THE DESIGN AND ECONOMICS OF LOW COST SINGLE STORY HOUSING FOR A SMALL COMMUNITY

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Bachelor of Architecture

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1965

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF ARCHITECTURE
July, 1970

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Thesis Approved:

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PREFACE

Throughout history, the problems associated with inadequate housing have plagued civilized man. Today, with immense technical knowledge within his grasp, man has begun to commit himself to the elimination of inadequate housing and its related social effects.

This study is an attempt to determine the needs of low-income families, and to investigate methods of reducing the cost of homes which fulfill those needs, without reducing the quality of the living space or the quality of the building materials.

I would like to express my sincere appreciation for the assistance and guidance given by the members of my graduate committee: Professor F. Cuthbert Salmon, whose guidance and encouragement were invaluable; Associate Professor Christine F. Salmon, whose personal interest in housing was a source of encouragement; Dr. Thomas Scott Dean, whose experience and knowledge were of great value; Professor W. G. Chamberlain, for his personal interest and guidance. A special acknowledgement goes to William H. J. Cleverly for his personal interest and assistance. Further acknowledgement goes to William H. Myers, of the Stillwater Metropolitan Area Planning Commission for providing the opportunity to gather the necessary data.

In addition, I would like to thank my wife Joan for her sacrifices and understanding throughout the compilation of this report. Also my sincere appreciation goes to Thomas G. Hawthorn for contributing his time and energy in editing this report.

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CHAPTER I

INTRODUCTION

At a time when the need for low-cost housing grows, as the nation's population increases, housing research is being directed towards application in large urban areas. This focus of attention upon the housing problem in big cities, although intensely needed, has ignored the housing problem in smaller communities.

The purpose of this study is to examine the need for low-cost housing in the smaller community and to propose a housing design which will fulfill that need.

Chapter II examines the general social and economic background of low-income families in an attempt to grasp an understanding of the problems involved in providing adequate low-cost homes. Part of this chapter focuses upon the effects of inadequate housing upon the individuals who are forced to live in it. Another part attempts to analyze the existing housing situation and the community's response to the need for low-cost housing.

Chapter III examines the housing needs of the low-income families with emphasis upon methods and techniques of fulfilling those needs. Included is an analysis of the material and psychological needs of the families with special attention focused upon housing maintenance, renewability, and flexibility.

Chapter IV examines the costs involved in the final purchase of a home. Ways of reducing those costs are specified, including the organization of a cooperative housing corporation, which is shown to be helpful in dealing

with both the political and the economic problems encountered during the implementation of a housing project.

The next chapter describes in detail the design of a housing unit based upon a concept of flexibility which allows the home to adapt to the individual family's needs by the use of prefabricated components. A cost estimate is included to show the feasibility of the final solution.

CHAPTER II

HOUSING BACKGROUND

Why is Adequate Low-Cost Housing Needed?

Housing has a greater social impact on the individual and on the community than any other single physical factor. Although slums have been with us since the beginning of history (1), only recently has the general public become aware of the alarming costs to the individual and to the community.

We have begun to realize the absurdity of the statement . . . "a child raised in a slum area has equal opportunity with a child raised in more favorable surroundings". The foul environment in which a slum child is raised saps his vitality, corrupts his morals, and usually leaves him with a hostile attitude toward society. It materially reduces his chances of becoming a well-adjusted and useful member of society. Slums in general have a higher juvenile delinquency rate than surrounding areas (2). The lack of playgrounds and adult supervision of the children's activities in these areas aggrevates this condition. Adult crime seems to flourish more in blighted areas than in other sections of the city. High disease and mortality rates are commonplace in slum areas. A study of two contrasting residential areas undertaken by the San Francisco Planning and Housing Association illustrates the magnitude of social problems in slum areas as compared to those of a "normal" community (3). In addition, the slum area of Geary-Filmore had 36 times as many tuberculosis cases, 66 times as many hospital cases, and 3 times as many infant deaths as the Marina Area. The San Francisco study did not merely cite

an isolated example. Similar studies in other large cities have found the same results.

TABLE I

SOCIAL PROBLEMS IN SLUM AREAS AS COMPARED WITH THOSE OF THE "NORMAL" COMMUNITIES

	"normal" Marina Area	"blighted" Geary-Filmore
Area	53 Blocks	41 Blocks
Population	12,188	13,750
Number of Fires	133	251
Juvenile Court Cases	17	100
Police Cases	39	4,771

SOURCE: James Dahir, Communities for Better Living, (New York, 1950), p. 78

The social costs to the total community as well as the inhabitants of the blighted areas are disastrous. The direct costs to the entire city in the form of police and fire protection are exceedingly high, and slum areas create a heavy burden on the city treasury for other services such as relief and medica attention (4). Since the people living in the slum areas have low incomes, the revenue to pay for the social services must come from the taxpayers residing in the other areas. This inequity of taxation causes many people to move to

the suburbs, thereby further reducing the city's tax base (5). If concrete proposals are not made for the redevelopment of the slum areas, this flight to the suburbs will continue to grow in the years to come.

The major factors responsible for slums are a combination of social and economic problems which can be divided into two broad categories of primary and secondary causes.

The primary cause of slums can be traced to obsolete housing. As housing ages, it becomes increasingly expensive to maintain. If adequate maintenance is neglected, which is often the case, the rents must be reduced to keep the vacancy rate at a minimum. This contributes to further deterioration because it is no longer profitable to keep the buildings in good repair. This downward spiral of deterioration usually contributes to other conditions of blight such as overcrowding and incorrect land use.

The secondary causes of slums are largely economic. They are not very important individually, but collectively they constitute a major problem. Incomes that are too low to provide adequate housing chain many people to the slum areas. High building costs, including land, taxes, and finance charges, which are far above the earning ability of the residents, create unsurmountable obstacles to these people (6). Presently, they must be content to live in a deteriorating area and watch it grow worse with each rise in the inflationary economy.

Where is Adequate Low-Cost Housing Needed?

Although the greatest need for adequate housing is in the large urban centers, smaller communities are recognizing their own problem areas and are beginning to formulate plans for redevelopment. Since the purpose of this study is primarily to determine methods to reduce the cost of adequate

housing, the scope of this study is limited to the smaller community.

Any small community, upon critical examination, would reveal the presence of blighted areas. In particular, the Metropolitan Area Planning Commission, of Stillwater, Oklahoma, studied the ". . . extent and nature of blight and deterioration within various portions of the community" (7) through a Community Renewal Program financed by a grant from the Housing and Home Finance Agency of the Department of Housing and Urban Development. This study revealed that of a total of 4,733 structures which were surveyed, 2,955 were in need of rehabilitation and an additional 328 needed to be removed (8). It can reasonably be assumed that the number of deteriorated structures will increase during the coming years if no housing within the economic reach of these residents is provided.

Of the 121 building permits issued in Stillwater during the 1969 calendar year, the average valuation was $22,800 (9), which is well above the economic reach of the low-income families. Also, the fact that no building permits were issued for houses costing less than $10,000 emphasizes the shortage of adequate low-cost housing in Stillwater (10).

Because of the high cost of home ownership and the low-income of the residents of the blighted areas, the need for adequate low-cost housing in Stillwater must be fulfilled through innovative organization, design, and construction techniques which will not allow the constraints of the local industry to greatly restrain its completion.

What Kind of Low-Cost Housing is Available?

Housing available to families in the Stillwater area include mobile homes, rehabilitated older homes, conventional F.H.A. homes, Federally assisted housing projects, and modular homes. These different types of

units may all contribute to the effort to provide adequate low-cost housing for the low-income families; however, at the present, they are being used to fulfill the needs of the middle income families (11).

The mobile home manufacturers have capitalized on the obvious advantages of central fabrication and assembly to lower the cost of the mobile home. They have also eliminated wastes caused by shut-down time, subcontractor difficulties, and scattered purchasing methods (12). These and other waste cutting measures taken by the manufacturers have lowered the cost of the mobile home below all other types of housing units available in the Stillwater area.

On the other hand, the disadvantages of the mobile home which make it undesirable or unsuitable to the needs of the low-income family are listed below:

1. Zoning restrictions which prohibit the placing of mobile homes on inexpensive individual lots (13).
2. High rental cost of mobile home space which must be added to the cost of the monthly payments for the units (14).
3. Exterior appearance (box-like with corrugated sheet metal siding) which creates a monotony of form and allows for no expression of individuality.
4. Exterior storage space for automobiles, garden tools, and trash is not provided with the mobile home.
5. Structural strength of the walls of a mobile home is of absolute minimum construction and does not provide adequate protection during high winds or other threatening weather conditions. (The foundations are also not adequate.)

The second type of housing, the rehabilitated older home, has several

advantages over the other types of housing available to low-income families in the Stillwater area. First, the floor area is usually larger than that found in the newer homes being built today. Second, these older homes are usually located much closer to the center of the city and, therefore, closer to the necessary service facilities such as grocery stores, laundries, etc. Last, these older homes are complimented by various outbuildings and exterior spaces such as garages, porches, and fenced yards. These older homes could provide a great resource to the low-income housing market if techniques could be found to reduce the cost of rehabilitation.

At present, the disadvantages of rehabilitating older homes are too great to overcome. Some of these disadvantages are listed below:

1. High original cost of the older homes due to high land value or the practice by some owners of holding the land for future profits.
2. Individual problems presented by each project add to the cost of rehabilitation, and the solution to each individual problem cannot be reapplied to the next housing unit.
3. High bids for rehabilitation work by the subcontractors because of the unknown problems which might be encountered.

The third type of housing, the new F.H.A. insured homes, have just recently become available to the low-income families through various Federally subsidized programs. These homes are designed with the middle class "American Dream" in mind and are usually built in large tract developments with little concern for or relationship to the neighborhood or the community. The following description of the average F.H.A. insured home should repudiate any claim that these homes are a solution to the low-cost housing problem (15).

House Size: 1,175 sq. ft.

Rooms: 6 rooms, 3 bedrooms and 2 baths

Lot Size: 7,842 sq. ft.

House Cost: $15,118.00 or $12.75 per sq. ft.

Lot Cost: $3,690.00

House and Lot: $18,808.00

Average Payment: $141.00 per month

Federally assisted housing projects are just beginning to appear in Stillwater with the start of a large apartment project on North Perkins Road. This project, called Town and Country Incorporated, is co-sponsored by the Payne-Noble Counties Housing Development Corporation and the Mt. Zion Baptist Church. Being constructed under Section 236 of the Federal Housing Administration, 20% of the residents of the 85 units will receive rent supplements from the Federal Government (16). This project will also provide office space, a community building for 150 people, a complete laundry, a workshop, and storage space for each resident. This housing development appears to have good community backing and if it should prove successful would enhance the acceptance of future low-cost housing projects.

There are two disadvantages to the Town and Country housing project: 1) the fact that units will not be owned by the residents could increase the friction between them and the management; 2) the location of the project will not improve or encourage the redevelopment of the blighted areas of Stillwater.

The last type of housing which is available to the low-income families in Stillwater is modular housing. At present, contractors are not convinced that this will cut the overall price of the houses to the homeowners (17). The shipping costs generally negate the expected profit to be gained over the conventional building procedures. The "Jim Walter's" homes and the "Tandy" homes are modular shells only and, if finished with conventional building

materials and labor, are just as expensive as the conventionally built homes, yet smaller.

It should be noted that today a multitude of industrialized building systems which might be applicable to the housing problem in the smaller community such as Stillwater are being explored nationally. However, these systems, at present, do not satisfy the needs of the low-income families in Stillwater. This is due to both technical and psychological reasons.

First, the large scale systems being developed by General Electric and other giant corporations demand a large market before they become economical to produce. Economic feasibility studies indicate that an initial capital expenditure of approximately $1 million is necessary to set up the production line of even the smallest plant (18). These studies also indicate that a volume of 200 houses per year, for a period of 5 years, is needed to justify that expenditure. This quantity of housing is obviously too large an operation for Stillwater which has an average annual demand for 120 to 125 houses for units of all prices. At best, Stillwater has shown a need for approximately 40 low-cost houses per year.

Second, industrialized building systems are not now available in the Stillwater area. The systems being built under programs such as Operation Breakthrough are limited in application and are only being used to provide research data. While this research is important in the long range solution of housing problems, it does not help the present situation.

Next, the acceptance by the public and by the building contractors of these new building systems, however near perfect they may be, will remain an obstacle to their practical application in Stillwater. The public's willingness to change will have to be overcome before these systems can be successful (19). Changes will have to have the complete support of the total building

community: the real estate, financing, and building industries. Each of these various vested interests must also contribute innovations which are applicable to the successful completion of any local industrialized building system. Without this support and acceptance, there is little chance of the realization of this type of project in Stillwater.

The introduction of industrialized building systems must greatly improve the quality of the home before public acceptance is obtained. Some of the designers of these various building systems are approaching the problem of cost by: cutting the quality of the product; reducing floor space; or eliminating essential equipment. These approaches alienate the public acceptance of industrialized buildings.

For years, one innovator after another has tried to put housing on the assembly line. And for years, these attempts have failed to cut the final costs (20). The reason for this is because most innovators have concentrated on the shell of the building, the cheapest part. The bulk of the cost is in the land, financing, overhead, profit, interior finishes, and mechanical equipment (21).

CHAPTER III

HOUSING NEEDS OF LOW INCOME FAMILIES

The Housing Act of 1949 set this nation's standards in broad, general terms when it established the goal of "a decent home and a suitable living environment for every American family. . ." Despite the many technological and social advances since that date, no definition of "a decent home" or "a suitable living environment" has yet been established (22). The major reason for this is because of the sheer complexity of standards. It is easier to set rigid standards on materials, room sizes, and equipment than to recognize the necessary flexibility which must be built in to those standards because of changing materials, topography, climate, and human desires.

Most minimum housing standards (of the type that F.H.A. has adopted) tend to become maximum building standards. A better housing standard would be one that represents a goal, something to strive towards.

The study of housing needs eventually comes to the problem of deciding what is "a decent home". This problem may be easily dismissed with the answer, "a standard F.H.A., 3 bedroom home". However, this answer does not consider the full impact of traditional housing design upon today's society. Most suburban homes will not actually satisfy today's housing needs.

Technological changes within the past 50 years have not been accompanied by corresponding advances in housing design. The invention and use of new products such as radio, television, automobiles, dishwashers, and central heating and cooling, have greatly changed the use of the traditional

housing designs of 50 years ago (23). Today, these new products are put in old containers to form units which create conflict in the lives of the inhabitants. These traditional designs do nothing to relieve the stress and strain of the technological world created by these new products. Because of this, it has become more and more difficult to find peace of mind and quiet in traditional designs.

Instead of developing new housing designs to cope with these stresses, we have allowed them to intrude into our privacy to the point that they now seem like normal occurrances rather than invasions of privacy. To eliminate these invasions of privacy, the traditional concepts of housing design will have to be discarded and new concepts will have to be formulated.

These new concepts must be based upon needs and ways of fulfilling those needs rather than upon the traditional concept of "a three-bedroom house on an individual plot of ground". New concepts should base the design of the house upon needs such as freedom, contact with nature, peace of mind, quiet, family, security, and protection. The fact that these needs may be more difficult to fulfill does not make them any less valid.

Neighborhood Environmental Needs

The establishment of environmental standards for use throughout the nation is beyond the scope of this paper, but an analysis of the important aspects related to low-income families is most important. This analysis of environmental standards should include (1) land crowding, (2) conflicting land uses, (3) transportation, (4) topography, (5) utilities and sanitation, (6) community facilities, (7) site requirements, and (8) orientation.

Land Crowding

The first aspect, land crowding, is a direct result of poor design and not the result of high density. Good design can accommodate a very high density without sacrificing the land surface. One method to achieve this is to place the houses around common green areas or green belts (see Figure 1). On the other hand, bad design can crowd the land even in areas of low population density (see Figure 2). This practice of land crowding as in the typical suburban subdivision, is especially absurd when considering the low income family, since their limited incomes should not be burdened by the cost of this wasted land. A much better design, which would eliminate land crowding and its high cost, would be to arrange the housing units side by side so that a greater utilization of the land could be obtained from a common green in the rear of the units (see Figure 3).

Conflicting Land Uses

Conflicting land use, the practice of locating housing adjacent to the industrial area, is most prevalent in slum neighborhoods (24). Regardless of whether the industry was there originally and the housing moved in afterwards or vice versa, the result is always the same: conflict. Housing located adjacent to industry or other commerical enterprises (such as car lots, junk yards, and trucking firms) is constantly subjected to noise, smoke, and other nuisances which are indigenous to these activities. These conditions create unsafe and unhealthy environments for low income families.

Businesses such as grocery stores, drugstores, and laundries, have legitimate reasons for their location within residential areas and could be located in neighborhood centers along with community and entertainment facilities. The main criteria for allowing or not allowing businesses to

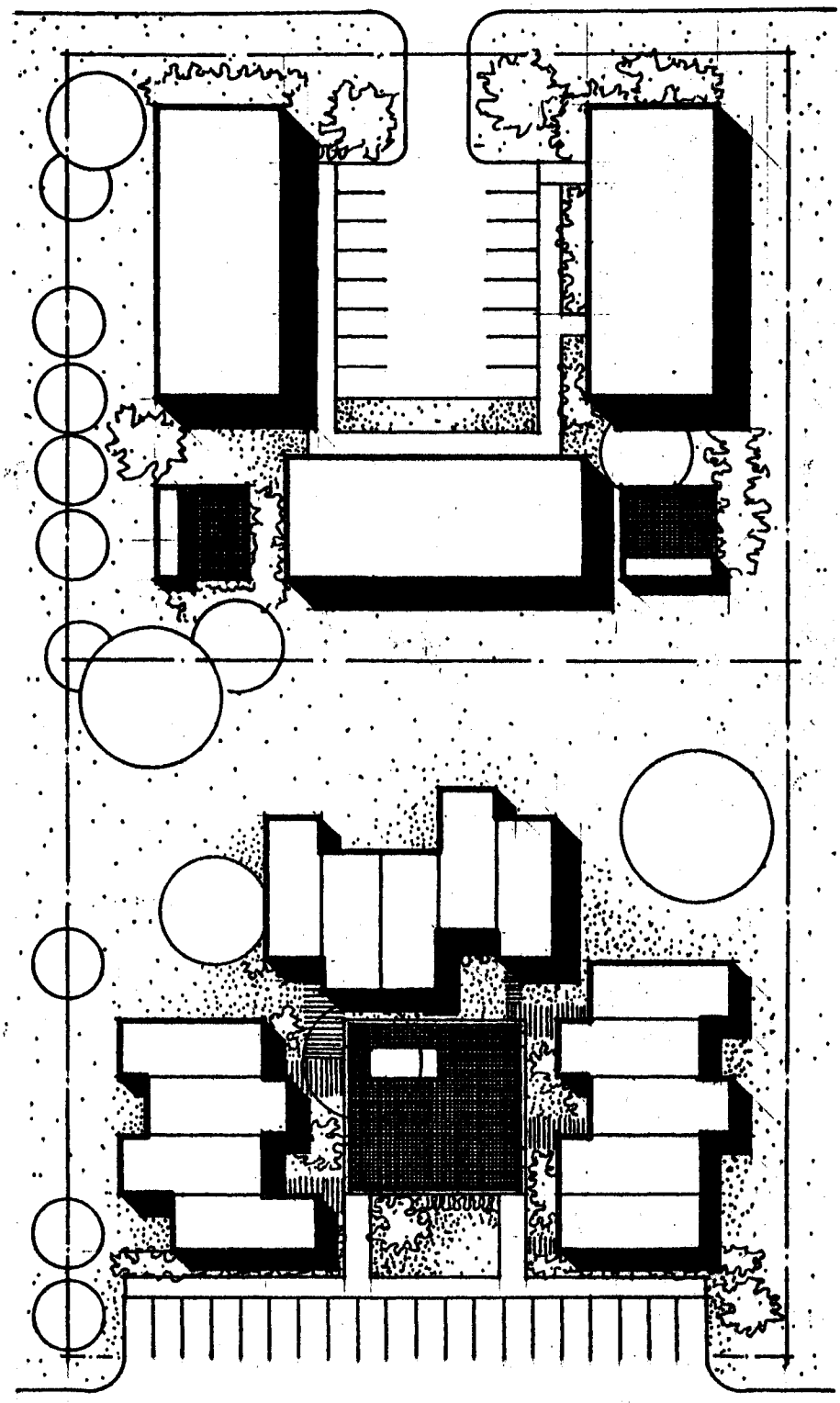


Figure 1. Examples of High Density Without Land Crowding

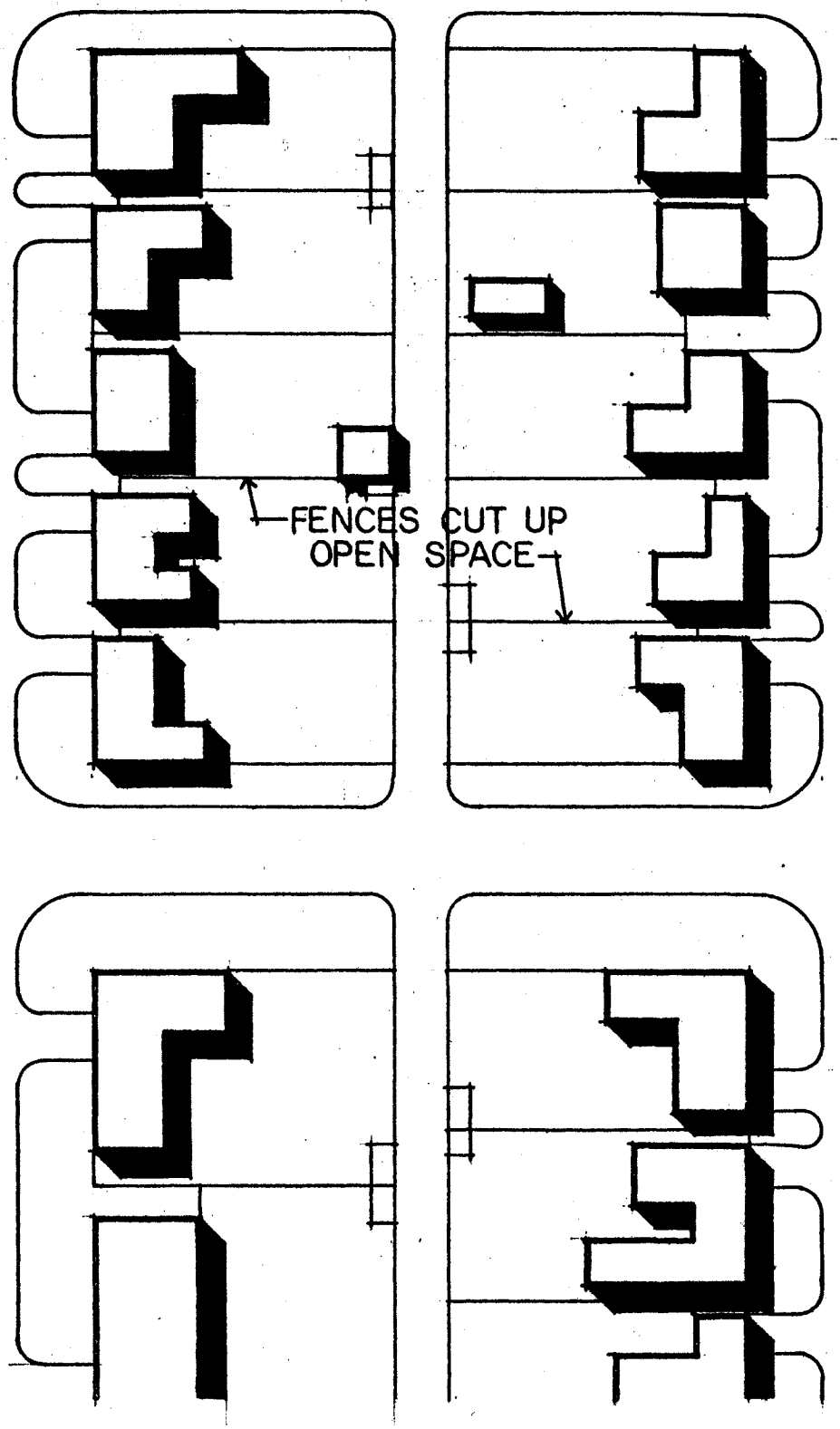


Figure 2. Typical Suburban Land Crowding

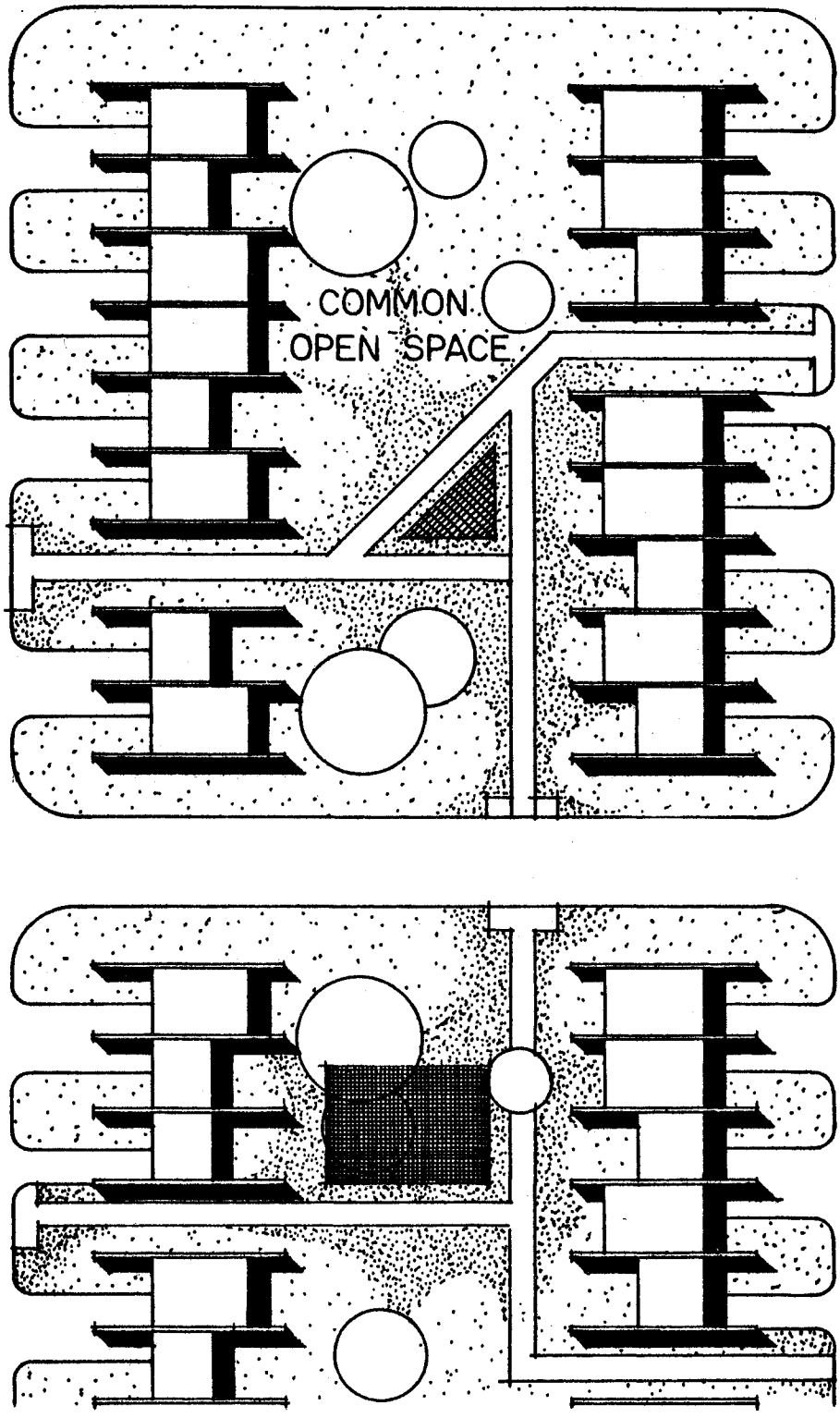


Figure 3. Proposed Higher Density Without Land Crowding

locate in residential areas should be based upon the degree of conflict or compatibility that a particular business has with the residential area.

Transportation

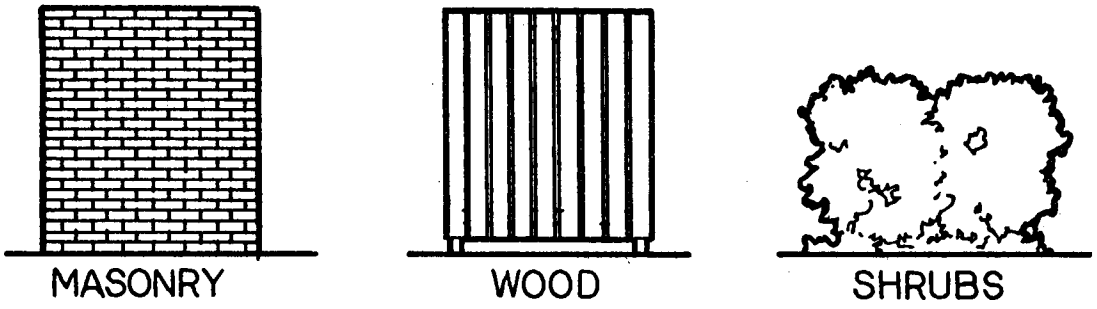
Transportation, in general, should not be situated so as to cause a hazard or a nuisance. Street traffic should be separated from children's playgrounds by buildings and should not invade the privacy of the housing units. This can be accomplished by proper site design or by effective landscape screening (see Figure 4).

Inexpensive local public transportation is of particular importance to low income families. Without it, the family is burdened with the expense of owning and maintaining an automobile. Even though a family may already own an automobile, local public transportation would allow the wife to do her shopping or the children to ride to school much more independently.

Public facilities serving long distance transportation needs (airport and railroads) should not have housing located adjacently. These facilities create noise and safety hazards.

Topography

When topography is ignored in housing design, it produces unlivable environments. The location of housing in areas subject to surface flooding or in areas of marshes and swamps creates an obvious blighting effect upon the neighborhood and a potentially unhealthy condition for the families who live there. Also, the presence of sewers and water supply lines in flooding and moist areas creates hazard to the health of the residents. Building codes should be strictly enforced to prevent the location of housing in these areas. Proper consideration of individual topographic conditions to prevent placing



SCREENING MATERIALS

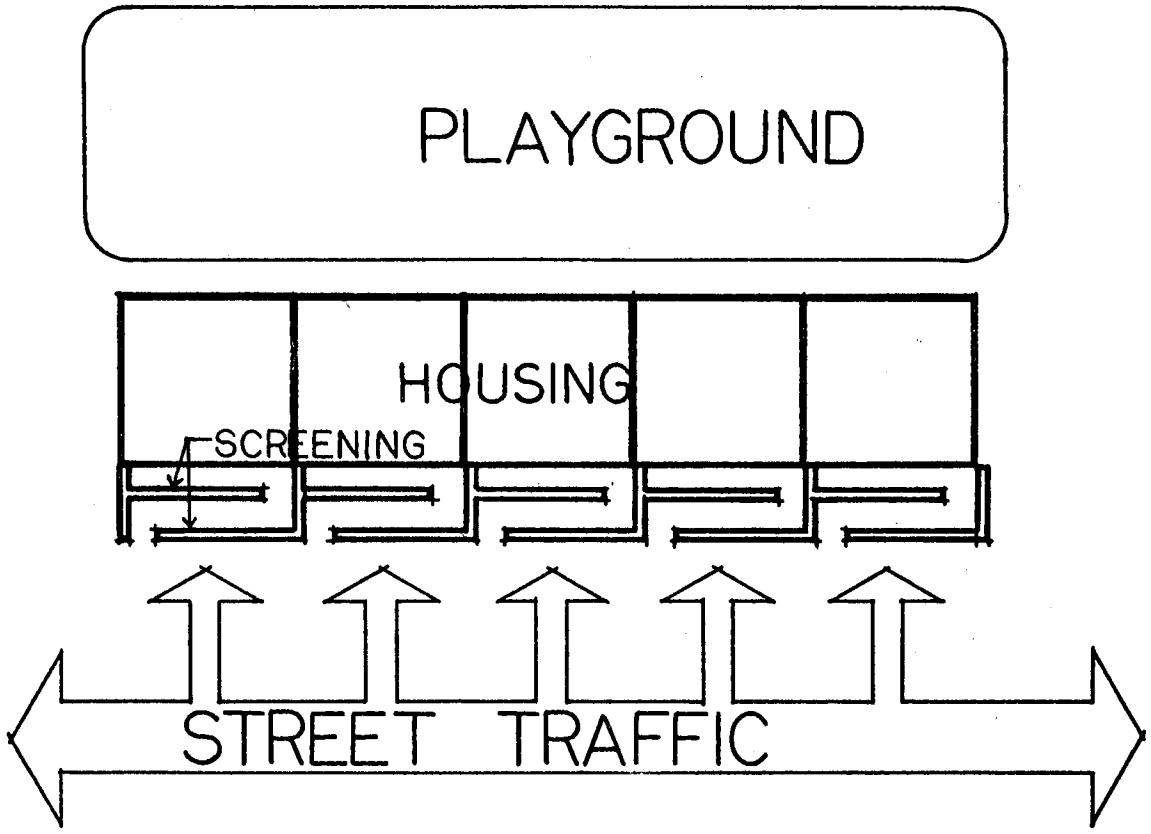


Figure 4. Separation of Playground and Street

the house in competition with nature is the best solution to this problem.

Community Facilities

Low income families are in particular need of common community facilities which are located in the neighborhood. Facilities, such as community buildings, playgrounds, parks, and recreation areas are needed to provide the variety of experiences necessary for the happy, stable, and eager development of the community. In addition to providing enjoyment and education, community facilities can also provide the catalyst for neighborhood pride and improvement (an ingredient which is lost in slum areas).

Site Requirements

Individual site requirements, such as utilities, parking space, storage space, drainage, and landscaping can be better approached on an individual basis; however, some general aspects of site requirements should be noted. Housing for low income families demands adequate outdoor areas since their homes are usually small and cannot contain the many activities that other families might hold indoors, i.e., birthday parties, family reunions, etc. These families also need outdoor storage space for lawn tools, children's toys, and general storage. Parking for one car per dwelling, with adequate street width for guest parking, or two cars per dwelling where street is more narrow than 26 feet, should be provided. Also, the parking areas should be a permanent hard surface such as concrete or asphalt. Landscaping, which is often overlooked or omitted from low-cost housing, may be one of the primary factors in the stabilization and future development of low income neighborhoods. This is due to the psychological connection of landscaping with wealth and also the physical beauty which landscaping provides. The

above site requirements are general requirements for low income families, but individual site problems will require individual design studies.

Orientation

The major factor which affects the orientation of a house for low income families greater than houses for other families is the cost of heating and cooling. For low income families, the orientation of the windows should be towards the south or north and not the east or west. This orientation will offer better year around comfort and overall lower heating and cooling bills.

Housing Needs

A study of housing encompasses the total range of family needs and desires. For this reason, deciding upon the type of housing that is needed can never be completely resolved. However, the type of housing that is planned can be more responsive to a majority of those needs, if they are considered at the beginning of the design process. It is important to realize, at this point, that there is no difference in the basic needs of the low income families as compared with the middle income families. The real difference in the housing needs of these two groups is a result of their different life styles.

General housing needs can be divided into two broad categories: (1) material needs, (2) psychological needs. Both of these categories can be further divided according to specific needs which are important to low income families.

Material Needs

Low maintenance cost is extremely important to low income families.

The high cost of maintenance, through the short-sightedness of some builders and designers, causes the early deterioration of these homes. Maintenance costs for repair of flimsy materials are extremely high, and these repair costs reoccur every few years. When low income families are faced with such costs, they have a choice of using a part of their small incomes for the repairs, or of buying some needed item for their family. It is not difficult to guess which decision they will make; they will postpone the maintenance for "another year". This eventually leads to the decay of the home to a point beyond repair and the slum is again created. If builders and designers would realize the small cost difference between materials which have a high maintenance cost and those which have a low maintenance cost then they might be persuaded to construct low maintenance homes and much of this decay would never occur. But some builders and designers, embarking on a low cost housing project, throw maintenance out of the program in favor of low initial cost. This is false economy for the low income family and for the community.

Another physical factor which creates a problem for low income families is "designed obsolescence". Mechanical equipment becomes obsolete because of age or because of new research and development (25). This equipment should be replaced by new equipment or by its new counterpart, which is more efficient. But usually this equipment remains in a house, whether or not it is economical to operate, simply because it is too expensive to replace. This high replacement cost is a result of poor design, a design which permanently connects a short-life element (mechanical equipment) to a long-life element (the shell). It would be more economical to physically separate the mechanical core from the basic shell so that periodic replacement of the obsolete element could be accomplished with the minimum of cost. To achieve this, a walled enclosure, technically simple but very durable, could

be built to contain a separate mechanical core, which could be replaced periodically, as warranted by obsolescence. Hence, "designed obsolescence" could be replaced by "designed renewability".

The next two physical needs of low income families are safety and good health. Both of these needs are important to all families and not just low income families; however, as pointed out in Chapter II, it is the low income families who have been excluded from enjoying the benefits of safe and healthy homes. Safe homes should be structurally sound and free of hazards to life and limb. This amplifies the necessity of strong, durable, and fireproof building materials such as masonry, concrete and steel. A healthy home satisfies the physiological and biological needs of the individuals such as clean air, water, food and the sanitary removal of body wastes. Both safety and good health are important needs of low income families.

The next physical need is protection or shelter. Housing today must do much more than to merely provide shelter. Shelter in the past had to be permanent protection from nature's elements such as wind, rain, snow, insects, and rodents. Today's definition of shelter has been enlarged to include "comfort". This new definition of shelter is called "environmental control"; it encompasses temperature, humidity, air distribution, and air cleanliness, illumination, and acoustics. With complete environmental control, occupants can be surrounded by clean, fresh air of the proper temperatures, regardless of the conditions outdoors. Because of the advances being made in this field, it is essential that housing units today be equipped with the most advanced environmental control equipment available. This is not only for the comfort of the families, but also as a guard against future obsolescence.

The last physical need is flexibility. The need for flexibility in house design is apparent by the diversity of family characteristics which a house

must contain. One of these characteristics is family size which can be divided into four main groups: (1) Young Couple, (2) Founding Family, (3) Expanding Family, (4) Contracting Family (26). It would be unreasonable to expect a custom tailored house to satisfy the needs of all of these groups. On the other hand, it would also be unreasonable to expect these families to function properly in the same unchangeable house design. It is obvious that families are dynamic and that their needs and desires are constantly changing. For this reason, proper planning should make the house design as flexible as possible to allow for these changes. When the house design can be made flexible in arrangement and facilities, each family will have much greater control of their own space and will be able to adapt and change this space according to their own family's needs and desires.

Psychological Needs

The psychological needs are difficult to satisfy with tangible solutions, but this does not invalidate their importance to the low income families. To state these needs and then state the physical solutions which attempt to satisfy them is the purpose of this section.

The first psychological need is freedom. This need encompasses the right to enjoy the home and land on which it rests as set forth in real estate law, plus the right to "feel" free in the use of that property. This latter aspect, the "feeling" of freedom is related to the saying, "a man's home is his castle," (27) and he is free to do with it as he desires.

This kind of feeling can never be achieved in the public housing projects or other non-ownership projects. What is needed is the true ownership of the home by the family. Only through home ownership can this "feeling" of freedom be fulfilled.

The next psychological need is privacy, which includes both visual and acoustical privacy. There should be privacy of the family from public invasion, and privacy of the individuals from each other (28). The home should be separated from the public by a series of spaces which progressively become more private, until the most private family area is attained at the entrance to the dwelling. In addition, the activities within the home can be divided into three categories of privacy: (1) children's, (2) adult's, and (3) family's. Each of these areas should be visually and acoustically separated from each other so that the simultaneous use of any of these areas will not interfere with the privacy of another area. This separation of areas can be achieved by the correct physical planning of the dwelling or by the use of the correct building materials.

Close relationship is the next psychological need. This includes the close relationship of neighbors usually found in the low income areas of the community. The low income families are much closer in their family relationships (uncles repair cars; aunts babysit, etc.,) than the higher income families (cars are repaired in garages; strangers babysit). Part of this close family relationship in the low income family is a result of their low economic status (cannot afford to pay for car repair and babysitting) and part is a result of family location (aunts and uncles live in the same neighborhood). It is important that these family relationships are not disturbed, and that the housing units reflect these relationships in their design. For this reason, the housing units should be arranged closer together than would be necessary for other income groups in the city. The row housing and garden apartment arrangements are two methods of fulfilling this need of the low income families.

The importance of the variety of experiences which are offered by

nature is the next psychological need of the low income families. The most often stated disadvantage suffered by the children of low income families is the lack of a variety of experiences (29). Much of this variety could be provided by arranging the areas of the dwelling in a closer indoor-outdoor relationship. This could be accomplished by providing courtyards which retained their privacy, but provided the opportunity for this closer relationship with nature.

Aesthetics is also a psychological need of low income families; however, as the saying goes, "Beauty is in the eye of the beholder". Aesthetics applies to low income families in two ways. First, there is the beauty of the exterior appearance which is implanted in the "tastes" of low income families by past experiences with materials that are expensive and therefore, beautiful. This close association of "cost" to "beauty" is firmly entrenched in the preference of the low income family. The second way in which aesthetics applies to low income families is in the individual tastes of each family. This individual choice of decoration is denied to the occupants of the public housing projects, and they are penalized if they attempt to alter their own dwelling units (30). This ability to add their own decoration and their own "aesthetics" should be an integral part of the housing design for low income families.

The next psychological need is a feeling of permanence. Low income families, because of their inadequate education and job training, are subject to fluctuations in their job security. This causes them to consider themselves as temporary citizens and not really a permanent part of the community. This feeling is further promoted by the inadequate and flimsy housing in which many of these families must live. For this reason, it is important to reinforce the feelings of permanence and security by providing permanent

homes for low income families.

The last psychological need is pride. To instill pride in a home, a combination of many of the above mentioned requirements must be present: high quality, good community relationships, privacy, etc., but the most important requirement is involvement. It would be difficult for these families to take genuine pride in a home which had been planned and executed without their participation. For this reason, many of the public housing efforts, which did not ask for community participation, have become overnight slums. Low income families must become involved with the planning of a housing project to be able to take pride in the finished product.

CHAPTER IV

HOUSING COST ANALYSIS

Faced with the task of building 26 million more housing units by 1979, it is not surprising that many designers are looking to technology to reduce building costs (31). True, technology has achieved remarkable results in other fields, but is this approach applicable to housing? In the mad scramble that presently ensues, as the search for the Utopian "Breakthrough" intensifies, the hard facts of high building costs are being overlooked.

The myth that technology can cut costs continues to confuse the issue. It is unrealistic to count on some marginal breakthrough in technology, to solve the cost problem. The fact is that materials and labor represent only 55% of the initial cost of a single family home (32). The Kaiser Committee concluded that, if materials and labor costs were held to zero (given free), one would be able to reduce the final cost of the house by 25%! Interest, land, profit, overhead, and taxes account for the remaining 75%.

Two differing lines of action are open to reduce these home building costs (33). One is to attempt to resolve the internal problems of the housing industry: to increase productivity and output, to work on the 25% represented by materials and labor costs. The other is to attack the issues that are external to the individual home builder: to influence land costs, zoning restrictions, and of course financing. A combination of both of these lines of action will result in the most effective reduction of housing costs.

External Costs

To attempt to reduce housing costs, one must have a thorough understanding of what costs are involved and where they originated. This can be shown by a breakdown of costs which can be analyzed individually.

Housing costs must be clarified as to the initial cost or final cost. The initial cost of a home, referred to as the "purchase price", includes only the price of the land and the house. This cost is irrelevant to low-income families since they do not have the necessary cash to purchase a home outright. On the other hand, the final cost of the home includes the land, the house, loan costs, taxes, insurance, and professional fees. This is the cost which is most important to low-income families since monthly income will determine their ability to purchase a house and not the "purchase price" of that house. Therefore, it is the final cost of housing which will be investigated in an attempt to reduce housing costs. Table II is the final cost breakdown of a typical new home which has a "purchase price" of $10,000.

From Table II, it is apparent that the largest single final cost is the interest charge. The Federal Housing Administration also recognized this and initiated F.H.A. Section 235, an interest supplement program which allows qualified low income families to pay only 1% of the current 8-1/2% interest charge, the balance of which will be paid by the Federal Government (34). In the above case of the $10,000 home, this subsidy will amount to a $11,489 reduction in final cost or a lowering of the monthly payments from $81.78 to $49.86. This type of government subsidy can substantially reduce the final cost as well as the monthly cost of a home to a low-income family.

Another method of supplying this subsidy also should be tested. As the 235 program exists, the total cost to the government is approximately 1-1/3 times the cost of the purchase price of the house. This cost will continually

TABLE II

FINAL COST BREAKDOWN OF A HOME WHICH HAS A "PURCHASE PRICE" OF $10,000

Item	Cost	%
Land	$ 2,000	7%
House	8,000	27%
Interest	13,021	44%
Discount	400	1%
Taxes	5,010	17%
Insurance	210	1%
Miscellaneous (fees)	800	3%
Total	$29,441	100%

SOURCE: Editors of McGraw-Hill Publication; A Special Report, "Business and the Urban Crisis," Feb., 1968, p. C-11.

TABLE III

FINAL COST OF A $10,000 HOME AS COMPARED TO FINAL SUBSIDIZED COST OF THE SAME HOME

Item	Final Cost	Subsidized Cost
Land	$ 2,000	$ 1,000
House	8,000	4,000
Interest	13,021	6,500
Discount	400	200
Taxes	5,010	5,010
Insurance	210	210
Miscellaneous (fees)	800	800
Total	$29,441	$17,920

SOURCE: Ibid.

increase as costs of financing increase. Therefore, to relieve the Federal Government (tax payers) of this burden and at the same time free the "tight money" situation, it is suggested that a direct subsidy of 1/2 the purchase price be given to the qualifying home buyers (low-income families). This direct subsidy, in this case $5,000, would lower the final costs of the home as shown in Table III.

From Table III, this 1/2 subsidy would also cut the cost of a $10,000 home, by the difference between the $11,489 paid under the 235 program, and the $5,000 paid under this proposal, or a savings of $6,489 to the Federal Government. Another benefit under this new subsidy proposal would be to ease the "tight money" situation by applying for smaller loans (i.e. a $5,000 loan as compared to a $10,000 loan under the present situation). This would decrease the demand for loan money and consequently, would cause the present "discount" rates to disappear.

If this new subsidy were immediately put into effect and, if a half of the proposed national housing goal were subsidized, the initial yearly cost would be only 5 billion dollars, and this amount would steadily decrease as the need for housing was fulfilled. On the other hand, if the present F.H.A. 235 subsidy program remains in use, the total cost to the Federal Government for these same units will be three times as great as the total cost under this new subsidy proposal. Subsidy programs are necessary to meet this nation's housing needs, but these subsidies need to be reduced as much as possible. This new proposal will reduce these subsidies. . . all that is lacking is a reordering of national priorities and a commitment to "buy now" rather than "pay later".

Another large final cost, as shown in Table II, is land, which has risen greatly in the past 20 years. Part of this cost increase is due to normal

appreciation, but a great portion is attributable to the practice of holding land for future profits. This practice creates an increased demand for land within the city and, therefore, a higher value. This may be a wise policy for those who hold land, but it creates a hardship for people in the cities who are in desperate need of inexpensive vacant land.

Reduction of the high cost of vacant land is presently within the power of the local government by the formulation of new tax policies. Vacant land, which is not used for public parks and open spaces, and is located in the densely populated areas of the city, should be taxed higher than the adjacent developed land. This greater taxation would force these "land holders" to develop that land or reduce their price in order to sell to others who would develop that land. Rather than continuing the present taxation policies which reward the nondevelopment of land within the city, and force the developers to go outside the city, this new tax policy would reduce the cost of vacant land within the city and reward the utilization of that land. The cities do not have a shortage of land but rather a shortage of land utilization incentives.

The last method of reducing land cost is not a new one, but is applicable to low cost housing. This is the reduction of land per dwelling unit. This method when carried to its extreme causes "land crowding". As pointed out in Chapter III, this "land crowding" is a cause in itself of blight and deterioration, and is undesirable for family living. For this reason, it is more desirable to reduce the land area only to the point where the land is utilized to its fullest, but not to the point where it is covered completely.

Internal Costs

The final cost of a home can be investigated further by a cost breakdown of the elements which compromise the typical housing unit (see Table IV).

TABLE IV

COST BREAKDOWN OF A $8,000 HOME (DOES NOT INCLUDE COST OF LAND @ $2,000)

Item	Cost	%
Basic Shell	$2,400	30%
Overhead	400	5%
Profit	800	10%
Interior Finishes	3,200	40%
Mechanical Equipment	2,000	25%
Total	$8,000	100%

SOURCE: Editors of McGraw-Hill Publications; A Special Report, "Business and the Urban Crisis", Feb., 1968, p. C-11.

This cost breakdown clearly shows that a 1/2 cost reduction ($1,200) of the basic shell would amount to a 15% savings in the direct house cost, but only a 4% savings in the final cost. It also shows that 65% of the direct house cost is allocated to interior finishes and mechanical equipment. For this reason, it seems foolish to dwell upon methods of reducing the cost of the basic shell and at the same time to fill that shell with expensive interior finishes and mechanical equipment.

Any substantial reduction in the house cost must come from substantial savings in the interior finishes and mechanical equipment. To get these savings, interior finishes must utilize more economical materials and construction methods or eliminate the materials completely. Mechanical equipment must be handled in the same manner.

One method of reducing the cost of interior finishes and mechanical equipment is prefabrication, which can reduce the cost of on-site labor, raw materials, construction time, and material waste. Prefabrication is best suited to the highly technical components which require greater skill and closer construction tolerances than can be reasonably obtained in the field (35). Included in these components are: (1) roof trusses; (2) cabinets and shelving; (3) windows and doors; (4) finish hardware; (5) mechanical equipment. It should be kept in mind that prefabrication is limited by the weight of the component and the distance that it must be transported. Builders such as Levitt, Bohannon and Ponty seemed to find that some combination of precutting the main structure and prefabricating the minor components gave the most economical results (36). It would be unreasonable to prefabricate and transport components which can be easily constructed in the field, components such as masonry walls and concrete floors. Because of this, a combination of prefabrication and conventional construction will result in the

greatest economy.

In addition, there are other cost saving techniques which can be utilized in the actual design of the home. These are the techniques of construction, selection of materials, and actual layout of the floor plan. Where the quality of the home is not jeopardized, these techniques will be employed to their fullest potential.

Other savings can be obtained after construction is completed. Reduction of the cost of maintenance can be accomplished in two ways: (1) a sufficient number of units must be constructed to justify the utilization of maintenance personnel, (2) the selection of building materials and equipment must be based upon low maintenance qualities.

The last cost saving technique will not apply to all families, but only to those who wish to participate. This is the "self-help" concept where the families can build the dwelling unit themselves and then either pay themselves a salary or deduct their labor charge from the price of the house. This saving technique takes a great deal of advance planning, but to those experienced in building skills, it can be a worthwhile endeavor.

Cooperative Concept

The application of a housing cooperative can be utilized to reduce both the external and internal costs of home building. By its organization and administration, it is well suited to exert pressure on the political or economic sectors of the community to assure the best return on the dollars spent. It can exert pressure on zoning restrictions, tax policies, and public acceptance equally as effective as it can exert pressure on material suppliers, labor groups, and designers. In the preceding cost analysis, the utilization of a housing cooperative would facilitate the implementation of many of these cost

saving techniques.

It has been demonstrated in the past that cooperative buying practices can effectively reduce the cost of a wide range of materials and products. This practice is based upon the fact that a supplier can and will reduce his unit price when a large quantity of units are purchased at one time (37). This is true regardless of whether the units are land, labor, or lumber. Large block purchases reduce the suppliers' overhead cost for things such as stock invoices, marketing, and shipping; which savings can then be passed on to the buyer. Therefore, if low income families were organized into a cooperative buying group, they would be able to take advantage of this saving method in the construction of their own homes.

The initial organization of a cooperative might be instigated by leaders in the community. The logical groups which can supply this leadership are community housing authorities, non-profit groups such as churches, or highly motivated individuals from the low income community. Whomever the leaders are, they must be acquainted with and respected by the low income segment of the community.

The first step in the organization of a cooperative is the formation of a group of families who want homes and who are eligible to pay for them. This group will be assisted by the necessary professionals, attorneys, realtors, architects, and builders, as they are needed.

The exact organization of the cooperative would have to be determined by the families involved with the help of an attorney, but a general outline of the purpose and organization of a cooperative is given below.

Cooperative

Cooperative ownership is an expression denoting multiple ownership

with profits and losses shared by the respective owners (38). Generally, it is used to describe apartment buildings taken over by a group of families, to be owned, occupied, and operated by them for their mutual benefit and profit. It differs from single home ownership in the sense that the cooperative owner does not have the same degree of responsibility as the individual home owner does. This type of ownership is customarily under a corporate setup, each owner being a stockholder and holding his apartment under a proprietary lease. This corporation may be organized with the property as the principal asset. The organizer of the corporation can then issue stock for the purpose of raising funds necessary for the construction of the housing units. This method is simple and inexpensive. Death of any stockholder creates no problem, since the corporation's life continues. Any mortgage obligations are executed by the corporation, so that no stockholder becomes personally liable. Yet each stockholder shares in any profit in accordance with his stock holding.

Financing

To facilitate cooperative home ownership, the Federal Housing Act under Title II, Section 213, provides for cooperative housing insurance (39). This form of Federal mortgage insurance is designed to help non-profit membership corporations or trusts construct housing for their members at a saving. Sponsors of cooperative housing who seek financing under the Federal Mortgage Insurance Act apply through an "approved mortgagee" for loan processing. The cooperative non-profit trust agreement is submitted to the Federal Housing Administration together with schedules showing proposed rents, charges, capital structure, rate of return, and methods of operation. If approved, the maximum insurable mortgage is 20 million dollars for a private mortgagor and 25 million dollars for a public (city or state)

mortgagor. The mortgage loan limit is 97% of the replacement cost new (40).

Administration

A cooperative housing project, generally a multifamily building, is managed for the cooperative owners by a managing agent who is compensated on a salary basis. Members of the cooperative acquire ownership of the dwelling unit and have the privilege to use or sell the premises subject only to restrictions which are pre-set by themselves. Each owner-occupant pays in addition to initial down payment a monthly charge as his proportionate share to cover mortgage principle, interest, taxes, hazard insurance, and operating costs including the use of common utilities and managerial expense.

A housing cooperative will be used which is similar to the above description with these two exceptions: 1) The land on which the homes are being built is not in one piece, but rather in several locations throughout the low income community. This would facilitate the development of "odd tracts" in the area. It would also insure the continuing existence of the cooperative for other low income families who might want to participate after the initial date of organization. 2) The cooperative's families will be their own contractors, and the profit and overhead normally paid to the contractor for supplying goods and services will be returned to the families in the form of savings. This might seem risky at first glance, but with adequate involvement, the families will exercise the tight controls which are necessary for a successful cooperative.

CHAPTER V

DESIGN

Site Planning

Some of the most glaring shortcomings of contemporary site planning include lack of privacy, (both visual and acoustical), unusability of open space, no definition of public and private areas, and poor relationships between interior and exterior spaces.

Privacy in today's suburban home is meager. Usually the houses are separated by small yards which act as insulators, but the window shades must be drawn to obtain the visual privacy needed by each family. Also these homes are exposed to incidental noises such as heavy trucks, aircraft, and the neighbor's lawn mower motors.

To overcome these intrusions upon the family's privacy, a heavy permanent wall should be built to separate the individual housing units. (see Figure 5). This wall between housing units (party wall) would also eliminate the waste land cost of typical suburban developments, and would provide a substantial savings for the low income families.

The suburban developments often have set-back requirements which chop the land into small islands and render the open space unusable. By building the housing units wall to wall, this drawback is eliminated, and the housing units can be consolidated on less land area. This would also provide larger areas of common land for playgrounds and open space.

By exposing the fronts of typical suburban houses directly to the

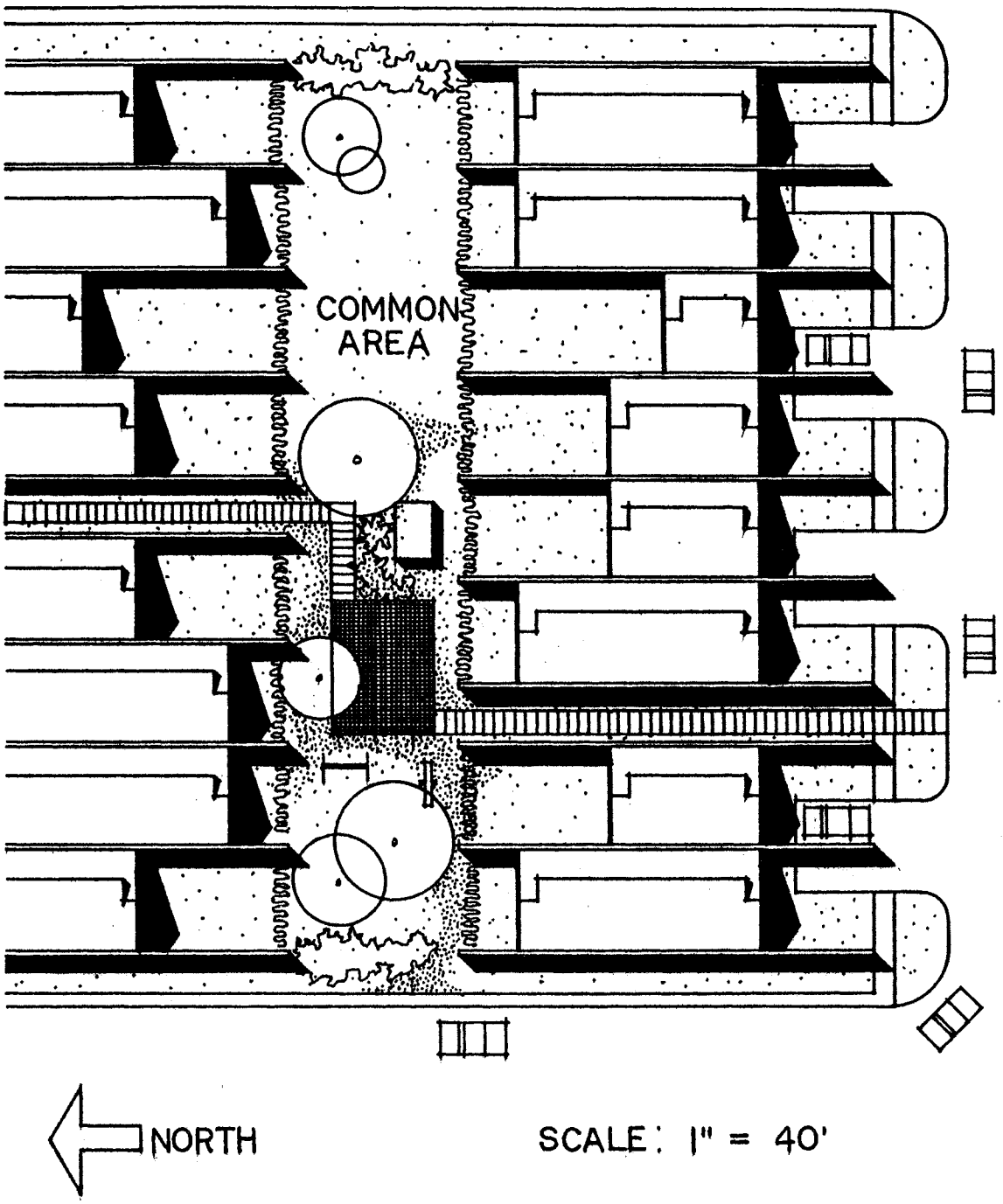


Figure 5. Proposed Site Plan

street, the public area is not separated from the private area, and consequently, the front lawn goes unused. The front doors of the houses provide the only separation of public and private areas. A series of spaces should be provided which progressively become more private, to define the areas of public or private activities. This could be accomplished by the arrangement of walks and fences from the street (public) to the front door (private).

The last shortcoming of today's typical suburban home is the lack of relationship between interior and exterior spaces. Today's homes usually have small windows screened by drapes or curtains to provide interior privacy. If the outdoor spaces surrounding the house were made private, then larger windows could be provided, thus creating a much closer relationship between the interior and exterior spaces, without any loss in privacy.

All of the above solutions to the shortcomings of suburban housing sites have been incorporated into a site design for this project. This proposed site design is shown in Figure 5. This design is intended to be used in the typical "grid" layout common to many small communities. The basic plan is 23' 6" wide, so that two housing units can be located on each 50 foot wide lot. This provides a cost savings to the low-income families in terms of land area without sacrificing the benefits of usable outdoor area.

Housing Design

Housing design will be successful only if it responds to the needs of the human occupants. As stated by Serge Chermayeff, "form is the ordered expression of a need; the end product of a process of response to pressure" (41).

For this reason it is important that the first step in the design of a housing unit be a clear statement of the forces at work and the pressure

patterns the form is to reflect. Only with such a clear statement is it possible to approach the design.

Housing design for low-income families must reflect the forces of (1) a dynamic family, (2) a changing technology, and (3) family privacy. In contrast to these forces, the emphasis upon a technological breakthrough in housing design, focuses the attention of "new" materials and methods of construction which have little importance upon the success or failure of a housing design. As Christopher Alexander said (42),

> "Our ability to manufacture a plastic container the size of a house and then fill it with mechanical gadgets, hardly commends itself as progress in housing, if the plan serves obsolete purposes."

Dynamic Family

As was pointed out in an earlier chapter, the family is constantly changing. These changes in the family are accompanied by corresponding changes in their needs. This fact is not new to housing designers, and yet it is ignored in the majority of house plans. Designers surrender themselves to a fixed plan which is a compromise with the values and needs they considered desirable at the beginning of the design process. This does not have to be the case.

Today the technological methods are available which can provide a flexible home to meet the needs of the dynamic family. A dynamic family requires flexibility in space arrangement, growth potential, and exterior appearance. All of these requirements can be met if recognized and programmed at the start of the design process.

As shown in the following drawings (Figure 6 through 11), the requirements of flexibility are fulfilled by providing a basic permanent shelter, the space in which can be arranged in a variety of ways to meet the needs of many

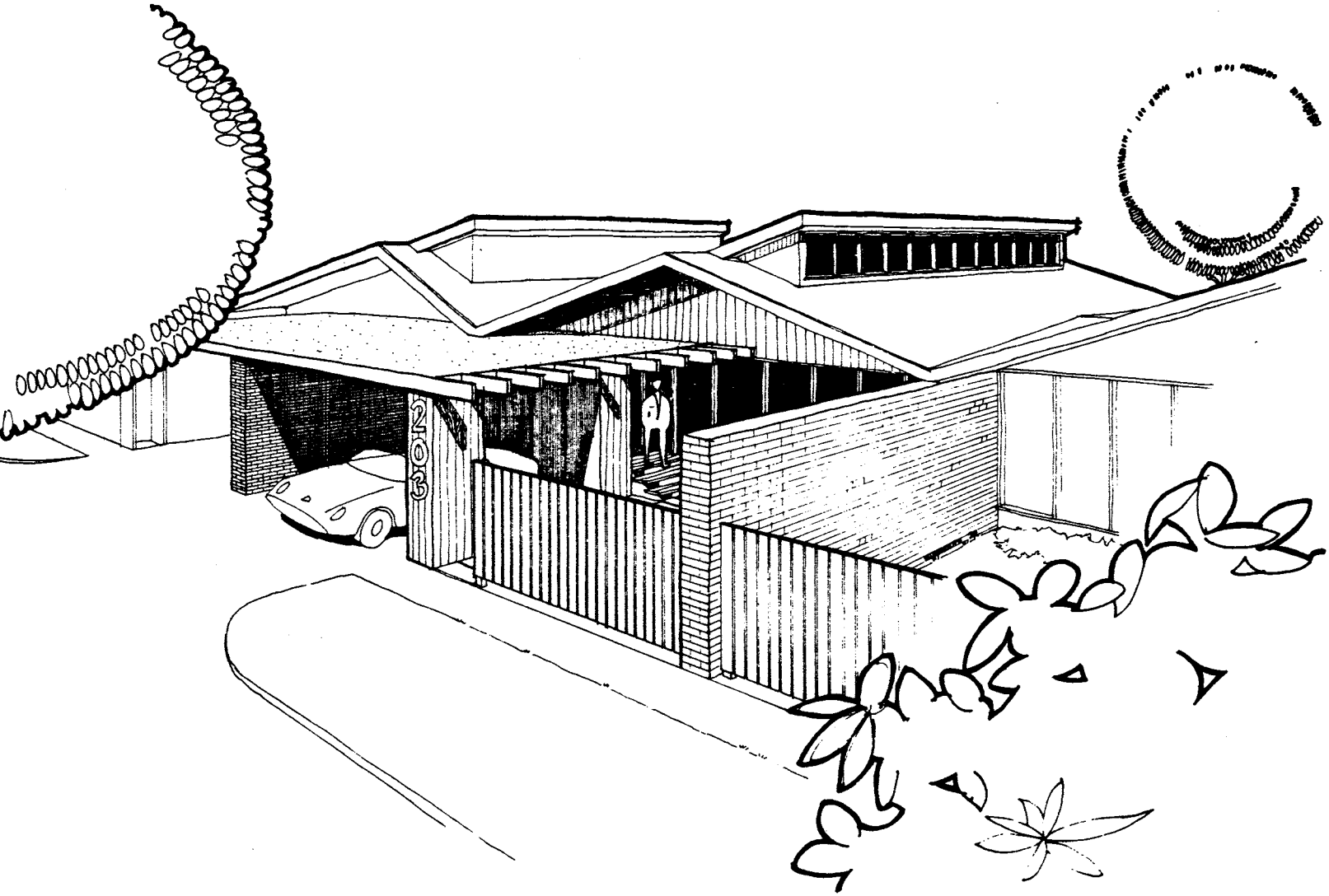


Figure 6. Perspective of Proposed Housing Unit

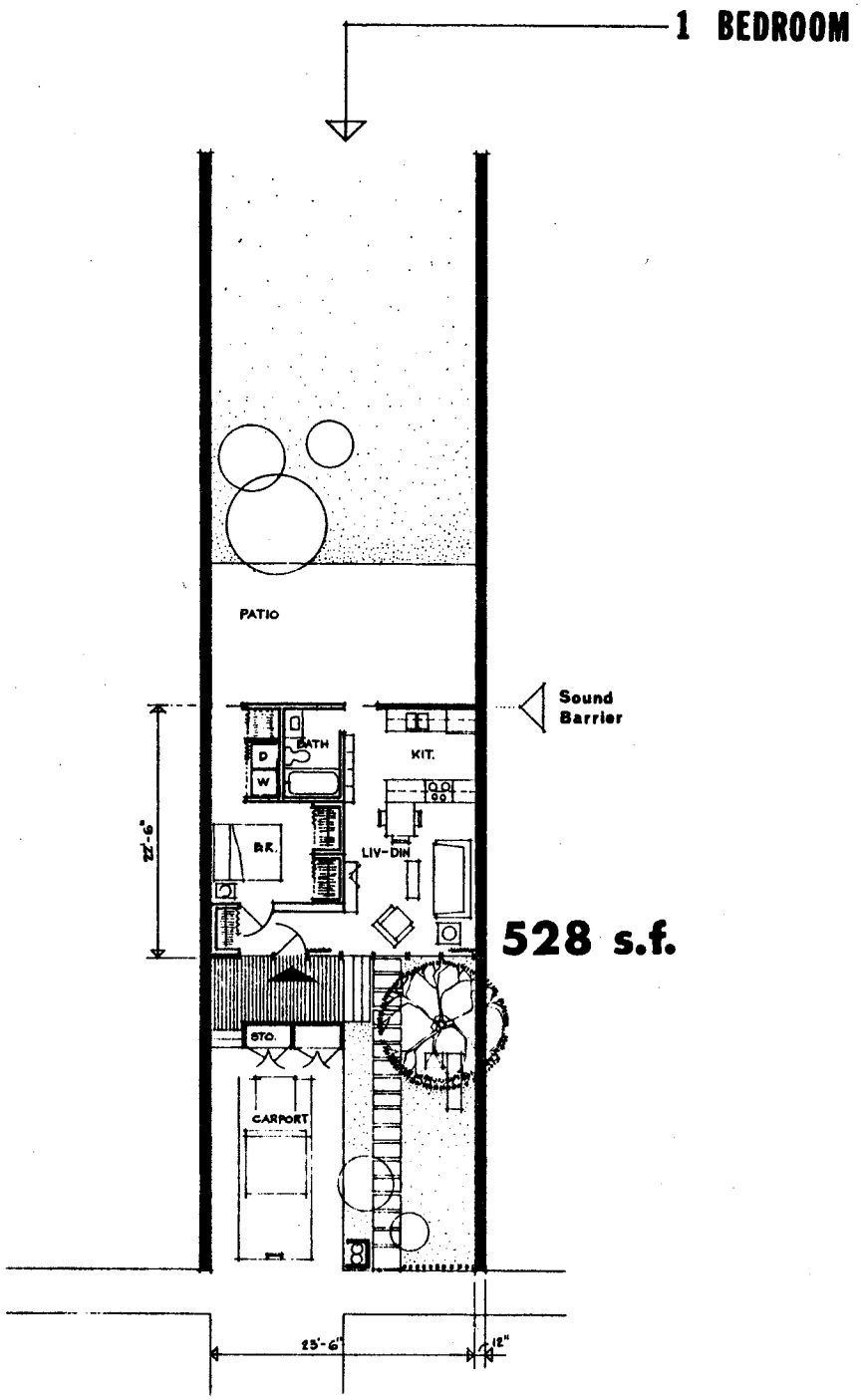


Figure 7. Proposed Floor Plan (Basic Unit)

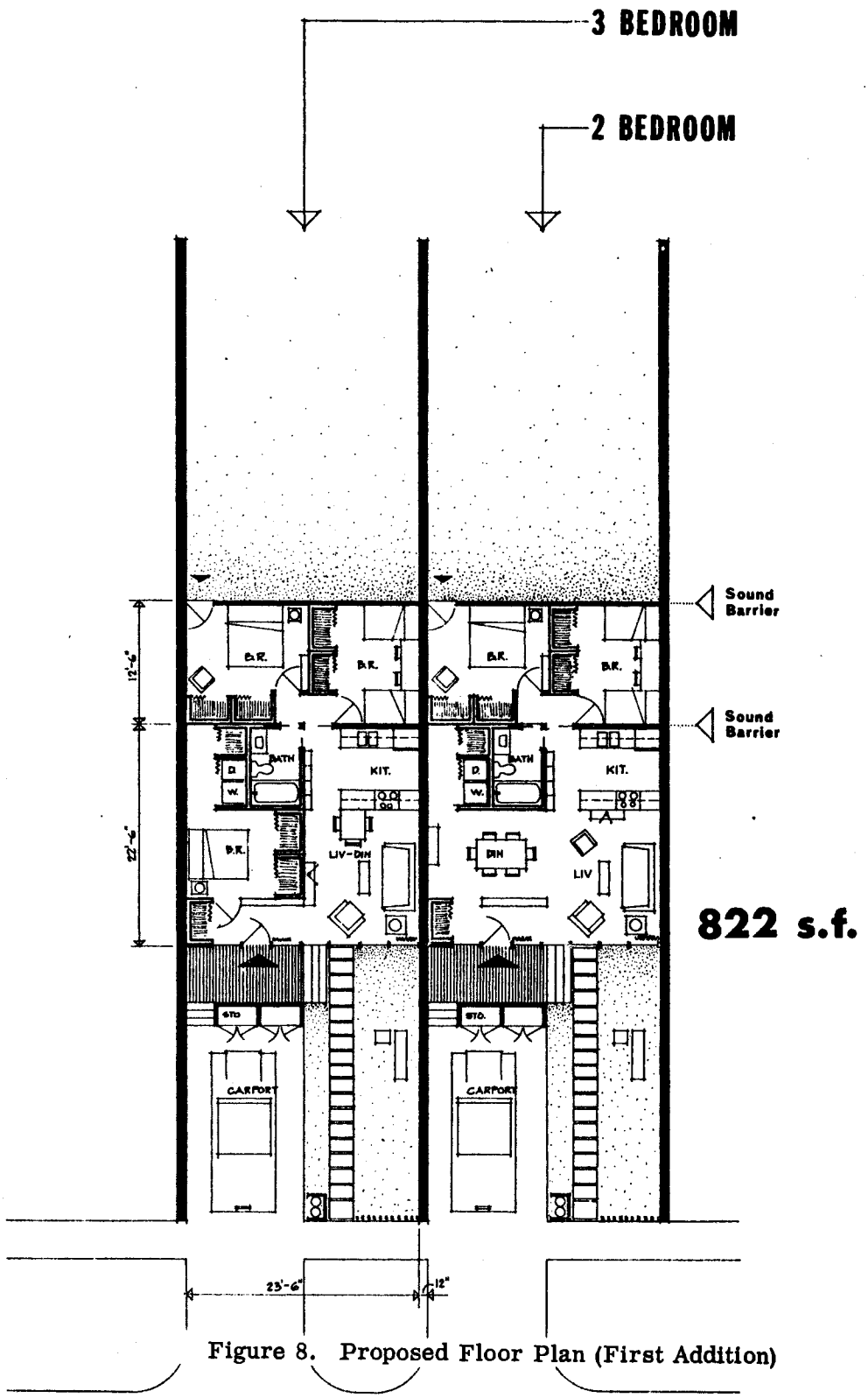


Figure 8. Proposed Floor Plan (First Addition)

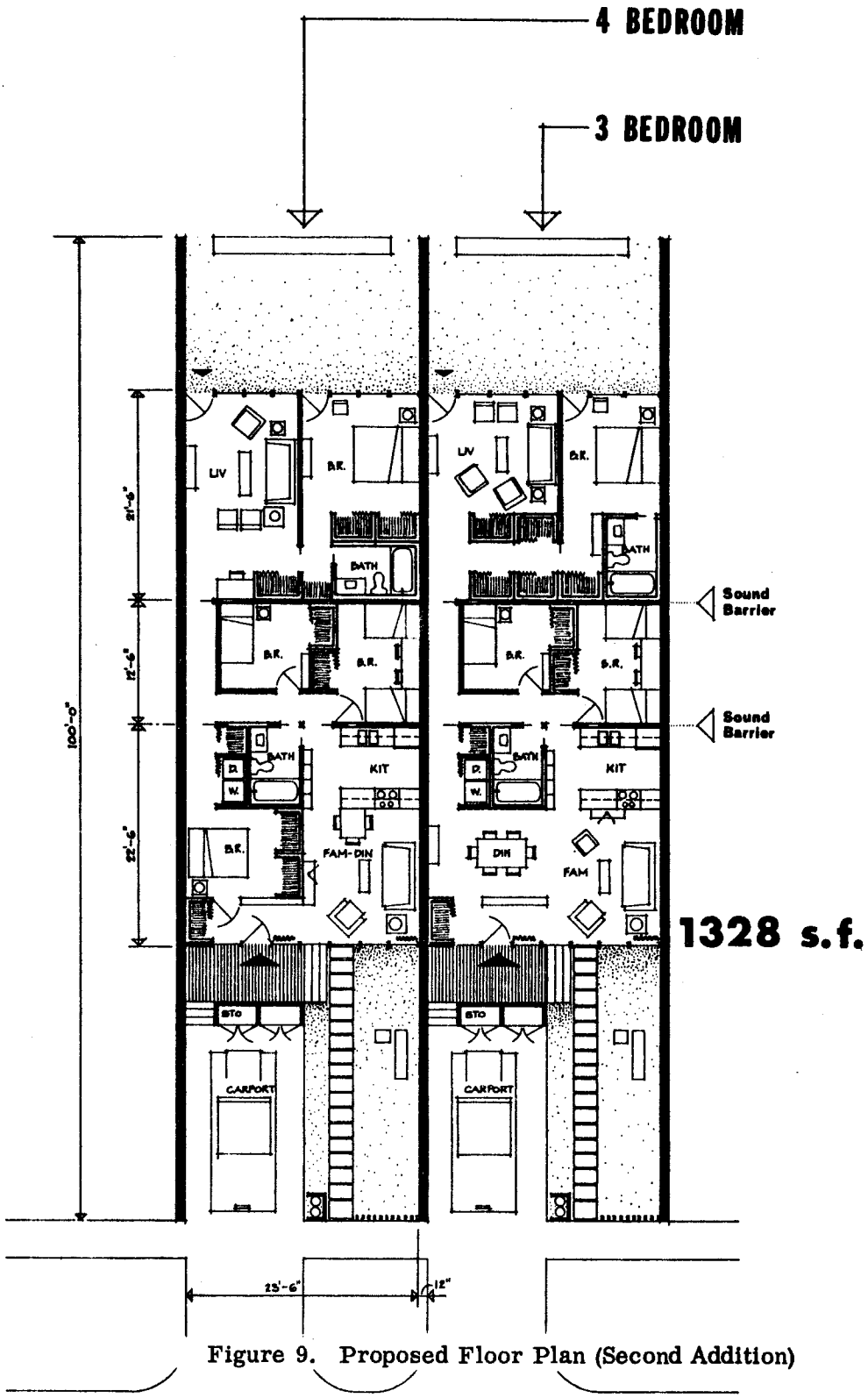


Figure 9. Proposed Floor Plan (Second Addition)

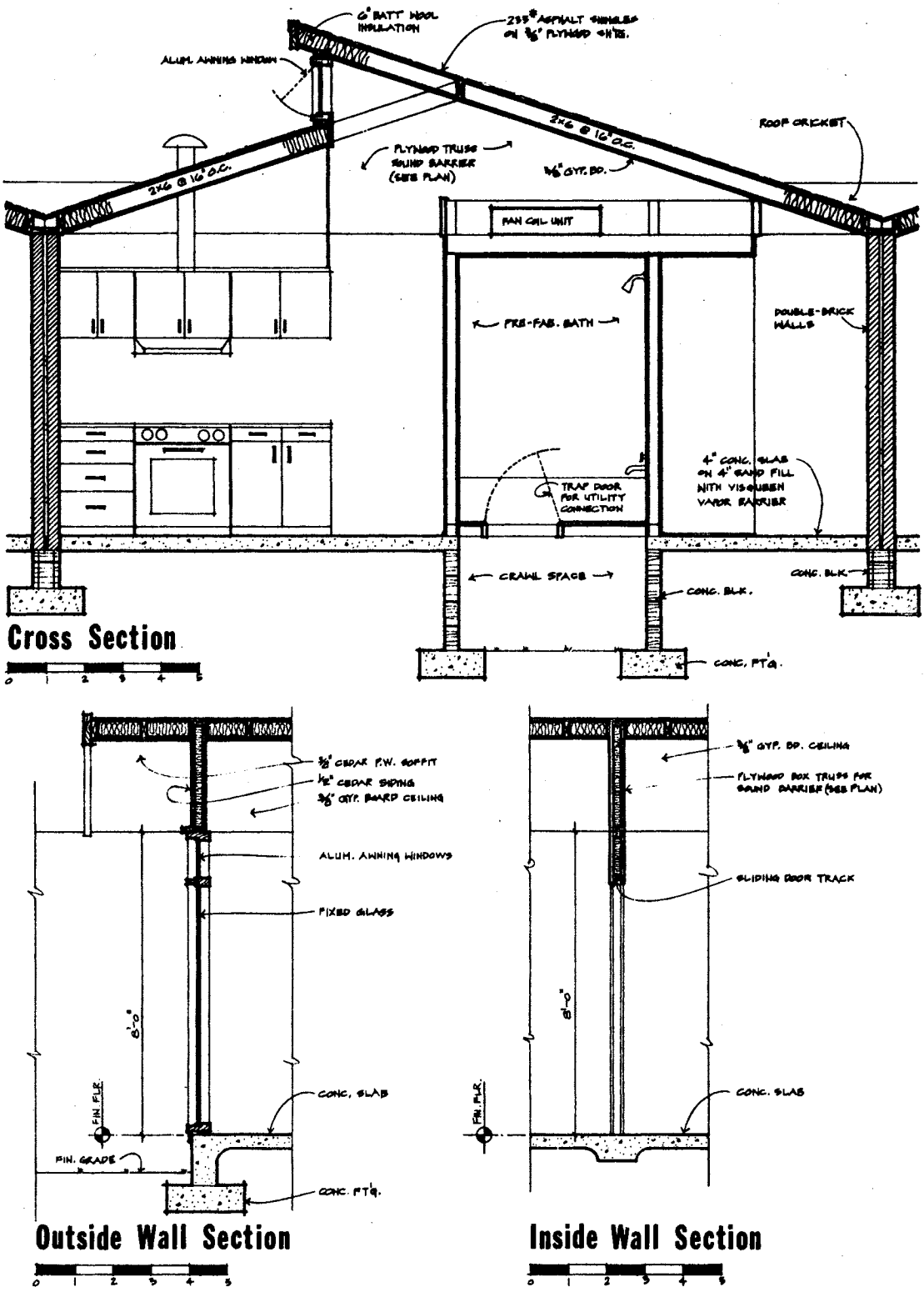
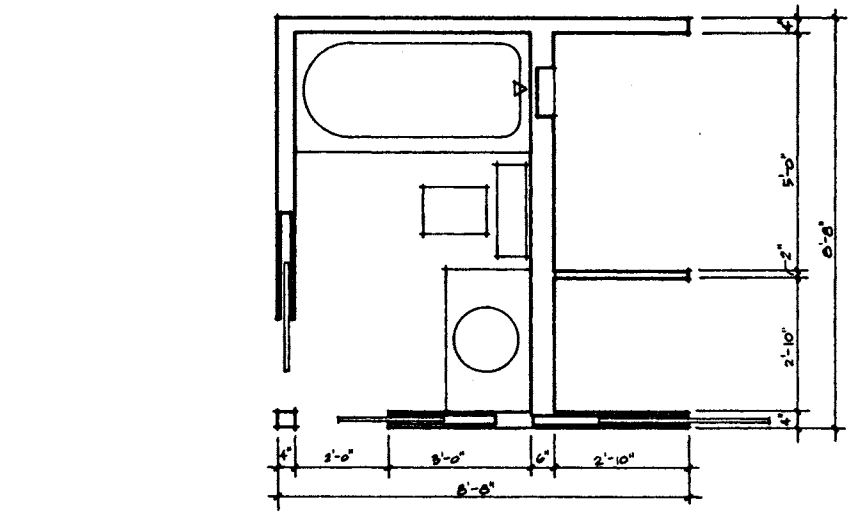
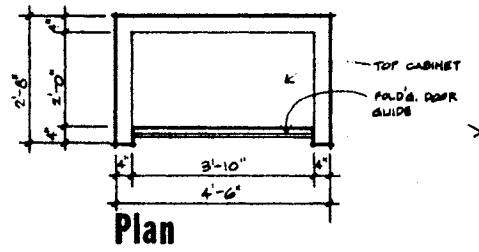


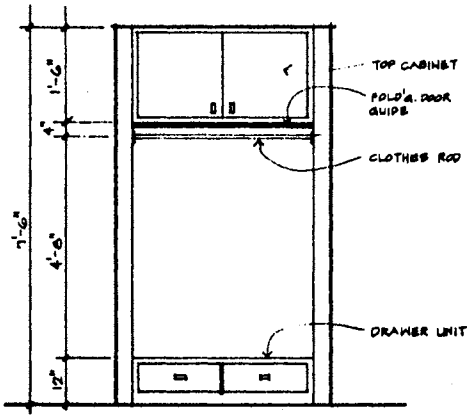
Figure 10. Cross Section Through Typical House



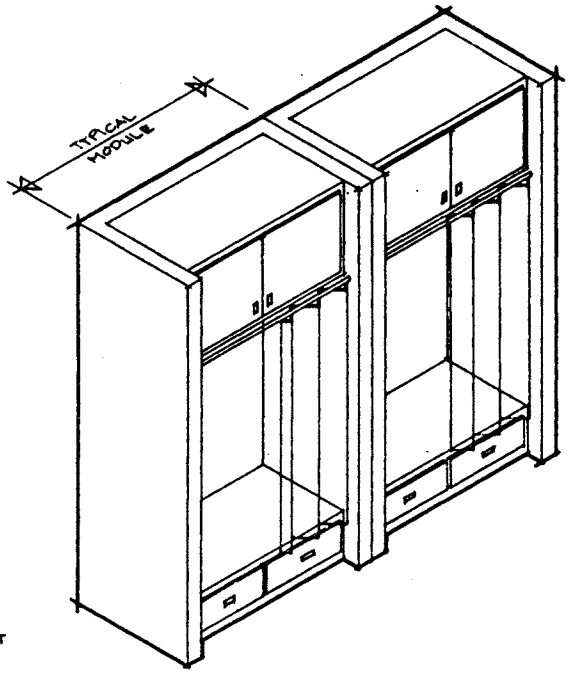
Prefabricated Bathroom



Plan



Elevation



Prefabricated Closet

Figure 11. Prefabricated Closet and Bathroom Units

families. The plan can also be expanded to provide additional space as the family enlarges. This would permit the family to remain in the same house for many years even though their family size changes. The last requirement, that of a flexible exterior appearance can be accomplished by designing the exterior of each housing unit according to the desires of the family. There need not be a fixed "overall" project design. Variety can be accomplished by changing materials on the front and rear walls and also by variations in the roof forms which span from one masonry wall to the other.

The basic flexible modules are the bathroom core unit and the closet unit. (see Figure 11). Both of these units are prefabricated and then transported to the site. The bathroom is situated so that its outside walls form dividing partitions for the other areas. The closets are movable so that they can be located according to the family's needs. The closet units are available either with or without the shelf and drawer cabinets. The kitchen cabinets are also prefabricated and need not be selected until the basic shelter is completed. This will allow the housewife to visualize the space before the size and type of cabinets are specified.

Changing Technology

Since all technology is susceptible to change and obsolescence, housing must be created which provides an inexpensive permanent shelter that can be updated at a reasonable cost in the future (43).

Slums today are a result of buildings which are impossible to economically rehabilitate. The short-life elements of mechanical equipment are intricately connected to the long-life elements of the structure. The mechanical equipment wears out rapidly or becomes obsolete due to research and development. On the other hand, structural elements usually have a very long life

without any loss in efficiency. In replacing the mechanical elements, so as not to damage the more permanent structure, the two elements must be physically separated. Hence, as housing technology is improved, these improvements can be incorporated into the permanent structure.

This is accomplished in the design of this housing unit. The mechanical core is prefabricated with all piping included, then shipped to the building site to be connected to the permanent structure. Eventually, as the mechanical elements begin to wear out, the entire unit can be replaced by the most recent models of mechanical equipment. This assures the renewability of the house, without damage to the structure.

There are two arrangements for the air conditioning equipment. In the case of individual homes, the furnace and cooling coils can be placed in the closet adjacent to the washer and dryer. In the case of ten or more homes, common chiller and boiler units will be located in a building to the rear of the property and will serve all the units.

Family Privacy

The two parallel masonry walls provide both visual and acoustical protection from neighbors. In addition, the front is protected by a wood fence and a wood storage unit which acts as a buffer between the house and the street. The rear is protected by a row of shrubs. These barriers assure privacy for the entire family regardless of whether they are indoors or outdoors.

The interior of the house is planned so as to provide privacy for the individual members of the family. The house is separated into three areas of activity: (1) the family area, including the kitchen, family room, and dining area; (2) the children's area, which includes the bedrooms; (3) the adult area,

which includes the rear living room and the master bedroom and bath. Each of these three areas is separated by a physical "sound barrier"; an insulated wall which extends from floor to ceiling. (see Figures 7 through 10). This barrier isolates the activities of one area from the activities of another and assures the privacy of each member of the family.

Savings Analyzed

As described in a preceding chapter, savings can be obtained by a combination of technical, political, and economic innovations, but the technical innovations will be easier to implement than either the political or economic ones. The technical considerations include new materials and new methods of construction. The political considerations include changes in tax policies, subsidy programs, and land regulations. The economic considerations include changes in financing and purchasing.

Table V is an itemized list of the savings which could be obtained if the technical, political and economic innovations which are shown were implemented. Using these suggested innovations, and calculating the new cost estimate as shown in Table VI, the final cost of a house is $13,960, and the monthly payments are $38.77.

As a comparison, Table VII is an itemized list of the savings which can be achieved under the present restrictions of the home building industry. Using these restrictions, and calculating the new cost estimate shown in Table VIII, the final cost is $16,795 and the monthly payments are $46.65.

These tables graphically demonstrate the extra cost paid by low income families because of the potential political and economic innovations which are not available to the home building industry.

TABLE V

TECHNICAL, POLITICAL AND ECONOMIC INNOVATIONS AND THEIR EFFECT ON THE TOTAL COST OF A HOME (HYPOTHETICAL)

Item	Innovation	% Cost Reduction
Land	1) Better land utilization	1.50%
	2) Tax policy which prohibits land "holding"	1.25%
	3) Cooperative buying of large land tracts	1.50%
House	1) Cooperative purchasing	2.00%
	2) Prefabrication (closets and bath)	1.00%
	3) Increased quality	-4.00%
	4) Profit and overhead omitted	3.00%
	5) 1/2 government subsidy	10.00%
Interest	1) 1/2 government subsidy (on house)	28.00%
Discount	1) "Tight" money situation cleared	1.25%
Taxes	1) Reduce tax for developed land	10.00%
Insurance	1) Improve fireproofing	.25%
Miscellaneous	1) Cooperative fee sharing	.50%
	Total % Savings	56.25%

TABLE VI

*HOUSE COST ESTIMATE BASED UPON A COMBINATION OF HYPOTHETICAL INNOVATIONS IN THE BUILDING INDUSTRY

Item	Cost Reduction		New Cost Estimate	
	Percentage	Dollars	Percentage	Dollars
Land	4.25%	$ 1,640	2.50%	$ 360
House	12.00%	4,635	15.00%	3,365
Financing	28.00%	8,178	16.00%	4,843
Discount	1.25%	400	0	0
Taxes	10.00%	501	7.00%	4,509
Insurance	.25%	52	.75%	158
Miscellaneous	.50%	75	2.50%	725
Totals	56.25%	$15,481	43.75%	$13,960

*House with a "purchase price" of $10,000

TABLE VII

TECHNICAL, POLITICAL AND ECONOMIC INNOVATIONS AND THEIR EFFECT ON THE TOTAL COST OF A HOME (FEASIBLE)

Item	Innovation	% Cost Reduction
Land	1) Cooperative buying of large land tracts	1.50%
House	1) Cooperative purchasing	2.00%
	2) Prefabrication (closets and bath)	1.00%
	3) Increased quality	-4.00%
	4) Profit and overhead omitted	3.00%
Interest	1) F.H.A. 235 subsidy	39.00%
Discount	NONE	- - -
Taxes	NONE	- - -
Insurance	1) Improve fireproofing	.25%
Miscellaneous	1) Cooperative fee sharing	.50%
	Total Cost Reduction	43.25%

TABLE VIII

*HOUSE COST ESTIMATE BASED UPON A COMBINATION OF FEASIBLE INNOVATIONS IN THE BUILDING INDUSTRY

Item	Cost Reduction		New Cost Estimate	
	Percentage	Dollars	Percentage	Dollars
Land	1.50%	$ 442	5.25%	$ 1,558
House	2.00%	588	25.00%	7,412
Financing	39.00%	11,489	5.00%	1,532
Discount	0	0	1.25%	400
Taxes	0	0	17.00%	5,010
Insurance	.25%	52	.75%	158
Miscellaneous	.50%	75	2.50%	725
Totals	43.25%	$12,646	56.75%	$16,795

*House with a "purchase price" of $10,000

Building Materials

The selection of building materials was based upon three major considerations: (1) low maintenance, (2) high quality, (3) low initial cost. The first two considerations have been given a greater priority than low-cost. This was due to the fact that low-income families cannot afford the expense of maintaining cheap materials. On the other hand, the initial cost difference between low quality and high quality building materials makes little difference in the monthly payment to the low-income family.

A complete summary of the selected building materials and a cost estimate follows:

Summary of Building Materials

1. Foundation: Steel reinforced concrete footing with concrete block stem wall.

2. Flooring: 4" thick concrete slab on 4" sand cushion and 4 mil. visqueen vapor barrier.

3. Exterior Walls: Double 4" common brick at sides; wood frame windows at end walls with insulated stud walls above 8' 0".

4. Finish Flooring: 1/16" x 12" x 12" vinyl asbestos tile in family room, dining room and kitchen; nylon carpet and rubber pad in all bedrooms and in living room.

5. Roof Framing: 2 x 6 @ 16" o.c. with built up plywood trusses at sound barriers (see Figures 7 through 9).

6. Roofing: 235 lb. asphalt composition shingles on 2 plys of 15 lb. felt on 3/8" plywood roof sheathing.

7. Interior Partitions: 2 x 4 studs @ 16" o.c., fully insulated, 1/4" prefinished wood paneling.

8. Ceiling Material: 1/2" gypsum board, painted.

9. Doors: Exterior; 1-3/4" S.C. Mahogany (w.s.) Interior; 1-3/8" H.C. Mahogany.

10. Windows: S.S.B. glass at end walls, aluminum frame awning windows @ roof ridge, with S.S.B. glass.

11. Kitchen Cabinets: Pre-finished wood cabinets with lam. plastic counter top.

12. Insulation: 3" wool batts @ end walls. 6" wool batts @ ceiling.

13. Prefabricated Closets: 2" x 4" wood frame with 1/4" prefinished paneling (insulate with 3" batts.) Pre-finished wood cabinets.

14. Prefabricated Bathroom: Walls and ceilings: 1/2" gypsum board. Structure; 3-1/2" metal studs @ 16" o.c. Floor; steel channel members. Finished Floor; sheet vinyl on plywood. (Note the floor opening for utility connection.) Tub, porcelain steel tub with laminated plastic wainscot. Lav; vitreous china. W.C.; vitreous china.

Note: Washer and dryer connection behind tub wall.

15. Mechanical Equipment: Exhaust fans in kitchen and bath. Ten houses or more: Central boiler and chiller located in a separate building in the rear. Fan coil units in each dwelling above the prefabricated bathroom. Side wall air supply registers. Return air thru duct in back of lavoratory wall. Less than 10 houses: individual warm air furnaces with cooling coils located in closet behind lavoratory. Compressor located on roof of carport.

16. Electric Wiring: Wiring in ceiling, central panel in back of space for washer and dryer. Ceiling hung light fixtures.

Cost Estimate

Tables IX through XIII are itemized cost estimates of the proposed housing design components. A wide range of "total" costs are available by the selection of (1) the size of the housing unit, (2) the optional components that may be added. Therefore, to narrow this range, the housing units drawn in Figures 7 through 9 were selected to serve as models for a cost estimate of the proposed housing design. Table XIV is the tabulation of that cost estimate. In addition, the land, interest, discount, taxes, insurance and miscellaneous costs have been calculated and then added to the house cost to obtain the total cost and the total monthly payments. It should be noted that these costs were estimated using all of the potential political, technical and economic innovation existing today. This cost estimate demonstrates the savings that can be obtained by utilizing these innovations.

TABLE IX

COST ESTIMATE OF PROPOSED HOUSING DESIGN
(Basic Unit)

Item	Quantity	Unit Cost	Total Cost
Aggregate	12 cu.yds.	3.00	$ 36.00
Concrete	12 cu.yds.	14.00	308.00
Reinf. Steel; (Rebars)	600 L.F.	.03½	21.00
(Mesh)	1 roll	16.45	16.45
Masonry; Brick	12,800 units	.04½	576.00
4" conc. blk.	40 units	.24	9.60
8" conc. blk.	300 units	.30	90.00
Rough Hardware	- - - - - -	- - -	40.00
Roof Framing 2 x 6	918 B.F.	.10	91.80
Roof Sheathing, p.w.	18 pieces	2.60	46.80
Roofing Felt 15#	2 rolls	2.15	4.30
Roofing Shingles 235#	5½ squares	6.39	34.06
Roof Trusses	2 units	15.00	30.00
Glass @ End Walls	184 S.F.	.50	92.00
Wood Frames @ End Walls	56 B.F.	.16	8.96
2x4 Stud Wall, Exterior	18 studs	.60	10.80
Exterior Doors 1-3/4 SC	2 units	7.70	15.40
Insulation; 6" batt	530 S.F.	.08	42.40
3" batt	200 S.F.	.05	10.00
Siding p.w. cedar	284 S.F.	.21	59.64
Finish Hardware	- - - - - -	- - -	25.00
Alum Awning Windows	6 units	15.60	93.60
Wood Fascia 1x6	38 B.F.	.37	14.06
Wood Trim 1x4	23 B.F.	.37	8.51
Metal Flashing 26 ga.	12 L.F.	.60	7.20
Vinyl Downspouts	2 units	3.89	7.78
Gypsum Board, Ceiling	530 S.F.	.14	74.20
Kitchen Cabinets & Top	- - - - - -	- - -	305.00
Finish Floor, Asb. tile	530 S.F.	.50	265.00
Labor: Carpenters	80 Hr.	6.00	480.00
Masons	60 Hr.	10.00	600.00
Conc. Finish	4 Hr.	10.00	40.00
Subcontractors:			
Plumber	- - - - - -	- - -	350.00
Electrician	- - - - - -	- - -	220.00
Excavation	- - - - - -	- - -	90.00
Mechanical	- - - - - -	- - -	60.00
		TOTAL	$4,183.56

NOTE: See Tables XII and XIII for optional items.

TABLE X

COST ESTIMATE OF PROPOSED HOUSING DESIGN
(First Addition)

Item	Quantity	Unit Cost	Total Cost
Aggregate	4 cu.yds.	$ 3.00	$ 12.00
Concrete	5 cu.yds.	14.00	70.00
Reinf. Steel; (Rebars)	142 L.F.	.03½	4.97
(Mesh)	½ roll	16.45	8.23
Rough Hardware	- - - - -	- - -	10.00
Roof Framing 2x6	252 B.F.	.10	25.20
Roof Sheathing, p.w.	10 sheets	2.60	26.00
Roofing Felt 15#	1 roll	2.15	2.15
Roof Shingles 235#	3 squares	6.39	19.17
Roof Truss	1 unit	15.00	15.00
2x4 Stud Wall, Exterior	18 studs	.60	10.80
Exterior Doors 1-3/4 SC	1 unit	7.70	7.70
Insulation: 6" batt	300 S.F.	.08	24.00
3" batt	188 S.F.	.05	9.40
Siding p.w. cedar	188 S.F.	.21	39.48
Finish Hardware	- - - - -	- - -	25.00
Alum. Awning Windows	3 units	15.60	46.80
Wood Trim 1x4	12 B.F.	.37	4.44
Duct Chase p.w.	2 sheets	4.80	9.60
Duct Work	8 L.F.	4.30	34.40
Air Grilles	2 units	3.50	7.00
Labor: Carpenters	40 hr.	6.00	240.00
Conc. Finish	4 hr.	10.00	40.00
Electrician	8 hr.	8.00	64.00
Gypsum Board Ceiling	300 S.F.	.14	42.00
Gypsum Board Walls	350 S.F.	.14	49.00
Finish Floor, Carpet	300 S.F.	.75	225.00
Painter	- - - - -	- - -	40.00
		Total	$1,111.34

NOTE: See Tables XII and XIII for optional items.

TABLE XI

COST ESTIMATE OF PROPOSED HOUSING DESIGN
(Second Addition)

Item	Quantity	Unit Cost	Total Cost
Aggregate	12 cu.yds.	$ 3.00	$ 36.00
Concrete	12 cu.yds.	14.00	308.00
Reinf. Steel (Rebars)	142 L.F.	.03½	4.97
(Mesh)	1 roll	16.45	16.45
Rough Hardware	- - - - -	- - -	40.00
Roof Framing 2x6	630 B.F.	.10	63.00
Roof Sheathing, p.w.	16 pieces	2.60	41.60
Roofing Felt 15#	2 rolls	2.15	4.30
Roof Shingles 235#	5 squares	6.39	31.95
Roof Truss	1 unit	15.00	15.00
2x4 Stud Wall, Exterior	18 studs	.60	10.80
2x4 Stud Wall, Interior	22 studs	.60	13.20
Exterior Door 1-3/4 SC	1 unit	7.70	7.70
Insulation: 6" batt	500 S.F.	.08	40.00
3" batt	188 S.F.	.05	9.40
Finish Hardware	- - - - -	- - -	25.00
Alum. Awning Windows	5 units	15.60	78.00
Glass @ End Walls	184 S.F.	.50	92.00
Wood Frames @ End Walls	56 B.F.	.16	8.96
Window Trim 1x4	20 B.F.	.37	7.40
Gypsum Board Ceiling	500 S.F.	.14	70.00
Finish Flooring, Carpet	500 S.F.	.75	375.00
Labor: Carpenters	80 hr.	6.00	480.00
Conc. Finish	4 hr.	10.00	40.00
Subcontractors:			
Plumber	- - - - -	- - -	60.00
Electrician	- - - - -	- - -	75.00
Mechanical	- - - - -	- - -	40.00
		Total	$1,993.73

NOTE: See Tables XII and XIII for optional items.

TABLE XII

COST ESTIMATE OF OPTIONAL ADDITIONS

Item	Quantity	Unit Cost	Total Cost
FRONT PORCH:			$ 105.60
2x12 R.W.	360 B.F.	.16	57.60
Labor, Carpenter	8 hr.	6.00	48.00
TRASH BOX:			$ 48.16
2x4 Studs	8 studs	.50	4.00
Siding, Cedar p.w.	96 S.F.	.21	20.16
Labor, Carpenter	4 hr.	6.00	24.00
TOOL STORAGE:			$ 147.72
2x4 Studs	12 studs	.50	6.00
Siding, Cedar p.w.	112 S.F.	.21	23.52
Doors, H.C.	4 units	4.10	16.40
Hardware	4 pair	1.45	5.80
Labor, Carpenter	16 hr.	6.00	96.00
FENCE:			$ 86.68
2x4 Frame	20 B.F.	.10	2.00
1x6 Cedar	100 B.F.	.35	35.00
Labor, Carpenter	8 hr.	6.00	48.00
4x4 Posts	14 B.F.	.12	1.68
CARPORT ROOF:			$ 184.74
2x8 Joists	280 B.F.	.16	44.80
4x14 Beam	90 B.F.	.23	20.70
Roof Sheathing, p.w.	240 S.F.	.08	19.20
Built-up Roof	3 squares	15.00	45.00
Wood Fascia 1x12	44 B.F.	.16	7.04
Labor, Carpenter	8 hr.	6.00	48.00
CARPORT DRIVE:			$ 114.23
Sand	4 cu.yds.	3.00	12.00
Concrete	5 cu.yds.	14.00	70.00
Reinf. Steel (Mesh)	$\frac{1}{2}$ roll	16.45	8.23
Labor, Carpenter	4 hr.	6.00	24.00

TABLE XIII

COST ESTIMATE OF OPTIONAL ADDITIONS

Item	Quantity	Unit Cost	Total Cost
PREFABRICATED CLOSET:			$ 178.65
2x4 Studs	8 studs	.50	4.00
2x4 Plates	16 B.F.	.10	1.60
Pre-fin. Paneling	6 panels	2.79	16.74
Pre-fab. top cab't.	1 unit	42.00	42.00
Pre-fab. bot cab't.	1 unit	36.00	36.00
Labor, Carpenter	8 hr.	4.00	32.00
Overhead & Profit (35%)	- - - -	- - -	46.31
PREFABRICATED BATHROOM:			$1,146.15
Steel Channels	26 L.F.	1.85	48.10
Metal Studs	20 studs	.50	10.00
Gypsum Board	288 S.F.	.14	40.32
P.W. Partition	40 S.F.	.10	4.00
Bath Fixtures	- - - -	- - -	180.00
Sliding Doors	3 units	10.00	30.00
Wood Fascia 1x12	34 B.F.	.27	9.18
Air Grilles	4 units	3.50	14.00
Metal Ducts	10 L.F.	.50	5.00
Piping Mat'ls	- - - -	- - -	48.40
Sub-floor p.w.	40 S.F.	.10	4.00
Fin. Floor, vinyl	40 S.F.	.50	20.00
Electric Fixture	1 unit	4.50	4.50
Medicine Cab't.	1 unit	6.00	6.00
Towel Bars, 24"	3 units	1.50	4.50
Exhaust Fan	1 unit	25.00	25.00
Exhaust Duct	8 L.F.	1.00	8.00
Fan Coil Unit	1 unit	80.00	80.00
Labor; Carpenter	40 hrs.	6.00	240.00
Painter	4 hrs.	5.00	20.00
Electrician	4 hrs.	6.00	24.00
Mechanical	4 hrs.	6.00	24.00
Overhead & Profit (35%)	- - - -	- - -	297.15
Installation Labor:		Closet	6.00
		Bathroom	40.00
Freight Cost:		Closet	11.00
		Bathroom	40.00

NOTE: Freight costs will vary depending upon method of transport.

TABLE XIV

TOTAL COST OF PROPOSED HOUSING DESIGN
(using all available political, technical and economic innovations)

using Unit	Base Cost	*Land Cost	Interest (30 yr.)	Discount 5%	Taxes	Insurance	Misc. Cost	Total Cost	Monthly Payment
Bedroom	$ 6,841.79	$1,558.00	$1,149.53	$383.17	$3,954.39	$57.47	$38.31	$13,982.66	$38.84
Bedroom	8,344.43	1,558.00	1,364.73	454.91	4,694.68	68.23	45.49	16,530.47	45.91
Bedroom	8,701.73	1,558.00	1,415.48	471.82	4,869.27	70.77	47.18	17,134.25	47.59
Bedroom	12,020.26	1,558.00	1,884.12	628.04	6,481.38	94.20	62.80	22,728.80	63.13
Bedroom	12,020.26	1,558.00	1,884.12	628.04	6,481.38	94.20	62.80	22,728.80	63.13

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CHAPTER VI

SUMMARY AND CONCLUSIONS

After research into the background of the housing situation, it was found that inadequate housing is directly related to the increases in crime, disease and death among slum inhabitants. This condition is becoming more difficult to cope with because of the rapid population growth and the inability of the housing industry to produce adequate low-cost homes.

The definition of an adequate home means different things to different people. The low-income families also have their own ideas as to what is adequate. In an attempt to determine their needs and desires, it was found that the design of an adequate home must satisfy more than the basic needs of shelter and comfort. It must also fulfill material and psychological needs. Specifically, the material needs of low maintenance, renewability, and flexibility, and the psychological needs of freedom, privacy, close family relationship, relationship with nature, beauty and pride, must be fulfilled before the term "adequate" becomes relevant. With these needs in mind, ways of reducing the cost of adequate housing were examined.

Attempts are being made by larger corporations to find suitable materials and methods which will substantially reduce the cost of housing. This research is primarily directed toward solutions for the large urban centers and the mass housing market. Consequently, the small community which needs only 30 or 40 low-cost homes per year is being neglected.

Because of this small market and the large difference between the

cost of conventional construction and the low income of the families in blighted areas, the small communities must utilize innovative cost sharing techniques in the political and economic segments of the housing industry to provide adequate housing. To determine these innovative methods, the costs of purchasing a home were examined. This examination revealed three general facts: (1) the reduction of the internal costs of the house will have very little effect upon the total cost of that house; (2) the external costs of financing, taxes, insurance and land account for 75% of the total cost; (3) the house shell is the most economical component of a house, and the interior finishes and mechanical equipment are the most expensive. Methods of reducing these total costs were then proposed as follows: External Costs; (1) a new 1/2 house cost subsidy from the Federal Government; (2) a new land policy to discourage land "holding"; (3) higher densities with better land utilization; Internal Costs; (1) prefabrication of repetitive interior finishes and mechanical equipment; (2) flexible arrangement of the floor plan; (3) lowering the maintenance of the home; (4) by self help. In addition, the formation of a housing cooperative corporation will facilitate the implementation of these savings through: (1) bulk purchasing; (2) land acquisition; (3) united political pressure; (4) lower maintenance and utility costs. It is concluded that a combination of technical, political and economic innovations will result in the most effective reduction of housing costs. After revealing these cost saving techniques, an actual housing design was proposed which would meet the needs of the low-income families of a small community without reducing the quality of the living space or the quality of the materials.

The proposed house design criteria were based upon the needs of the low-income families and the external pressures which are linked to these needs. The site planning criteria included the needs for: (1) family privacy;

(2) usability of open space; (3) definition of public and private spaces; (4) relationship between interior and exterior. The site was planned for application in the typical "grid" layout of streets common to smaller communities.

The housing design criteria included the needs of: (1) flexibility in space arrangement, growth potential and exterior appearance; (2) planned renewability of mechanical equipment; (3) privacy for the family and for each individual of the family. The actual design of the house is shown in the drawings presented in Figures 6 through 11. It should be noted that numerous living arrangements can be provided and that the drawings only demonstrate 5 of these.

During the planning process, all of the technical, political and economic innovations which are feasible were incorporated into the housing design, in an attempt to gain as much savings in total cost as possible. The building materials were then selected, based upon the considerations of low maintenance, high quality and low initial cost. The cost estimates confirm the feasibility of the house design for low-income families. The monthly payments on a 30-year amortization range between $38.84 and $63.13 for the houses shown in Figures 6 through 9. These costs are within the reasonable monetary limits of the low-income families.

Below is a summary of the conclusions reached by this writer:

1) Adequate low-cost housing is not available to anyone at present, nor is it likely to become available in the near future.
2) Adequate housing for low-income families is available with the help of federal subsidy programs such as FHA Section 235.
3) Technological breakthroughs will have little effect upon total housing costs as long as the bulk of the cost is in the land, financing, taxes and insurance.

4) One of the most effective methods to reduce housing costs for low-income families is the formation of a housing cooperative which can exert political and economic pressure upon the housing industry.

Considering the problems encountered in reducing the costs of housing, it is felt that as the housing situation becomes more critical, the federal government will initiate a public housing system similar to the public school system now in use. Through this public housing system, an adequate home for every American family might become a reality.

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