LOW COST HOUSING IN INDIA; UPGRADING THROUGH BETTER DESIGN

by

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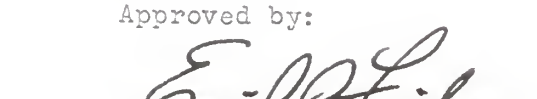

Major Professor

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INTRODUCTION

The need for low cost housing in India has reached acute proportions in recent times. Although a number of agencies, both governmental and private, have endeavored to resolve the problem, the complexity of it requires considerable research.

In partial preparation for this thesis, a paper was presented at the end of the spring semester of 1965 at Kansas State University, entitled "A Survey of Low Cost Housing Problems in India," in order to explore the possibilities for bettering the design of low cost housing in India. The present study is an attempt to develop a scheme which might provide solutions to the problems as well as produce quality low cost housing. The objective is to create a well-planned community consisting of dwelling units of higher quality than those that have been built previously, but of no higher cost. Specifically, this thesis is a case study of housing for the low-income labor force of the handloom textile industry at Ramagundam, Andhra Pradesh, India.

In developing this scheme, sociological, economical, physical, and other factors have been taken into consideration. The discussion of these factors and a description of the selected site form the subject matter of the first chapter.

Chapter II presents a systematic approach to the design problems and forms the backbone of the study. It deals with the Plan-organization of the dwelling units in their environment, and also presents details of units with special consideration of minimum indoor space requirements, orientation, sun-control

and outdoor living spaces.

India is still in the initial stages of industrial development, and the application of building techniques and materials used in most of the western countries is not feasible from an economic point of view. A more efficient use of locally available materials would, however, achieve considerable reduction in cost. This subject is dealt with in Chapter II. A factor of major importance is the availability of an inexhaustible supply of cheap labor, which permits labor-intensive construction methods.

Chapter III particularly emphasizes the need for improvement in systems of drainage, sewage disposal, water supply, and electricity. These factors are of primary importance for good health, comfort, and convenience, and they cannot be overlooked.

Included with the report are graphical presentation on five illustration boards. The sequence of work on these boards is as follows:

Plate I. Map of Andhra Pradesh State in India.
Site location.
Site plan, 1" = 150' scale.

Plate II. The "Plan Form," 1" = 50' scale.
Cluster of dwelling units, 1" = 16'.

Plate III. The Dwelling units, plan and elevation, 1" = 8'.

Plate IV. Sections and structural details, 1/8" = 1', and $\frac{1}{2}$" = 1'.

Plate V. Kitchen and toilet details, plans and elevations, 1" = 4', and drainage layouts.
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Area plan, location of sewage disposal and water supply.

Plate VI. Perspective sketches.

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Figure 1.--Orientation Map of India

CHAPTER I

GENERAL BACKGROUND: A CASE IN POINT; RAMAGUNDAM, ANDHRA PRADESH, INDIA

Region, town and site location.

The town of Ramagundam, in the District of Karimnagar, Andhra Pradesh, India, is located 137 miles north of Hyderabad City. (See map of India, Fig. 1.) Hyderabad, the capital of Andhra Pradesh State, forms the center of all administrative and business activities in the area and has a significant place in the history and culture of India. Ramagundam has a population of 5,581 and is linked with the capital city by a railroad and a highway.

The area around the town is primarily agricultural land. Recently, however, there has been a tendency towards industrialization, making use of the existing mineral and coal belts. Textile and paper mills, coal mines, and two cement factories are already in operation. The rapid rate of industrialization has placed increasing demands on bulk thermal power, and a thermal power station with 16⅔ MW capacity is already installed.

A site has been proposed in the town for the accommodation of a handloom textile industry and housing for the workers. This industry falls into the category of light industry as set forth under one of the Five-year Plans for the development of

India.[1]

Climate and physical structure of the land.

Ramagundam has very hot summers and mild winters. The summer season lasts from February to June; May is the hottest month. The temperature in summer varies from 90°F. to 104°F. The winter months are December and January, with an average temperature of 60°F. The monsoons, which come from the southwest, occur during the period of June till October. The prevailing winds are from the southwest. The average rainfall is between 20" and 40" annually. Sometimes the northeast monsoons come in November and December. Humidity is no problem at all, and dust storms do not occur.

The elevation of this area is about 500 feet above sea level, lower than that of Hyderabad City. The land slopes gently, and the rolling ground creates natural surface drainage of rainwater. The soil is hard "muram" and consists mainly of limestone, much of which is used for cement manufacturing. Abundant shrubs and trees, particularly teak and shisham, are found in the region. Forest covers 20 per cent of the land, and the rest of the land is used as permanent pasture. Bamboo is

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[1]Report, July, 1965 from "Director" of Handloom Textile Industry. Handloom Industry is the largest cottage industry providing remunerative employment to a large sector of the country's population. Its employment potential is high and can further absorb new entrants into the profession. This industry does not require much capital investment and does not create problems like scarcity of raw materials. It is intended to absorb into the profession of weaving the low-income labor force. (Hyderabad, A. P. July, 1965.)

plentiful in this area and also in the adjoining districts. It grows easily anywhere in the region.

The People: Cultural and social forces.

Traditional forces still have a strong effect on the living habits of the people. They have "caste" and "class" consciousness, although this is decreasing today in the modern sectors of society. Within the low-income group with which we are dealing, the class consciousness is not too distinct, but there are some religious and caste differences. Every living group has its own distinct customs, which are mostly ceremonious. Although these may not be essential for existence, they are important to the individuals themselves and also to the communities to which they belong. Some of the social characteristics have been listed as follows:

Members of one caste like to be together and separated from others and will not eat or drink with others.

Wish for temples.

Marriage is to a person from another village.

Extended family in one house.

Family solidarity and neighborliness, even after separation.

Village has fixed men's social groups.

Place for social events: dancing, plays, singing, wrestling, etc.

Sentimental system: Wish not to destroy the old way of life, adherence to present habits governing bathing, food, etc.

Family is authoritarian.

Proper boundaries of ownership and maintainance responsibility.

Provision for daily baths.

Segregation by sex, caste, and age.[2]

Of course, some of the characteristics may not apply to all groups of people in a particular area, because it has been found that the newer generations always wish for a "change." This element of "change" suggests something new and destroys something old, and it must be considered in any social and economic planning. The design of mass housing, or low cost housing, in this changing society must suggest new standards of sociability, serviceability, security, and beauty. The design of the living environment should not be restricted because of the social institutions. The layout should achieve flexibility and individuality, retaining all good community associations. The houses must adapt to various ways of living, as well as liberate the occupants from old restrictions.

Physical and emotional needs within economical limits.

Better housing is needed to raise the existing standards of living, which are again related to the social and economic conditions and the level of industrial development. The masses gradually attain the desire to improve living standards through their own efforts, if good living conditions are available.

The agricultural sector today is tending to be more indus-

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[2]Alexander Christopher, Notes on the Synthesis of Form, (Cambridge, Mass.: Harvard University Press, 1964).

trialized, and this tendency can be seen in this particular area. The workers are apparently changing their patterns of life. Training facilities will help the people to acquire skill in their work and to earn a better living. This change in occupation at first needs a great adjustment and is not a very happy period for most of the people.

A point worth noting is that families prefer group living. A closer proximity to the neighbor helps to build up a feeling of security. The workers have been living in clusters and groups in their own villages, isolated from the other villages and big towns.

Living spaces must, therefore, be related to different family sizes and characteristics. The average size of a family in India is probably four or five persons. The types of families to be housed in the units to be proposed in this paper will be mostly 1) a couple with no children, 2) a couple with one child, 3) a couple with two or more children, 4) a single man with an old father or mother as a dependent, 5) an independent single man or woman. In these types generally there will be the single head of the family employed, or sometimes both man and wife may be employed. The rest of the family is dependent upon the single earning member (unless young people at highschool level are earning members also). Hence, it is obvious that there are economical limitations to the family, and rent must be low enough to be accommodated by limited earnings.

Land use and accommodation.

The available site of 886 acres has been allotted by the state government free of cost for the development of the whole township. Out of the total area, about 314 acres is set apart for housing during the first phase of development. A large amount of open land will be reserved for future expansion of the industrial development beyond the northern and southern borderlines.

The whole project is mainly a government responsibility as far as funds and administration are concerned. The workers are classified as low-income industrial labor, and it has been proposed to develop low cost housing for 1,000 families (approximately 5,000 people). The project presented in this paper will be designed to meet the immediate needs of the people employed in the handloom industry, including community facilities as well as housing.

A systematic approach for the planning of the whole scheme will be proposed as follows: The industry on the west side is to expand along the main route, north and south; the housing is to spread out eastward, with large spaces as green areas; the central portion of the land is to be left for the development of necessary community facilities, such as a market center, schools, administration offices (including a workers' service center), a temple and a clinic. (See Plate I, p.26) The high school will be used as a community hall on social occasions after school hours.

Since this thesis is primarily concerned with residential requirements and architecture, these will be dealt with in detail in forthcoming chapters, supplemented by a graphical presentation. Details of industrial, commercial, and school requirements will not be included, but general area requirements and locations will be indicated on the site plan. (Plate I, p.26)

The site is approached by the main highway running north-south on the west side of the site. A secondary road is proposed on the east end of the site, which also leads to the cement factories, power plant, and paper mills. The main highway, which links the site to the city of Hyderabad, is the principal feeder to the industry. A railway line passes close to the east of the site but does not serve this light industry area. The Godavari River flows only a mile and a half north of the site.

Although vehicular traffic will not be considered a problem in planning the scheme, adequate major and minor roads have been indicated to provide for any future requirements stemming from the growth of the industry. (See site plan, Plate I.) The workers will mainly use bicycles as a means of transportation. Owning an automobile is beyond the reach of this working class.

CHAPTER II

IMPROVED CONCEPTS FOR BETTER DESIGN

The Search for a "Plan Form."

To give physical form to the layout, the "plan organization" for the houses, streets and open spaces on the site is to be used.[3] By "plan organization" we mean the grouping of dwelling units to enable the occupants to share communal facilities and amenities (which are not available in existing projects), and making these houses virtually "apartments on the ground" with the additional inestimable advantage of private outdoor living.

The principle applied here is to give special consideration to the orientation of the dwelling units, the grouping of several types of units together, in order to create diversity, with adequate open spaces within the groups of houses and also around them. This will be, in other words, forming "clusters," an important term acknowledged today in residential land use planning. The cluster fits most appropriately and suitably to the living habits of the people and the requirements of the site (See Plates I and II.) This form is particularly appropriate here, considering the various factors, social, cultural, economical, and climatic, discussed in the previous chapter.

An integrated community, instead of the individual lot, will become the unit for planning (in contrast to what is done today

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[3]Urban Land Institute, Technical Bulletin No. 40, New Approaches to Land Development, (Jan., 1961).

in government housing in India). Between each cluster open spaces will be left for recreational purposes and outdoor activity for the tenants. The green wedges will also serve for pedestrian paths which will link the residential area to the commercial and industrial areas. The aim will be to develop an atmosphere that will accommodate the emotional needs and the interests of the inhabitants, that is, to let them enjoy, for example, gardening and also privacy in their units, even though they may live in clusters.

The "cluster," which is a contemporary term applied in housing in the more developed countries like the United States and those in Europe, is a completely new concept in planning in India. It should be given more importance here, because it has many advantages in its application even in India. It controls density and provides a certain percentage of the land for open spaces.[4] (See Plates I and II, p. 26 & 27.)

As proposed here, the cluster will form an internal court, surrounded by dwelling units. This open court will be very useful for occupants for social activities and for gardens, patios, and pedestrian paths. (See Plate II, p. 27 .) Each cluster will consist of 21 to 25 houses; the maximum net density for housing is 12 houses per acre. The maximum neighborhood density is 48 persons per acre of total residential land (taking four persons per family as the average size).

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[4]Arthur B. Gallion, The Urban Pattern: City Planning and Design (New York: D. Van Nostrand Co., Inc.) pp. 243-249.

Design of dwelling types and units.

Site density and site coverage will be controlled by the dwelling types chosen. It has been observed that the majority of the people in India have not developed a liking for apartments in multi-story buildings. Since this region is semi-urban, houses at ground level will be much preferred. The cost of these spread-out units will be balanced by economical construction techniques and use of local building materials and labor. The dwellings will be detached and semi-detached houses grouped together in a cluster form. (See Plate II, p.27 .) This will provide a good flexibility and variety in design layout. One of the main considerations in the design of the units will be to provide beautiful conditions for the growth and development of a healthy family life, especially for children.

The dwelling units must be simple in design and construction. (See Plate III, plan 5, p.28 .) The plans should be easy to follow and be implemented by the local labor force. Standardization as well as efficient use of material is desirable here especially to simplify structural requirements. (This subject will be treated more fully below.) Hence, square forms were selected for the three different types of units. Each type (A, B, and C) differs from the others in specific requirements and floor areas. Each dwelling unit is separate from the others, yet they are in a group. Each will have its own front and back yards with private outdoor spaces. The units will be so designed that the openings of one unit will not overlook another's, thus

maintaining privacy.

1. Minimum indoor space requirements. The living room or family room comprises the largest space, including space for dining also. The kitchen is planned and organized with adequate storage space.[5]

A sleeping room or bedroom with attached bath and water closet will be essential requirements for a family with children. Closets will be provided in dressing cubicles between bathrooms and bedrooms. The bath and water closet will be directly accessible from living areas. (In existing projects, these are located outside the houses for community use.) Detailed kitchen and toilet requirements can be seen in Plate V.

The floor areas for the three types of units are as follows:

Type A: One bedroom unit; 784 sq. ft. (detached).

Type B: Two one bedroom units; 613 sq. ft. per unit each, (total 1,225 sq. ft. semi-detached).

Type C: Efficiency unit; 400 sq. ft. (detached).

A family with children will live in a one bedroom unit; the parents will sleep in the bedroom and children in the living room, or this could be reversed. Provided with this minimum space, every individual will be given a chance to improve his living conditions according to his taste. He will be able to make his own choices about the luxuries he would like to introduce, such as furniture and other material accessories inside

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[5]Tessie Agan, The House (Kansas State University, Department of Home Economics, 1964).

the house.

2. Cross ventilation. Since the prevailing breezes are from the southwest, dwelling units will be oriented on the north-south axis. By staggering the units in the plan, all rooms will be able to get some breeze. Bamboo grill in the openings helps to cool the air. Cross ventilation is maintained by staggering the openings in the plan and also by leaving a vent shaft which runs through the center of each dwelling unit to sweep out warm air from under the roof and from the interior, thus creating the circulation of air and maintaining a comfortable temperature inside the rooms. (See Plate V, section and plans, p.30.)

The openings will consist of adjustable mosquito screens (plastic) which will prevent dust and insects from entering the dwelling units.

3. Private outdoor spaces. Outdoor living becomes a necessity when indoor spaces become uncomfortable in very hot summer evenings. Hence semi-private courts or some outdoor spaces and rear gardens immediately accessible from living rooms will be provided. This open space can also be used for sleeping. The open space will create a pleasant environment when planted with trees and lawns. Rear gardens can be kitchen gardens for family use, and in addition adjoining paved areas will serve as work areas for the housewives.

4. Sun control. Shade is important for the dwelling units because of the intense sunlight in this area. Trees grow easily here, and advantage can be taken of this to simplify the problem

of shade. Shade trees are necessary mainly on the west and south sides, where the heat and glare are intense most of the day.

Another way to provide shade is to closely group clusters of living units. (See Plate II, p. 27 .) In a cluster, dwelling units close to each other protect most of the exterior walls from direct sunlight. Insulated roofs are necessary to avoid the heat also. This will be taken care of by the use of proper building materials, like cement slurry mixed with rice hulls poured over the roof structure. The roof structure itself will be light, made of factory-built bamboo boards over bamboo framework. (Refer to Plate IV, p. 29 .) The exterior surface will be given a light color which will reflect heat.

Economy through innovations.

India has a plentiful supply of natural construction materials, but the techniques for the advantageous use of these materials have not been significantly developed. Definite reduction of cost can be achieved through the use of these materials in suitable forms. Also, profits can be maximized by employing the abundant cheap labor in the construction of the dwelling units.

A brief description of some of the available materials for building are given in the following paragraphs.

1. Materials.

a. Cement. The fact that this region consists mainly of limestone has encouraged the construction of two cement factories. Hence, cement is available and can be used for walls

and foundations. The use of cement has to be limited because it is still an expensive item.

b. Bricks. Locally made bricks which are kiln-dried are found to be less economical for use in mass-produced housing; the disadvantages are their small size, and also their low quality. During the manufacturing process, almost half are either broken, under-dried, or over-dried. A small quantity can be used for non-structural parts of the buildings and also for decorative purposes.

c. Cement-soil-stabilized blocks. Blocks 4" x 9" x 12" are prepared on the site, with a suitable mixture of cement, lime, and soil. This building material is highly recommended since such large quantities are required. Either they are hand molded (with wooden forms) or they could be machine molded. A machine would give better and quicker results, especially when blocks have to be mass-produced. For stabilization purposes 1½ per cent cement and 1½ per cent lime is added to the soil.[6]

d. Bamboo. Bamboo is found extensively in the area and is available in any size and length. It can be advantageously used in the roof structure. Bamboo is used widely in the country and serves for almost every necessity of man and beast. The people can handle it conveniently and skillfully. It is highly economical because the supply is not scarce and no transportation and storing costs are required. In low-cost building

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[6] Punjab Engineering College, Rural Plan-Rural Housing Wing (Chandigarh, India, Dec. 1962), pp. 39-40.

it can replace steel and hence furnish a light roof structure over the dwelling units. Steel is an expensive item in India at present, and the supply is limited.

Bamboo has properties similar to steel when used as a reinforcing material. It has high tensile and compressive strength, and it bends considerably without breaking. Several tests have proved that bamboo failed only by crushing.[7] The joints in bamboo construction can be light and strong. Occasionally wood and aluminum are used; for strapping and hooking purposes aluminum is a better choice.

2. Construction. A description of the procedures applied in the construction of the units follows.

a. Walls. Walls of 9" thickness will be constructed with soil-stabilized blocks over a cement concrete bed (1'-6" x 9") foundation. The block walls will be the load-bearing external walls. All partition walls will be 4" thick and will be laid over 9"-thick concrete. The interiors will be finished in cement-soil plaster (1:8 ratio). If kiln bricks are used as partition walls, they will be pointed with lime mortar and may be left bare.

b. Roof structure. Bamboo will be used to form a framework over the square-shaped units. (See Plate IV, p. 29.) The framework will be held rigidly to the exterior walls with cross ties, hooks, and straps. Over the framework, 2"-thick

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[7]Vincenti B. Manalo, Comparative Tests of Bamboo with Woods for Structural Purposes, Thesis, Kansas State Agriculture College, 1908.

bamboo boards will be laid and fixed with nails. These boards will be manufactured in factories, possibly near the existing paper mills, in standard lengths and sizes (4' x 8' x 2" thickness). In the factory, cured bamboo is cut into slats which are laid to overlap each other, then pressed together with adhesives to form boards. These boards are light in weight, strong, and good for insulation purposes. They are easy to cut into required sizes and shapes, and they take plaster on both sides. When the boards are fixed over the structural framework, cement slurry mixed with rice hulls and lime will be poured (or sprayed if possible), in order to make the roof well insulated from heat and also waterproof. A layer of waterproofing (polyethelene) will be laid for additional protection between the bamboo pressed boards and cement slurry. (See Plate IV, p.29 .) A better way of roof contruction is suggested, where steel is available. Rolls of steel mesh bonded in plastic could be made use of instead of bamboo boards. This will be little costlier, but will be much more stronger. Roll of steel mesh in 3 ft. width is fixed to the framework and cement plaster is sprayed on top and bottom of the roof.

The vent shafts in the center of the roof, one of which is 4' x 4' and the other 8' x 8', will be covered on the top with bamboo pressed boards fixed to the extension of the roof framework. This covering will help in keeping the rain from entering the shaft.

c. Openings. Between the wall units will be decora-

tive double screens made with bamboo splats. In some places the tenants may replace the screens with brick grilles (jalli), if their funds permit it. The openings in living rooms and sleeping rooms may be draped with heavy handloom material made by the occupants themselves.

d. Floor. The flooring will be 6" above ground level. Bricks will be laid in decorative patterns on a cement-soil bedding. The bricks will be pointed with cement mortar. Colorful straw mats, woven by the dwellers themselves, will serve as floor covering, if desired.

CHAPTER III

IMPROVED SERVICES AND UTILITIES

Efficient systems of drainage, garbage and trash removal, sewage disposal, water supply, and electricity have been particularly neglected in India, and this neglect has been one of the causes for the substandard conditions in housing. Therefore it has been found necessary to place emphasis on improved services and utilities.

1. Drainage. (See Plate V, p.30 and isometric sketches on drainage layout.)

All bathrooms will be installed with necessary sanitary fittings and drainage lines. The waste lines from the sinks, and the soil lines from the water closets, join the main soil stack and house drain. Branch vents and stack venting will be provided to avoid trap-siphonage. Thought has been given to minimum lengths of drainage lines. The layout has to be as simple and as inexpensive as possible.

Each unit will be provided with adequate fixtures in the toilet and kitchen. The toilet will consist of an (Indian) water closet (with tank), a lavatory, 18" x 20", and a shower stall, 3' x 3' or 3'6" x 3'6". The kitchen will contain one sink, 2' x 2'. Separate garbage cans will be provided here, for periodical disposal.

The house drain and sewer from each unit carrying the waste and soil water will join the street sewer, which runs through

the open space to the rear of the houses. The street sewer will join the main sewer, which carries waste to the sewage disposal system. (See 'Area plan' on Plate V, p.30 .) The kitchens are planned to adjust to the general cooking habits of Indian women. Good storage spaces above and below the counter are provided in the form of open shelves, which are desirable for convenience in work and also for seeing stored things easily. (See Plate V, p. 30.) This also gives good light and air movement inside.

Refrigerators are not provided, because they are still a luxury item. A thorough study of kitchen requirements was considered to be necessary, because the kitchen is the heart of the home.

2. Garbage and trash removal.

Garbage collectors, who will be hired by the community authorities, will go to every house to collect garbage and trash every morning. All the waste will be carried out of the town and burned in large incinerators.

3. Sewage disposal.

The estimated average amount of sewage flow for disposal is 50 gallons per capita per day. The main sewer lines will run through the open space at the lowest elevation in the layout. Pumps will be provided at intervals to lift the sewage, which will be carried to the sewage treatment area. The sewage will be treated in two built-on-site lagoons of 40' x 50' sizes. These lagoons are situated on the southeast corner of the site

and will be well protected by a raised parapet from the ground, and also will be surrounded by trees. The sludge from the lagoon will be periodically removed. The affluent will then flow into sub-surface sand filters.[8] The liquid that will come out of these filters will be at least 90% pure. This liquid later is led to the nearest pond in the area which will be used for fishing and boating. The above method will be least expensive and easy to install in this particular case, because it does not require any mechanical devices or maintainance costs. Later, this community may afford a better and more efficient method of sewage disposal.

4. Water Supply.

The source of water supply for this development will be the Godavari River, which is about one and one-half miles away from the site. The water consumption rate will be about 50 gallons per capita per day for all purposes. Total consumption will be 500,000 gallons. This will include requirements for housing, fire, schools, and shopping, etc. Analysis of the available water shows that the appearance is clear, color is normal, and there is an odor of decomposed matter. Water softening and purification are required in order to use this river water for drinking and washing purposes. Water will be taken from the river by means of pipes to the settling tanks near the site, where lime

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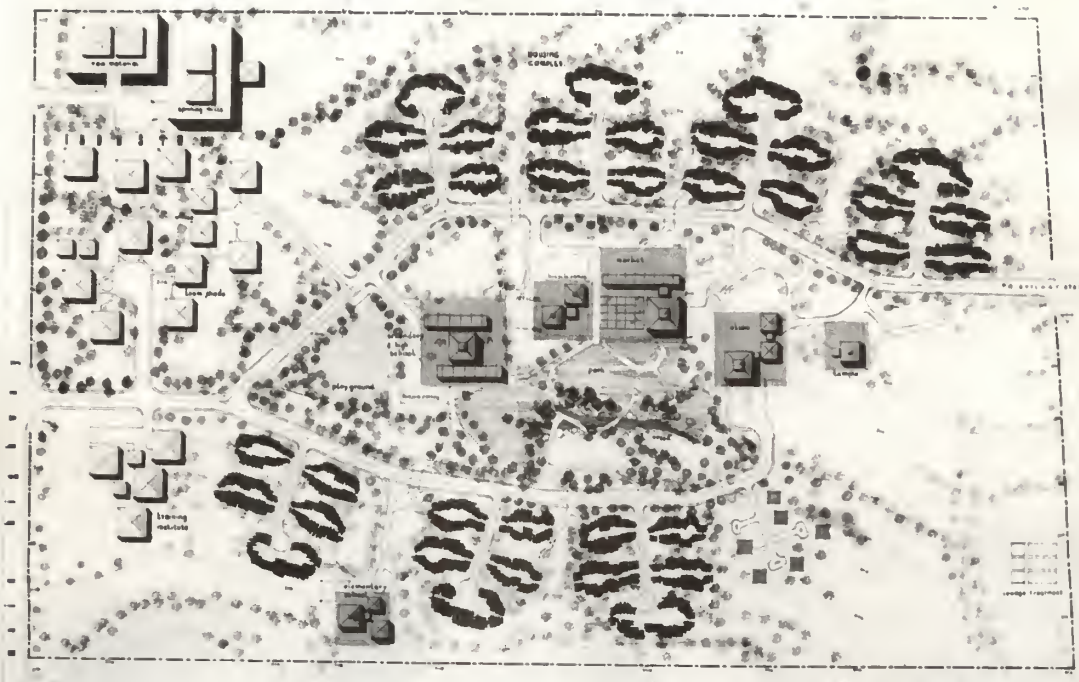
[8] Manual of Septic Tank Practice, U.S. Department of Health, Education and Welfare, Public Health Service, pp. 56-57.

will be added to soften the water. The water then will flow into filter beds, where it will be purified and then stored in large storage tanks, 100' x 100' below ground level. From the tanks, the water will be pumped up from the pumping chambers to an elevated tank of 35' diameter and 30' depth. This is calculated by taking the depth as 30 feet; capacity = 1/3 total consumption, required for minimum storage of 8 hours, because the supply of river water will be constant. Also an extra storage tank below the ground level will contain the surplus water for emergency use. The exact height of the tank will be calculated by specialists on the job. This requires details of piping system for the whole housing scheme, allowable pressure head to the several fixtures in the house and frictional losses. The water level in the tank will also take care of the minimum pressure for fire hydrants. From the tanks, the purified water will flow to the housing and other commercial areas by gravitation. The elevated tanks, because of its height, will maintain terminal head and will distribute even pressure to the farthest point in the site.

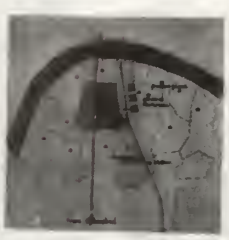
5. Electricity.

The town has a thermal power plant very close to the site. A substation will be built to supply electricity for the housing in the area.



S I T E P L A N.

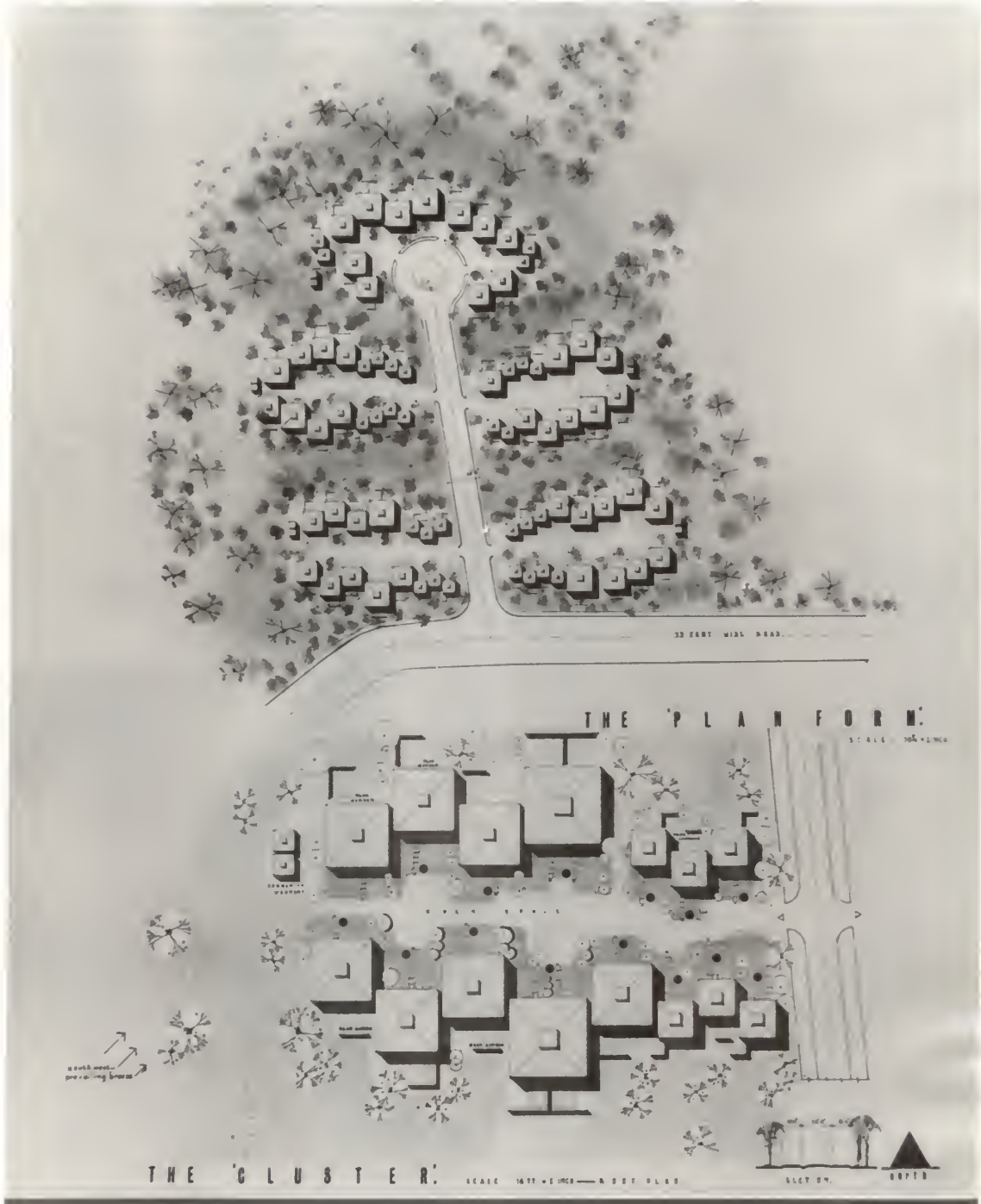
state of Andhra pradesh.
India.



S I T E L O C A T I O N

SITE LOCATION &
SITE PLAN.

1


THE 'PLAN FORM'.
THE 'CLUSTER'.

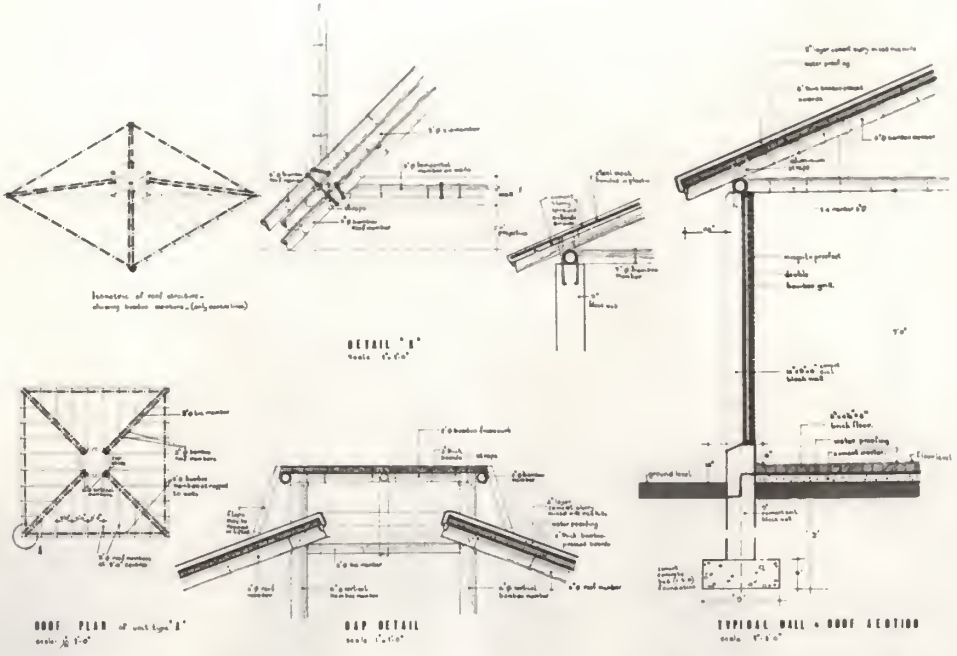
THE DWELLING UNITS.

SCALE 1/8" = 1 FOOT

ELEVATION. SCALE 1/8" = 1 FOOT

PLANS AND ELEVATION OF UNITS.

3



DETAIL "A"

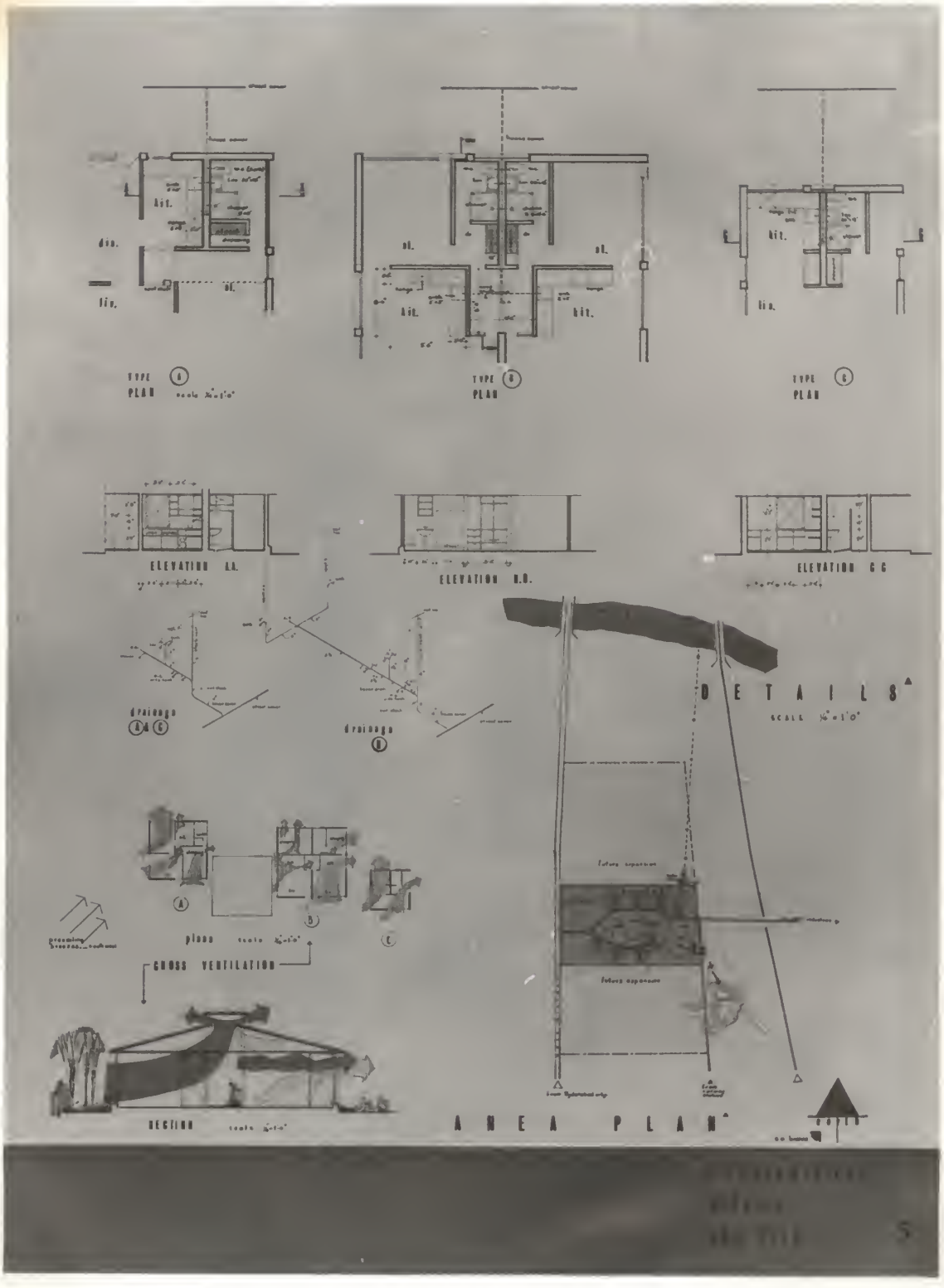
ROOF PLAN

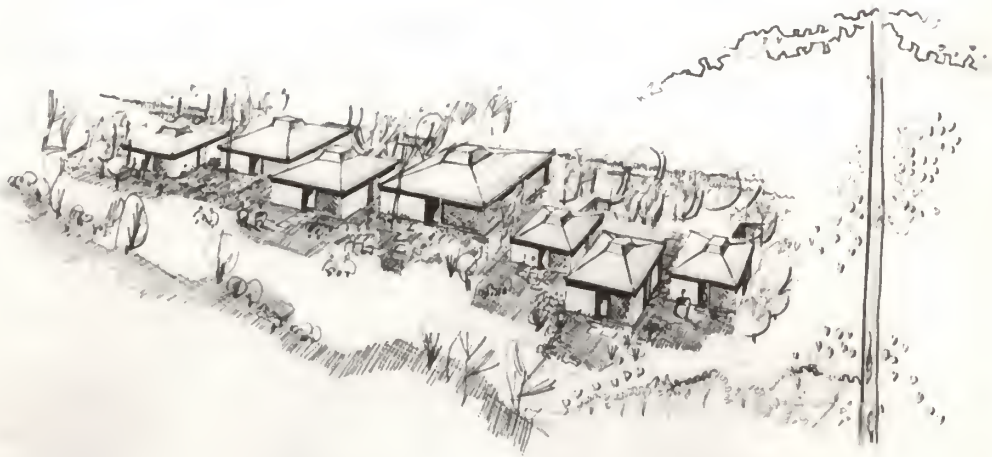
GAP DETAIL

TYPICAL WALL & ROOF SECTION

D E T A I L S.

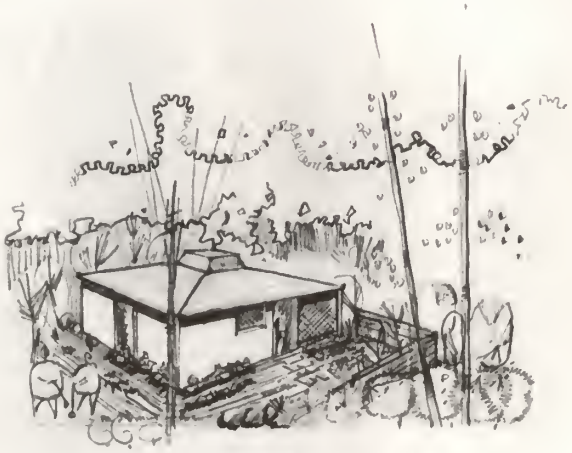
S E C T I O N S.


TYPE A PLAN
TYPE B PLAN
TYPE C PLAN
ELEVATION A.A.
ELEVATION B.B.
ELEVATION C.C
drainage A & C
drainage B
plans
CROSS VENTILATION
SECTION
DETAILS
AREA PLAN



VIEW OF THE 'CLUSTER'.

VIEW FROM THE LIVING ROOM.



OUTDOOR LIVING AREAS.

SUMMARY AND CONCLUSION

The proposed project essentially presents an upgrading in the quality of low cost housing in India, indicating solutions to some of the present problems in housing. An attempt is made to coordinate all the diverse elements of the project design, from the most human values down to structural requirements, into a complete harmony, meeting not only functional demands but also those of a more spiritual kind.

A comparative analysis of the existing and the proposed projects is presented below. It compares the design elements of both the projects in summarized form.

Comparative Analysis of the Existing and Proposed Low Cost Housing Projects in India.

Existing	Proposed
Planning	Planning
Poor generally, basically formal gridiron pattern in layout of streets and lots -- not economical -- a lot of space is wasted. Roads on all four sides of plot --house is isolated -- mixed land uses. No association between houses, streets, shopping, schools, and industry -- spatial organization lacking. (Refer to	Effort to maintain all spatial associations -- houses, streets, open spaces, shopping, schools and industry. Systematic approach to the "Plan Form". (Plate I and II) Good open spaces left between clusters and streets. Open spaces directly accessible from all dwelling units. Thought given to future expansion.

Appendix No. I)

Dwelling Units	Dwelling Units
1) No standardization in design for the efficient use of material. Waste of space within the individual lot. (Refer to Appendix II)--Insufficient spatial requirements in dwelling units -- These could be planned more simply and economically. Family is crowded in one room with kitchen and verandah. (Refer to Appendix III)	1) Thought given to standardization of forms -- use of square forms for all dwelling units -- more spacious, simple, convenient, and economical. Sizes of units related to family sizes and needs -- units grouped in clusters, hence less expensive and better organized -- creates variety and diversity. (Refer to Plate II and III)
2) No thought given to cross ventilation -- rooms very hot during day -- remain warm also in the night.	2) Cross ventilation provided -- staggered openings and vent shafts. Interiors remain cool in summer -- provision for sun control and shade on living units during very hot seasons.
3) Outdoor spaces are provided within the lot, but are too open and unprotected -- feeling of security lost. (Refer to Appendix II) Individual lots require more	3) Private outdoor spaces are enclosed and have paved areas. Rear gardens could be kitchen gardens -- planting of trees and lawns encouraged. Outdoor areas can be used for sleeping

space and land is wasted -- lack of useable space.

4) Bath and W.C. outside the main house -- not immediat ly accessible from the dwelling units. Sometimes community baths and W.C.'s are provided.

Building Materials and Construction

Materials used -- kiln bricks, lime and mud for mortar -- rubble for foundation. Roof structures vary from place to place, differ from rural to urban areas -- Thatched roof requires maintenance ever rainy season. Asbestos cement sheets (Appendix IV) too hot in summer and can crack easily -- expensive. Reinforced cement concrete roof -- too expensive, steel and cement both out in the nights. (Refer to Plate III)

4) Bath and W.C. economically planned -- utility lines are cut down to minimum lengths -- all fixtures like W.C., shower stall, lav. are provided in each unit -- kitchen has a sink and good storage spaces in the form of open shelves.

Building Materials and Construction

Materials used -- cement-soil blocks -- manufactured on site. Bamboo roof structure, strong and light -- bamboo pressed boards made waterproof and insulated. Also, steel wire mesh bonded in plastic is recommended for roofs where steel is available easily. Cement plaster mixed with rice hulls is sprayed on the outside as well as inside the roof. This roof structure requires less steel than reinforced cement

expensive -- supply limited. Requires specialized and skilled labor.

Construction is not simple -- walls are too thick -- efficient use of materials is required in standardization and economy. Kiln bricks are not economical for large-scale projects. (Appendix V)

Utility and Services

Most of the later projects provide for drainage lines and water supply, but still they need improvement and could be made more economical and efficient. In most of the houses, proper systems of drainage, trash removal, sewage disposal and water supply is neglected. No attention is paid to the health, comfort and convenience of the community. The toilets which are for group or community use are not at all convenient -- they

concrete -- bamboo can span greater lengths and is definitely economical, because the supply is not limited. Construction is simple and plain -- can be handled expertly by local labor with little guidance.

Utility and Services

Emphasis is placed on efficient and improved systems of drainage, waste and trash removal, sewage disposal, water supply and electricity -- cost is kept to minimum, but optimum living standards are maintained. (See Plate V)

All dwelling units have attached bath and W.C. and also a well-planned kitchen.

are not cleaned daily, because
no one is responsible for them.

As things stand in India, the problem of food supply has to be given a priority, but once this food crises is overcome, significant economic and social development can take place for the benefit of Indian society.

It is clear that there are possibilities for raising the quality of low cost housing in India. With the application of better designs and building techniques, more successful housing can be provided for the economically backward sections of the society.

Although suggestions have been made for bettering housing conditions and much research and study have been done in this field, the actual implementation of the proposed design is hampered today. The reason for this is the lack of modernization in Indian society. Economic progress moves at a slow pace, thus slowing down industrial development. The existing budgetary limitations in the government plans are not too encouraging. Government must take bolder steps toward the country's economic stability, and must be a good relationship between working government bodies and the concerned masses.

As opportunities are given to newer generations in India, especially to trained and qualified personnel in all scientific and technological fields, economic advances can be made, and standards, including low cost housing standards, can be improved.

ACKNOWLEDGMENT

I wish to express my sincere appreciation to Professor James H. Miller, major advisor, for his encouragement and many helpful suggestions and criticisms in the preparation of this thesis.

I have a deep sense of gratitude for Dean Emil C. Fischer and Professor Theodore A. Chadwick for their valuable guidance.

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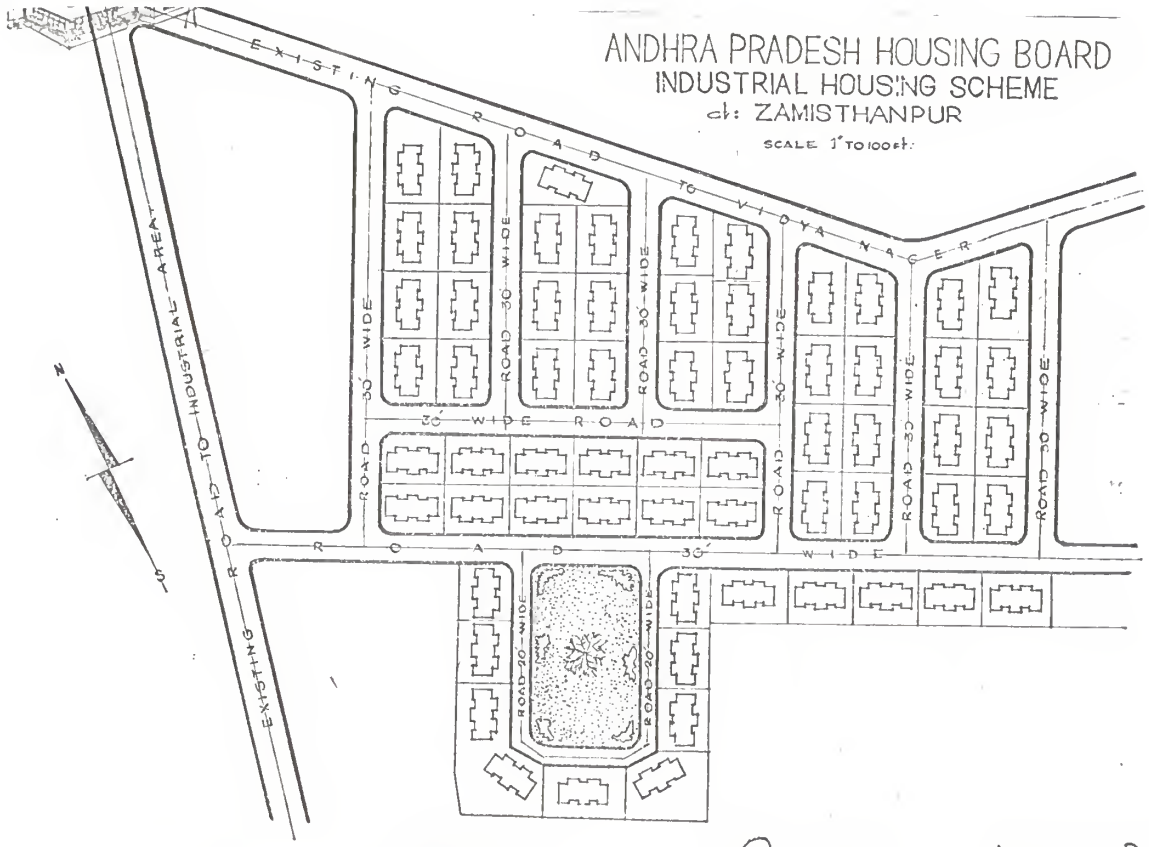
APPENDIX I

Layout in Existing Housing Projects

ANDHRA PRADESH HOUSING BOARD
INDUSTRIAL HOUSING SCHEME
at: ZAMISTHANPUR

SCALE 1" TO 100 ft.



DRAWN BY
S. BABURAO.

HEAD-DRAUGHTSMAN,
CENTRAL DRAWING BRANCH A.P.

HOUSING ENGINEER,
ANDHRA PRADESH HOUSING BOARD.

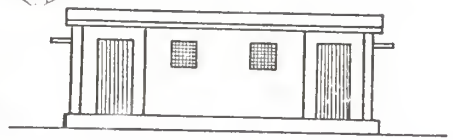
CHAIRMAN,
ANDHRA PRADESH HOUSING BOARD.

I

APPENDIX II

Planning and Design of Houses

4



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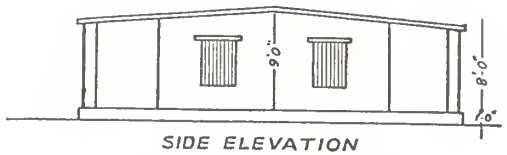

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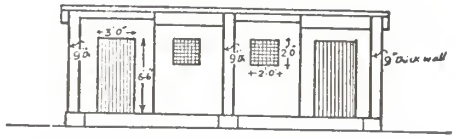
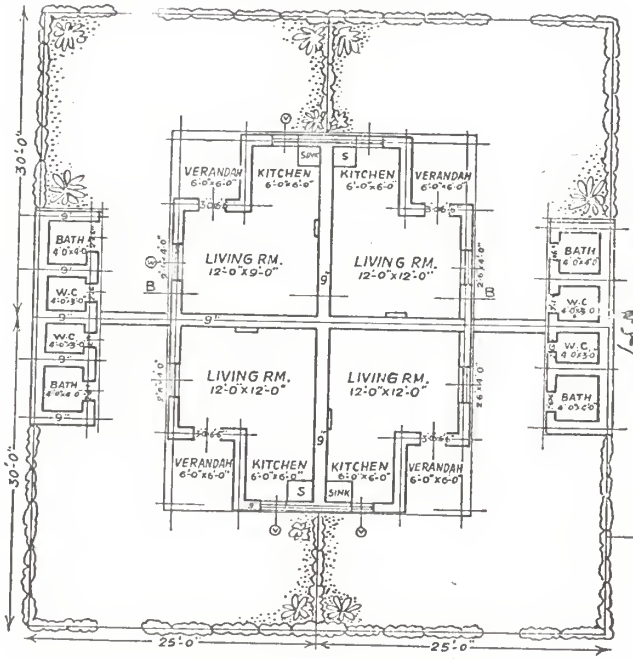
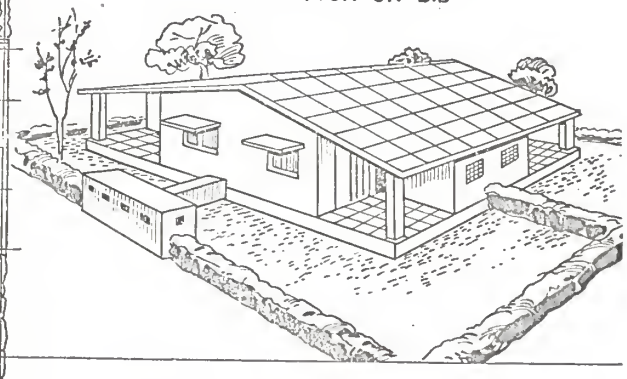


SECTION ON B.B

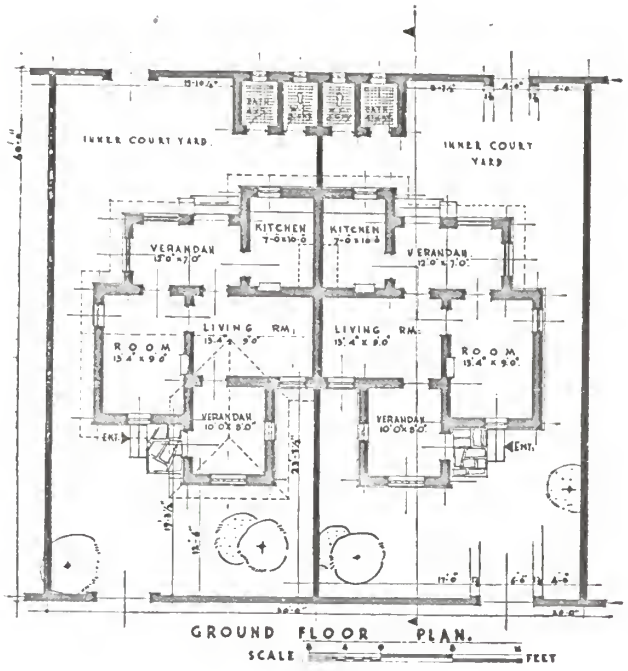




ANDHRA RRADESH HOUSING BOARD

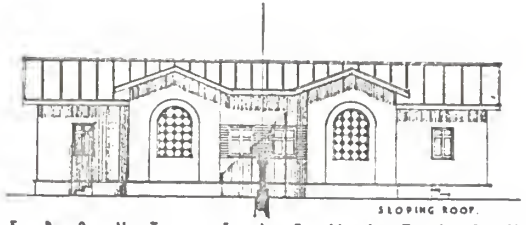
LOW COST HOUSES

II



GROUND FLOOR PLAN.

SCALE 0 4 8 16 FEET



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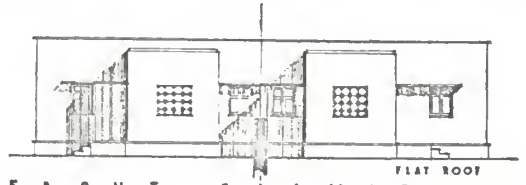

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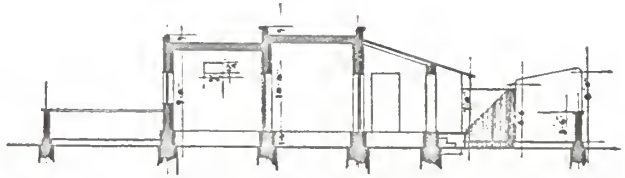


SECTION ON A.A.

VILLAGE ARTISANS' QUARTER

FOR

GOLDSMITH, BANGLEMAKER, SHOEMAKER, ETC.

Mohd. Ismail

NOTE.

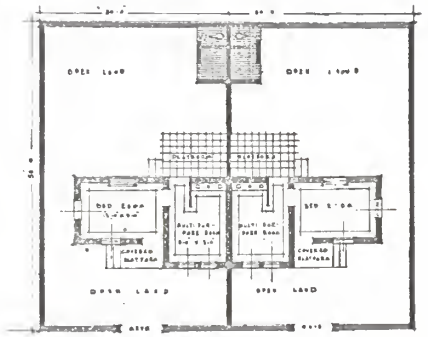
AREA OF PLOT. ..... 1000.00 Sft OR 2,00.00 Sqm.
PLINTH AREA ..... 630.00 Sft
ROOFING:-
LIVINGROOM, ROOM & VERANDAH FLAT ROOF.
VERANDAH & KITCHEN-ASBESTOS OR COUNTRY TILES.
WALLS BRICK IN MUD WITH ONE COAT OF LIME PLASTER.

Jayagadh
A.R.I.B.A
CHIEF TOWN PLANNER.

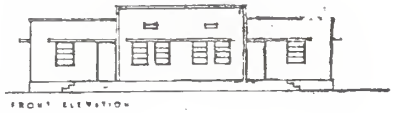
APPENDIX III

ANDHRA PRADESH HOUSING BOARD
LOW INCOME GROUP HOUSING SCHEME

TYPE DESIGN 3



GROUND FLOOR PLAN



FRONT ELEVATION

DRAWN By

HEAD DRAUGHTSMAN,
CENTRAL DRAWING BRANCH

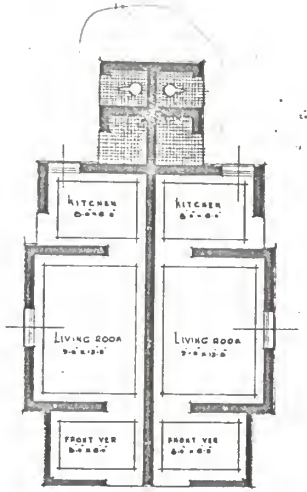
REGIONAL HOUSING ENGINEER,
ANDHRA PRADESH HOUSING BOARD

CHAIRMAN,
ANDHRA PRADESH HOUSING BOARD

III

ANDHRA PRADESH HOUSING BOARD
LOW COST HOUSING SCHEME

TYPE DESIGN 2



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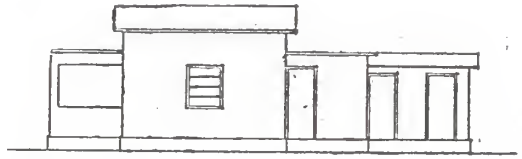


SIDE ELEVATION

Drawn by

HEAD DRAUGHTSMAN,
CENTRAL DRAWING BRANCH

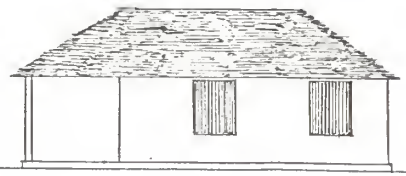
PERSONAL HOUSING ENGINEER, HOD,
ANDHRA PRADESH HOUSING BOARD.

CHIEF MANAGER
ANDHRA PRADESH HOUSING BOARD

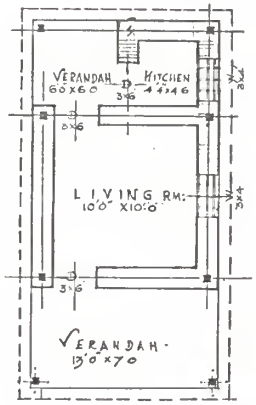
IV

APPENDIX IV

FRONT ELEVATION

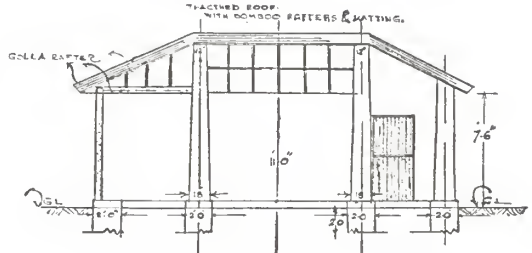


SIDE ELEVATION.



PLAN.

PLINTH AREA 341.25 SFt:
COST Rs: 770.00
COST PER SFt: Rs: 2.26 NP.



CROSS SECTION ON A.To B.

DESIGN OF A LOW COST HOUSE NO: 1
CONSTRUCTED BY ANDHRA PRADESH HOUSING BOARD.
AT MALAK PET. HYD:

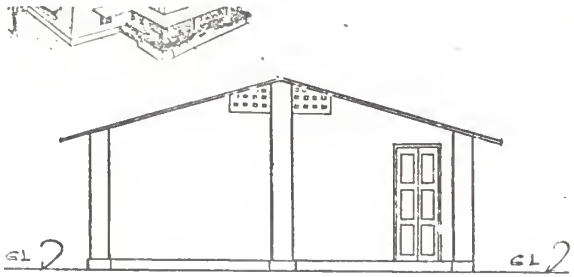
S Bahri

M Trivikrama Reddy
HEAD - DRAUGHTSMAN.
CENTRAL DRAWING BRANCH APHB.

Koppula Subbarao
HOUSING ENGINEER.
ANDHRA PRADESH HOUSING BOARD.

A Raghavarao
CHAIRMAN.
ANDHRA PRADESH HOUSING BOARD

IV.



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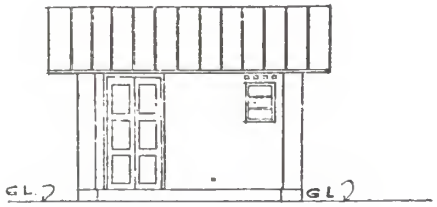
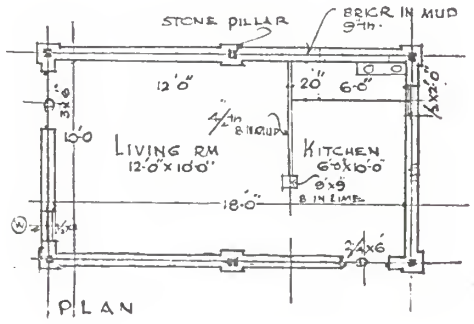


SIDE ELEVATION



PLAN

DESIGN OF LOW-COST HOUSE No.3 CONSTRUCTED BY ANDHRA PRADESH HOUSING BOARD AT MALAKPET HYD

SCALE: AN INCH TO 4 Ft

REFERENCE

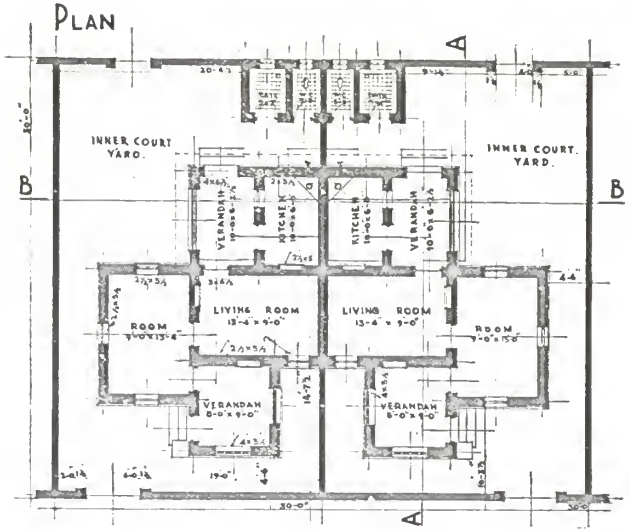
PLINTH AREA : 248.06 Sft:
TOTAL COST: RS:770 00
COST PER Sft RS: 3.10 NP.

M Krishna Reddy
HEAD-DRAUGHTSMAN,
CENTRAL DRAWING BRANCH APHB

Koppolu Subbarao
HOUSING ENGINEER,
ANDHRA PRADESH HOUSING BOARD

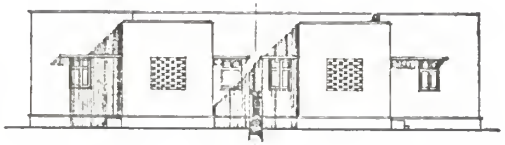
A Raghava Rao
CHAIRMAN,
ANDHRA PRADESH HOUSING BOARD
IV

APPENDIX V

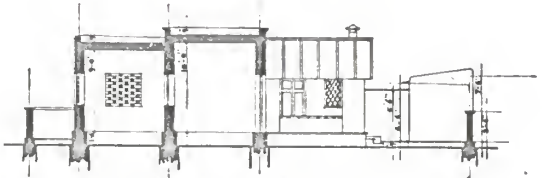


DOUBLE ROOMED QUARTER

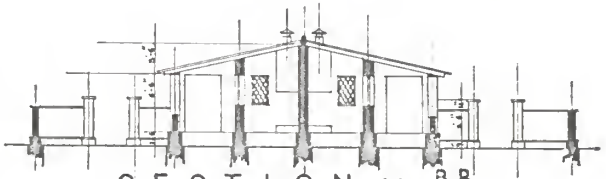
Scale 8 4 0 8 16 24 feet



FRONT ELEVATION



SECTIONAL ELEVATION on A A



SECTION on B.B

NOTE,

AREA OF PLOT.... 1500.00 Sft OR 166.66 SQYDS
PLINTH AREA..... 721.00 SFT.
ROOFING:- LIVING ROOM FLAT ROOF.
VERANDH & KITCHEN ASBESTOS OR COUNTRY TILES
WALLS BRICK IN MUD WITH ONE COAT OF LIME PLASTER.

Jnaik

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CHIEF TOWN PLANNER

LOW COST HOUSING IN INDIA; UPGRADING THROUGH BETTER DESIGN

by

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Today the need for low cost housing is receiving much attention in India. The object of low cost housing is to provide adequate housing for the economically backward sections of the community. Like most underdeveloped countries, India is faced with a need to provide housing for a great many people with very low incomes, and the urgency of the need is now becoming recognized.

To study the problems in low cost housing a specific area is taken, i.e. the town of Ramagundam in Andhra Pradesh, India. Hence, this thesis is a case study of housing for the low income labor force of the handloom textile industry at Ramagundam. The present study is an attempt to develop a scheme which might provide solutions to the problems as well as produce quality low cost housing. The objective is to create a well planned community consisting of dwelling units of higher quality than those that have been built previously but of no higher cost.

In developing this scheme, sociological, economical, physical and other factors have been taken into consideration. These factors have definite effects in the plan form of the housing. Here the housing complexes are planned in clusters.

The design of the dwellings is influenced mainly by the minimum space requirements, cross ventilation, sun control, private outdoor space and also the available building materials and construction techniques. The main building materials used are cement-soil-stabilized block, kiln bricks, cement, bamboo and bamboo pressed boards. The construction techniques are very

simple and standardized which the local labor can handle easily.

Special emphasis is given to improvement of drainage, garbage and trash removal, sewage disposal, water supply and electricity in order to provide safe, sanitary, healthy and comfortable dwelling units.

In this project possible solutions have been proposed to upgrade the quality of low cost housing in India through better designs and planning methods.