A COMPARISON OF WOOD FRAME HOUSING UNITS AND CONCRETE BLOCK HOUSING UNITS FOR CONSTRUCTION IN JAMAICA

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ABSTRACT

A COMPARISON OF WOOD FRAME HOUSING UNITS
AND CONCRETE BLOCK HOUSING UNITS
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This study was initiated to determine the perception of Jamaican builders in terms of: the availability of wood versus concrete block, the factors limiting the use of wood frame residences in Jamaica, and the cost of using wood frame versus concrete block residences in Jamaica.

The research procedure was based on a selected sample without replacement taken from names of Jamaican building construction companies as listed in the 1983-84 Jamaica Telephone Directory. Questionnaires were mailed to each company's director.

From the results of the questionnaires, it was determined that builders in Jamaica perceived that wood frame housing units were more economical to construct, and concrete block housing units were more readily available. The research concluded that one major factor limiting the use of wood frame housing units in Jamaica was the level of knowledge in the area of construction.

In addition, a cost analysis for a wood frame and a concrete block housing unit of similar dimension revealed that the wood frame unit cost less to build in Jamaica.

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INTRODUCTION

.1 JUSTIFICATION

With the advent of the "economic changes" (resulting from Jamaica's independence in 1962) government officials, economists, general building contractors and researchers have been concerned with the question of how to reduce the rising cost of residential construction in Jamaica. Numerous technical devices and adaptations in building construction and equipment have been identified as methods to reduce rising construction cost. Education in appropriate building construction economics has been urged by the Minister of Construction in Jamaica. Many studies have been done to combat the high construction cost.

To date, no empirical data have been obtained to evaluate the knowledge in and the use of wood frame residential construction in Jamaica, (See Figure 1). Is it not timely and appropriate for government officials, economists and building construction researchers to affirm their concerns for more economical housing by giving consideration to wood frame residential construction? The wood frame housing unit is a less time consuming type of construction to erect in comparison to the traditional concrete block and cement housing unit; it lends itself readily to "self help" construction and could prove to be the greatest means of utilizing indigenous materials in Jamaica, (Desmond Flowers, 1983).

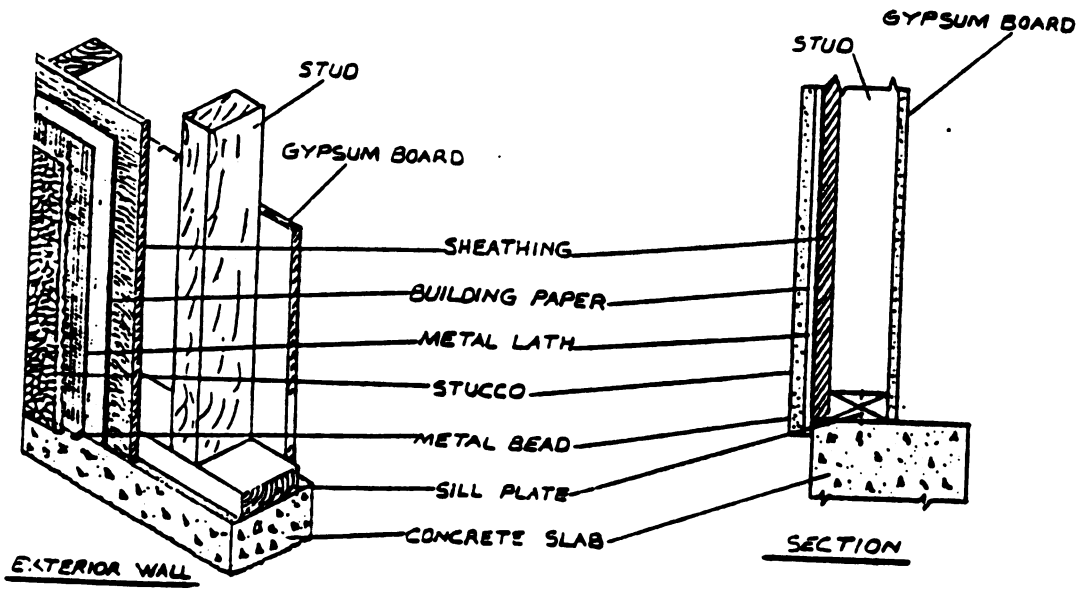

FIGURE 1

TYPICAL WOODFRAME WALL SECTION

.2 STATEMENT OF THE RESEARCH PROBLEM

Recognizing the economic conditions of Jamaica and the high escalating price of traditional building materials (concrete block), this study is designed to indicate the financial aspects (cost comparison) of wood frame housing units when compared to concrete block housing units in Jamaica and to do a pre test in order to indicate the factors limiting the present use of wood frame housing units, as per the preception of Jamaica residential building contractors.

.3 OBJECTIVES

1. To determine the availability of wood versus concrete block as a construction material in Jamaica as perceived by Jamaican builders.
2. To identify the factors which limit the use of wood frame residential construction in Jamaica as perceived by builders in Jamaica.
3. To investigate the financial aspects of using wood frame residences versus concrete block residences in Jamaica.

CHAPTER I

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

1.1 PAST TO PRESENT

When Christopher Columbus landed in Jamaica and claimed possession of the island in the name of the government of Spain, Jamaica was inhabited by an Indian people called Arawaks. These Arawak Indians lived in houses built from logs. Whole logs were used in the entire construction of the cabin, with the exception of the roof, on which the logs were covered with straw, grass or the boughs of the coconut plant, (See Figure 2).

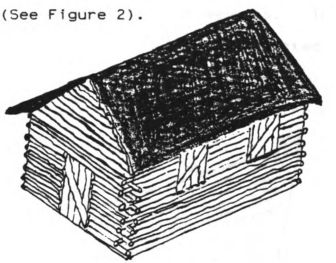

FIGURE 2

LOG CABIN HOUSE SHOWING WHOLE LOGS FOR SIDES AND MAIN MEMBERS

Soon after Columbus' discovery, Spanish activists began to use the island as a staging post for exploitation of the South American mainland. (West Indian History 1979). Seeking mercantilist expansion, the English took control of

Jamaica in 1655, extinguished the Arawaks and opened the country for incorporation into an expanding commercial empire.

Under this British administration, the predominant mode of agriculture in Jamaica shifted to larger sugar plantations run by agents of absentee owners. As the society shifted largely to the production of sugar cane, so did the original residential architectural construction from the log cabin structure to the "wattle and daub" structure. The wattle and daub residence was constructed with logs only for the "uprights" or main members. The siding was made from split pieces of bamboo, platted between the main vertical members. Clay was then mixed to a workable solution and used as a plaster over the wattle, (See Figure 3).

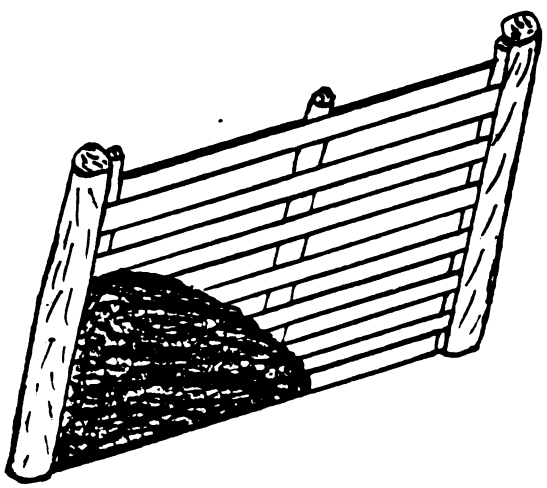

FIGURE 3

TYPICAL PANE OF WITTLE SHOWING WATTLE PLATTED BETWEEN POSTS

The development of the bauxite and tourist industries in Jamaica during the 1950's phased out the wattle and daub residence and ushered in a more rigid type of construction called the "nog house." It should be noted that during the period of wattle and daub construction, several wood frame and concrete block houses began to appear. These houses were mostly occupied by the middle and upper class people in Kingston and its vicinity. The Caribbean Cement Company, which came into existence in 1952, brought about the nog house construction by allowing cement to be used as a mixture with sand and gravel to form its walls. In this type of construction, wood was used only for the main members, but instead of bamboo wattle covered with clay plaster, wires were strung across the main members. Sand, crushed stones, cement and water mixed to a semistiff but workable consistency was then poured in wooden forms around the wooden posts and strung wires. After the walls were set in place, the forms were removed, and the walls generally washed with a mixture of limestone and water which left a white finish, (See Figure 4).

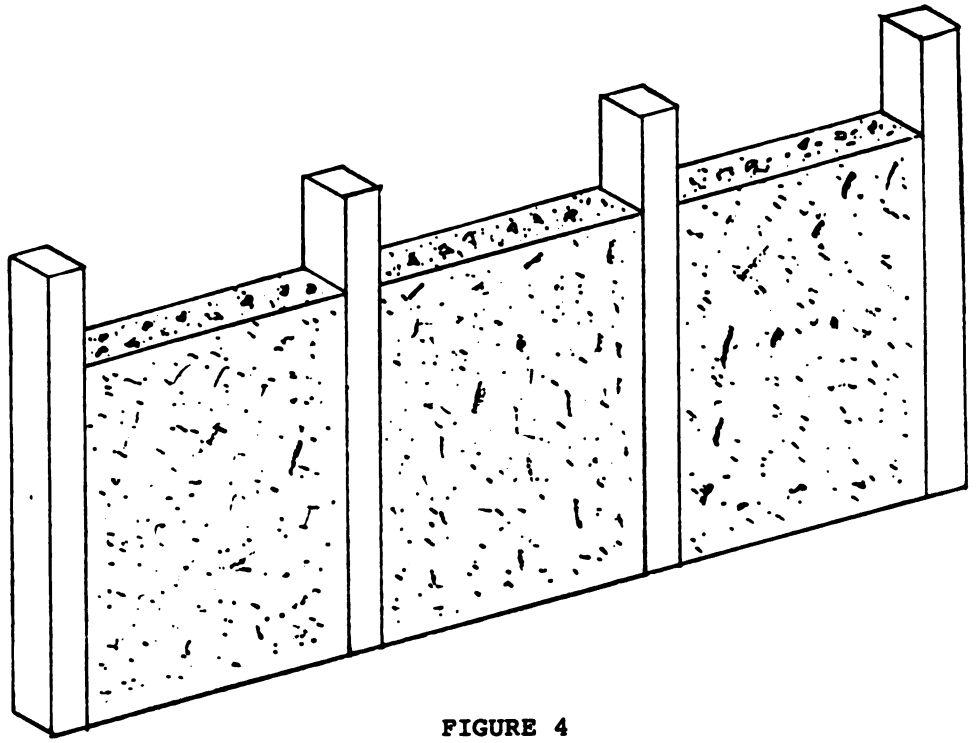

FIGURE 4

TYPICAL WALL ELEVATION OF NOG HOUSE

With the development of the cement company and numerous small private concrete block producers, the nog house era did not last long but gave way to the more modern and structurally sound structure of the concrete block residence. In this type of construction the walls of the house are of concrete blocks forming bonds. One half-inch diameter steel bars are generally placed vertically in the blocks for load bearing walls. The wall is then covered with a sand and cement plaster to a smooth granite like finish, (See Figure 5). With the beginning of the economic growth of the 1950's, the concrete block residence became the predominant method for constructing housing.

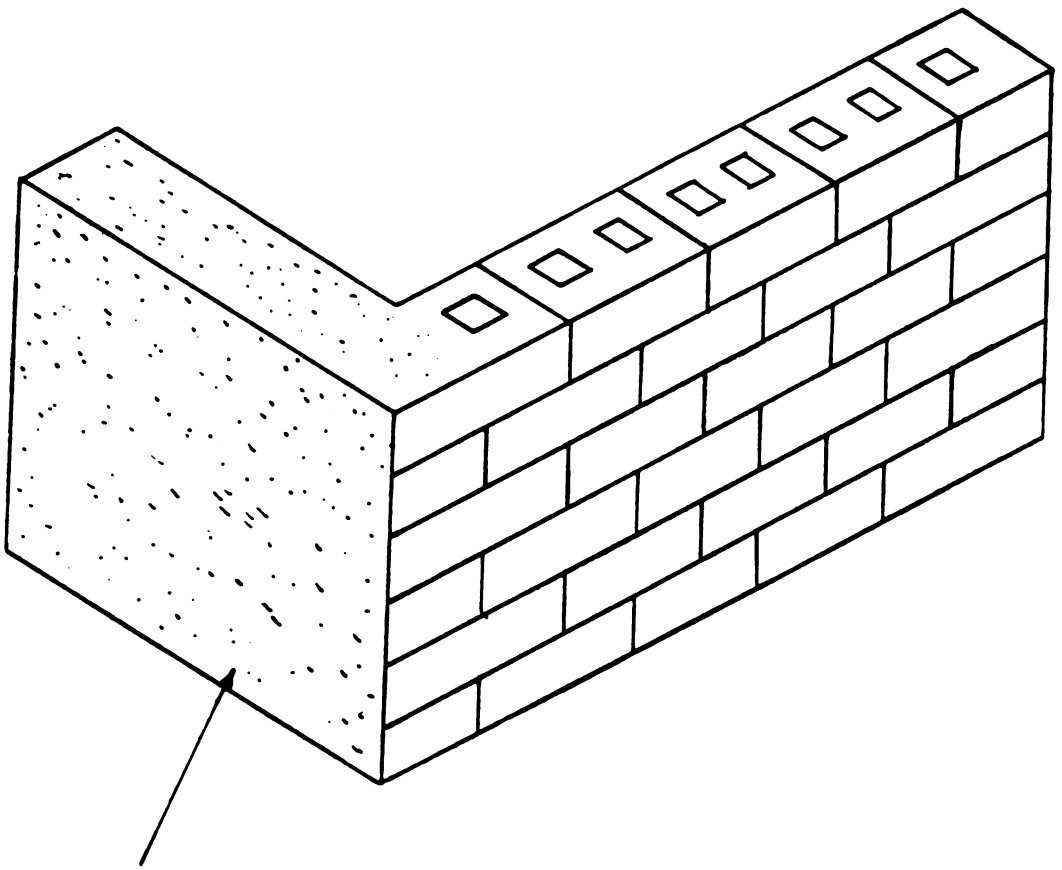

FIGURE 5

TYPICAL CONCRETE BLOCK WALL

In general, the development of bauxite and tourist industries in the 1950's ushered in a period of economic growth which, no doubt, contributed to the internal government's increasing ability to deal with national affairs, and contributed to growth in both economic and social sectors, (Robert Nicholas Grose, 1979). First, there was an increasing dependence on non-agricultural produce, international trade in the form of bauxite, tourism and capital intensive manufacturing sectors, all largely foreign owned. Secondly, the two party government system was dominated by a strong middle class, which established alliances with the descendants of the planter commerce elite and thus became increasingly important in the operation of those sectors. Thirdly, the economic growth was such that benefits tended to flow to the middle and upper class people causing a growing disparity between rich and poor, (Robert Nicholas Grose, 1978).

1.2 ECONOMIC CHANGE

The economic development that has taken place in Jamaica through the years and especially so in the Twentieth Century has favored urban growth. However, many migrants who were attracted to the city by limited but real employment opportunities found themselves excluded from this growth. Although industrial and service jobs were increasingly available, there were not enough to cater to the demand. The number of unemployed doubled between 1946 and 1950 when it stood (officially) at about 15 percent of

the working class, (Robert Nicholas Grose, 1978). By 1960, the unemployment rate in Kingston was about 18 percent, and about one-third of those persons never worked. In 1972, a new government was elected on a platform of change, but in 1982 there was a growth in unemployment in Jamaica to 25 percent.

Another economic factor in Jamaica is the state of poverty. A study done by the United States Agency of International Development (USAID) found that 70 percent of the population earns less than it needs to meet minimal standards of living, (USAID Shelter Sector Analyses, 1978). These conditions have compelled poor people to minimize their housing costs. They settle on whatever land seems to be available and build their own homes out of whatever materials are available. The USAID Study found that most of those who own their homes owe no mortgages because they have had no access to credit, and (if they are squatters) have no title to the land on which they have built.

The USAID Study also noted that to counteract these problems the Jamaican government has instituted several programs. Government housing projects of various kinds, in 1978, represented 70 percent of all the construction dollars spent on the island. The government of Jamaica has set up an emergency production plan to limit imports and stimulate the local production of the greatest possible amount of goods and services consumed by the population. The government sees its housing program as a tool to employ

a large number of unemployed workers and thereby stimulate growth in other sectors of the economy while making relatively small demands upon imports, (USAID Shelter Sector Analyses, 1978).

Through the Ministries of Security, the local government and other public agencies, there is a combined effort to make indigent housing more readily available, (Hugh Metts, 1983). Metts states that indigent housing is an area of particular concern to the ministries, but presently only owners of land are qualified for indigent houses. There are many among the poor who are in need of houses but do not own land. The government is now seeking to address that problem.

The poverty problem also has had a large impact on Jamaican youths as there are a number of children whose parents find it difficult to send them to school because of lack of monetary resources. The high rate of unemployment has seriously affected many young people who are willing to work but are unable to secure jobs. The influx of these young people who are forced to be self-supporting without any real jobs adds to the list of lower income housing seekers. With this continual growth and no visible solution, the housing problem in Jamaica has become a serious concern.

1.3 HOUSING CONCERN

During the last 15 years, many attempts have been made to improve the housing situation. Nevertheless, housing

problems in Jamaica continue to worsen. The government of Jamaica, through the Ministry of Housing, has shown interest in the production of houses for its citizens, (Edward Seaga, 1981).

In a press release, Mr. Bruce Golding, Minister of Construction, in coordination with the Ministry of Housing, reported that his ministry is working "assiduously" on a comprehensive national housing policy. He spoke of problems being experienced by the ministry in producing housing for the country, particularly for low income consumers. Some specific problems mentioned were problems of rising costs, inadequate financing, a failure of supply to keep pace with demand, and the need to restructure mortgage requirements in such a way that "poor people can afford", (Bruce Golding 1981). Giving an illustration of the financial bind facing the ministry, Mr. Golding said that at least Ja $350 million a year should be invested in low income housing. In 1981, however, only Ja $100 million was invested. This meant that the balance of Ja $250 million should have been picked up in the budget of the following year.

Mr. Golding also referred to the question of specifications by which houses were built. This factor, he believes, helped to force up the price of housing. He said that he wondered if it was necessary to have specifications covering the events of earthquakes and hurricanes. Concerning possible solutions to the present housing problems, the ministry had to look at new shelter concepts

which had to be the fundamental part of a new approach to the business of housing. Reference was made to the "starter home" concept which would be the primary responsiblity of the State and Services Section of the Ministry. Mr. Golding identifies spiraling building costs as a main problem to be tackled and said the ministry would be seeking to use indigenous material. The minister said he did not think that enough work had been done on this in the past and he was hoping to announce the development, in the future, of a Building Research Institute of Jamaica, (Jamaica Weekly Gleaner N. America Edition, Press Release, October 1981).

Previous to Mr. Golding's press release in October, 1981, there was an announcement by the Office of Disaster Preparedness in Jamaica, on September 9, 1981. The Office of Disaster Preparedness (ODP) reported that their consultant was carrying out a study of the vulnerability of non-engineered housing in Jamaica to hurricanes. It states that the study is seeking to identify the requirements for strengthening housing and to define means by which occupants and local builders can be motivated to effect improvements on existing buildings, as well as to new construction. The study is being funded by the USAID and is one of a series of technical studies being implemented by the ODP to reduce the effects of future disaster. According to the release from the ODP, a large percentage of the Jamaican population live in non-engineered housing. The study sought to identify

ways by which such houses can be made stronger, using local materials and keeping costs low, (Office of Disaster Preparedness Report, 1981).

The housing concern in Jamaica has been viewed from many angles, from technological to economical to managerial. At a seminar, organized by the Building Societies Association of Jamaica, Mr. Bruce Golding, Minister of Construction, spoke on the problem of material procurement in Jamaica. He remarked, "Some crazy things are happening out there." As an example, Mr. Golding used the fact that lumber was imported by the government through Jamaica Building United, yet the ministry's permanent secretary was precluded from buying from that company. The permanent secretary had to wait until the lumber was sold to the private sector, then join the line and purchase the lumber, all of which raised the final price. Mr. Golding mentioned, "inefficiences in importation" was an area which would have to be rationalized with likely "dismantling" being carried out. The area of construction management he said, would also have to receive more attention in an attempt to keep down costs, (Building Societies Association of Jamaica, Seminar, Bruce Golding, 1983).

As a result of the high cost of housing construction in Jamaica, housing rents are also at an extraordinarily high level. In some cases, prices are so high that the government is forced to intervene. The managing director for the National Housing Trust (one of Jamaica's largest

providers of lower income housing) reported that the trust had to crack down on illegal renting of units and take "firm steps" to collect outstanding mortgage payments. He told home owners in the Avalon Court Apartment (developed by the trust), that the National Housing Trust (NHT) housing should not be rented. Yet information to the trust was that in one case of illegal renting, a single unit was being rented for Ja $560 a month when the monthly mortgage, including maintenance, was Ja $175, (National Housing Trust Report, Morin Seymour, Managing Director, 1981).

Because of the situation reported by the NHT and similar situations, the government has placed a rent control on housing. Although a great many of the people are in favor of the Rent Control Act, there are still those who are against it. Some economists, like Mark Ricketts (1981), contend that the implication of the reasoning behind the act was not focused in the right direction.

Ricketts' contention is that in examining the proposal for the Rent Control Act, it seemed to reflect that the proposal was based on a perception that the most critical problem facing the rental property market is the immense advantage enjoyed by landlords at a time of inadequate housing supply.

According to the Ministry of Construction, this advantage has led to the situation where tenants are being asked to pay exorbitant rent and rent increases, which, in many instances, are in excess of the landlord's monthly

mortgage liability. In such cases, tenants are in actuality purchasing the houses for landlords while being denied the advantages of any equity appreciation or the opportunity to participate in profits. These are capital gains that the landlord will likely enjoy when the property is sold. To the ministry, the inequity of this position is aggravated by the fact that tenants have limited income to pay for these outrageous rents and limited options regarding alternative sources of accommodations. While acknowledging the limited bargaining position of tenants, the ministry has also paid heed to the precarious position of some landlords when it comes to rent collecting.

To protect the tenants from exorbitant rent increases and to reduce what is regarded as a combative process of rent negotiations, the ministry has proposed establishing a nationwide system of rental property evaluation, as well as a restraining of the judicial and quasi-judicial bodies that deal with rent, (Ministry of Construction, Jamaica, Report 1981). The ministry's proposals, according to economist Mark Ricketts, are inadequate since they do little to change people's perception of their housing needs, in the context of what society can afford. In addition, they do not come to grips with the cause-effects relationships, (i.e. weakness in supply or strengths in demand in various sub-markets) or make distinctions between problems pertaining to the whole market versus those affecting particular aspects of it. Mr. Ricketts said that what the ministry has done is

to isolate the effects and regard them as critical rather than focus on the causes that produce the effect. He said the causes that are critical and are not likely to be alleviated by the perpetuation of rent controls include the following:

1. The reality that a growing number of Jamaicans have middle class values which manifest themselves in a demand for newer housing in desirable neighborhoods. The strength of this demand is greater than the available units, indicating that the upward pressure on prices will likely persist.
2. The reality that price escalation in building material has pushed new housing and preferred areas beyond the reach of many Jamaicans with middle class values.
3. The reality that an ever increasing number of middle class Jamaicans are shunning older homes in traditional neighborhoods. Their reasons in this case are based on personal preferences for new units, social stigma, dissatisfaction with irregularity in garbage collection, or the mix of commercial and residential accommodations.
4. The reality that much of the older stock has deteriorated and will require large sums of money for rehabilitation.

5. The reality that over commitment and past policies of housing trusts and corporations have impaired the cash flow of these institutions thus weakening their current capability to launch massive production of low income housing.
6. The reality that there is not enough research, publicity or prototype, regarding substitute materials that could fundamentally alter the way Jamaicans build, and consequently reduce dependency on foreign exchange.
7. The reality that in many areas, Jamaicans are over housed, what economists define as over-consumption of housing services.

Concerning being overhoused, Ricketts indicated that it was not unusual, upon entering many homes to see "empty nesters," referring to cases where children have grown up and left home, or young families with one or two children occupying huge amounts of space in terms of living room dimensions, number of bedrooms and bathrooms, and yard space. While in a free society, people are entitled to their housing options, higher prices, rather than a bizarre system of nationwide assessment, might induce some of these families to offer surplus space for rent, (Mark Ricketts, Economists; 1981).

Ricketts' observation suggests that the first policy of the Ministry of Works Administration should be geared to shifting the role of lending institutions and government agencies to ensure increased production, as well as encouraging more efficient utilization of scarce resources, scarce space and even scarcer foreign exchange. A system of rent controls does none of these things, and in fact, it provides an illusion about the ability of government to vigilate inexpensive accommodations during high demand periods. Compounding the deficiencies in the government's approach is the uncertainty arising from the hiatus between policy announcement and implementation.

Ricketts believes that people's frustrations will not ease because the demand pressure in established middle class neighborhoods is less prone to crime. He also believes the bias in new construction towards owner occupied housing will be even more firmly entrenched because of lower rates of return from rental units. Moreover the prohibitive cost of renovation, combined with the proposed rent control, will inhibit more intensive utilization of the existing stock. For many people, the inability to pay for and find adequate housing is only one of their problems. They are also having difficulty paying for many other basic consumer items, such that housing deprivation must be considered as part of the general problem of poverty.

Alternately, if housing deprivation is viewed in the context of an individual's inability to find desirable accommodations in secure neighborhoods, (Ricketts contended) then the solution must lie in expanding the choice of available housing and locations. This Ricketts believes can better be achieved by higher levels of expenditure on research for building innovation, on building maintenance and repairs, more rigid zoning regulations, and increased assurances of personal protection. According to Ricketts, if there is a general concern by society to assist tenants who are in the grip of the exploitative practices of some landlords, it is surely not equitable to arbitrarily impose a burden on the entire class of landlords. In situations where the gains of landlords are unwarranted or excessive, then the solution lies in a more equitable general system of taxation which could explicitly transfer funds from general tax revenues to tenants who are in need. If the problem is one of inadequate production of low income housing, then policies at the outset should be geared to builder incentive programs and a re-direction to the thrust of public sector housing agencies, (Mark Ricketts, 1981).

1.4 A LOOK AT WOOD FRAME HOUSING UNITS

Although advanced building technology has been seen as a potential solution to ease housing problems in developing countries, the importing of complex industrialized housing systems has generally been a failure in poor countries because the conditions necessary for the success of

industrialized systems do not exist, (Ian D. Turner and J.F. Turner, 1972). In Jamaica, as in many other developing countries, another solution, that of a simple, easy to assemble, structurally sound "erector set" technology has similarly had a poor record, (Flowers, 1983). Other solutions, such as the development of appropriate technologies especially suited to conditions in developing countries, have been proposed. Although some encouraging research has been reported in the development of appropriate building technologies for developing countries, it is increasingly recognized that there are no easy technological solutions to housing problems, (W. Paul Strassmann, 1979).

The many attempts to solve the housing situation in developing countries through methods of construction (building innovations) can be categorized. The five general categories are: (1) off-shelf; (2) organizational change; (3) improve-traditional; (4) science dependent; and (5) adopt-advanced, (Strassmann, 1979).

Off-shelf innovations borrow some well known materials or methods from abroad. Organizational change involves the instances where builders are already using an adequate set of materials, tools and blueprints, but are doing so inefficiently. In these cases, improvements in organization are possible.

Improved traditional technology essentially concerns the modification of materials usually seen in rural areas. This involves the improvement of the method of building while using traditional building materials.

Science dependent technology innovation is based upon investigation into the properties of materials, structures, and soil and their behavior rather than minor adaptations or engineering modification. The development of new building materials from indigenous raw material or waste products is one of the major research areas of this type.

Adopting advanced technology essentially concerns engineering modification of off-shelf materials, methods and designs to suit local conditions for building conventional urban dwellings. Adopting advanced technology is very similar to improving traditional technology in that both concern engineering modification that adopt building techniques to current needs in poor countries. They differ in that improving the traditional essentially concerns modification of materials traditionally being used, while adopting the advanced essentially concerns modification of off-shelf types of materials, methods, and designs for conventional urban dwellings, (Strassmann, 1979).

The introduction of wood frame residential construction to Jamaica would be a means of utilizing the priniciples of adopting advanced technology.

Jamaica, like most other developing countries, has been utilizing off-shelf building materials such as galvanized iron roofs, concrete blocks, asbestos, cement, pipes, reinforced concrete, plywood, milled lumber, gypsum tiles and building wire for several years, (Monica Richards, 1981). The fact that Jamaica has already been utilizing most, if not all, of the off-shelf materials necessary to construct wood frame housing indicates a strong possibility that wood frame housing units, if adopted, could be a cost saving reality for the building industry of Jamaica.

1.5 APPROPRIATENESS, INAPPROPRIATENESS

In considering the appropriateness or inappropriateness of any technological changes within an organization or culture, there should first be a reason for such change/changes. Usually shifts from one technology to another take place in response to one of the following: (1) changes in demand, (2) new productive knowledge, and (3) changes in relative wages and prices of capital and material, (W. Paul Strassmann, Housing and Building Technology in Developing Countries, 1978.)

The law of demand tells us that people tend to buy more of a good or product when its price goes down. In the case of a normal product, like housing, the tendency will be reinforced by the income effect, and the fall in price will produce an even stronger increase in the quantity demanded, (Edwin G. Dolan, Microeconomics, 1977). Amman Jordan contended, therefore, that the introduction of a less costly

production method can follow a change in income or asset distribution, (Amman Jordan, Paper Presented to the UN on Appropriate Building Technologies, 1977). Some writers argued that distribution should be less equal to encourage saving and the accumulation of capital for modern technology. Others held that mass production methods imply mass consumption, hence more equal distribution of income.

Of late, the technology-distribution issue which has surfaced is the claim that the rich consume goods that are more import intensive and less labor intensive than goods preferred by the poor. If capital and foreign exchange were adequately priced, the problem would remain distributional, not technological; but factor price disequilibrium is widespread in developing countries, (Jordan, 1977). The lack of supply equalling demands might, in any case, lead to a waste of both capital and labor in producing goods with characteristics sought only by a few. For many products these issues of scale, labor intensity, and import characteristic have to be settled by empirical research, but in the case of housing the evidence is already overwhelming, (Strassmann, 1978).

In a comparative study (done by Frances Stewart) between housing in England and housing in India, it was argued that if British housing standards were adopted in India, where average incomes are about one-twentieth of those in England, each person would need to spend 300 pounds (approximately US $600) a year, which is

more than the average income, on housing. Obviously this would be inappropriate. In such case it was concluded that there are two alternatives; (1) modifying housing standards so that cost of an average house would be 200 pounds (approximately US $400), (2) providing 5,000 pounds (approximately US $10,000) houses identical to those produced in England and allowing sufficient inequality of income. Such distribution would enable some of the population to be able to afford houses that cost 5,000 pounds, (Frances Stewart, Technology and Employment in LDC's, 1974).

In another study (done by E. Abebe) pertaining to appropriate technology, it was argued that the choice of appropriate technology should be placed in the broader perspective of cost-benefit analysis. A full cost-benefit analysis considers all of the desirable and undesirable aspects of not only the available technologies, but the types, quantities and prices of goods or services to be produced; the location and physical design; and the distribution of the project's expected monetary and non-monetary cost benefits among different types of people in the society. The choice of technology should be made in close coordination with the choice or forecasts of these other aspects, (E. Abebe; Paper, Selection of Appropriate Building Technologies; UN Meeting 1977).

1.6 INDIGENOUS MATERIAL

> The differences in financial, material, and human costs and consequent quantities and qualities of resources used for housing between locally controlled and centrally administered systems are so great that they cannot be ignored or dismissed as secondary bureaucratic problems. The connections between values, economy and authority in housing are direct. Only a radical change in the structure of power can release the human and material resources so desperately needed and actually available for real and rapid growth, (J.C. Turner, Housing for People, 1978).

Building technology for housing in practice has not been remarkably dynamic. Houses made of traditional materials such as adobe, bamboo, wattle-and-daub, natural stone, oil drums and cardboard boxes, using indigenous materials and self-help skills are mainly built outside the monetary and measured construction sector, (Strassmann, 1978). In Jamaica, as well as in most developing countries, modernistic dwellings of aluminum, fiberglass, plastics, lightweight pre-stressed or post-tensioned concrete modules have made little impact in the general business of

residential construction, (Flowers, 1973). Hence, most building construction activities demand at a conventional stage, using concrete blocks, in-situ poured concrete, and ordinary carpentry. Technological alternatives involve ways of digging, mixing, sawing, transporting, lifting, and plastering that are well known to experienced builders.

The switching of one building material to another is generally looked upon by economists as falling within the process of substitution, (Strassmann, 1978). The process of substitution implies that if two inputs are perfect substitutes for one another, one switches entirely from the first to the second when the latter's price falls. Either one or the other is used but not both, unless the price and quality are equal. In building construction it is readily observed that such perfect substitutes are virtually nonexistent. It is viewed that one cannot make a building with labor alone, with material alone, nor with capital alone. Each of the three is, in itself, a complex integral, as in any building, and therefore relative price changes can occur within the category, causing changes in the composition of all categories.

Consequently, it is often debated and argued by Jamaican builders that if indigenous materials were used in the construction of houses the building cost could be cut remarkably, both in terms of labor and materials. For example, in a seminar which was sponsored by the Caribbean Development Bank and the Food and Agriculture

Organization through the United National Development Program, it was discussed that Jamaica and other Caribbean Islands could be greatly benefited by the use of coconut wood as construction and furniture materials. It was brought out that increased use of coconut wood would result in improved demand and, eventually, increased production to meet that demand. If, therefore, local users of wood should use more coconut this could help to reduce significantly the cost of furniture and housing. It would also be a means of utilizing indigenous material not now being fully used, and at the same time saving valuable foreign exchange, (Winston Ulett, 1983). Ulett estimated that 100,000 coconut palms die each year in Jamaica and that the trunks of the dead coconut tree could be put to greater use in the building industries, (Winston Ulett, Board of Directors of Foreign Industries Development Company, LTD., 1983).

Another area in which researchers and economists believe that Jamaica as a developing country could better utilize its use of indigenous building material is in its gypsum products. Jamaica exports a minimum of 20,000 metric tons of gypsum per year to the United States cement industry. This does not include the wallboard industry of the USA and other countries such as Costa Rica, Panama, Colombia, Trinidad, Haiti, Puerto Rico, and Venezuela. It is reported that Jamaica exports 90 percent

of its yearly gypsum production, which could be a great asset to its own building industries in terms of indigenous material, (Jamaica Weekly Gleaner N. American Edition, 1983).

It is said that the greatest asset to the housing industry of any developing country is its utilization of indigenous material, (W. Paul Strassmann 1978). In this respect, one serious limitation faced by the housing programs of the government of Jamaica is the proportion of imported materials that are normally used in building construction. The government is making an effort to develop locally produced substitutes, but one important aspect which cannot be excluded is the aspect of the standard of material specifications and building codes.

1.7 BUILDING CODE

The National Building Code of Jamaica provides the standard for the construction and modification of buildings throughout the island. The building codes were put together in subjection to regulations issued under the Kingston and St. Andrew Building Act, which is applicable to the corporate area, and also to regulations issued under the Parish Council Act. The code allows for changes and modification where such changes can be proven nondetrimental to human lives. One such example is that under the Parish Council Act each local authority may alter or revoke regulations concerning the construction of buildings in

towns and impose suitable conditions and restrictions as to the elevation, size, and design of houses to be built with the approval of the Ministry of Local Government.

The initial formal building code which appeared in the Kingston and St. Andrew Building Act, passed in 1883, covered the use of materials and set standards required for methods of construction. The building regulations of 1883 have either been added to or amended over the years in response to particular circumstances. For example, the Kingston and St. Andrew (reinforced concrete construction) regulation of 1908 appeared to have been drafted to meet public and private pressure following the disasters in 1907. The first disaster was an earthquake, followed by fires which resulted in the destruction of a significant number of buildings in the capital city of Kingston. A high percentage of the destruction, with its accompanying loss of life, was due to the inadequacies in the engineering and design of many of the structures. (The Standing Review Committee on the Building Code, 1983).

Seeing the circumstances at the time of the formation of the 1908 Building Regulations, the codes were both restrictive and inflexible. With the advancement of new technologies and building innovations, the original building code has been constrained to entertain amendments and additions, in such that an adoption for specification

governing the construction of wood frame houses should encounter no difficulty. As a matter of fact, the codes support wood frame construction when it states:

> The requirements of this code are not intended to exclude the use of any method of construction not specifically described or recognized herein. Any such method of construction shall be approved provided it can be shown to be satisfactory for the purpose intended and at least equal to requirements of this code for quality, strength, effectiveness, fire resistance rating, durability and safety and provided that if special knowledge is used it shall only be used by an approved specialist, (National Building Code of Jamaica, Sec. 5.2.1, 1983).

In addition to Section 5.2.1 of the Building Code, it was also announced to the Jamaica Master Builders Association that it intended that persons in the building industry comment on the provision of the National Building Code; and that there was a Standing Review Committee on building construction whose task was to keep the code under continuing review. According to the announcement, a major part of the task would be to examine the development of

designs, the use of indigenous material and improvement in construction skills which can together contribute to significant reduction in building costs, (The RT Hon Hugh Shearer, 1983).

1.8 MAINTENANCE

Maintenance, as used here, is the offsetting of deterioration before the point of need for repair. In Jamaica maintenance is the most widespread way of adjusting production methods to scarce capital and abundant labor. Expenditures for maintenance permits capital goods (materials) to stay on the production line longer so that more labor is added to, and more use is gained from an initial investment, (W. Paul Strassmann 1978). Under normal conditions, a structure (housing unit) can last longer if material quality is higher or if the structure receives better care. The higher quality refers only to resistance to wear, tear, natural disaster, not to construction quality in general. To get durability other qualities, such as rigidity, may be sacrificed.

While it is often argued by many Jamaican builders that over a long period a cheaply built house can accumulate a total cost in excess of the total initial cost of a more expensively built house, there are still those who cannot afford the initial cost of the more expensively built house. In general, it is for the latter reason that maintenance is of high importance in Jamaica and other developing countries. Under normal circumstances a concrete block

house, as well as a wood frame house, can outlive a family generation, (Donald Farquharson, Reference to Magdala, 1981). The primary questions are: What condition will the house be in at the end of the generation? Will it be suitable to live in or not? Both answers depend on the degree of maintenance and not the physical materials with which the structure is built, (Farquharson, 1981). If durability is the long use of an existing structure, then wood frame constructed housing units can be as durable as concrete block housing units with proper maintenance application, (Flowers, 1984).

In Jamaica it is often argued by the consumer that wood frame housing (even when treated lumber is used) would need more frequent maintenance than concrete block and cement, hence in the long run, it would cost more, (Monica Richards, 1981). Apart from the fact that with proper maintenance of the wood frame housing unit, it can be almost, if not equally, as durable as concrete block housing, most Jamaicans cannot financially afford the initial cost of purchasing or constructing a concrete block house, (Ricketts, 1981). Another serious limitation facing the construction of concrete block housing in Jamaica is the scarcity of cement which results in very high prices for traditional building materials, (Howard Young, 1984). In general building material costs are very high, and distribution outside the Kingston metropolitan area is a problem because roads are narrow and often unpaved, (Shelter

Sector Analysis ASI:1978). In the case of wood frame housing units, transportation costs could prove less expensive since material distribution centers could be easily accessible to rural settlers. This is possible because material could be obtained from any of the various shipping ports around Jamaica instead of depending on the single cement company in Jamaica which is located in Kingston. In terms of self-help housing, rural settlers could also erect their own manpowered saw mills to produce lumber on their property; this procedure is not an unusual one, but with the introduction of wood frame housing no doubt the process would be popularized. For those Jamaicans who cannot afford the high initial cost of a concrete block house but desire durability (in terms of long use) in their housing unit, proper maintenance of wood frame housing could prove to be a good alternative, (Young, 1984).

1.9 SKILLED TECHNICIANS

Jamaica's construction industry has always been concerned with the type of labor force used, (Hugh Shearer, 1983). As a result, the use of skilled technicians has always been essential in the building industry. The emphasis on the use of skilled and trained workers is advocated not only by private construction companies, but by government, as well as individuals. For example, the Master Builders Association of Jamaica was challenged to get involved in and assist in expanding the advanced building skills project. A project is being administered by the

Ministry of Youth and Community Development to train young boys and girls for the building and construction industry, (Shearer, 1983). The master builders are to accommodate trainees who are enrolled in the youth and community building program on their building sites in order to allow them to acquire the necessary on-site experience, to develop incentive for existing workers, to upgrade their technical skills and to provide facilities for in-house and on-site training in specific technical and specialized work. Shearer said that the shortage of skilled manpower has been identified as perhaps the major inhibiting factor affecting the advancement of the building construction industry of Jamaica. He also said that in order to satisfy this shortage there would be a demand for 2,300 persons to be trained annually in construction skills. The government of Jamaica has announced that a strategy for training these persons has been worked out, (Hugh Shearer, 1983).

In an effort to meet the skilled labor demands of the building construction industry, a short-term training thrust for construction workers has been implemented under the Human Education and Resource Training (H.E.A.R.T.) auspicies. This advanced, skilled training program seeks to train 7,000 trainees in five trades that serve the building industry, (Alfrico Adams, 1983). One of the trades that has been taught is carpentry. Both rough and finished carpentry have been taught to tradesmen all over Jamaica.

Along with the added training programs, there have always been trade schools and technical schools which prepare students for several practical professions. Centers such as the original St. Andrew Trades Training Center (an affiliate of the St. Andrew Technical High School), Operation Friendship, and the Papine Vocational Training Institute are schools which prepare skilled technicians directly for the job market, (Conrad H. Brown, 1983). These schools have specialized programs in individual trades. For example, a person could attend the St. Andrew Trades Training Center and register for a major in building construction. In training, that person would be taught related skills necessary to become a skillful building technician. Example of courses which make up the core for a typical building construction program are: (1) blueprint reading, (2) concrete block laying and brick laying, (3) carpentry and joinery, (4) wall paneling, (5) basic electricity, (6) basic plumbing and pipe fitting, and (7) building laws and regulations. Students are taught to construct a house from foundation to finish. This is generally done both for concrete block structures and wood frame cavity wall structures. By doing this, the students are able to practically familiarize themselves with the different components necessary to completely construct a housing unit, (Brown, 1983). Upon completion of any of these trades, the student may take the Ministry of Labor (similar to Civil Service) examination to achieve a skill

grade which also determines his daily wage. Example: a Grade III carpenter would make Ja $20.88/Day, a Grade II would make Ja $26.10 and a Grade I Ja $31.50, (Labor Management Agreement, 1982-85).

1.10 SUMMARY

Jamaica, as an island, has witnessed many changes since the days of Christopher Columbus (1492) until now (1985). Within the era of the different changes, four different modes of architecture have evolved. The four basic types of residential structure which have evolved are: (1) log cabin, (2) wattle and daub, (3) nog, and (4) concrete block. The concrete block housing structure is presently the predominant mode of residential construction.

One of the changes witnessed by Jamaica is severe economic change. This economic change has created extreme price increase, unemployment and migration. Because of such conditions, the housing industries suffer impact in terms of price escallation. Government, as well as private citizens, have been greatly concerned and are seeking new building techniques and building innovations. The construction technique which seems favorable, but presently limited to Jamaica is wood frame. The wood frame construction technique utilizes many off-shelf and indigenous materials common to Jamaica. Some of which are: plywood, milled lumber, gypsum tiles, asbestos, pipes, building wire and galvanized iron.

The National Building Code of Jamaica is flexible and allows for the adoption of any innovation which proves to be effective, safe and durable. If the appropriateness or inappropriateness of technological changes should first depend on a reason for such change/changes, Jamaica's housing price escallation has demonstrated such a reason.

CHAPTER II

METHODOLOGY

CHAPTER II

METHODOLOGY-A

The research methodology has been divided into two sections. The first section deals with the method used in implementing the questionnaires and is covered in this section. The second section deals with the procedure and method used to obtain the cost analysis and is covered in Methodology-B.

2A.1 PROCEDURE

The research procedure is based on a selected sample without replacement. The names of all the building contractors listed in the 1983-84 Jamaica Telephone Directory were numbered consecutively. The total number of names was 78. One-inch square pieces of cardboard were also numbered in the same order as the names in the directory. The cardboard pieces were then placed in a bag, sealed and properly shuffled. After shaking the bag, one of the cardboard squares was taken from the bag. This procedure was repeated until fifty cardboard squares were selected. The number on the cardboard squares corresponded to a construction company in the Jamaica Telephone Directory. A questionnaire was then mailed to each construction company's director.

2A.2 SAMPLED POPULATION

The Jamaican building industry consists of professional, semi-professional and non-professional residential builders. Professional builders are those who

have formal knowledge of the building profession and are practicing it as a career; semi-professional builders are those who have formal knowledge of the profession and are practicing it not as a career but as a side job or simultaneously with another profession; non-professional builders are those builders who have no formal knowledge but out of necessity build houses for themselves, family and friends. The latter falls under the category of self-help housing.

The Jamaican professional builders were the sampled population of this research.

2A.3 COLLECTION OF DATA

Attached to each questionnaire which was mailed to the selected companies was a letter of introduction (See Appendix B). The letter of introduction gave the purpose of the research, the use of the end result, provided credibility for the researcher, associated the research with Michigan State University and pointed out the importance of the information which could be gained from the individual's response. Three weeks after the questionnaires were mailed, collection commenced. Collection of the questionnaires was done by a personal visit to each existing company that was selected.

2A.4 PROCESSING OF DATA

After the completed questionnaires were returned to the researcher, the data were checked to see the completeness of the responses. The raw data which were already coded were

key punched and verified. Key punching and verification were done by Joshua Bagakas at Michigan State University Computer Center. After the cards were returned to the researcher, they were further verified against the raw data and found to be correct and accurate.

2A.5 ANALYSIS OF DATA

For the purpose of this research, it was not necessary to recode the original data from the questionnaires. The following operational definitions focus on the ways the original data were transformed in order to be used in the analysis for this research.

2A.6 OPERATIONAL DEFINITIONS

Information Sought: (See Appendix B for specific questions).

(1) How knowledgeable are builders in constructing woodframe and concrete block housing units?

(2) Of wood frame and concrete block housing units which is most costly to build?

(3) What are the areas in which cost is reduced for the less costly construction?

(4) How available are building materials for wood frame and concrete block housing units?

(5) What are the advantages and disadvantages of wood frame and concrete block housing units when constructed in Jamaica?

Background information sought:

(1) Title or position in company.

(2) Years worked in construction business.

(3) Where was knowledge in construction obtained?

(4) How is knowledge level in constructing wood frame dry-wall and concrete block housing unit ranked?

(5) What percent of work done by the company was related to residential construction?

(6) How many housing units (separate for each type of construction) has each company constructed in the previous two years?

(7) What percentage of the housing units built by each company are government subsidized?

(8) What is the average price of the housing units constructed by each company?

(9) What is the average size (in square feet) of the housing units constructed by each company?

2A.7 STATISTICAL ANALYSIS

The information from the questionnaires was coded and the data developed. The data were then entered into the Michigan State University (MSU) Cyber 750 Computer. A program to run the data was written using the statistical package for the social sciences (SPSS). The SPSS package is available in the MSU Cyber 750 Computer. To run the program the frequencies procedure card was used and percentages calculated.

2A.8 LIMITATIONS THIS STUDY

There are at least three factors which contribute to possible limitations on the results of this study. The three factors are: (1) Six of the companies included in the sample were either no longer in business or had relocated without any forwarding address; (2) At least three of those managing directors who responded by filling out a questionnare did so while the researcher waited outside their office door, and (3) Fourteen of those managing directors who were selected refused to participate in completing the questionnaire as requested.

The fact that six of the companies included in the sample were either no longer in business or had relocated without any forwarding address, plus the fact that fourteen of the managing directors who were selected as a part of the study refused to participate lowered the validity of the research by reducing the number of respondents from 50 to 27.

Finally, the fact that at least three managing directors out of the selected sample actually responded by filling out the questionnaire while the researcher waited outside their office door could contribute to possible limitations due to hurrying and not spending an appropriate amount of time on each question.

METHODOLOGY-B

This section covers the procedure and methods used in obtaining the cost estimate as shown in Appendix B.

2B.1 PROCEDURE

The cost estimating procedure is based on the format used by quantity surveying companies of Jamaica. The method of measurement is based on the guidelines as outlined in "The Jamaica Standard Method of Measurement", a quantity surveying hand book used in Jamaica. The information includes the present price and labor rate as utilized by the quanitity surveying firms of Jamaica, and as put forth by the Jamaica Master Builders Association in accordance with the Labor Management Agreement of 1982-1985. This cost estimating procedure was obtained from Berkley and Spence Quantity Surveyors, 7 Norwood Avenue, Kingston, Jamaica, West Indies. Information as tabulated, included the items of building materials used throughout Jamaica, the major suppliers of the materials, the unit and rate at which the materials were locally obtained. In the tables of cost estimate, quantities of materials are given in both the British System of Measurement and the Metric System of Measurement. This method of quantity take off is used to aid readers of the research who might not be familiar with one of the systems of measurement.

2B.2 VERIFYING THE INFORMATION

After the quantities of materials cost and labor costs were obtained, the information were compared to see if there

were any remarkable differences in prices of material or labor costs locally throughout Jamaica. (The comparison was done by telephone calls to several of the local hardware stores throughout Jamaica.) The information was found to be in accordance with the general price and wage range as set forth by the Master Builders Association and the Labor Management Agreement of 1982-1985.

2B.3 ANALYSIS OF FLOOR PLANS

The length of the house as shown on the floor plan equals 39′ - 0" (11.89 meters), and the width as shown equals 25′ - 6" (7.77 meters). There are two walls of length 39′ - 0" (11.89 meters) and two walls of length 25′ - 6" (7.77 meters). The result, therefore, is 2 x 39′ - 0" plus 2 x 25′ - 6" which resulted as (78 + 51) 129′ - 00" or 39.31 meters. 3.5′ (1.06 meters) is subtracted from the result for door openings. See example below.

TABLE I
COST ESTIMATE ILLUSTRATION

Times	Dimensions	Totals	Meters R.
2	39′-0"	78′-0"	23.77
2	25′-6"	51.00	15.54
		129.00	39.31
	Less	3.50	1.06
		125.50	38.25

Quantities	Unit	Rate	Dollars	Cents
126	F.R	4.00	504	00

[1]Extracted from Table XV, Appendix B.

Total quanitity in Foot Run (F.R) as shown in Table I is 125.50' rounded off to 126.00'; rate per unit (in foot run) is $4.00 . 4 multiply by 126 equals 504.00. This procedure is followed throughout each cost estimate using the appropriate measures such as cubic yard, foot run, or square feet.

2B.4 COST ESTIMATE

The tabulation pertaining to the cost estimates, as shown in Tables I and II in Appendix A, is in accordance with the procedure put forth by the Jamaica Standard Method of Measurement and the quantity surveying firms of Jamaica. The method of procedure is similar for both tables. The rates include a 33 percent labor and contractor mark-up cost. The cost of materials was obtained from Berkley and Spence, a Jamaican quantity surveying consulting firm. The dimensions were obtained from Plan A and B respectively (See Appendix A).

2B.5 OPERATIONAL DEFINITIONS

Terminology used: See cost estimate for specific usage of terms.

(1) Foot Run (F.R) - A method of measuring linear dimensions in feet, such as 10 feet along the base board (10 F.R).

(2) Feet Square (F.S) - A method of measuring in square feet; example 10' x 10' is 100 square feet, (100 F.S).

(3) Yard Cube (Y.C) - Another way of referring to cubic yard, such as 0.764 cu. meter is 1 cubic yard or 1 yard cube.

(4) Yard Square (Y.S) - The British way of referring to square yards; example, 9 square feet equals 1 square yard or 1 yard square (Y.S).

2B.6 LIMITATIONS
THIS STUDY

There is one major factor which contributes to possible limitations on the result of this cost estimate analysis. The factor is the fluctuation of the Jamaican currency. The Jamaican dollar value as used in this research was set at a rate where JA $3.75 equals US $1.00. Because this rate is not a fixed rate and it depends on the appreciation or depreciation of the United States currency at any time, there could be a change in price of those materials which are being imported.

CHAPTER III

ANALYSIS OF DATA

CHAPTER III

ANALYSIS OF DATA-A

3.A1 FINDINGS AND DISCUSSION

This chapter contains the results of the analysis of the data. For each of the major areas of concern which the questionnaire addressed, the statistical findings are reported and discussed.

3.A2 YEARS IN PROFESSION, AND KNOWLEDGE LEVEL

Of the twenty-seven managing directors of construction companies in Jamaica surveyed, fifteen had been in the profession for less than 15 years. There were 6, however, that had more than 20 years experience. Table II indicates that out of the 27 managing directors in the sample, 15 have been in the profession for less than 16 years, 5 between 15 and 20, 3 between 20 and 25, and 3 more than 25 years. One managing director did not respond to the question.

TABLE II
FREQUENCY OF RESPONSE FOR YEARS IN BUSINESS

YEARS IN BUSINESS	NUMBER OF RESPONSES	PERCENT OF SAMPLE
10 years or less	5	18.5
11 to 15 years	10	37.1
16 to 20 years	5	18.5
21 to 25 years	3	11.1
26 or more years	3	11.1
No Response	1	3.7
TOTALS	27	100.0

Table III indicates that the knowledge level of the managing directors with respect to concrete block housing units was high. Twenty-two (81.5 percent) out of 27 in the sample indicate that they were very knowledgeable, and 5 indicate that they were extremely knowledgeable.

TABLE III
FREQUENCY OF RESPONSE FOR KNOWLEDGE LEVEL
OF BLOCK AND FRAME CONSTRUCTION

KNOWLEDGE LEVEL	WOOD FRAME	PERCENT OF SAMPLE	CONCRETE BLOCK	PERCENT OF SAMPLE
No Knowledge	1	0	0	0
Some Knowledge	15	55.6	0	0
Very Knowledgeable	8	29.6	22	81.5
Extremely Knowledgeable	3	11.1	5	18.5
TOTAL	27	100.0	27	100.0

In comparison to knowledge about concrete block housing units, the knowledge level of the managing directors with respect to wood frame housing units was not as high. One managing director said that he had no knowledge at all in constructing wood frame housing units, 15 (55.6 percent) had some knowledge, 8 were very knowledgeable, and 3 were extremely knowledgeable in wood frame construction technique.

The fact that these people were less knowledgeable in the construction of wood frame when compared with the construction method in concrete block, may imply that their opinions on the cost comparison between the two may be somewhat biased.

3A.3 COMPARISON IN COST

The general opinion of the managing directors was that wood frame housing units are less costly to construct than concrete block housing units due to saving cost in construction time, labor and cost of material combined. Table IV shows that out of the 27 managing directors of construction companies in Jamaica, 17 responded that wood frame housing units were less costly than concrete block. Nine responded that concrete block housing units were less costly than wood frame housing units. One managing director did not give his opinion.

TABLE IV
FREQUENCY OF LEVEL OF KNOWLEDGE OF CONCRETE BLOCK CONSTRUCTION

RESPONSE TO LEAST COSTLY CONSTRUCTION	NO KNOW-LEDGE	SOME KNOW-LEDGE	VERY KNOWLEDGE-ABLE	EXTREMELY KNOWLEDGE-ABLE	TOTAL
NO ANSWER	0	0	1	0	1
CON-CRETE	0	0	8	1	9
WOOD FRAME	0	0	13	4	17
TOTAL	0	0	22	5	27

Also from Table IV, of the 22 managing directors who were very knowledgeable in the construction of concrete block housing units, 13 considered wood frame housing units to be less costly. However, 8 of them considered concrete block housing units to be less costly than wood frame. Also, out of the 5 managing directors who were extremely knowledgeable in concrete block housing construction, 4 considered wood frame to be the less costly. One managing director who was extremely knowledgeable in the construction of concrete block units considered concrete block housing construction to be the less costly.

Table V shows that of the 8 managing directors who were very knowledgeable in wood frame housing construction, 4 of them considered wood frame to be less costly, and the other remaining 4 considered concrete block to be less costly.

One may consider accepting the opinion of the people who are knowledgeable in wood frame construction because probably the managing directors who have limited knowledge in wood frame may have had biased opinions.

TABLE V
FREQUENCY OF LEVEL OF KNOWLEDGE OF WOOD FRAME CONSTRUCTION

	NO KNOW-LEDGE	SOME KNOW-LEDGE	VERY KNOWLEDGE-ABLE	EXTREMELY KNOWLEDGE-ABLE	TOTAL
NO ANSWER	0	0	0	0	0
CON-CRETE	0	4	4	1	9
WOOD FRAME	1	11	4	2	18
TOTAL	1	15	8	3	27

Also, among the 3 managing directors who considered themselves extremely knowledgeable in wood frame housing construction, 2 gave the opinion that wood frame housing units are less costly and the other gave the opposite opinion. However, according to Table VI, all three agreed that the main detriments to savings in the cost of constructing wood frame housing units are cost of labor, cost of material, cost in construction time and cost in transportation.

TABLE VI
LEVEL OF KNOWLEDGE (WOOD FRAME)

RESPONSE TO AREA OF COST SAVINGS	NO KNOW-LEDGE	SOME KNOW-LEDGE	VERY KNOWLEDGE-ABLE	EXTREMELY KNOWLEDGE-ABLE	TOTAL
NO	1	0	0	0	1
LABOR	0	2	0	0	2
MATE-RIALS	0	2	2	0	4
TRANS-PORTATION	0	0	0	0	0
CONSTRUC-TION	0	1	3	0	4
ALL	0	10	3	3	16
NONE	0	0	0	0	0
TOTAL	1	15	8	3	27

3A.4 NUMBER OF UNITS CONSTRUCTED

Table VII indicates the frequencies of residential related work done to the total amount of construction done by each company. Out of the sample of 27 managing directors of construction companies in Jamaica, 16 had between 61-80 percent of their construction related to residential construction, 3 had between 41-60 percent, 2 had between 21-40 percent, and 6 had less than 20 percent related to residential construction.

TABLE VII
FREQUENCY OF RESIDENTIAL RELATED WORK DONE

PERCENT RANGE	NUMBER OF RESPONSES	PERCENT OF SAMPLE
Less Than 20	6	22.2
21 to 40	2	7.4
41 to 60	3	11.1
61 to 80	16	59.3
81 to 100	0	0
No Response	0	0
TOTALS	27	100.0

From Table VII it is clear that most of the construction work done by the companies was related to residential construction. However, out of the units constructed very few were wood frame. Table VIII shows that out of the 27 construction companies in the sample, 17 have never constructed a wood frame unit, and 2 have constructed only one wood frame unit. However, there was one construction company which had constructed about 100 wood frame units in the last two years.

TABLE VIII
FREQUENCY OF WOOD FRAME UNITS BUILT

NUMBER BUILT	NUMBER OF RESPONSES	PERCENT OF SAMPLE
0	17	63.0
1	2	7.4
2	1	3.7
3	4	14.8
4	2	7.4
100	1	3.7
NO RESPONSE	0	0.0
TOTALS	27	100.0

3A.5 AVAILABLITY OF MATERIALS

Table IX illustrates that just over ninety-six percent of all managing directors in the sample indicated that the materials for concrete block housing units are readily available while the availability of materials for wood frame is a problem in Jamaica. There was only one managing director who indicated that both materials were equally available.

TABLE IX
FREQUENCY OF AVAILABILITY OF MATERIAL

HOUSING UNITS	MOST AVAILABLE	PERCENT OF SAMPLE	EQUALLY AVAILABLE	PERCENT OF SAMPLE
Concrete Block	26 Responses	96.3	0 Responses	0
Wood Frame	0 Responses	0	1 Responses	3.7
No Response	1	3.7	26	96.3
TOTALS	27	100.0	27	100.0

3A.6 ADVANTAGES AND DISADVANTAGES OF WOOD FRAME AND CONCRETE BLOCK HOUSING UNITS

From Table X responses to the questions of major advantages of concrete block housing units showed: twenty-two of the managing directors indicated that concrete block housing units are more durable than wood frame housing units; seventeen managing directors indicated that it was more socially accepted; five managing directors indicated that concrete block housing units cost less to be protected with insurance, and one managing director indicated that availability of material is a major advantage for concrete block housing units.

Also in Table X, responses to the categories of questions of major disadvantages of concrete block housing units showed: fifteen managing directors indicated that extended construction time is a major disadvantage to

concrete block housing units, seven managing directors indicated that high cost of construction was a major advantage to concrete block housing units; six managing directors also indicated that the difficulty in remodeling or modifying concrete block housing units was a major disadvantage; five managing directors indicated the difficulty in transporting materials for concrete block housing units as a major disadvantage, and three managing directors indicated that the high initial cost of construction was also a major disadvantage to concrete block housing units.

TABLE X
FREQUENCY OF CATEGORY
OF ADVANTAGES AND DISADVANTAGES

HOUSING UNIT: CONCRETE

MAJOR ADVANTAGES	NUMBER OF RESPONSES PER 27	PERCENT OUT OF 27 SAMPLED
Durability	22	82
Acceptability	17	63
Lower Insurance Cost	5	19
Availability of Material	1	4

MAJOR DISADVANTAGES	NUMBER OF RESPONSES PER 27	PERCENT OUT OF 27 SAMPLED
Extended Construction Time	15	56
High Cost of Construction	7	27
Difficult to Remodel or Modify	6	22
Difficult to Transport Material	5	19
High Initial Cost of Construction	3	11

** Note: One person may have answered in more than one category, therefore, the responses will not total 27 nor the percent total 100. Also, all responses are out of a sample of 27.

From Table XI, responses to the question of major advantages of wood frame housing units showed that: sixteen managing directors indicated that wood frame housing units require a shorter construction time; ten indicated that it cost less to build; seven indicated that it requires less skilled workers; seven indicated that wood frame housing units are more easily modified, and five indicated that materials for wood frame housing units are more easily transported.

Also from Table XI, the disadvantages of wood frame housing units are listed: fifteen managing directors indicated that high maintenance cost was a major disadvantage; eleven indicated susceptability to insects and termites; ten indicated high insurance cost as a major disadvantage; and nine indicated that low resistance to natural disaster is a major disadvantage.

TABLE XI
FREQUENCY OF CATEGORY
OF ADVANTAGES AND DISADVANTAGES

HOUSING UNIT: WOOD FRAME

MAJOR ADVANTAGES	NUMBER OF RESPONSES PER 27	PERCENT OUT OF 27 SAMPLED
Shorter Construction tiem	16	59
Less Costly to Build	10	37
Easy to Modify or Remodel	7	26
Less Skilled Workers Needed	7	26
Easier to Transport Material	5	19

MAJOR DISADVANTAGES	NUMBER OF RESPONSES PER 27	PERCENT OUT OF 27 SAMPLED
High Maintenance Cost	15	56
Susceptable to Insects/Termites	11	41
High Insurance Cost	10	37
Low Resistance to Natural Disaster	9	33

** Note: One person may have answered in more than one category, therefore, the responses will not total 27 nor the percent total 100. Also, all responses are out of a sample of 27.

ANALYSIS OF DATA-B
COST ESTIMATE

3B.1 FINDINGS AND DISCUSSION

The following contains the results of the cost estimate analysis. For each type of construction (concrete block and wood frame) the results from the cost analysis is discussed.

3B.2 THE WOOD FRAME UNIT

The result of the analysis for wood frame housing units revealed some cost savings when compared with concrete block housing units. Table XIII revealed that for a 995 square feet (92 square meter) wood frame house, the cost is JA $31,050, and Table XIV revealed that for a similar housing unit constructed of concrete blocks, the cost is JA $33,779. On the one hand, when the results of Tables XIII and XIX are compared, the comparison reveals a difference of JA $2729 with concrete block construction being the most costly. On the other hand, this difference of JA $2729 in cost could prove a significant advantage in the construction of wood frame housing units. For example, Table XII shows that 10 managing directors out of 27 responded to have built less than 25 concrete block housing units within the two year period ending August 1984. Table XII also shows that there was one company which constructed more than 100 concrete block housing units in the same period. If each of the 10 managing directors who responded "have built less than 25 concrete block units," had built 10 wood frame housing units, they could have reduced the cost

by 10 times the difference in cost of constructing 10 concrete block units. In the case of this example, a reduction of $27,290 ($2,729 x 10) would result. The managing director whose company constructed more than 100 units would have experienced a reduction in cost of more than $272,900. Such reduction in construction cost for any construction company in Jamaica would be remarkable. From Table XIII it can also be observed that all the items used in the estimation of the wood frame unit are indigenous to Jamaica, while from Table XIV such items as stiffeners, 1/2" diameter steel rods, 3/8" diameter steel rods, and 1/4" diameter steel rods are strictly imported materials. These materials account for JA $7,584.60 (22.5 percent) of the construction dollars used to construct a concrete block unit. In the case where more than 100 units are built, the result would be more than JA $758,460. In a time of scarce foreign currency, this is a very large sum of money to be allocated by the Jamaican and by private companies for the importation of material.

TABLE XII
FREQUENCY OF THE NUMBER OF TYPES OF HOUSES BUILT
WITHIN THE TWO YEAR PERIOD PRIOR TO AUGUST 1984

RANGE OF NUMBER OF UNITS BUILT	CONCRETE BLOCK UNITS	PERCENT OF SAMPLE
Less Than 25	10 Responses	37.0
26 to 50	10 Responses	37.0
51 to 75	4 Responses	14.9
76 to 100	1 Response	3.7
More Than 100	1 Response	3.7
No Response	1 Response	3.7
TOTALS	27 Responses	100.0

RANGE OF NUMBER OF UNITS BUILT	WOOD FRAME	PERCENT OF SAMPLE
Less Than 25	25 Responses	92.6
26 to 50	0 Responses	0
51 to 75	0 Responses	0
76 to 100	1 Response	3.7
More Than 100	0 Response	0
No Response	1 Response	3.7
TOTALS	27 Responses	100.0

TABLE XIII
SUMMARY OF WOOD FRAME COST ANALYSIS

ITEM	QUANTITY		RATE	COSTS
3/4"X4" Rain Drip	126 F.R.	38.25 M.R.	4.00	504.00
1"x4 Rain Drip	126 F.R.	38.25 M.R.	5.00	630.00
4'x8' Clinker Boarding	1,072 F.S.	99.59 M^2	1.30	1,393.60
Carib Spray	1,072 F.S.	99.59 M^2	6.00	6,432.00
4'x8' Gypsum Boarding	3,172 F.S.	294.63 M^2	1.30	4,123.60
2"x4" Sole Plate	219 F.R.	66.60 M.R	7.50	1,642.50
2"x6" Sole Plate	126.F.R	38.25 M.R.	8.00	1,008.00
2"x4" Head Sill	320 F.R.	97.44 M.R.	7.50	2,400.00
2"x4" Stud	908. F.R	276.66 M.R	7.50	6,810.00
2"x4" Nogging Piece	525 F.R	159.88 M.R	7.50	3,939.50
2"x4" Braces	240 F.R.	73.15 M.R	7.50	1,800.00
2"x6 Fill	41 F.R.	15.54 M.R	9.00	369.00
Total Cost				31,050.20

[2] Extracted From Table XV, Appendix B.

Note: From Pages 49-50, Section 2B.5 Operational Definition - F.S = Foot Square, F.R = Food Run, Y.S = Yard Square, and Y.C = Yard Cube.

TABLE XIV
SUMMARY OF CONCRETE BLOCK COST ANALYSIS

ITEM	QUANTITY		RATE	COSTS
Stiffeners	3 Y.C	1.98 M^3	330.00	990.00
Belt Beam	5 Y.C	3.3 M^3	330.00	1,650.00
Lintel	2 Y.C	1.32 M^3	330.00	660.00
Sides of Stiffeners	31 Y.S	25.92 M^2	51.00	1,581.00
Sides of Belt Beam	56 Y.S	46.82 M^2	51.00	2,856.00
Sides of Lintel	25 Y.S	20.90 M^2	51.00	1,275.00
6" Thick Blocks	182 Y.S	152.15 M^2	62.00	11,284.00
1/2" Diameter Steel Rods	2,836 LB	1,286.40 Kg	1.50	4,354.00
3/8" Diameter Steel Rods	546 LB	247.67 Kg	1.70	928.20
1/4" Diameter Steel Rods	321 LB	145.61 Kg	4.40	1,312.40
Reveal of Blocks	17 Y.S	14.21 M^2	15.50	263.50
1/2" Rendering	416 Y.S	347.78 M^2	14.00	5,824.00
Arris	211 Y.R	192.85 M.R	3.50	738.50
3/4 Groves in Rendering	14 Y.R	12.80 M.R	5.00	70.00
Total Cost				33,786.60

[3] Extracted From Table XVI, Appendix B.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

4.1 OVERVIEW OF THE RESEARCH PROBLEM

Initially the reason for the housing problem in Jamaica was thought of as the high rate of population increase, heavy migration to the cities, or more generally, "the scale of urbanization". During the last fifteen years many attempts have been made to improve the standard of housing. Nevertheless, the situation continues to worsen. The approach has evolved naturally, so that different techniques and approaches to the problem become more or less favorable. Slum clearance and relocation, for instance, is no longer heralded as the country's answer to unsatisfactory housing. The high cost of traditional building materials (concrete block) is now seen as the major contributory factor to the housing problems, while the concept of self-help and flexible standards continues to gain in popularity.

A major goal of this research has been to determine the factors which limit the use of wood frame residential construction in Jamaica, as perceived by Jamaican builders, and to examine the estimated cost differences between wood frame and concrete block residential construction. The research was prompted out of a concern, by both the

government and people of Jamaica, over high escalating costs of traditional building materials, and consequently the escalating price of housing.

4.2 ANALYTIC

There were interesting differences in construction managers' perception when comparing wood frame and concrete block residential construction in Jamaica. These differences as indicated by the responses to the questions on the questionnaire are summarized as follows:

1. Thirty-seven percent of the sampled construction managers have been in the construction business between 11 and 15 years (See Table II, Page 52).
2. Eighty-two percent of the sampled construction managers were very knowledgeable in constructing concrete block housing units, as opposed to 30 percent for wood frame housing units. In addition 19 percent were extremely knowledgeable in constructing concrete block housing units as opposed to 11 percent for wood frame (See Table III, Page 53).
3. Thirty-seven percent of the sampled construction managers constructed less than 25 concrete block housing units in the previous two year period while 93 percent constructed less than 25 wood frame housing units. In addition, 37 percent of those sampled constructed between 26 and 50 concrete

block housing units while zero percent constructed between 26 and 50 wood frame housing units (See Table II, Page 67).

4. Seventeen of the sampled construction managers agreed that wood frame housing units cost less to build in Jamaica, while 9 agreed that concrete block housing units cost less to build, (See Table IV, Page 55).
5. Ninety-six percent of the sampled construction managers agreed that materials for concrete block housing units are more readily available to Jamaicans. Only 4 percent agreed that materials for wood frame is more readily available, See Table IX, Page 60.)

Difference was found when the cost estimates of the wood frame and concrete block housing unit were analyzed. Figures from the analysis reveal that to construct a 995 square feet, (92 square meters) concrete block housing unit cost Ja $33,779.00. For a similar housing unit constructed of wood frame the cost is Ja $31,050.00. The difference in cost to construct each housing unit is $2,728.00. This may be argued as reason to switch one generation of housing to another, especially in terms of lower income, mass produced housing and for government housing.

4.3 SPECULATIVE

One possible reason for the closely related costs shown by the price comparison of the housing units could be that certain material used in the construction of the wood frame housing units are available in Jamaica but are not in a usable state. The raw material for the production of gypsum board is mined in Jamaica, but gypsum board is not presently being manufactured there. Lumber is produced locally in Jamaica but not enough to presently satisfy the construction consumption. In contrast it is believed that there are vast numbers of uncultivated trees in Jamaica; if those trees were tested for their use as lumber Jamaica they could possibly be used for supplying Jamaica's lumber needs.

4.4 SUMMARY OF CONCLUSIONS

The research found factors which possibly contribute to the limitation of wood frame residential construction in Jamaica. The foremost factor is the level of knowledge in the area of wood frame construction. Of all the managing directors who completed a questionnaire, 56 percent reported that they had some knowledge of wood frame construction (See Table III). One hundred percent reported that they had received their knowledge from college. However, only 37 percent reported to have had any first hand experience with wood frame construction. Eighty-two percent of the managing directors reported to be very knowledgeable in the

construction of concrete block housing units, and 100 percent reported to have had first hand experience in construction with concrete.

It is the overall conclusion of this research that:

1. Materials for wood frame housing units are perceived to be not readily available in Jamaica when compared with that for concrete block.
2. Builders in Jamaica are very knowledgeable in the art of constructing concrete block housing units and are not very knowledgeable in constructing wood frame housing units.
3. Builders in Jamaica believe that wood frame housing units demand higher maintenance costs when compared to concrete block housing units.
4. Builders in Jamaica believe that wood frame housing units are more susceptible to insects and termites when compared to concrete block housing units.
5. Builders in Jamaica believe that wood frame housing units have a lower resistance to fire and natural disaster than concrete block.

The review of literature also indicates that:

1. With the proper utilization of indigenous building materials, Jamaica's building industry could be significantly improved.
2. A switch to high modernistic "rich country" technology will not help Jamaica's building industry.

3. Wood frame housing units, if socially accepted, by Jamaican builders and consumers could be more cost effective in construction than concrete block and cement housing units.
4. The "Jamaica National Building Code" allows the production of wood frame housing units.

4.5 IMPLICATIONS

Future Research

The major benefit for extending this research would be to find out more about what are the actual material, social, and economic factors limiting the use of wood frame residential construction in Jamaica. In terms of the actual material factors, the research could look into the possibility of the Jamaica Forestry Department actually testing uncultivated trees that are not presently being used as lumber in order to establish their usability and cost. The Department could also look into the possibility of producing more cultivated trees to be used in the construction industry as lumber. The research could investigate the possibility of the Jamaica Gypsum Company commencing the production of drywall and the aluminum companies of Jamaica beginning production of aluminum sidings. A total feasibility study, along with an economic study showing estimated cost for such an upgrading program and their long term effects, could prove to be a vital area for future research. In addition to the "material factor" study, the "human factor" study would look into the possible

sociological and physiological impact which a switch from concrete block housing unit to wood frame housing unit would bring. Very little research has been done in this regard. Research in this respect could be beneficial to the local builders of Jamaica as well as to the Master Builders Association of Jamaica to be aware of possible steps which could greatly, if not totally, alleviate the building construction economic crisis.

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APPENDICES

APPENDIX A

Glossary of Terms
Cost Comparison of Housing Units
Floor Plan A
Floor Plan B
Typical Wall Section

GLOSSARY OF TERMS

Arris: The sharp edge formed where two moldings meet is commonly called an arris.

Brace: A piece of wood or other material used to resist weight or pressure of loads; an inclined piece of timber used as a support to stiffen some part of a structure.

Carib Spray: A mixture of water, cement and crushed limestone.

Ddt. Ditto: In Quantity Surveying means deduct from what has been stated before.

Fillet: In architecture, a narrow vertical band separating two surfaces meeting at an angle.

Head Sill: The highest horizontal member which runs above the super-structure of the house and where the roof connects.

Lintel: A piece of wood, stone or steel placed horizontally across the top of door and window openings to support the walls immediately above the opening.

Nogging: The filling of spaces between timber, such as studding in walls and partitions.

Rain-Drip: A molding designed to prevent rain water from running down the face of a wall.

Rendering: A term used in concrete block work meaning to finish with concrete mortar to a smooth surface.

Reveal: The part of a jamb or vertical face of an opening for a window or door between the frame and the outside surface of a wall.

Sole Plate: The lowest horizontal member of a wall or partition which rests on the rough floor, which the studding is nailed.

Stiffener: In architecture, any steel angles, bars, rods, or other types of materials secured to structural members to strengthen joints and to prevent buckling in any part of the building.

Stirrups: In reinforced concrete, construction a support used to hold the bars.

Stud: In building, an upright member, usually a piece of dimension lumber 2 x 4 or 2 x 6, used in the framework of a wall or partition.

Wrot: To smooth or finish a wood surface by the use of a carpenters plane. Also to cut or trim to shape.

APPENDIX B

Letter of Introduction
Questionnaire

TABLE xv. WOOD FRAME DRYWALL CONSTRUCTION

TIMES	DIMENSIONS	TOTAL	METERS R		QUANTITY	UNIT	RATE	DOLLARS CENTS
2	39' 0"	78.00	23.77	3/4" x 4" Rain Drip	126	F.R.	4.00	504.00
2	25' 6"	51.00	15.54					
		129.00	39.31					
	Less	3.50	1.06					
		125.50	38.25					
	129' 0"			4' x 8' Clinker Boarding	1,072	F.S.	1.30	1,393.60
	10' 4"	1,332.96	123.83					
	Less	260.92	24.24					
		1,072.04	99.59					
		1,072.04	(99.59M)	Carib Spray	1,072	F.S.	6.00	6,432.00
2	5' 0"			Ddt. Ditto				
	4' 0"	40.00	3.72					
	2' 0"							
	2' 0"	4.00	.37					
6	4' 0"							
	4' 0"	96.00	8.92					
2	2' 0"							
	4' 0"	16.00	1.49					
	13' 6"							
	6' 0"	81.00	7.52					
	3' 6"							
	6' 1"	23.92	2.22					
		260.92	24.24	Carried to Collection				8,329.60

TABLE XV. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS R		QUANTITY	UNIT	RATE	DOLLARS CENTS
	280' 0"			4' x 8' Gypsum Boarding	3,172	F.S.	1.30	4,123.60
	1' 0"	280.00	26.01					
2	248' 6"							
	1' 0"	497.00	46.17					
2	98' 6"							
	1' 0"	197.00	18.30					
2	1,634' 9"							
	1' 0"	3,269.50	303.74					
		4,243.50	394.22					
	Less	1,072.00	99.59					
		3,171.50	294.63					
				1" x 4" Splayed fillet as Rain Drip	126	F.R.	5.00	630.00
	248' 0"	248.50	75.74	2" x 4" Sole Plate	219	F.R.	7.50	1,642.50
	Less	30.00	9.14					
		218.50	66.60					
				Ddt. Ditto 2/ 3' 6" 7.0				
				6/ 3' 4" 20.0				
				3.0				
				30.0				
				Carried to Collection				6,396.10

TABLE XV. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS R		QUANTITY	UNIT	RATE	DOLLARS CENTS
	248' 6"	248.50	75.74	2" x 4" Head Seal	320	F.R.	7.50	2,400.00
3	5' 0"	15.00	4.57					
5	4' 0"	20.00	6.10					
3	2' 0"	6.00	1.83					
2	3' 6"	7.00	2.13					
6	3' 4"	20.00	6.10					
	3' 2"	3.17	.97					
		319.67	97.44					
4/2	10' 4"	82.67	25.20	2" x 4" Stud	908	F.R.	7.50	6,810.00
1+3+3+1	10' 4"	82.67	25.20					
3+2	10' 4"	51.67	15.75					
3+2+3+2	10' 4"	103.33	31.49					
1+2+3	10' 4"	62.00	18.90					
2+2	10' 4"	41.33	12.60					
4+3	10' 4"	72.33	22.05					
1+2+2+2+ 1+2	10' 4"	103.33	31.49					
2+2	10' 4"	41.33	12.60					
1+8+3+6	10' 4"	186.00	56.69					
3	6' 4"	19.00	5.79					
6	10' 4"	62.00	18.90					
		970.66	276.66					
				Carried to Collection				9,210.00

TABLE XV. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS R		QUANTITY	UNIT	RATE	DOLLARS CENTS
1+1+3	5' 0"	45.00	13.72	2" x 4" Nogging Piece	525	F.R.	7.50	3,937.50
3	9' 6"	28.50	8.69					
3	10' 6"	31.50	9.60					
2/3	3' 0"	18.00	5.49					
1+2/3	4' 0"	36.00	10.97					
3	10' 0"	30.00	9.14					
2/3	3' 0"	18.00	5.49					
3	7' 0"	21.00	6.40					
3	6' 0"	18.00	5.49					
3	3' 0"	10.50	3.20					
2	2' 0"	4.00	1.22					
3	15' 0"	45.00	13.72					
3	4' 6"	13.50	4.11					
3	13' 0"	39.00	11.89					
3	2' 6"	7.50	2.29					
3	10' 0"	30.00	9.14					
2/3	8' 0"	48.00	14.63					
2/3	3' 3"	19.50	5.94					
3	9' 6"	28.50	8.69					
3	5' 0"	15.00	4.57					
3	4' 0"	12.00	3.66					
3	2' 0"	6.00	1.83					
		524.50	159.88					
4+4	10' 0"	80.00	24.38	2" x 4" Braces	240	F.R.	7.50	1,800.00
9	10' 0"	90.00	27.43					
2+2+3	10' 0"	70.00	21.34					
		240.00	73.15	Carried to Collection				5,737.50

TABLE XV. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS R		QUANTITY	UNIT	RATE	DOLLARS CENTS
				2" x 6" Sole Plate	126	F.R.	8.00	1,008.00
3	5' 0"	15.00	4.57	2" x 6" Fill	41	F.R.	9.00	369.00
5	4' 0"	20.00	6.10					
3	2" 0"	6.00	1.83					
		41.00	15.54	Carried to Collection				1,377.00

COLLECTION

	DOLLARS CENTS
From Page No. 56	8,329.60
From Page No. 57	6,396.10
From Page No. 58	9,210.00
From Page No. 59	5,737.50
From Page No. 60	1,377.00
Amount of Wood Frame Drywall Construction	31,050.20

TABLE XVI. CONCRETE BLOCKWALLING (Including Stiffeners & Belt Beams)

TIMES	DIMENSIONS	TOTAL	METERS CU.		QUANTITY	UNIT	RATE	DOLLARS CENTS
				REINFORCED CONCRETE (3,000 p.s.i.) AS SPECIFIED IN:				
4	1' 0"			Stiffener	3	Y.C.	330.00	990.00
	0' 6"							
	9' 4"	18.67	0.52					
5	1' 6"							
	0' 6"							
	9' 4"	35.00	0.99					
2	1' 9"							
	0' 6"							
	9' 4"	16.33	0.46					
		70.00	1.98					
	248' 6"			Belt Beam	5	Y.C.	330.00	1,650.00
	0' 6"			3/39' 0" 117.0				
	1' 0"	124.25	3.52	4/24' 6" 98.0				
				3/ 2' 9" 8.3				
				6.6				
				12.3				
				2/ 3' 3" 6.5				
				248.7 (22.88M^2)				
				Carried To Collection				2,640.00

TABLE XVI. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS SQ.		QUANTITY	UNIT	RATE	DOLLARS CENTS
	98' 6"			Lintol	2	Y.C.	330.00	660.00
	0' 6"			6/6' 0" 36.0				
	1' 0"	49.25	1.39*	2/7' 0" 14.0				
				3/3' 4" 10.0				
				2/8' 4" 16.8				
				4.6				
				5.2				
				4.4				
				2/3'11" 7.1				
				98.1 ($9.03M^2$)				
				FORMWORK AND SUPPORTS AS SPECIFIED TO:				
4/2	1' 0"			Sides of stiffeners				
	9' 4"	74.66	6.87	including narrow widths.	31	Y.S.	51.00	1,581.00
5/2	1' 6"							
	9' 4"	140.00	12.88					
2/2	1' 9"							
	9' 4"	65.33	6.01					
		279.99	25.76					
2	24S' 6"			Sides of soffit of belt beam				
	1' 0"	497.00	45.73	including narrow widths.	56	Y.S.	51.00	2,856.00
	17' 0"			12' 9"				
	0' 6"	8.50	0.78	4' 3"				
		505.50	46.51	17' 0" ($1.56M^2$)				
				Carried to Collection				5,097.00

*METERS CU.

TABLE XVI. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS SQ.		QUANTITY	UNIT	RATE	DOLLARS CENTS
2	98' 6"			Sides and soffit of Lintel				
	1' 0"	197.00	18.13	including narrow widths.	25	Y.S.	51.00	1,275.00
	64' 4"			5/4' 0" 20.0				
	0' 6"	32.08	2.95	3/5' 0" 15.0				
		229.08	21.08	3/2' 0" 6.0				
				5/3' 4" 16.8				
				3.0				
				3.6				
				64.4 (5.93M^2)				
	248' 6"			6" Thick hollow precast				
	9' 4"	2,319.25	213.37	concrete blockwall laid in				
	Less	684.47	62.97	cement mortar (1:3) and				
		1,634.78	150.45	with all cavities filled				
				solid with concrete (2,500				
				p.s.i.) as specified and				
				built around rod rein-				
				forcements, (measured				
				separately).	182	Y.S.	62.00	11,284.00
4	1' 0"			Ddt. Ditto				
	9' 4"	37.32	3.43	4' 3"				
5	1' 6"			9' 3"				
	9' 4"	70.00	6.44	13' 6" (1.24M^2)				
2	1' 9"							
	9' 4"	32.67	3.01					
	98' 6"							
	1' 0"	98.50	9.06					

(Continued on next page)

Carried to Collection 12,559.00

TABLE XVI. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS SQ.		QUANTITY	UNIT	RATE	DOLLARS	CENTS
5	4' 0"			6" Thick hollow precast					
	4' 0"	80.00	7.36	concrete blockwall (Cont.)					
3	5' 0"								
	4' 0"	60.00	5.52						
	2' 0"								
	2' 0"	4.00	0.37						
2	2' 0"								
	4' 0"	16.00	1.47						
2	3' 6"								
	6' 1"	47.83	4.40						
6	3' 4"								
	6' 1"	136.65	12.57						
	3' 0"								
	6' 1"	20.50	1.89						
	13' 6"								
	6' 0"	81.00	7.45						
		684.47	62.97						
				1/2" Diameter mild steel rod reinforcement as specified vertically in cavities of block wall.	1,274	Lb.	1.50	1,911	.00
				3/8" Diameter ditto horizontally in beds of blockwall.	546	Lb.	1.70	928	.20
				Carried to Collection				2,839	.20

TABLE XVI. (Continued)

TIMES	DIMENSIONS	TOTAL	METERS SQ.		QUANTITY	UNIT	RATE	DOLLARS CENTS
				1/2" THICK CEMENT AND SAND (1:3) RENDERING IN TWO COATS FINISHED WITH A WOOD FLOAT AS SPECIFIED INCLUDING HACKING (OR BONDING AGENT, ETC.) AS NECESSARY TO FORM KEY:				
	280' 0"			Block or concrete walls.	416	Y.S.	14.00	5,824.00
	1' 0"	280.00	25.76					
2	246' 6"							
	1' 0"							
2	98' 6"							
	1' 0"	197.00	18.13					
2	1,634' 9"							
	1' 0"	3,269.50	300.79					
		3,746.50	344.68					
	298' 6"			Top, end or reveal of block or concrete walls in narrow widths.				
	0' 6"	149.17	13.72		17	Y.S.	15.50	263.50
				5/2/ 8' 0" 80.0				
				5/2/ 9' 0" 54.0				
				2/ 4' 0" 8.0				
				2/6/ 6' 0" 24.0				
				2/ 10' 4" 20.8				
				6/ 10' 2" 61.0				
				16.0				
				2/ 17' 0" 34.0				
				298.6				
				Carried to Collection				6,087.50

TABLE XVI. (Continued)

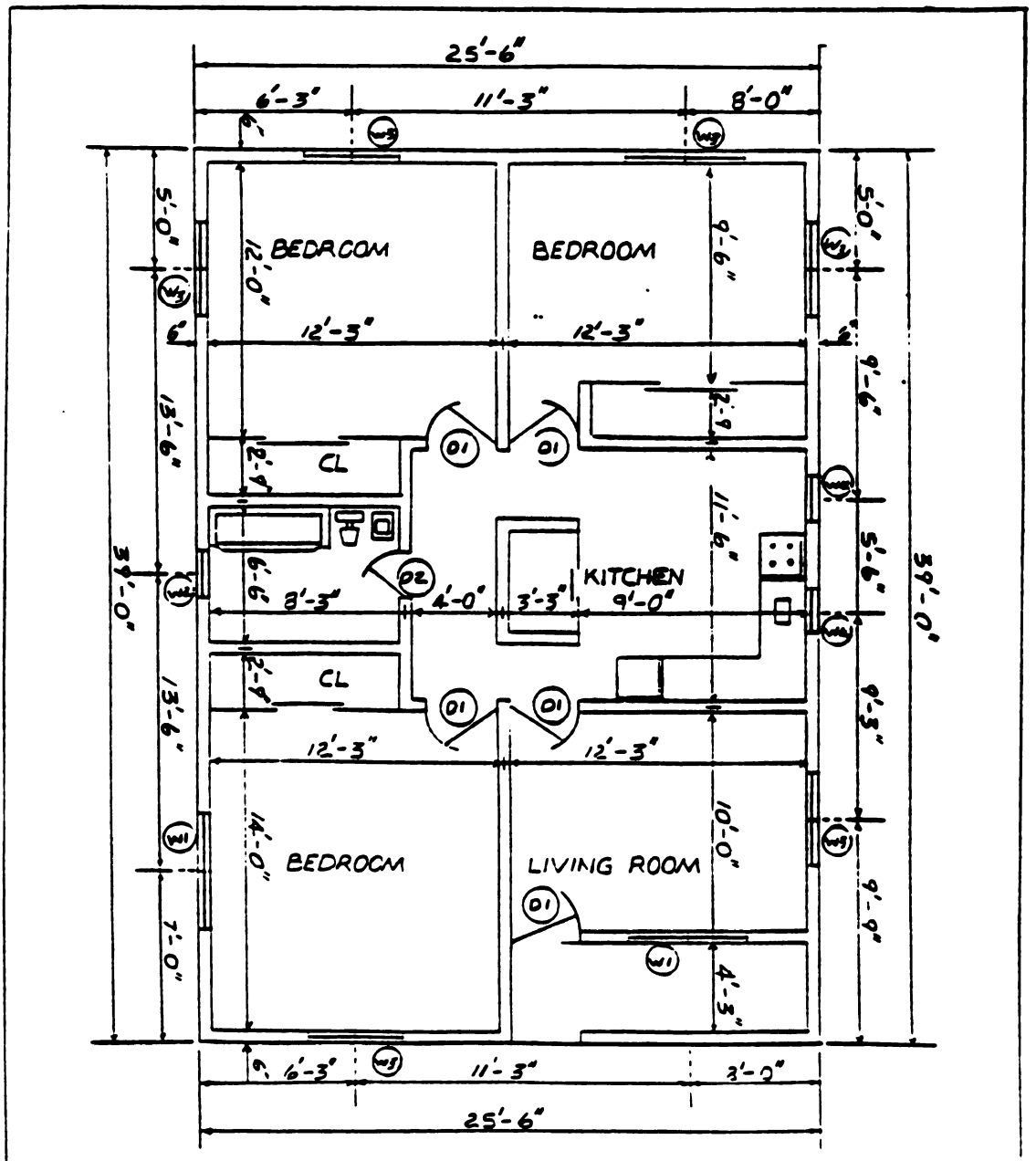
TIMES	DIMENSIONS	TOTAL	METER R		QUANTITY	UNIT	RATE	DOLLARS CENTS
				MILD STEEL ROD REINFORCEMENT AS SPECIFIED:				
4/4	13' 0"	208.00	63.39	1/2" Diameter in stiffener.	582	Lb.	1.50	873.00
5/7	13' 0"	455.00	138.68					
2/8	13' 0"	208.00	63.39					
		871.00	265.46					
4	268' 5"	1,073.67	327.25	1/2" Diameter in belt beam. 248.6 + 8% 268.5	717	Lb.	1.50	1,075.50
4	98' 6"	394.00	120.09	1/2" Diameter in Lintel.	263	Lb.	1.50	394.50
4/12	2' 1"	135.96	41.45	1/4" Diameter as stirrups				
2/5/12	2' 1"	339.96	103.62	in stiffener (In No. 216).	102	Lb.	4.40	448.80
2/2/12	2' 1"	135.96	41.45					
		611.92	186.52					
3+3+2	2' 1"	940.56	286.68	1/4" Diameter as stirrups in belt beam (In No. 332).	157	Lb.	4.40	690.80
1+3+2	2' 1"	373.96	113.98	1/4" Diameter as stirrups in Lintel (In No. 132).	62	Lb.	4.40	272.80
				Carried to Collection				3,755.40

TABLE XVI. (Continued)

TIMES	DIMENSIONS	TOTAL	METER R		QUANTITY	UNIT	RATE	DOLLARS CENTS
4	9' 4"	37.33	11.38	Labour forming arris.	211	Y.R.	3.50	738.50
2	298' 4"	592,67	180,65					
		630.00	193.02					
5	4' 0"	20.00	6.10	Ditto forming 3/4" groove				
3	5' 0"	15.00	4.57	in rendering.	14	Y.R.	5.00	70.00
3	2" 0"	6.00	1,83					
		41.00	12.50					
				Carried to Collection				808.50

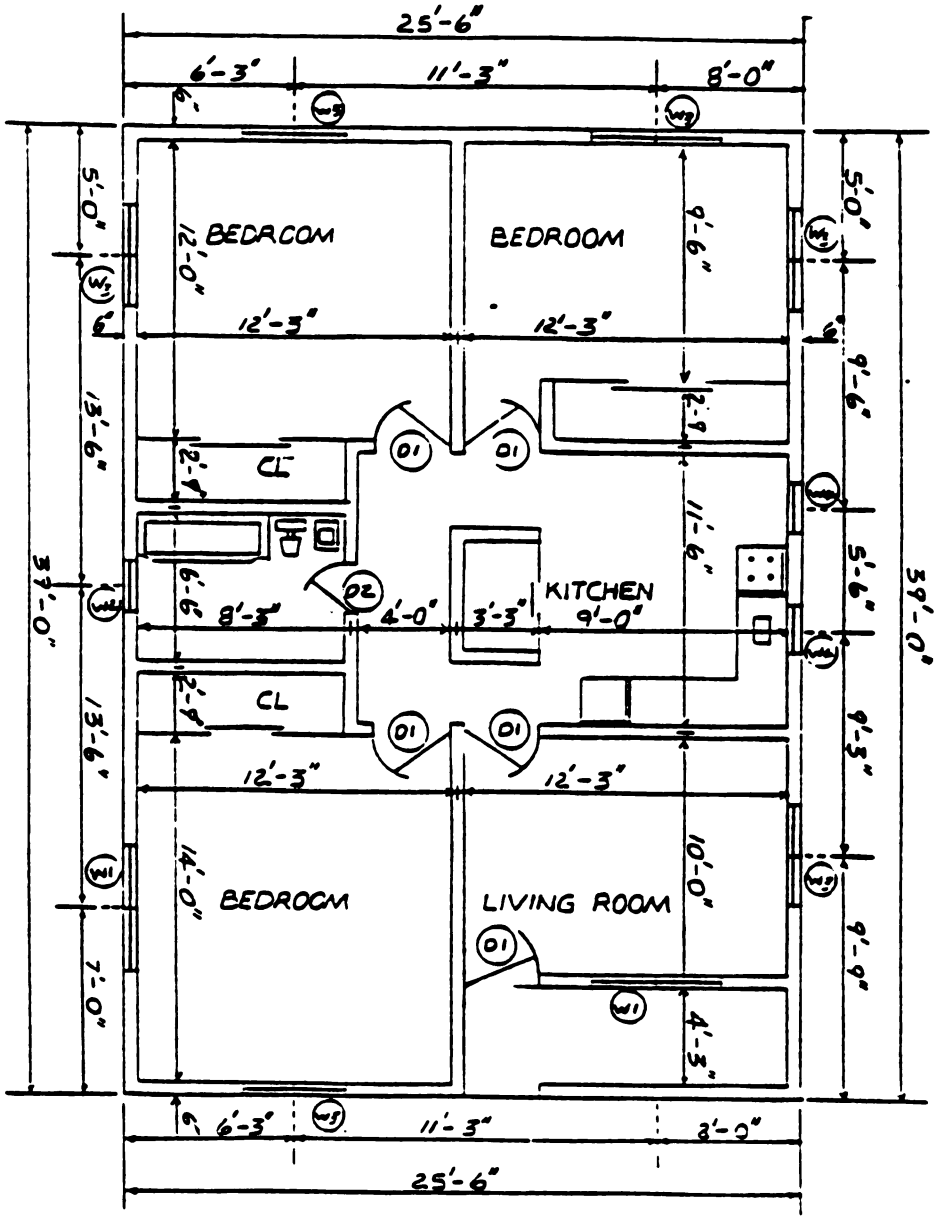
COLLECTION

	DOLLARS CENTS
From Page No. 61	2,640.00
From Page No. 62	5,097.00
From Page No. 63	12,559.00
From Page No. 64	2,839.20
From Page No. 65	6,087.50
From Page No. 66	3,755.40
From Page No. 67	808,50
Amount of concrete blockwalling (Including stiffeners and belt beams)	33,786,60



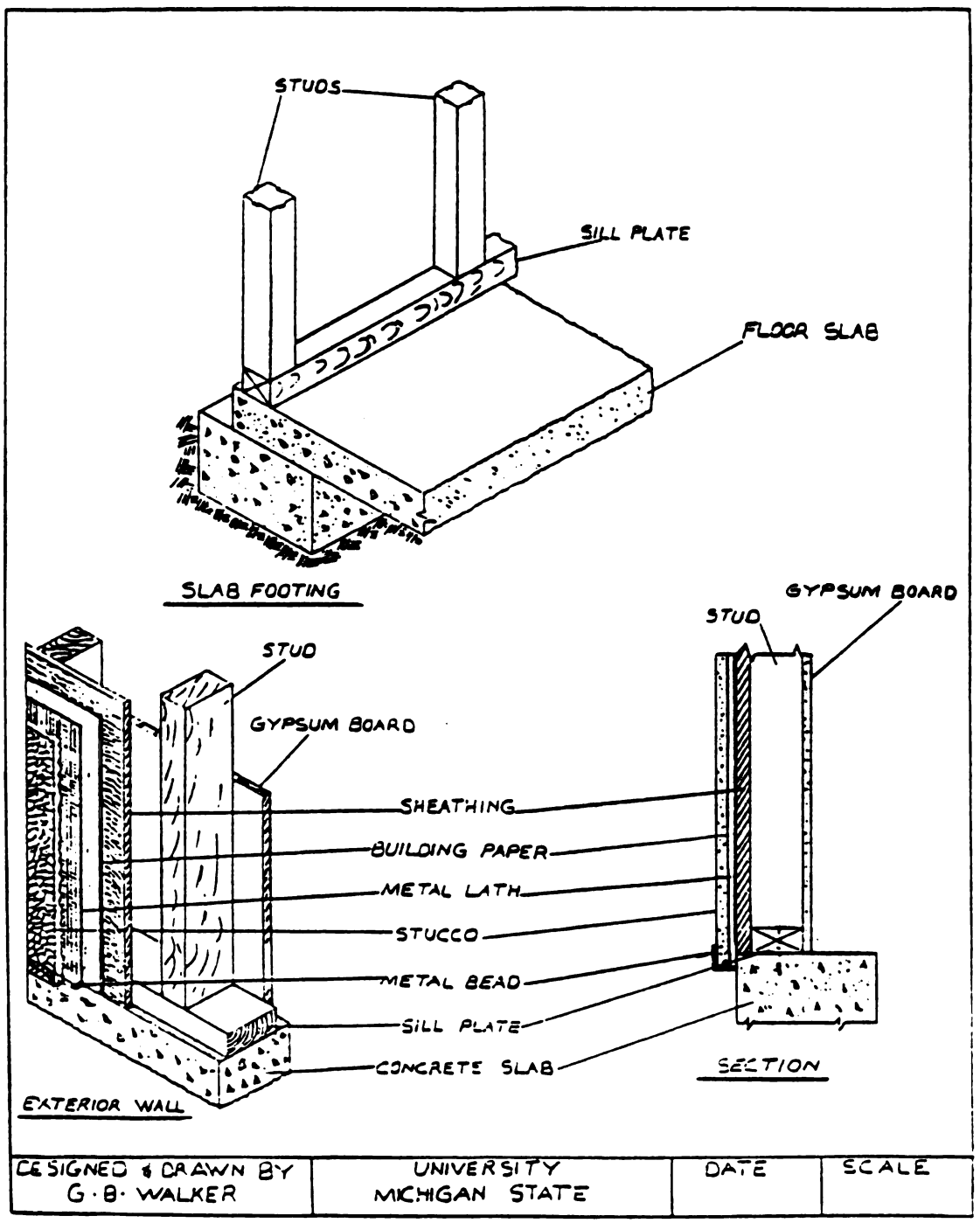
FLOOR PLAN - A

DESIGNED & DRAWN BY	UNIVERSITY	DATE	SCALE
G · B · WALKER	MICHIGAN STATE		3/16" = 1'



FLOOR PLAN-B

DESIGNED & DRAWN BY	UNIVERSITY	DATE	SCALE
G·B·WALKER	MICHIGAN STATE		3/16" = 1'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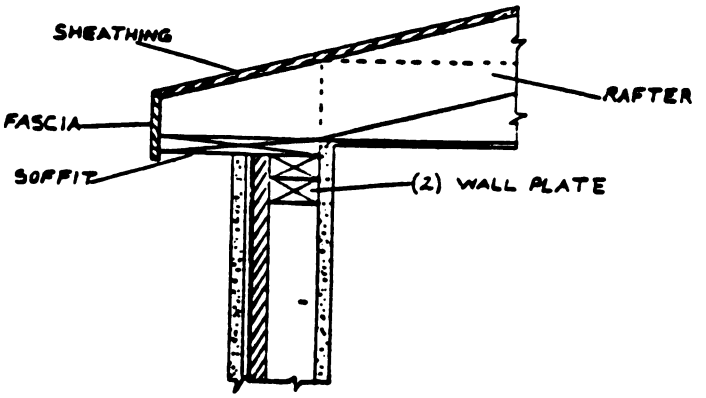
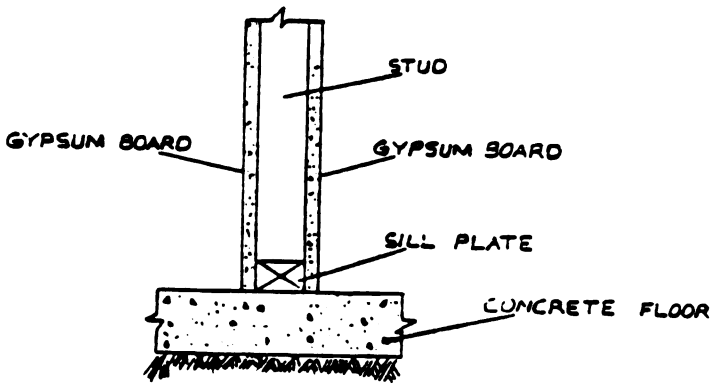
SILL PLATE
FLOOR SLAB
SLAB FOOTING
STUD
GYPSUM BOARD
SHEATHING
BUILDING PAPER
METAL LATH
STUCCO
METAL BEAD
SILL PLATE
CONCRETE SLAB
EXTERIOR WALL
STUD
GYPSUM BOARD
SECTION
DESIGNED & DRAWN BY
G·B· WALKER
UNIVERSITY
MICHIGAN STATE
DATE
SCALE



ROOF AT WALL



INTERIOR WALL

DESIGNED & DRAWN BY G. B. WALKER	UNIVERSITY MICHIGAN STATE	DATE	SCALE

1527-J Spartan Village
East Lansing, Michigan 48823 USA
July 9, 1984

Dear Sir/Madam:

My name is Gladstone B. Walker. I am a Jamaican attending the Michigan State University in East Lansing, Michigan, USA. Presently, I am a graduate student in Building Construction and am engaged in a Master's Thesis Research Project. My study is focused on the relative advantages of concrete block and cement and wood frame drywall in residential buildings. This research is being conducted under Mr. Timothy Mrozowski, Department of Agriculture Engineering.

Attached is a questionnaire which I am requesting that you complete as a representative of your company. The information you and your company provide will be kept confidential. Although you are not obligated to respond to the attached questionnaire, your assistance would be greatly appreciated.

The information you disclose will be of vital importance in the completion of this research project. Also the findings may prove to be beneficial to the advancement of your company. If you desire, I will share the findings of this research project with you/your company at completion.

During the weeks of July 23 through August 3, 1984 I will be in Jamaica to pick up the answered questionnaires and I am looking forward to meeting you.

Thank you for your time and effort spent answering the attached questionnaire.

Respectfully yours,

Gladstone B. Walker

GBW

Attachment

QUESTIONNAIRE
Gladstone B. Walker: Master's Student
Building Construction: Michigan State University
Department of Agriculture Engineering

Questions No. 1 through 6 are about yourself as a builder.

1. What is your present title or position in your company? _____

2. How long have you personally been in the construction business? (Circle answer)

   a. 10 years or less
   b. 11 to 15 years
   c. 16 to 20 years
   d. 21 to 25 years
   e. 26 or more years

3. Where did you personally obtain your knowledge of constructing housing units? (Please indicate for each type of housing unit by placing a check mark in the corresponding space/s).

	CONCRETE BLOCK/CEMENT	WOOD FRAME/DRYWALL
a. Trade school		
b. Apprenticeship		
c. Technical school		
d. College courses		
e. Books		
f. First hand experience		
g. Other (specify)		
h. _____		
i. _____		
j. _____		

4. How would you personally rank your knowledge of constructing housing units? (Please indicate for each type of housing unit by placing a check mark in the corresponding space/s).

	CONCRETE BLOCK/CEMENT	WOOD FRAME/DRYWALL
a. No knowledge		
b. Some knowledge		
c. Very knowledgeable		
d. Extremely knowledgeable		

5. From your personal knowledge and/or experience, which of the following units cost less to build in Jamaica? (circle answer)

   a. Wood frame, drywall
   b. Concrete block and cement

6. Depending on your answer to Question No. 5, which of the following area/s save/s costs? (circle answer)

   a. Labour
   b. Material
   c. Transportation
   d. Construction time
   e. All of the above
   f. None of the above

Questions No. 7 through 13 are about your construction company.

7. What percent of the work done by your company is related to residential construction? (circle answer)

   a. Less than 20%
   b. 21 to 40%
   c. 41 to 60%
   d. 61 to 80%
   e. 81 to 100%

8. How many housing units has your company constructed in the last two years?

   NUMBER OF HOUSES

   a. _____ Concrete block and cement

   b. _____ Wood frame, drywall

9. What percent of the housing units built by your company are government subsidized? (circle answer)

   a. 0%
   b. Less than 20%
   c. 21 to 40%
   d. 41 to 60%
   e. 61 to 80%
   f. 81 to 100%

10. What is the average price of the housing units constructed by your company?

    $_____

11. What is the average size (in square feet) of the housing units constructed by your company?

    _____ square feet

12. When you consider purchases of building materials for housing construction which types of materials would be most available to Jamaican builders? (circle answer)

    a. Material for wood frame, drywall construction
    b. Material for concrete block and cement construction
    c. Both types of material are equally available

13. In comparing wood frame, drywall housing units with concrete block and cement housing units for Jamaica, what are the major advantages/disadvantages? (list in the space provided, No. 1 being the most important — No. 4 being the least important).

CONCRETE BLOCK AND CEMENT
MAJOR ADVANTAGES

1. _____

2. _____

3. _____

4. _____

13. Continued

CONCRETE BLOCK AND CEMENT
MAJOR DISADVANTAGES:

1. _____
2. _____
3. _____
4. _____

WOOD FRAME, DRYWALL
MAJOR ADVANTAGES:

1. _____
2. _____
3. _____
4. _____

WOOD FRAME, DRYWALL
MAJOR DISADVANTAGES:

1. _____
2. _____
3. _____
4. _____

Thank you for your time in completing this questionnaire.
Additional comments may be made on the bottom and reverse side.