of the population actually does live in adequate housing. However, is this adequate housing available at reasonable prices? No! The answer must be that many families are forced to stretch incomes to the breaking point in order to afford decent shelter. The small down payment and long term amortization necessary to buy housing at today's prices only serves to increase the risks inherent in home ownership. The pitfalls of such a policy in terms of cyclic effects of national economy and unemployment risks incurred by the homeowner are indeed dangerous. Therefore in order to provide more realistic priced housing this plan, for the national co-ordination of housing, will present definite measures designed to:

1. reduce housing costs,
2. promote local enterprise,
3. improve architectural standards,
4. offer reasonable choices of design and location and
5. permit the construction of used housing with salvaged materials.

These principles are not generally achieved by the existing housing industry for a variety of reasons. One of the most predominate faults of the existing system is

1 Hughes and May, op. cit., p.123.
the lack of application of progressive technology to construction processes. Whether or not houses, as currently constructed can be considered manufactured products is certainly debatable. Each house instead tends to be more of an individualized handicraft type of product. If the housing industry could be organized to rely less on site handicraft and more on manufactured elements it is entirely possible that technological advances could more readily be incorporated. Such a policy might permit immediate cost reductions of housing and even help provide ultimate solutions to all aspects of current housing problems.

Since mass production of a manufactured product usually results in substantial cost reductions, the mass production of a manufactured house could likewise result in cost reductions. Types of houses, such as advocated by this thesis, would not be entirely manufactured, however; but would instead consist of modularized prefabricated components. Only a large organization will be capable of wielding the power necessary to initiate fundamental changes in fabrication, construction and purchasing procedures. To achieve the principles advocated by this plan it will be necessary to organize for purchasing and manufacturing through centralized control. Only then can substantial savings be realized.1

"The loose organization of housebuilding activities is in marked contrast to the integration of processes characteristic of many other industries. The degree of integration varies, of course, with the industry and with the firm. In its most advanced form, all operations from design to final assembly of the product and frequently also the distribution of the product to consumers, are subject to centralized control."

In other words, a large centralized operation, organized at a national level, will be necessary in order to wield the power necessary to initiate fundamental changes in the various fabrication and construction processes.

Nationally centralized operations cannot operate at optimum effectiveness without due regard for local conditions.

In the words of P. H. Lopatnikov, Manager-Commercial Research, United States Steel Homes:

"Housing markets are primarily local markets. There are extensive local variations in the costs of labor, costs of materials and costs of special services. There are significant variations as well in local building practices—as for example, in the use of tilt-up wall construction which characterizes the Long Island housing market. There are even more significant market variations in housing tastes, sizes, types, prices, etc."

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The plan for national co-ordination of housing, which provides for centralized control of purchasing and manufacturing, will take local housing policies into account by delegating a large amount of responsibility for actual house construction to local groups. In this manner not only will local tastes and policies be satisfied but local enterprise will also receive maximum benefits from centralized operations.
II

PHILOSOPHICAL IDEALS

A large scale operation, such as the national co-ordination of housing, cannot be merely a philanthropic movement. Obviously, incentives must be offered in order to gain the financing necessary to finalize the objectives. This incentive will naturally be in the mode of profit. However, it cannot be emphasized too strongly that the abortive profits that have characterized much of the housing industry in the past have no place in an organization designed to provide for the welfare of the country. A limited-dividend policy must be enforced. Profits must result from the accumulation of small profits on many units not from excessive profits on a few units. The various philosophical ideals that may finalized into principles by this plan are presented in the following section.
COST REDUCTION OF HOUSING

Housing costs may be thought of in terms of capital costs, monthly payments or both. The monthly costs are determined to a large extent by the capital costs. If capital costs can be lowered, reductions in monthly costs will automatically follow.

Capital costs are composed of:

1. land costs,
2. materials,
3. labor and
4. contractor's overhead and profit.

Monthly costs are composed of:

1. debt service,
2. operation and maintenance,
3. local taxes and
4. utilities.

Initial studies were taken to evolve a solution of the low-cost housing problem by members of the staff of the Department of Building Engineering and Construction at the Massachusetts Institute of Technology in 1930. These studies indicated that a reduction of 20 per cent in interest rate, amortization period, taxes, maintenance and first cost, indicated savings in the monthly carrying charge given as follows:

1 Voss, Walter, Housing Research Corporation, Files of Building Construction Department at Massachusetts Institute of Technology.
Interest (from 5% to 4%) 5.4% -
Amortization (from 25 yrs to 31 yrs.) 4.5% -
Taxes (from 2 1/2 to 2%) 4.4% 9.9%
Maintenance (from $100 to $80 per year) 3.5% 7.9%
First cost (from $5000 to $4000) 16.4% 11.9%

Therefore, this study indicated that the most important factor in reducing carrying costs is first or capital costs. The plan presented in this paper, for co-ordination of housing at a national level, intends to affect a substantial reduction in capital costs. Capital cost reductions will in turn pave the way for a reduction in the monthly debt services.

IMPROVED ARCHITECTURAL STANDARDS

Much of the housing under construction at the present time is inadequate both from architectural and functional standpoints. The untold social monotony which results from endless repetition of design and construction certainly cannot be underestimated. There is a definite lack of evidence to indicate that homeowners actually desire the "endless rows" of repetitive designs with only minimum clearances between houses. Actually, under the present setup, a prospective home buyer, shackled by definite cost limitations, often has no choice but to buy one of these standardized type dwellings. The building contractor, looking forward to immediate sales, often makes little effort to reduce costs other than by repetitive construction. Of course, a certain degree of
standardization is necessary in order to achieve cost reductions. However, it seems only reasonable that a sensible compromise can be reached. A varied number of standardized designs should be made available to the prospective home buyers. These designs should include models in a number of price ranges. The plan here presented not only will offer a variance of choice of standardized designs but will actually provide for the adaptation of individual design preferences to the construction system involved!

Excessive repetition is not the only violation of good architectural standards. The fact cannot be ignored that many new dwellings are inadequate from the standpoint of:

1. functional uses,
2. space requirements and
3. construction methods and materials.

Speaking before the American Institute of Architects, meeting in Salt Lake City in June, 1948, Dr. Charles Winslow, professor-emeritus of Yale University's public health school said that the $10,000-$15,000 houses were "doll houses which out-slum the slummiest of our pre-war slums". The postwar house, according to Dr. Charles Winslow, was too small to entertain guests, lacked sufficient storage and failed to provide adequate child play areas.

Most of the above mentioned difficulties, if not all, could be avoided by proper architectural guidance through all stages of design. Yet, the influence of the architect
throughout the various stages of design and construction of mass produced housing is indeed small. According to the Twentieth Century Fund Survey in regard to the use of architects:

"Moreover as independent practitioners, their services are probably not used on more than 20 or 25 percent of all housing units built."¹

It is realized, of course, that architects themselves are somewhat to blame for the existence of such a situation. Architects have not participated fully in the current production and design of houses because of:

1. lack of cost consciousness,
2. lack of desire because of small fees involved and
3. unrealistic designing.

However, it is realized that architectural guidance is a necessity in well designed and adequately constructed houses. This plan intends to provide architects with the sufficient challenges and monetary rewards necessary to fully realize their potential effectiveness in the final products.

¹ Colean, op. cit., p.
FLEXIBILITY

At the present time, a family seeking a home is often forced to buy an immovable, inflexible type of house. The family is burdened with the mortgage on such a house for perhaps twenty or thirty years even though requirements may, in that length of time, undergo radical changes. It is, therefore, imperative that any plan designed to provide adequate housing, encompass a large degree of flexibility in regards to:

1. **Plan Arrangements**

   Changes in a family's needs and requirements due to births, marriages and deaths serve to create a need for a variety of plan arrangements within the basic house structures. The members of a family passing through various stages of development create new requirements on size and plan arrangement.

2. **Liquidation Values**

   It is often necessary that families change localities due to such considerations as employment opportunities or health difficulties. One of the major handicaps of home ownership often is the lack of mobility imposed by possession of an immovable house. If the owner is forced to leave the community, he is handicapped by difficulties inherent in the liquidation of
property. Rapid liquidation at reasonable costs is usually a necessity in order that provisions may quickly be made for living quarters in the new locality. Ease of liquidation will, therefore, be a desirable feature to incorporate into this plan.

USE OF LOCAL ENTERPRISE

The use of local enterprise in the production of housing is not justified merely because the market for housing happens to be local. There are other considerations which dictate, however, that local enterprise be substantially responsible for certain operations of house construction. Some of these considerations are:

1. **Building Codes**

   These codes vary from locality to locality and very probably will show considerable variances for sometime to come. It might be noted that although some of these variances are justified by different climatic conditions, the larger percentage of variances are unjustified and serve as a hindrance to modern technology.

2. **Subdivision Requirements and Zoning Ordinances**

   These ordinances often involve as much variance as do building codes. Restrictions on lot sizes, types of houses and plat layouts are common throughout the country.
Existing types of housing coupled with requirements and desires of the communities for industrial developments play important roles in the extent and nature of these ordinances.

3. Labor Unions

Local labor unions wield much power in the determination of types of labor to be used and methods of construction. Ignoring the policies of local union practices could only lead ineffectiveness of operation.

A plan for co-ordination of houses which utilizes local groups and abides by local policies would probably meet with less public opposition than a plan designed to affect radical changes in present techniques. These local groups would be qualified to deal with familiar building codes, zoning ordinances and labor policies. The degree of local participation in the program should naturally depend to a large degree on local housing demands together with available labor and construction facilities.

STABILIZATION OF THE HOUSING INDUSTRY

In the past, the housing industry has shown violent fluctuations in regard to both yearly and seasonal production. (See Figure 2 and 3) Although it is impossible to completely determine all the factors that might account for these fluctuations, several of the more obvious ones are:
SEASONAL FLUCTUATION IN PRIVATE RESIDENTIAL CONSTRUCTION CONTRACT AWARDS, 1929, 1932 AND 1940

Figure 2

Colean, M., op. cit.
INDEXES OF PERMITS ISSUED FOR RESIDENTIAL AND NONRESIDENTIAL BUILDING CONSTRUCTION
1856-1936

Figure 3

Index numbers, 1920-1930 = 100

Semilogarithmic scale

Number of residential buildings

Number of nonresidential buildings
1. **Seasonal Variations** (See Figure 2)

Due to weather conditions, housing construction in many areas is largely seasonal in nature. High rates of wages are usually paid to tradesmen during the working seasons in order to compensate for time lost during the "off season". This in turn means higher costs per unit of construction. Labor costs per house might be somewhat lowered through a stabilization of these seasonal variations. Providing continuous work throughout the year to tradesmen could help stabilize this portion of the housing industry.

2. **Yearly Variations** (See Figure 3)

a. **Costs and Prices**

Costs and prices have an important effect in determining housing demands. However, the effect of economic conditions, such as depressions or inflationary periods, must be jointly considered together with costs and prices. (i.e., During inflationary periods, demand may be great even though prices are high. Conversely, in an economic depression, demand may be virtually non-existent regardless of prices.)
b. Population Changes

Yearly demands for housing may vary quite radically due to changes in birth, marriage and death rates. For example, increased marriage rates indicate an increase in family formation. This in turn could cause housing demands to immediately increase. Increased birth rates need not indicate an immediate necessity for new housing facilities, but could instead provide indications of future needs.

c. Miscellaneous Factors

Some of the other dominate factors that may affect housing demands are:

1. down payments,
2. amortization periods,
3. replacement demands and
4. undoubling.

Although attempts have been made to derive relationships between the various conditions that may affect yearly fluctuations of the housing market, the entire system of possible interchanging patterns between the pertinent factors is much too complex to accurately explain periodic fluctuations.
It is important to note that demands or housing markets do not necessarily reflect the actual needs for housing. The low income groups have certainly needed more adequate housing for a number of years. Yet rarely, if ever, have they played dominate roles in the actual housing market, primarily because the housing industry has not provided a product that these groups could reasonably afford. Cost reductions could, in general, greatly increase demand by offering outlets for satisfaction of the needs of a larger segment of the population.

3. Replacements

For most manufacturing concerns, a large and ever present market usually exists in replacement of used products. However, this situation has obviously not applied to the past operations of the housing industry. The plan, for national co-ordination of housing, will promote replacement methods as another means of providing a greater degree of stabilization to the housing industry.
REASONABLE CHOICE OF LOCATION

In order to obtain the cost savings which are usually inherent in mass construction methods, operative builders often construct large groups of houses in highly localized areas. Since a house in such a group should offer maximum economies to the average homeowner, this same type of operation should be encouraged under the plan here presented. However, provisions should be included to require at least a minimum variance of design within any group of houses. Moreover, a plan will be evolved that will permit the construction of individual designs at desired locations while still affecting substantial cost reductions.

PROTECTION OF OWNER'S EQUITY

Purchasers of new homes must often invest all available savings in down payments, title fees, closing costs, moving expenses and the like. Any accumulation of savings by owners during the amortization periods is usually substantially curtailed by the necessity of meeting periodic mortgage payments. Since this resulting dearth of savings necessitates sufficient income to meet mortgage payments, fluctuations in income could result in serious consequences. Fluctuations in a mortgagor's ability to fulfill mortgage obligations could occur due to:

1. unemployment,
2. illness,
3. cyclic economic conditions and
4. additional expenses due to miscellaneous reasons.
To help provide some measure of protection for the owner's equity this plan suggests several types of insurance. Insurance programs might cover:

1. **Mortgage Insurance**
   
   In event of the mortgagor's death, the existing mortgage would be liquidated through the insurance program. Such a measure would provide the mortgagor's family with a debt free home.

2. **Overall Householder's Policy**
   
   Such a policy might cover fire, earthquake, wind, or flood damage. The extent and nature of coverage would be entirely optional.

3. **Homeowner's Funds**
   
   Arrangements might be made by the homeowner for payment into a sinking type fund. Such a fund might be drawn on, subject to certain predetermined requirements, to meet mortgage payments or to provide maintenance and modernization loans.
III
THE NATIONAL HOUSING CORPORATION

Under the plan presented in this thesis, housing would be co-ordinated at the national level by several competing national corporations. These national corporations would be formed and managed in such a manner as to operate entirely independently of one another.

In order to achieve the economies and cost reductions that are usually associated with large scale operations, the national corporation will assume several functions. These are:

1. purchasing,
2. design,
3. limited component assembly,
4. advertising,
5. research,
6. overall co-ordination of local groups,
7. inspection and
8. distribution.

Each national corporation will in turn license a number of local or regional corporations to perform local distribution and site construction. This plan thereby proposes to maintain free enterprise on both a local and national level.
OBJECTIVES

The objectives of the National Housing Corporation should be based on the principle of providing adequate housing at reasonable prices to a large segment of the population. Immediate objectives of this plan are to:

1. preserve both national and local enterprise,
2. accept only limited dividend profits,
3. offer a variety in design and location and
4. lower housing costs.

CAPITAL

A large amount of initial capital will be necessary in order to provide for plant organization, material purchase and other general expenses. Obviously, the capital needs of the National Corporation, particularly if organized on an effective scale, will be quite high. Local groups, such as contractors, architects and material dealers would be strongly encouraged to invest in the National Corporation. In this manner, ultimate control of the National Corporation might possibly rest with those, in the housing industry, who stand to derive the benefits of national co-ordination. Prefabricators and materials manufacturers, whose companies and plants are already in existence, might find it profitable to combine interests in the promotion of a National Corporation, since a program designed to lower costs would in turn encompass larger markets.
Sources of capital, in general, might be from:

1. commercial and private banks,
2. insurance companies,
3. basic materials manufacturers,
4. existing contractors and prefabricators,
5. financial aid resulting from government policies and
6. sale of stock to the general public.

MANAGEMENT

Ideally, management should cover all phases of the corporation's activities from the technical, financial, legal and general angles. Since the National Corporation acts primarily to provide housing for local markets, it would seem that local groups should have some degree of participation in the management of the National Corporation. An adequate system of management should certainly encompass representation of local desires and policies. Above all, it is very essential that the management of the National Corporation direct all operations toward the promotion of adequate housing at reasonable prices.

DESIGN

A staff of architects and engineers will be employed by the National Corporation to plan a large variety of standardized designs. Architects, operating at the local levels, will not only provide minor variances in the standard designs but will also design custom type houses to fit individual preferences.
PLANT OPERATIONS

The potentially broad scope of manufacturing processes, required to provide prefabricated components, may necessitate elaborate plant facilities. In order to preserve free enterprise, all prefabrication should be accomplished by existing mills and factories at both national and local levels.

LEGAL

The National Corporation will cover and protect all new developments by patents, wherever possible, and provide a trademark for the panelized system of construction. Since numerous legal problems are certain to arise in such a complex organization, a competent legal staff should be maintained.

MATERIAL DISTRIBUTION

Materials and assembled components may be distributed to purchasers as:

1. basic materials only,
2. panels and materials,
3. complete wall, floor and roof sections or
4. complete house packages.

PURCHASING

By making arrangements with material manufacturers to purchase large quantities of materials, it is entirely possible that substantial cost savings will be affected. The National Corporation will usually purchase all basic materials for the
subsidiary participants in the program. Materials will be ordered in advance of use and shipped to local groups.

**ADVERTISING**

Advertising perhaps provides more of an aid to modern sales techniques than any other method available. The use of a common National Trademark by local groups will certainly bolster the effects of national advertising. However, advertising will serve only to attract attention to the products. If construction and design standards are maintained at reasonable costs, then the full effectiveness of advertising may be realized. Advertising will be undertaken for all local participants by the National Corporation.

**INSPECTION**

In this program, all houses produced by the local groups in co-operation with the National Corporation will be sold under a National Trademark. It is, therefore, very essential that all houses using the National Trademark be constructed in accordance with predetermined standards. Periodic inspections of local operations by the National Corporation will ascertain that all houses are constructed in accordance with plans and specifications using adequate construction methods.
RESEARCH

One of the primary reasons that progress in the house-building industry has failed to maintain pace with technological advances is that a definite lack of co-ordinated research exists in regard to new materials and new construction methods. Many individual material manufacturers use a considerable amount of their resources for research. However, this research is almost entirely directed toward the improvement of the one particular material that this manufacturer furnishes. Research that ties together various materials into a completed product is, with the exception of work performed by a few governmental agencies, almost nonexistent.

"The building industry itself is an aggregation of small operators. Such an industry has a hard time slashing costs by the normal techniques of industrialization. A new roofing method, for example may splendidly cut costs, but if it requires the building of a dozen units before the saving takes effect, the technical advance is of no use or interest to the great majority of small builders. Thus it is not surprising that the industry has done so little in the way of research. Building experts guess that $250 million a year is spent in research on materials used in home building—but that this is done mainly by the big manufacturers such as du-Pont or Johns-Manville which supply the industry. 1

1 Hughes and May, op. cit., p. 282.
The National Corporation should maintain research personnel equipped to investigate new methods and materials in order to derive more economical construction patterns.
IV

THE LOCAL HOUSING CORPORATION

One of the more important aspects of the plan for national co-ordination of housing is the preservation of local enterprise. Techniques in house construction are determined largely by local building codes, zoning regulations, available materials and existing labor policies. Moreover, due to the stationary characteristic of structures, housing markets remain predominately local ones. These factors dictate that a plan designed for effective operation, with minimum change in existing conditions, delegate much responsibility for construction of houses to local groups. In order to further public acceptance and also to promote the general welfare of the various localities, this plan will provide for maximum organization and use of local enterprise. The National Corporation will, therefore, encourage the licensing of Local Corporations. These Local Corporations may include a local:

1. architect,
2. engineer,
3. realtor,
4. lawyer,
5. tradesmen,
6. building contractor,
7. material dealer and
8. lending institution.
OBJECTIVES

Objectives of the Local Corporation will be similar in nature to the objectives of the National Corporation. The Local Corporation will help promote the general welfare of the locality by providing adequate housing at a reasonable price. The Local Corporation, although an independent corporation, is licensed by the National Corporation. Provisions should be included in the license agreements to insure adherence by the Local Corporation to the principles advocated by the National Corporation. It should, therefore, be the policy of the National Corporation to permit the Local Corporation as large a degree of freedom as possible. There will be some matters, however, in which the Local Corporation must be subordinate to the National Corporation. Requirements of the Local Corporation in regard to the National Corporation are:

1. To actively exploit the fabrication, erection and sale of houses using the system furnished by the National Corporation.

2. To purchase all materials and equipment, except where special permission is granted to do otherwise, through the National Corporation.

3. To sell houses at a profit not to exceed an amount established in an agreement with the National Corporation in order to extend the local market.
4. To reserve to the National Corporation, all rights to new methods and devises developed by the Local Corporation under agreements for mutual participation in each such instance.

5. To furnish the National Corporation with all estimates, bills of material, costs, photographs and other details which might assist other Local Corporations in the exploitation of the same plan in other communities and thus avoid duplication of effort and help reduce costs of construction.

6. Pay a service fee based on costs of materials and equipment to the National Corporation.

7. Agree to periodic field and office checks by the National Corporation.

8. Agree to use the National Trademark only on houses constructed in accordance with plans and specifications approved by the National Corporation. Of course, any National Trademark may be used only with the permission of the National Corporation.

CAPITAL

Local Corporations should be primarily owned by the architects, contractors, engineers and others, who are participating in the program. In this manner, control of the Corporation will remain with those groups best qualified
to manage the various activities of the Local Corporation.

Besides the initial capital that might be raised from the above groups, other sources of capital are:

1. building and loan institutions,
2. commercial and private banks,
3. government loans,
4. loans from the National Corporation,
5. public sale of stock and
6. basic material manufacturers' funds.

ARCHITECT

Most of the houses built by the Local Corporations would probably be in accordance with the designs issued by the National Corporation. For each such house, constructed under the auspices of the National Corporation, the local architect would receive a standardized fee from the Local Corporation. A young architect, who is a member of the A.I.A., would be a preferable choice for membership in the Local Corporation. Custom designs, to meet individual preferences would be accomplished by the local architects.

ENGINEER

A local engineer may be engaged on a unit basis by the Local Corporation to operate in the same way as the local architect. He would work with the architect on specific structural details that might arise and would be available for land planning operations.
Substantial cost reductions may be obtained by purchasing materials from the National Corporation. Using mass purchasing techniques, the National Corporation will in turn, place orders with the material manufacturers. Since the National Corporation can achieve cost reductions only by offering guaranteed markets to the material manufacturers, it will be necessary for the Local Corporation to purchase all basic construction materials involved in the designs through the National Corporation. Contractors, who are members of Local Corporations, will be expected to order materials or panel components from the Local Corporation. The Local Corporation in turn will submit these orders to the material procurement division of the National Corporation. It is realized that the Local Corporation may be able to purchase materials, which are manufactured locally, at a cost less than that offered by the National Corporation. In this case, the Local Corporation may request permission to deviate from the standard buying schedule, and perhaps make such cost advantages available to all Local Corporations through the National Corporation.

It is only natural that many problems of a legal nature should arise within the Local Corporation. A local lawyer could be retained on fee basis for consultation on legal matters. However, the lawyer would probably be of more
value if he were actually a profit sharing member of the corporation. For this reason it is suggested that, whenever possible, a local lawyer be encouraged to actually become a member of the Local Corporation.

These lawyers could handle all legal problems at the local level and at the same time co-ordinate with the lawyers of the National Corporation in instances where the policies of the National Corporation are involved.

**REALTOR**

Sale of houses constructed under this plan should be facilitated by the use of realtors who are members of the Local Corporations. The policies of this group of realtors in regard to sale of houses constructed by the Local Corporation should be to:

1. Promote the sale of all houses constructed under this plan.
2. Encourage "trade-ins" of used houses on new houses.
3. Co-ordinate services between Local Corporations, in order to allow homeowners who are moving from one locality to another to negotiate ready transfers.
TRADESMEN

In the past, new innovations such as prefabricated panels, and pre-installed plumbing and electrical equipment have met with strong resistance from various labor groups. Some of this opposition, if not most of it, results from the fact that the manner of employment of these new methods is often detrimental to local enterprise. It is certainly true that importation of elements fabricated in other localities serves to detract from enterprise within a given community. However, this serious objection to present prefabrication techniques could be removed by a local plan, which provides for prefabrication and site fabrication work by local tradesmen.

Therefore, in order to expand and utilize localized prefabrication, while at the same time operating within labor union principles, local tradesmen such as plumbing, masonry, electrical and carpentry subcontractors should be encouraged to become members of Local Corporations. In this manner, local labor would not only participate in profits but would actually be a determining factor in policy decisions.

CONTRACTORS

Existing house building contractors may be classified as:

1. small contractors,
2. medium size contractors,
3. operative builders and
4. prefabricators.
By participating in this program as members of either the National or Local Corporations, these groups may be able to achieve reductions in costs while at the same time raising quality of design and construction.

**INSPECTION**

Local Corporations may perform actual construction together with some degrees of prefabrication. In order to maintain and expand markets, it is very essential that all houses be constructed in an acceptable manner as economically as possible. Since it is the responsibility of the Local Corporation to ascertain that these policies are carried out, an adequate inspection system should be organized at the local levels. An effective inspection system should cover all local phases of operations with particular emphasis on adherence to plans and specifications by the local contractors.
V

DETAILED OPERATIONS

Operations such as design, research, material purchasing and advertising should be accomplished on a national basis to provide co-ordination of the various local groups. However, in order to maintain local enterprise, many operations may be delegated to the local participants. The degree of local participation in the program will depend on available labor sources and housing demands together with local construction policies. In all cases, however, actual house construction should be a local responsibility.

All houses built under the auspices of the National Trademark will reflect either favorably or unfavorably on the National Corporation. It is, therefore, essential that the work of each Local Corporation be subject to periodic inspections by the National Corporation in regard to construction standards and quality.
DESIGN FEATURES - STRUCTURAL

Preliminary study indicates that a system of prefabricated panels, constructed to permit adaptation to modularized design, would prove very satisfactory for the construction of a mass produced house. A system of connectors should be incorporated, together with the panel system, so that erection and disassembly can be easily and quickly accomplished. Standardized panels are now produced by the prefabrication industries in a variety of designs. Some of the various types of panels are:

1. **Stressed Skin Panels** (Diagrams 1, 3, 4, of Fig.4)
   These panels, which are commonly prefabricated from lumber studs and plywood sheathing, act primarily as deep girders. Economies are achieved through designs which permit the transfer of stresses through the exterior and interior coverings as well as through the skeleton framework of studs.

2. **Panelized Wood Frames** (Diagram 2 of Fig.4)
   This type of panel, usually prefabricated with 2x4 studs, appears to be conventional construction when erected. Exterior and interior sheathings may or may not be pre-applied.
Figure 4

3. **Metal Panels** (Diagram 5 of Figure 4)

Various machine panels that are precisely machined by factory operations have been used. However, such panels have not, in general, met with success due to expense, condensation problems and lack of public acceptance. The steel panel in Figure 5 has overcome many of the disadvantages of its predecessors.

4. **Paper Honeycomb Core Panel** (Diagram 6 of Fig.4)

A relatively new innovation in the field of structural components, this type of panel appears to possess great potentiality due to the high structural strength and light weight derived from the paper core. Exterior and interior faces can be composed of metal, plastic, gypsum or plastic.

5. **The Voss Panel** (Figures 5, 6 and 7)

This stressed skin series of plywood panels was devised by the Housing Research Corporation under the direction of Professor Walter C. Voss of the Massachusetts Institute of Technology. A complete set of these panels, incorporated with modularized designs, provides for rapid and complete erection of wall, floor and roof sections. The special system of
Figure 5
Figure 6
## FULL HEIGHT PANELS

<table>
<thead>
<tr>
<th>Panel Width</th>
<th>BLK</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>D1</th>
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Notes:
- Panel Widths range from 48 to 72 units.
- BLK, W1, W2, and W3 are columns for different panel types.
- D1 and D2 are columns for additional panel configurations.
- Each cell indicates the presence or absence of a panel type.

Legend:
- C: Column
- S: Single
- H: Half
- Full: Full panel
Connectors used to assemble these panels is particularly unique in that it readily permits disassembly of panels from used houses. Such a system, if fully exploited, could not only provide a large degree of flexibility to new housing, but could also serve, through the assembly of used panels, to provide low cost houses to various low income groups.

Excessive standardization of design is one primary objection to the houses being constructed by the present housing industry. Standard panels, either employing one of the above panel types or new innovations, could be arranged in various modularized designs to permit maximum flexibility in both design and construction. Modularized coordination of panels could allow radical variances in design while still employing standardized components. Various modularized systems of designs have been evolved in recent years but perhaps the most practical of these systems, at least from the standpoint of mass production techniques, is a standard unit which can either be an entity in itself or readily expanded to meet varying conditions.

Figures 8 & 9 illustrate the techniques employed in expanding a basic modularized design. In these illustrations, a 30'x30' basic house can be expanded in 3' sections on either side. Appendix A includes a complete series of designs which vary from the basic structure on page 96 to the house shown on page 104. All of these houses are de-
Starting point of most Rodney Walker designs is the 30' x 30' house at left. The larger sketch illustrates how house can be extended in 3 sections, how rooms can be added on at either side or at the far end.

**Figure 8**

Figure 9

House and Home, August 1953, p.117-118.
signed to employ the same standard panels (Voss Panel, page 47) and are varied merely by modular additions. Employment of this system permits not only the use of a wide variety of standard designs but also permits adaptability of individualized designs to the modularized system with little difficulty.

The local architect, who is a member of the Local Corporation, should be paid a predetermined fee for every house constructed by the Local Corporation under the National Trademark. For this fee, he would be required to make such minor changes as individual preferences dictate. If a local buyer desires to use the panelized system of construction offered by this plan but has his own design preferences, then the local architect, for a reasonable fee, will modularize the buyer's design to fit this system of panelized construction. Construction costs will probably be higher on non-standard designs, however.

LAND PLANNING

Proper land planning in subdivisions can provide a great deal of relief from the usual monotony of housing developments regardless of the type of houses constructed on the land. The old gridiron methods of land sub-dividing are rapidly giving way to new curvilinear patterns of land layouts. Benefits derived from curvilinear planning should be called to the attention of all local contractors and minimum
requirements for variances in land planning should be established by the Local Corporations. Figures (10 & 11) illustrate curvilinear patterns of land subdivision that serve to provide varied and adequately sized lots.

MATERIAL REQUISITION

The flow of materials in the housebuilding industry is very unique in comparison with the flow of materials in other manufacturing industries. Although other industries can buy materials directly from the mill or manufacturer, this is not the case with the home builder. In the housing industry, the manufacturers distribute their materials and equipment through wholesales, who, in turn, pass them on to retailers. There is often a 100% markup in the cost of materials with this system.\(^1\) It is not difficult to understand why the local builders have experienced difficulty in dealing with national manufacturers. House builders have long been notably weak in both management and financial arrangements. Due to the large capital outlay required to construct even a few houses, the builder is often forced to rely on trade credit for the basic materials required in house construction. National materials manufacturers are often reluctant to risk credit on unknown local builders. This

situation gave rise to local material dealers, who were willing to extend short term credit to local builders. The relatively small size of each individual builder dictates the purchase of materials in small quantities. Large material manufacturers do not find it profitable to permit discounts on small orders.

To overcome the excessive markups in materials it will be necessary to purchase directly from the manufacturers. The National Corporation by purchasing large quantities of materials and equipment and offering guaranteed markets could wield the influence necessary to buy directly from the materials manufacturers at discount prices. Each Local Corporation can provide estimates of their anticipated material and equipment requirements to the National Corporation. The National Corporation could then co-ordinate orders from all Local Corporations and place orders with material manufacturers for large quantities of materials and equipment. The Local Corporation would have to agree, in general, to place all orders for materials and equipment with the National Corporation. This serves to provide the National Corporation with the quantity orders it requires to affect cost savings. If the Local Corporation is able to obtain substantial savings through the purchase of materials from other sources, then it may request permission to vary from this pattern.
By purchasing materials in such large quantities, it may also be possible for the National Corporation to arrange to buy rebuilt refrigerators, stoves, television sets from the material and equipment manufacturers. These optional features could be offered by the Local Corporation with the houses at greatly reduced prices. In fact, it is not difficult to envision a service and sales type discount store in each Local Corporation which deals in all types of household necessities. A buyer shopping at this discount store might find anything from a used chair to a complete new "do-it yourself" house package. An owner, having a house constructed using the modularized panel system, might decide, with the birth of a new child, to divide the large master bedroom into two smaller bedrooms. He need then only to visit the Local Corporation's housing store where a wide variety of both new and used panels would be available for the needed partition, as well as architectural service to do the job effectively.

**MANUFACTURING**

In order to provide basic components and materials for the various localities, the National Corporation must initially make arrangements for plant operations. Several alternatives in regard to plant operations are:

1. The National Corporation could maintain a plant to manufacture many components and materials.
2. The National Corporation could maintain a plant to assemble components obtained from other manufacturers.

3. The National Corporation could employ an existing plant to process material orders.

The manufacture of a great number of components and materials, as suggested in step 1, would require elaborate manufacturing facilities. Under this system, lumber would be processed and many of the required connectors and other components would actually be manufactured by the National Corporation. In order to compete with the manufacturers of these same types of materials, this method would require an extremely efficient operation coupled with a large output. Once the plant was organized to produce certain types of components and materials, it would become uneconomical to change initial layouts for a period of time. This, in turn, could lead to inflexibility in both fabrication and design.

It would probably be more efficient and undoubtedly more economical to purchase manufactured materials and components from established manufacturers. Since each manufacturer deals with a relatively few number of manufactured parts and materials, he is usually well qualified to achieve cost reductions in his specialized field. These manufacturers would preferably be members of either the National or Local Corporation.
DISTRIBUTION BY THE NATIONAL CORPORATION

Materials and prefabricated components could be distributed to the Local Corporations as:

1. **Complete House Packages**

   A complete house package would consist of floor, roof, wall panels, plumbing and electrical elements and all other materials necessary to complete the construction of the house. Such packages would require a minimum of processing by the Local Corporation.

2. **Complete Wall, Floor and Roof Sections**

   Complete wall, floor and roof sections would be provided by the National Corporation for shipment to the Local Corporations. Local groups could then incorporate varied degrees of local prefabrication.

3. **Panels**

   Local Corporations could have the option of ordering panels together with the desired amount of miscellaneous materials.

4. **Materials Only**

   By ordering material only, Local Corporations could perform the desired degree of prefabrication in local plants or ship materials directly to the job site for site
MANUFACTURING AND DISTRIBUTION BY LOCAL CORPORATION

Since Local Corporations can receive either prefabricated components, complete house packages or miscellaneous materials, local plant requirements may vary from storage facilities to elaborate manufacturing setups. Materials may be distributed to the local contractor, who is a part of the Corporation as:

1. complete house packages,
2. complete wall, floor, roof sections,
3. panels or
4. miscellaneous materials.

This range of materials and components serves to allow the local building contractor the widest possible range in regard to the amount of site fabrication versus prefabricated construction.

Because prefabrication, to some extent, serves to determine, together with certain other intrinsic features of the plan, definite and perhaps substantial cost reductions; the maximum use of prefabricated components, whether manufactured at the national or local level, will serve best to promote the objectives of this plan. A wide use of prefabrication methods will serve to shift operations from the field, where a large degree of unnecessary handicaps result from weather conditions and handicraft techniques, to areas
such as inside workshops that permit more ready applications of advanced technology. More bluntly, the fullest advantages of this plan will not be realized by merely, slightly renovating existing techniques, such as by the introduction of mass purchasing techniques. Instead, even to partially achieve the desired objectives, substantial changes such as mass production of prefabricated components must be accepted by the local building contractor. However, in order to provide for evolutionary instead of revolutionary processes, provisions should be made to permit local contractors to gradually change from site to factory fabrication, if so desired.

**USED PANELS**

To provide maximum flexibility, panels should be connected in such a manner as to permit ready disassembly of wall, floor and roof sections without injury to the panels. These used panels may be sold to the Local Corporations at salvage values or taken as "trade-ins" for new panels. Although many industries maintain stability through replacement markets, such a pattern is relatively rare in the housing industries. A system relying on site replacement of panels could serve greatly to increase the scope of the housing industry. Such a program, if widespread, could serve to modernize housing standards while at the same time promote new markets for the housing industry. Used
panels would become available to the Local Corporation through one of the following means:

1. **Modernizations**

   Demountable systems of panels would enable homeowners, with little difficulty, to rearrange internal floor plans or even expand the basic shape of a house to meet fluctuating requirements. Panels, salvaged from these modernizations, may be sold to the Local Corporation or used as "trade-ins" on new type panels.

2. **Damages**

   Panels from houses partially destroyed or damaged by fire, tornado, hurricane, earthquake, and the like, can be salvaged and resold to the Local Corporations.

3. **Liquidation**

   Homeowners are often severely handicapped by difficulties involved in the liquidation of property. Liquidation of property, at best, is time consuming due to such various considerations as locating and interviewing potential buyers, dealing with realtors, title searches, mortgage arrangements, and the like. To alleviate and perhaps even
completely avoid these difficulties, the Local Corporations should provide means of rapid liquidation of houses. Perhaps under such a plan, the owner could merely notify the Local Corporations of the necessity for immediate liquidation together with the various considerations that may accompany this necessity. Coupled with this program for liquidation, the Local Corporation should provide means, by a system of co-ordination with the National Corporation, of locating housing in desired areas for owners liquidating property and moving out of the immediate locality. If called in to liquidate property, the Local Corporation will either make arrangements to purchase directly from the owner or will locate purchasers. Houses so purchased by the Local Corporation can be demounted, modernized or sold directly to other purchasers.

Proper utilization of used panels can result in a widespread demand for them throughout the country. Disposal of used panels may be entirely under the control of the Local Corporations. However, co-ordination of supply and demand between Local Corporations should be subject to control by the National Corporation, which may purchase excess used
panels. Sources of demand for used panels are:

1. **Low Income Groups**

   Houses might be readily constructed at greatly reduced costs using panels obtained from old houses. Such a program, in order to further reduce costs, could conceivably be some type of "do-it yourself" construction with technical assistance provided by the Local Corporation in the locality.

2. **United States Government**

   The government of the United States has a constant and varied need for many types of temporary and permanent low cost dwellings for soldiers, construction workers, civilian employees and low cost housing developments. This type of used panel would permit the construction of readily demountable dwellings at a minimum of cost.

3. **Foreign Governments**

   Severe housing shortages exist in many parts of the world at the present time. The recent economical and industrial development of some countries not only serves to intensify present housing problems but actually, in some instances, makes it
economically possible for some governments to provide limited amounts of low cost housing. However, before this housing can be provided, technological means of constructing low cost dwellings must be devised. Low cost, used panels shipped directly from the United States, might enable these countries to build the low cost housing needed for the further development of their countries.

**TECHNICAL ASSISTANCE**

Since Local Corporations may require assistance in the organization of local operations, the National Corporation will employ a staff to provide technical assistance for:

1. manufacturing layouts,
2. management,
3. financing,
4. design and
5. construction.

The methods and performance of each Local Corporation should be evaluated, in terms of technological advances and standard operations, by the National Corporation at periodic intervals.
INSURANCE

Because there are a number of financial risks in home ownership, insurance programs should be employed to safeguard the homeowner. Arrangements should be made by the National Corporation with existing insurance companies to provide buyers with:

1. Mortgage Insurance

Upon death of the mortgagor, the mortgage would be assumed by the insurance company. This policy would serve to provide the mortgagor's family with a debt free home.

2. Homeowner's Policy

Other insurance such as fire, earthquake, wind, flood, and the like, should be available to the purchaser.

Certain types of insurance, such as the mortgage insurance, should be made compulsory under this program in order to provide homeowners with economic safeguards against loss of property. Such a policy would serve to provide security for the equity investment in property from the mortgagors standpoint and at the same time could lessen risks incurred by the mortgagee. However, in order to provide free enterprise, the mortgagor should not be required to obtain this insurance protection from the National or Local Corporations but should be permitted a maximum degree of latitude in choosing insurance companies to provide the
required protection.

**HOMEOWNER'S FUNDS**

Besides insurance programs, added degrees of security in home ownership could result from the use of a "Homeowner's Fund". The National Corporation could organize a sinking fund program designed to provide a buffer zone against fluctuations in an owner's ability to meet mortgage payments. At the same time funds could be accumulated to provide for required maintenance of houses constructed by the Local Corporations. Each homeowner could be required to pay monthly fees into this fund. Whether participation in this program would be compulsory or voluntary would naturally be determined by policies set forth by the National and Local Corporations. It is suggested, however, that the degree of participation in such a program be left to the discretion of each individual homeowner. In this manner, any desired amount of payment, included in mortgage payments, would create an accumulation of equity in the fund. Minimum participation in the program could be accomplished by payment of a fee established by some percentage of the initial loan on the house. The owner, after a certain period of time elapses, could draw on this fund because of:
1. **Fluctuations In Ability to Pay**

Fluctuations in a mortgagor's ability to meet mortgage payments could occur for a variety of reasons. Some of these reasons are:

a. loss of employment,

b. illness,

c. changes in economic cycles and
d. additional expenses due to miscellaneous reasons.

In keeping with the policy of promoting the general welfare of the country, it would be well to safeguard the homeowner against loss of property due to fluctuations in income. The homeowner could draw on this type of fund to meet payments in case of emergency. Of course, the length of time a mortgagor could draw on the fund would be determined by the accumulated savings available. However, the plan should be designed to prevent a homeowner from losing his home due to a short term crisis.

2. **Maintenance**

One of the primary causes of rapid depreciation of houses is the lack of maintenance. This is harmful to:
a. **Homeowner**

Depreciation is harmful to the homeowner because it usually means a partial loss of his capital and equity investment.

b. **Community**

The community suffers since depreciation of the houses that compose a community may, in turn, cause a depreciation of the entire community. Slums and blighted areas are often end results of depreciated communities.

c. **Lending Institutions**

Lending institutions have based amortization periods, together with other factors, on certain rates of depreciation. If the depreciation occurs at a faster rate than estimated then the value of a house at a particular time might not cover the remaining mortgage.

Under this plan a homeowner may draw certain amounts, subject to the approval of the National Corporation, from this fund for maintenance or modernizations of his property. Predetermined policies would dictate that allotted periodic withdrawals be made in accordance with the
FINANCE

Since the capital requirements of the Local Corporation might be difficult to arrange at the beginning of initial operations, the National Corporation should help locate financing. Financing might be directly available to the Local Corporation through:

1. savings and loan institutions,
2. commercial and savings banks,
3. life insurance companies,
4. national manufacturers and
5. existing contractors and prefabricators.

It is intended that the National Corporation would eventually organize its own Acceptance Corporation to offer financing for local operations. This Acceptance Corporation, which would be formed through the equity investment of stockholders, could make loans to the Local Corporations for:

1. plant organization,
2. material purchases and
3. construction.

BUILDING CODES

Many building codes are based on unrealistic requirements. These codes are sometimes not even consistent in themselves and certainly change radically from community
to community. Code requirements vary so much in sizes and other specifications that they limit standardization of materials and components.

"Investigation of code provisions reveal a range in "live load" requirements for dwelling of from 25 to 100 pounds per square foot, minimum thicknesses of brick walls from 8 to 16 inches for the same height and load, working stresses in concrete from 500 to 1000 pounds per square inch, and variation in pipe sizes of 150%. Floor-area specifications for the same type room vary from 60 to 120 square feet, and ceiling heights from 7 to 9 feet. An analysis of plumbing codes of a dozen cities selected at random shows that the community requiring the lowest amount of metal in a one story house saves 100 pounds of cast iron, or about 30% of the total required by the city with the maximum requirements. Similarly, the minimum code saves 10 pounds of metals other than cast iron out of 50 pounds required by the maximum code."1

Some communities are unaware of the potential harm to the community due to archaic building codes. These types of codes aid in keeping housing costs high and this, in turn, can often cause slums to flourish. The National Corporation will constantly strive for revision of building codes by demonstrating the benefits of a modern and flexible code to the local community. This program can be carried out by:

1. advertising,
2. public information programs,
3. materials research and testing and
4. local technical efforts.

1 Colean, op. cit., p. 127.
INSPECTION

In this program, the house will become known by its National Trademark and it is, therefore, very essential that all houses bearing the National Trademark be constructed in accordance with predetermined standards. Since the National Corporations establishes certain policies and then licenses Local Corporations to carry out these policies, there is a definite necessity for the Local Corporations to:

1. construct houses in accordance with plans and specifications,
2. abide by the charter and by-laws under which they were licensed,
3. accept only a limited predetermined profit,
4. promote the general welfare of the locality and
5. maintain a high quality of construction.

To ascertain that these policies are adhered to in an acceptable manner, it will be necessary for the National Corporation to institute a system of periodic inspections. To insure high quality performance, it would be essential that the Local Corporation maintain an active inspection system at the local level. If the houses, at completion, have met all required standards, a certificate of approval bearing the National Trademark will be posted on the property. This certificate insures the owner or potential buyers that the house bearing the certificate has been built with high quality materials and construction techniques and in ac-
CORDANCE WITH THE PLANS AND SPECIFICATIONS.

UTILIZATION OF EXISTING CONTRACTORS

Since the history of the housing field has proven that changes must occur slowly or risk almost certain rejection, this plan for the national co-ordination of housing will seek to utilize the present housing industry to a large degree. Although certain changes in construction procedures and design are sought, this plan advocates a gradual evolution of the processes instead of radical changes. Existing contractors will be utilized at local levels to perform actual house construction. House construction in the United States is presently performed by:

1. small private contractors,
2. medium size contractors,
3. operative builders and
4. prefabrication companies.

Small Private Contractors

Until 1940, almost all house construction in this country was accomplished by relatively small contracting firms. This type of builder often included:

1. Individuals building their own home.
2. Part time builders, who might build from 2 to 5 houses per year, but for whom the construction of houses is not a major activity.
3. Small private contractors, who formerly accounted for a large bulk of the new housing and even today capture a large portion of the housing market; each of these contractors might build from 5 to 15 houses per year.

The small contractor is usually characterized by:

1. small annual volume of houses,
2. limited working capital,
3. small organization,
4. custom built houses,
5. large percentage of profits and
6. small overhead.

By contracting in advance for the construction of a house, this type of builder is sometimes known as a custom builder. Close co-operation between the owner and contractor is possible under this type of program providing a wide degree of freedom in the owner's preferences and permitting design changes at any stage of construction. Since the contractor has very close control over construction operations, a high quality product often results but because the house is custom built and not mass produced, the owner must usually pay a higher price.

**Small Contractor's Costs**

1. **Material Costs**

   Since the custom builder performs only a
limited volume of construction, he must purchase materials in small quantities. Unable to wield the influence necessary to purchase materials directly from the manufacturers, he must pay the pyramided costs which accumulate in the flow of materials from the manufacturer to the local materials dealer.

2. Labor Costs

These are usually high because mass production techniques generally cannot be applied. Intermittent or seasonal work will often cause labor costs per house to be very high.

3. Overhead

This type of contractor is often able to compete costwise with large organizations due to substantial reductions in his overhead. Important savings result through the elimination of office requirements, secretaries, purchasing agents, and the like.

4. Profit

A contractor constructing only a few houses per year must necessarily allow a large profit on each individual unit. This profit is often more than the operative builder requires.
Medium Size Contractors

This type of contractor, usually building from 15 to 30 houses per year, has operations and problems that can be likened in many respects, to the small private contractors. Contracting for work in advance, this contractor, sometimes offers custom built houses; but more often is associated with construction for large scale entrepreneurs.

Medium Size Contractor's Costs

1. Material Costs

Although the medium size contractor may gain slight reductions through material purchases, his nature of operation is usually such that materials for each house arrive on different schedules. Even if the contractor can order and receive all required materials for the yearly operations at once, the small scale of operation warrants only insignificant cost reductions from the material dealers.

2. Labor Costs

Labor techniques used at this stage are often identical to those used by the small contractor. Some degree of mass production techniques may be applied to a group of houses, but the limited amount of construction yields only slight reductions of labor costs.

3. Overhead

In this area, the medium size contractor is
at a disadvantage when compared to the small contractor. Due to his larger scale of operations, this contractor will incur slightly greater overhead expenses due to increased office requirements, purchasing, estimating and supervision costs.

4. Profit

A production of a greater number of houses than built by the small contractor would seem to indicate possible reductions in profits per house. However, depending to some extent on the state of the market, builders will often access profits which are in excess of what consumers should be expected to bear.

Operative Builders

Although many interpretations of operative builders may exist, we will, for the purpose of this discussion, define an operative builder as one who speculatively constructs over 30 houses per year on his own land and often in accordance with his own designs. Operative building was virtually unknown until the booming prosperity of the 1920's made it possible for entrepreneurs to accumulate the amount of capital necessary to begin operative building. In the 1930's, the New Deal Administration passed much legislation affecting the housing problems in this country.
Some of this legislation, notably that which established the Federal Housing Administration, acted to stimulate house building. The FHA made it possible, in many instances, for builders to initiate large housing projects with little investment of their own capital. Many of the existing operative builders took advantage of the FHA mortgage insurance to begin their widespread operations. Some of the operations often undertaken by operative builders are:

1. land purchase,
2. architectural planning,
3. land planning,
4. land development,
5. financing,
6. speculative house construction and
7. repair.

Although organizational setups may differ among operative builders, almost all use degree of mass construction techniques. Various systems employed by operative builders in the construction of large groups of houses are:

1. use of prefabricated house packages,
2. use of prefabricated wall, roof or floor sections,
3. site fabrication of standard wall, floor and roof sections; a notable example of this type of site fabrication is the light roof truss which may be fabricated at one area of the job and transported by truck to the job site and
4. use of conventional construction.

Operative Builder's Costs

1. Material Costs

Although the operative builder can gain cost concessions from local material dealers, his scope of operations is too limited to interest material manufacturers in direct sales in most cases. The operative builder, therefore, must usually pay the pyramided costs associated with the flow of materials in the building industry.

2. Labor Costs

Operative builders may, by proper utilization of equipment and construction methods, plan sequences of operation in a manner designed to result in ultimate cost reductions. Production of houses on a large scale, particularly where repetitive operations are involved, can result in substantial labor cost reductions.

3. Overhead

Due to the necessity of employing architects, engineers, purchasing agents, secretaries and the others, the overhead in this type of organization may become quite high.
4. Profits

By constructing large numbers of houses, operative builders could afford to accept profits that are lower than other types of builders require per house. Whether this policy is followed generally is highly doubtful. At least annual profits are increased, thereby providing turnover of invested capital.

Contractor Participation

To achieve the principles previously set forth in this discussion, all houses should be constructed of prefabricated wall, floor, partition and roof panels which have a high degree of repetitive use in any plan, which enables the fabricator to use plant methods to reduce costs, and which reduce the amount of site labor to a reasonable minimum. Such an assemblage of modular units permits great variety of plan, ease of change, salvage values and, when these units can be produced in volume, a substantial reduction in cost. This approach has several distinct advantages over the alternate field methods previously mentioned. These methods were:

1. pre-cut-site assembled,
2. site fabrication and erection,
3. full wall, floor and roof panels and
4. packaged units.
Pre-cut and site assembled housing has the advantage of choice of plan and location, but falls far short of the objective of change and expansion, presents a frozen equity and involves highly expensive site labor and unnecessary repetition of basic work.

Site fabrication and erection denies the owner any degree of freedom of choice of design or location, presents a group of frozen entities, high costs for change, necessity for the amortization of much of the plant for each project and high labor costs at the site.

Those schemes for full wall, floor and roof panels are highly restrictive to choice of design, expensive to transport, frozen entities depending upon system of assembly, and give only relative freedom of expansion and change.

The packaged units are the most highly restrictive in design and force the owner to the choice of size and equipment fixed by a single designing group. The modularized unit panels proposed in this plan come closest to the realization of the basic characteristics required. By such a system almost any plan or style of architecture can be modularized to fit into the pattern of standard panels. (Figure 12 shows elementary forms of panelized construction).

However, in order to provide for a gradual evolution of existing methods, materials will be made available in any desired degree of prefabrication. Contractors may then avail themselves of the maximum cost reductions (i.e., purchase of pre-assembled modularized panels); or of the
Truck delivers house package to site

Floor joists (here steel) are laid

Wall panels go up over floor panels

Roof trusses are erected

Soffits quickly slip into place

Finished house does not look prefabbed
minimum cost reductions (i.e., purchase of basic materials only), or any intermediate cost reduction (i.e., such as the purchase of pre-cut materials).

An optimum number of contractors in any Local Corporation will naturally be determined by the potential amount of construction available. Since the three types of builders previously discussed usually cater to different types markets—small and medium size builder perform custom building—a preferable distribution of contractors within the Local Corporation would include all three types of builders. Houses sold directly by the Realty Division of the Local Corporation could be assigned to each contractor on a rotational basis. However, the contractor should be permitted to construct, under this program, any house for which he contracts as long as the policies set forth by the National and Local Corporation are followed. At completion, each house constructed by a member of the Local Corporation would be issued a Certificate of Approval which certified that the house has met all inspections performed by the Local Corporation and is constructed in accordance with the plans and specifications.

Contractors, who are not members of the Local Corporations, may still avail themselves of the benefits offered under the program. Materials, panels, wall sections, floor sections, roof sections and house packages may be sold
"across the counter" to any individual desiring to buy. However, houses constructed by non-members of the Local Corporation will not, in general, be issued certificates of approval bearing the National Trademark. Non-members may qualify for this certification, however, by agreeing to submit all plans, specifications, costs and details of construction methods to the Local Corporations. Then, for a service fee, which is required for processing the plans and specifications and performing the required inspections, any individual may construct houses using the National Trademark.

Prefabricators

A prefabricated house is often defined as:

"One having walls, partitions, floors, ceilings, and/or roof composed of sections or panels varying in size which have been fabricated in a factory prior to erection on the building foundation. This is in contrast to the conventionally built home which is constructed piece by piece on the site."

Some of the concepts advocated in earlier sections of this study are practised to varying degrees by existing prefabrication companies. However, with the possible exception of a few of the larger prefabrication companies, these concepts are not co-ordinated in an effective manner. Many of the smaller prefabrication companies operate almost entirely on a local or regional basis and cannot affect substantial cost reductions.

Existing prefabricators could participate in the plan suggested in this thesis by becoming members of either National or Local Corporations. In this manner, fullest use could be made of existing manufacturing facilities. (A complete study of prefabrication companies and operations may be found in *The Prefabrication of Houses* by Burnham Kelly).
VI

ACHIEVEMENT OF PHILOSOPHICAL IDEALS

An investigation into methods of providing housing to all income groups is beyond the scope of this thesis. However, it is the author's contention that the middle income groups and even a large part of the lower income groups would be able to buy housing at reasonable costs if modern production and co-ordination techniques were applied to the housing industry. The various proposals, that were made in previous chapters, for the co-ordination of the housing industry at a national level, are correlated here in order to create a broader concept as to how the desired philosophical ideals might progressively become recognized principles.
COST REDUCTIONS

A reduction in housing costs would be of immediate economical benefit not only to consumers but also to the entire housing industry. Substantial reductions in housing costs, leading to like reductions in prices, could serve to broaden and strengthen existing housing markets. Areas in which cost reductions may occur are:

1. **Material Costs**

   Effective co-ordination of material orders placed by Local Corporations should lead to mass purchasing of materials by the National Corporation. The National Corporation, by offering material manufacturers large markets might then be able to avoid the pyramided costs so often reflected in present material costs.

2. **Labor Costs**

   Reductions in labor costs could occur through:

   a. **Use of Panelized Construction**

      Construction techniques involving prefabricated components could lead to labor savings by shifting a large percentage of site operations to local fabrication shops. Applications of mass production techniques and close managerial supervision made possible through factory
fabrication would eliminate many of the handicraft techniques that so needlessly add to construction costs.

b. Stabilization of Housing Industry

The extent to which yearly and seasonal variations in housing production affect labor costs is certainly indeterminable. It would appear though that a more stable pattern of construction should permit labor leaders to offer more definite indications of wage requirements. Stabilization of seasonal variations might, at least to some extent, reduce the high rate of wages paid to tradesmen now only intermittently employed. Speaking at the National Conference held at the National Committee on Housing in Chicago on March 8, 9, and 10, 1944, W. H. Hedges, Director of Research, International Brotherhood of electrical Workers, said:
"The union and the contractor have been struggling with the problem of the annual wage and have tried to determine on a statistical basis what should be the differential in the hourly wage. The union and the contractor have about reached the conclusion that the hourly wage on an annual basis would be about 30% less than the hourly wage on an open market basis."

Stabilization of the industry might occur through reductions in costs, thereby increasing demand and through factory fabrication, thereby offering continuous employment to the tradesmen.

3. Contractor's Profits and Overhead

Profits and overhead of private contractors can and should be reduced. If the builder is able to buy all basic materials from a single source (in this case the Local Corporation) instead of being forced to ferret out materials from many different dealers, overhead should be reduced. The profit in any private enterprise must naturally compensate for financial risks that might be involved. However, excessive profits would be eliminated by the

1 "Building Tradesmen's Viewpoint", Proceedings of the National Conference on Postwar Housing, Chicago, March 8, 9, 10, 1944, National Committee on Housing, Inc., 1944, p.207.
imposition of a limited dividend type profit.

Used panels can be demounted from old houses and resold to the Local or National Corporations at salvage values. These panels could be resold to low income groups to be used for the construction of low cost housing. Perhaps some type of "do-it-yourself" program could be introduced. In this program low income groups would buy used panels from the Local Corporation and, with technical assistance from the Local and National Corporations, construct decent low cost housing. In other variations of this same type program, the Federal Government could buy used panels at salvage values to be used for the construction of low cost housing.

IMPROVED ARCHITECTURAL STANDARDS

Through proper architectural guidance, at both local and national levels, housing design may be improved in regards to:

1. aesthetic values,
2. functional requirements,
3. space needs and
4. construction methods and materials.

Architects, functioning under the direction of the National Corporation, will provide a large variety of standardized designs for distribution to the Local Corporations. At local levels, architects who are members of the Local Corporation, would not only provide minor changes in standard designs but would also adapt particular custom designs to the panelized
system of construction. A flexible system of standardized panels could permit the construction of varied designs. Any prospective homebuyer may, under the plan for national co-ordination of housing, avail himself of the special talents and abilities of architects as part of the normal service offered by the Local Corporations.

FLEXIBILITY

1. Plan Arrangement

   Flexibility in plan arrangements will be achieved through the use of panels that can be readily erected or demounted. The use of non-bearing interior partitions together with the panelized system of construction should permit plan changes within the basic structure at little cost. Additions to the basic house structure could then be made with new or used panels purchased through the Local Corporations. These degrees of flexibility in regard to interior plan arrangements and exterior enlargements should prevent the early obsolescence of structure due to fluctuations in family space requirements.

2. Liquidation

   A Boston homeowner, who has just accepted a job offer in Los Angeles, finds it necessary
to liquidate his Boston house and find a new one in the Los Angeles area. He communicates with the Local Corporation in the Boston area and states his desire to locate a new dwelling in Los Angeles and liquidate his existing house. The Local Corporation in the Boston area then contacts the Local Corporation in the Los Angeles area and states the desires and requirements of the Boston resident. The Los Angeles Local Corporation then locates several houses that might fit the needs of the Bostonian and awaits his final choice upon arrival in Los Angeles. The Local Corporations should make all arrangements for rapid title transfer. These methods of liquidation would clearly be an improvement over present concepts. By close co-ordination of Local Corporations, such a policy could become a definite reality.

USE OF LOCAL ENTERPRISE

In order to preserve the maximum of free enterprise, fullest use may be made of existing elements of the housing industry. Local engineers, architects, material dealers, tradesmen and the like should be encouraged to avail themselves of the benefits offered by the Local and National Corporations by becoming stockholders in Local Corporations.
These local members will determine the operational policies of the Local Corporation and should naturally have some voice in operations at the national level. It would seem reasonable at the beginning that these local groups would be qualified to deal with local:

1. housing markets,
2. building codes,
3. subdivision and zoning ordinances and
4. labor policies.

REASONABLE CHOICE OF LOCATION

Due to the high prices of almost any type of adequate housing, prospective homeowners are forced to take advantage of even the slightest price reductions when purchasing a house. Reductions in price can often be obtained through the purchase of a house constructed by an operative builder. However, this type of house often has severe disadvantages in that large numbers of identical designs are grouped together in highly localized areas. The use of standardized panels erected in various ways should provide a greater interchange of basic designs than any present system does. Furthermore, costs of custom-designed houses constructed with this type of panel system could be substantially reduced, thereby making a wider variance of both design and location available to potential homeowners.
PROTECTION OF OWNER'S EQUITY

Arrangements with insurance companies, who preferably own stock in either the National or Local Corporation, will provide the homeowners with any desired degree of insurance. As previously explained, these insurance policies could contain provisions for mortgage insurance and overall household's policies. Coupled with these insurance programs, the National Corporation should establish a "homeowner's fund". Payments of any desired amounts, included in monthly mortgage payments, would provide accumulations of equity that could be drawn on in later years to meet mortgage payments, provide maintenance funds or meet unusual emergencies. This type of fund could, if established in a proper manner, safeguard the homeowner against loss of property due to short term fluctuations in income.

OBSTACLES

The reader will undoubtedly realize that obstacles such as building codes, zoning laws, local tax rates and labor policies may all serve as detriments to any plan designed to lower housing costs. These problems must all be considered in any program designed to lower housing costs. However, if communities can be encouraged to look forward progressively in the light of current technological advances then perhaps these obstacles may be surmounted and effective co-ordination applied to the housing industry.
APPENDIX A
BIBLIOGRAPHY


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