L O W C O S T I N D U S T R I A L
H O U S I N G U N I T S
I N I N D I A:

Submitted in partial fulfilment
Of the requrements for the Degree
Of Bachelor in Architecture

Habibur Rahman,. B.E.

Signature redacted

Author

Dean of Architecture

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Accompanying drawings are held at the MIT Museum.

Thank you.

The Graduate House
M.I.T. Cambridge, Mass.,
January 6, 1943

Walter R. MacCornack, Dean
School of Architecture
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Cambridge, Massachusetts

Dear Sir:

I should like to submit my thesis study, "Low Cost Industrial Housing Units in India" in partial fulfilment of the requrements for the Degree of Bachelor in Architecture from the Massachusetts Institute of Technology.

Respectfully submitted,

Signature redacted

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CAMBRIDGE, MASSACHUSETTS

November 4, 1942

Mr. Habibur Rahman
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Dear Rahman:

Following a conference this morning with the Fifth-Year students and with Professor Anderson present, I am giving formal approval for the Department of the subject you have selected for your Thesis. It is my understanding that Professor Anderson has gone over your program and has given his approval as well.

Sincerely yours,

Signature redacted

Walter R. MacCornack, Dean
School of Architecture

WRM/h

A C K N O L E D G M E N T S

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B I B L I O G R A P H Y

Should have author, full title, publisher, place & date

B. Shiva Rao
"The Industrial Worker of India"

Raj B. Gupta
"Labour And Housing In India"

A. R. Burnett-Hurst
"Labour and Housing In Bombay"

Edith Elmer Wood
"Introduction to Housing"

Catherine Bauer
" Modern Housing"

Lewis Mumford
"Culture of Cities"

U. S. H. A.
"Design ofLow Cost Housing Projects"

Richard L. Riess
"British and American Housing"

Hydrabad Municipality
"Works in the City of Hyderabad"

Aalvar Aalto
"Rehousing in Findand"

Bruno Schwan
"Town Planning and Housing Throughout the World"

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I N T R O D U C T I O N:

The acute problem of housing for the Indian industrial worker is still in a most primitive and undeveloped state. Speaking of this condition John Gunther in his Inside Asia said, " ... the worst slums in the world... workmen getting three or four rupees ($1.20) a week live in cells with no light, no sanitation, the entrance to the hovels is a tunnel streaming with sewage...Disease, squalor, and the degradation of the human being to the level of animals are rampant as men live in the stinking filth." Nothing could be a more precise and explicit description. As the industrial and labour situation in India is absolutely different from that in western countries, the author of this thesis shall try to give a comprehensive idea of the Indian industries and labour for a better understanding of the housing problem.

Although a few modern industries have sprung up in the last twentyfive years, India is still chiefly an agricultural country. More than 80% of the Indian people live in India's 730,000 villages. When the second World War broke out, India was supporting only 2% of her population by modern industries. There has been a substantial expansion in India's industries since 1939, but it has not been in proportion to either her potential resources or

her man power. However it is inevitable that there will be a rapid industrial expansion after the War.

The social composition of the large Indian industrial and commercial cities is unique and peculiar. A large floating immigrant population, drawn from the surrounding districts and more distant part of the provinces, is the outstanding characteristic of all large cities in India, and has had no counter-part in western cities, even during the Industrial Revolution. This condition is the result of an extremely poor agricultural situation in India. Agricultural methods are the same as they were centuries ago, and frequent famines caused by drought or flood have rendered the agricultural income both uncertain and insufficient. The economic condition of the farmer is simply appalling. Mr. Darling, a British official, in his report on the Punjab peasant, writes that the bulk of them "were born in debt, lived in debt, and died in debt." Inspite of their deep love for the soil and family life, the farmers and field labourers leave their homes and families behind, and flock to the cities in search of jobs. The farmer goes to the city to tide over difficult times, to supplement his meagre agricultural income or to pay off some cumulatively increasing debts incured by himself or his forefathers. The average peasant refuses to bow before the overpowering forces of economic pressure, and finds it impossible to reconcile himself to the dirt and squalor

of the city. With the advent of British Rule the appearance of cheap cheap machine-made goods rendered the cottage industies, which had helped the farmers to occupy their leisure hours and supplement their incomes unprofitable, and as a result the cottage industries have decayed. On the other hand the modern industries are not large enough to support more than 2% of the Indian population.

Present Housing Conditions In Large Cities.

As most of the modern industries have grown up around large ill-planned towns and cities, the result is a lack of housing and sanitation. For along time the employers and the gvernment were totally indifferent to the housing and health conditions of the factory workers. The employers were only interested in a large margin of profit by exploiting the cheap labour. Only recently, some interest has been shown by the authorities who have tried to provide some sort of shelter for the workers. With exception of very few cases there has been no improvement. It is extremely difficult to give a clear picture to a foreigner of the deplorable condition of the slums and tenement houses. Extracts from various reports on India's housing conditions may throw some light on the situation. Dr. Barnes, a lady doctor, appointed by the Government of Bombay writes, "In one room on the second floor of a 'Chawl' (block of flats) measuring 15' by 12', I found six families living. Six separate ovens proved this state-

statement. On enquiry, I ascertained that actual number of adults and children living in that room was thirty. Bamboos hung from the ceiling, over which at night clothes and sackings were flung, to partition each family allotment. Three out of six women were shortly expecting to be delivered. All the three said they would have the deliveries in Bombay. When I questioned the nurse who accompanied me, as to how she would arrange for privacy in this room, I was shown a small space 4' by 6', which is usually screened off for the purpose." There are many such examples. In Bombay about a quarter of the population live under conditions where in 6 to 9 persons occupy one room no bigger 10' by 12'. The streets of many cities are used for sleeping purposes during the night. Most of the tenement houses are single row houses or block flats built either of brick or mud. The space between two rows of houses is about 30 to 35 feet wide. This is the living, cooking and playing space for the occupants. The rooms are very badly lighted and ventilated, and, on the top of this, cooking is done in these rooms during the winter and rainy seasons. The drainage and sanitation problems have never been solved. Private toilets and bathrooms are unknown. Sometimes one public toilet serves more the fifty peoples. One report says, "Women residing in the slum area have to go out of their houses an hour or two before sunrise and go to some coconut plantation or an open space or an open drain because

of the lack of toilets." In most cases only a few taps are provided for bathing and washing purposes in the open, the space arround the basin may or may not be cemented or paved. The drainage problem in almost all the Busties(slums) is an immense one, particularly in cities where the rainfall is heavy. About 90% of the Busties are on low-lying lands without proper drainage. Filthy open drains are very common. In fact, after a heavy down-pour, water rushes from the road into many of these slums, and the whole area becomes a knee-deep swamp.

Health And Moral Life

From the above paragraphs some idea of the appalling living conditions of the Indian worker is obtained, and it is not difficult to visualize the effects of such conditions on health and moral life. The wretched housing condition in large industrial cities has caused an alarming disparity in the sex ratio. In about 90% of the cases the worker cannot bring his family because of lack of accomodation and high rent, not to mention the filthy condition of the Busties. The census report of Bengal for 1931 shows that the proportion of females to males was 420 to 1,000, and there were 17,000 registered prostitutes.(the population of Calcutta was little over 1,500,000). The overworked and underpaid workers find the liquor shops and brothels the only places of relaxation and recreation. The alarming

growth of prostitution in Calcutta and Bombay has caused a great anxiety to the authorities, but no step has been for improvement. Venereal diseases are prevalent among the factory workers, and there are no facilities for medical advice or care.

Other evil effects of bad housing conditions are infant mortality, tuberculosis and epidemic diseases.

What can be the fate of a child born in such a dingy cell? Without going into the details on child mortality, the census report of 1931 shows the compative infant mortality per 1,000 births in Indian cities and western cities:

Cities	1921	1925	1926	1927
Calcutta	330	326	372	340
Bombay	667	450	389	316
Madras	282	279	282	288
London	81	66	64	59
New York	71	64	68	56
Paris	95	89	--	86

It cannot be denied that there are other causes at the root of this appalling child mortality. The poverty and ignorance of the people, the 'Purdah' system which compels the women to resort to the inner most apartment from which air and sunshine are completely shut out, and, above all, ignorant and inefficient midwifery, all combine to aggravate the

evil. But there can be no doubt that congestion coupled with unhygienic and filthy surroundings, is the reason for this high motality.

The death-rate from tuberculosis in Indian industrial cities and towns is much higher than in any other cities and towns any where else in the world. The census report shows that two thirds of the victims of tuberculosis are women, who have to spend all their lives in those illventilated, dark, dingy holes, and get very little oportunity to breathe fresh air.

Epidemic diseases cannot be attributed only to the city life. Indian villages are also in constant danger. Cholera and small-pox are quite frequent and levy a high toll on the lives of the urban and rural folks.

Wages And Rent

The wage of the Indian labourer is unbelievably low. As has been pointed out before that it is the superfluous population in the villages, economically most backward, that migrate as an army to the urban areas in search of work. Being without any means to support himself in the city, the poor farmer accepts any wage offered to him. It is quite difficult to make any generalization in regards to wages (which no one pretends is anywhere near a living wage), because of the wide variation in the rates and

methods of payment in different parts of the country and in various industries. The following table gives an average wage scale:

Type of labour	Rupees/week	$/week°
Unskilled	5 to 6	1.60 to 1.92
Skilled	6 to 20	1.92 to 6.40

° according to the present rate of exchange Re. 1=32 cents.

Where there is no housing provided by the employer, or the government subsidies, the worker has to spend 25 to 30 % of his meagre income for a dark, illventilated room hardly over 8' by 10', if he is lucky enough to get one at all. Even the rent for a single room,12' by 15', in tenement flats (usually back to back, and three storied) built by government subsidies or Improvement Trusts, is excessively high, varing from 2 to 4 rupees per week. Thus the lack of accomodation and high rent compel the workers to crowd into a a single room.

The earnings, left, after paying the room rent, are spent mainly for food and clothig. Then there is the demand of the money-lender, which must be met under any circumtances. Drinks and drugs are a big item in the budget of a great majority of the workers. Amusements take the form of occasional visits to cinemas or festivals, but comparatively

few can afford to go. A large percentage of the workers have to send part of their income home to support their own families or near relatives.

Education And Community Life

The main reason for India's illiterate masses is due to the poverty of the people and the absence of a benevolent government. In most of the industrial areas there are no schools for the children of the workers. Only in a few cases an attempt at community life has been made for the workers.

Now the question is, __ how the living condition of the industrial worker can be improved so that he can live a healthy human life.

THE PROGRAM

The existing housing condition for the industrial worker all over India has been stated in the introduction. The need for planned housing projects is apparent and vital through the country. Although recently the Indian Government, the Improvement Trusts and the industrialists have shown a little interest in the housing problem of the workers, and a few housing committees have been formed in some large industrial cities, but unfotunately no solutuion, particularly from the architectural point of view , has been satisfactory.

The purpose of this thesis is to design and develop dwelling units,for the low income industrial workers, which will provide a healthy standard of living, and at same time be economical and suitable for the climate. Because of the present war-time condition the author has been unable to procure adequate datas for any definite housing project or location, as no information about the factories of India is given out. Under such limitations it will not be possible to go into the details of site or community planning. Being familiar with the industrial areas around Calcutta, the author proposes to base his design on the living habits of the people, climatic condition and the building materials available in that locality. But attempt will be made so that the same dwelling units could be adopted anywhere in the country with slight alteration.

Before taking up the actual design problem of the dwelling units, we must consider a few points ___ should India follow the mechanized living standard of the western world? how much the living condition of the working people can be raised in near future without encountering much difficulty? Answers to these questions are very difficult, and beyond the scope of this thesis, but some sort of assumption should be made for a rational solution of the design problem.

At present India is undergoing a revolutionary change. For the last two hundred years India's progress in every phase has been at a standstill, and she has practically lost her past culture and civilization. During the same period the Industrial Revolution brought prosperity and healthy life to western countries, while India fell a victim to the evil effects of the machine-age under an imperialist government, instead of getting a chance to take advantage of the machine and the modern industries of the west. The superficial influence of western civilization and modern industries has left the country in an utter chaotic condition -- economically, culturally and psycologically. The development of trade and industry has almost entirely changed the face of the towns and cities, while there are rural districts which are almost untouched by modern life. In cities like Calcutta and Bombay one find all the con-

veniences of modern life, sections of down town districts in these cities be mistaken for some western cities, while in the other sections one will find bullock carts and mud huts. Life in Indian cities, as in all other eastern cities, is partly oriental and partly occidental. Among the city dwellers there is a great tendency to adopt the western mode of life, that is to accept and recognize the conveniences offered by technological advancement. Now a days only a few well-to-do educated people are concious of the improved living conditions, and some are fortunate to afford the modern luxuries. People in the western countries are led to believe that the masses in India are not amenable to any changes to better their living condition. They however fail to percieve that the deplorable living standard of the Indian masses is a reflection upon the foreign government. Human nature may be reluctant to any radical changes, but can it be believed that any nation will refuse to live like human beings!

Whatever the political future of India be, the change in theliving condition of the people is bound to come, it may take time. It is apparent that India, like any other country, cannot go back to the preindustrial era. She has to accept the challenge of the machine-age. A country with such an enormous natural resources is certain to be one of the leading industrial countries in the world. In Europe and America theindustrial advancement has entirely changed the structure of society and the habits of the people, and at present India is undergoing the same sort of change. It is

stucture of society and the habits of the people, and at the present time India is undergoing the same sort of change. It is absolutely impossible to have any notion of the trend and extent of the change, but it should be the endeavour of the Indian people to learn from the experiences and mistakes of the west and not to copy.

Now the problem is how to design a house for the peoplle whose mode of life is undergoing a change. Beside the importance of building materials and climatic conditions, the design of the dwelling units will be influenced by the social and economic condition of the community. Two important assumptions can be made as regards the structure of the community: first ___ an ideal industrial community formed after a social and economic revolution,

second __ a community which is gradually progressing towards a better standard of living condition.

In this thesis the second assumption has been made.

C L I M A T E

Calcutta, situated in the lower deltaic Bengal, is directly under the influence Monsoon which originates in the Indian Ocean and sweeps across the Bay of Bengal. In general the weather for the delta district is rather humid, and while there is a wet and dry season, this district doesnot suffer from the extremes of either. The average yearly rainfall is about 75 inches, distributed as indicated in the rainfall graph. During the monsoon season four to five inches of rainfall in a twentyfour hour period is quite common. The average temperature is not very high, and the extremes of the temperature are best explained by the graph. The total variation is between the limits of 50° and 105° F. The prevailing winds in this district are very mild, and are generally from the south-east or south-west during the day time, and from the north-east or north-west during the night with definite lull at dawn and at dusk.

Monsoon usually sets in the month of June with heavy shower and high wind. Many cyclones originate in the Bay of Bengal at this time of the year, and few of these travel up to Calcutta with a wind velocity of 70 M.P.H. The average humidity during the rainy season is usually between 83% and 90%. Some of the driest and hottest weather occurs just before the heaviest rainfalls when the sun is perpendicularly overhead.

T O P O G R A P H Y

The land on the Delta is the typical delta type, very flat and criss-crossed with hundreds of rivers and streams. There is a very gradual rise in the land away from the sea, about 50' in a hundred miles. The Delta is exceptionally large and is bounded by two large rivers, and in the rainy season these rivers are likely to rise a considerable amount, due to heavy rain and melting of snow in the Himalayas, The entire deltaic region is danger flood during monsoon. As the delta has been formed by the gradual deposit of silt brought down by the mighty rivers the soil is very soft. In one case test boring failed locate any trace of rock for nearly 1300'. Geological survey shows that many rivers have changed their courses slightly within the last few centuries.

In bengal and districts around Calctta the land is richly covered with tropical trees and vegetations. Mango, coco-nut and banana trees are very common. There are numerous natural ponds and tanks in the low-lying areas, and these sometimes overflooded during monsoon.

This region is outside the earthquake belt, but occasion-al earth tremmors are not unknown.

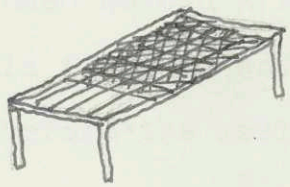
Insects

Like most of the tropical countries this district is not free from insects. Mosquitos, moths, ants and termites are the chief source of trouble.

W O R K E R' S L I F E

It has already been pointed out that at the present time the industrial worker in India comes from the village, and is extremely poor and totally illiterate. He comes to the city with practiaclly no personal belongings, sometimes with just one Dhoti(a white loin cloth) and a blanket. When he gets a job and lives in the city for sometime, he gradually acquires a few more articles absolutely necessary for city life. Usually he will have a couple of Dhoties, a couple of Punjabies or shirts, a coat and a pair of shoes. He is sometimes tempted to buy a cheap wrist watch or fountain pen. He does his own laundry and does not bother about ironing or pressing, but he usually sends a pair of Dhoti and shirt to the laundry and he keeps these for special occasion.

He sleeps either on a hard wooden bedstead,sort of low dining table, or on a Charpai - a bedstead of wooden framehaving seat of weaved rope- without any thick mattress. Just a couple of blankets, a bed sheet and a pillow go to furnish his bed. The Charpai is quite comfortable, the gives a nice springing action. It is very cheap and can be carried from one place to another quite easily. During hot summer nights when sleeping



outdoors becomes necessary , the Charpai comes very handy. Where the worker cannot afford a Charpai he sleeps on the hard floor either on a mat or a blanket.

The worker cannot afford to have rich or even healthy food. He is always under nourished and half-starved. His food is very simple. In the morning he gets up at 5:30 and has Muri (a kind of rice krispies) with a glass of water for his breakfast. Once in a while he can afford milk or mollaces. If he is married and lives with his wife, he takes his lunch to work. The lunch consists of Chapati(a kind of home made bread) or steamed rice and one vegetable or pea soup. His dinner at night is equally simple. Milk,meat and fish are considered as luxuries. The kitcken, if there any at all,,is very simple. There is usually a wood or coke burning stove either portable or built of brick and plastered with mud. The worker will have very few pots and pans for cooking, practically has no china and silver. He usually sits on the floor on a mat and eats with his fingers.. Even when he can afford a table and a chair he will always use his fingers, and will have to wash his hands twice, once before the meal once after the meal.

Ice box and refrigerator is unknown to him, and he does not need them. He buys fresh vegetables every evening on his way back from work. He may buy fresh meat or fish once or twice a week, and there is no need for storage. The only storage space he needs is for rice, flour, sugar,

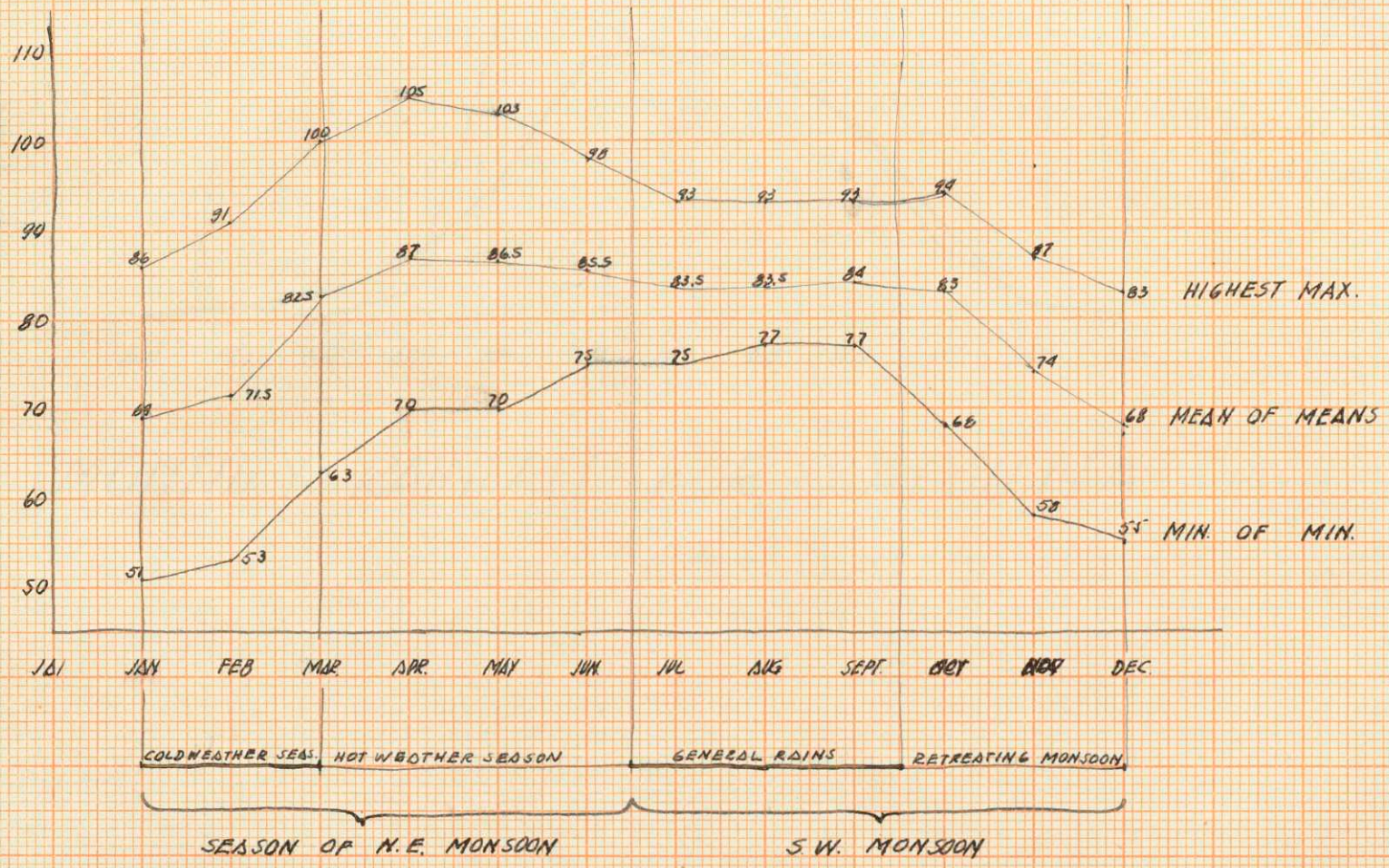
spieces and other few dry food stuff that can afford. These food stuffs are usually stored in earthen ware pots. His cooking pots and pans are sometimes of baked clay, dishes are of bell metal. As there is no hot water, ash from the oven is used for removing grease from the utensils.

The worker ~~is~~ sometimes smokes Biri or cigarettes. Most of the times he is extremely fond of chewing beetle leaf, a very nasty habit. It makes the teeth red and causes frequent spitting.

Indians as a rule are fond of bathing or swiming. In villages people usually bathe in the river or pond, but in an industrial slums a worker finds it extremely difficult to keep himself clean, because of lack of water supply. In some areas introduction of showers have been a tremendous success, people just love it.

It has already been pointed out that the lack of any organized recreation facilities is one of the causes of poor health and bad moral conditions. A bachelor or one not living with his family spends the evenings gossiping, gambling, drinking or by going to the movies and brothels. A married man spends his evenings with his wife and children.

In families with no children it is customary for both husband and wife to work.



MONTHLY TEMPERATURES FOR CALCUTTA

Actual rainfall for year 1938

Normal rainfall (average

NORMAL YEAR RAIN FALL : 74.74 in

ACTUAL RAINFALL YEAR 1938 : 82.73.

MONTHLY RAINFALL FOR CALCUTTA

THE FAMILY SIZE

According to the census report of 1931 the average family in India consists of 5.5 persons. In this thesis the maximum size of a family has been assumed as 5. As in most families of the income group under consideration, the daughters get married at the age of 16 and 17, and the sons go out to work at the same age, it is very unlikely that a family will have more than three children living with the parents. Moreover with the spread of education and increasing economic pressure the size of the is gradually decreasing.

Social and Religious Differences

In planning an entire community, the social and religious differences may play an important part, but they will have no influence on the design of dwelling units. The living habit of the different religious groups are exactly similar, and it is not necessary to discuss the religious practices of the various communities.

T H E S O L U T I O N

Three types of dwelling units have been considered in this thesis:

1. Unit for families with three children.
2. Unit for families without children.
3. Unit for bachelors.

In the design of the units particular stress was laid on the following points:

a. Privacy
b. Spaciousness
c. Light and Ventilation
d. Sanitation
e. Orientation
f. Economy of structure
g. Economy of maintanance
h. Suitability to climatic conditions
i. Esthetic

ANALYSIS OF DESIGN

Type No. 1.

Every human being aspires for a home of his own where he can live with complete freedom and privacy, and it should be the endeavour of every housing project to satisfy such an aspiration.

After studing the minimum needs of a family with three children, a dwelling unit with

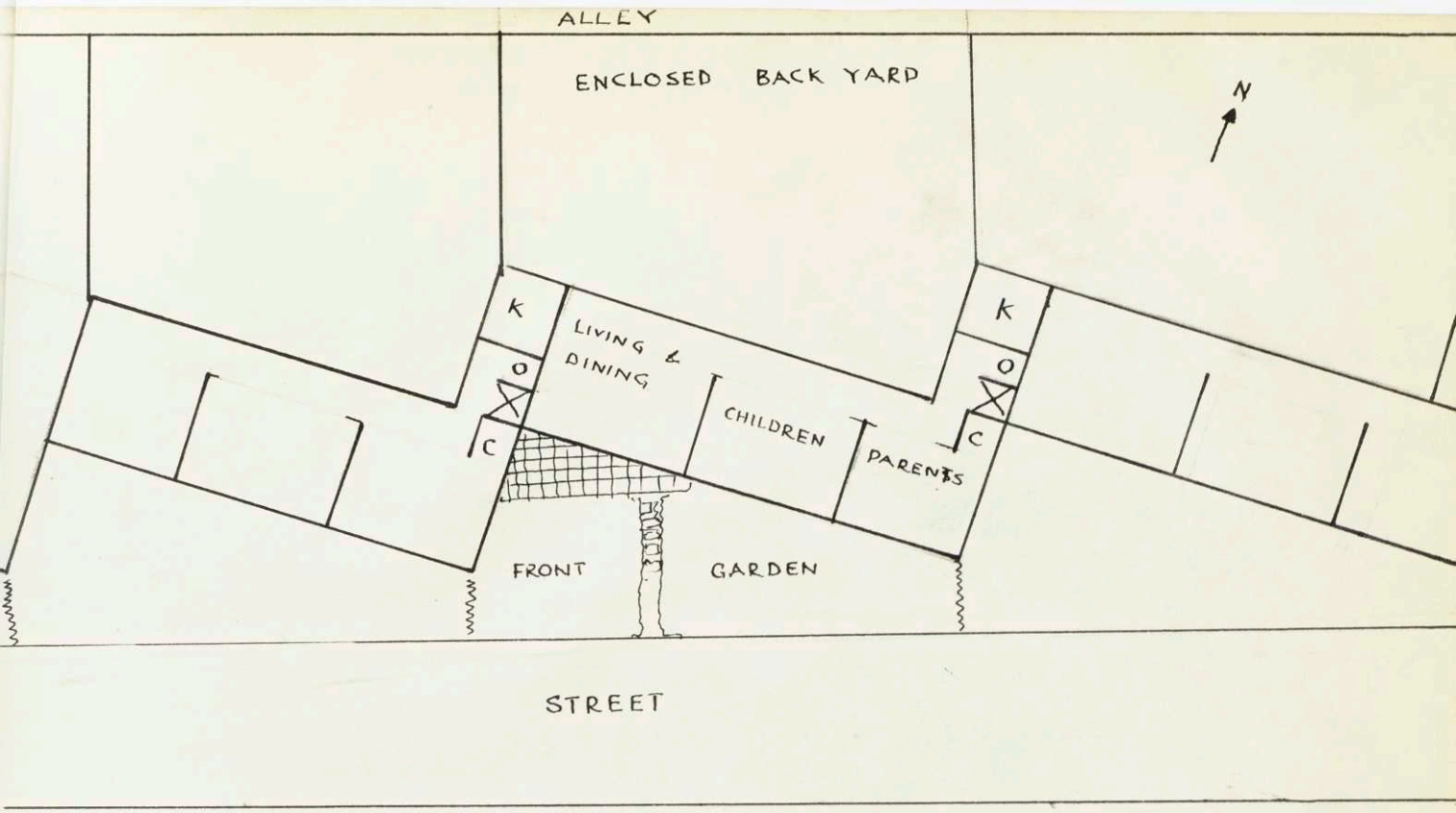
2 bed rooms
1 living room
1 shower
1 w.c.
kitchen
small front garden
and an enclosed back yard

is chosen. There are several possibilities in arranging the units, such as

1. two storied detached house
2. two storied row house
3. single storied detached house
4. single storied row house

From the point of economy of land and construction the single story row house system has been thought desirable. Had there been the problem of heating the two storied row house system would be suitable.

In tropical climate cross ventilation in the rooms is of extreme importance, and for that reason the rooms have been arranged in a row.



Instead of joining the units into an unbroken straight block, each unit has been set back as shown in the sketch. This arrangement is chosen for several reasons: it gives more seclusion and privacy of the garden, gives extra window space in one the bed rooms, solves the bath room and kitchen problem nicely, and finally breaks the monotony of a long block. Four to six such units should be joined together. The front garden is mainly a flower garden, but the small area in front of the living room may be used for sitting purposes, The enclosed back yard will be used for sleeping outdoors during the summer, and also for drying laundry and growing vegetables. This kind of enclosed court yard is typical of Indian houses. The walls should be more than 6' high for complete privacy. The alley at the back is ment for municipal service trucks. The areas of the front garden and back will depend on the land available, but thedistance between two row of houses

Should never be less than 60'.

Bed Rooms. The master bed room is about 12' sq. has a built-in closet. The window opening into the neighbour's garden is a high one. This room is adjacent to the bath room. The children's room is about 15' by 12'. There will be one bed and one double bunk, two closets has been provided. the middle space will be used for playing and studying. In case of grown up children of different sex living in the same room, screen can be hung for privacy.

Living Room. This room is about 15' by 16'.It serves as the dining and living area. The room opens both to the garden and yard. The furniture in this room willbe very simple, one small dining table and chairs.

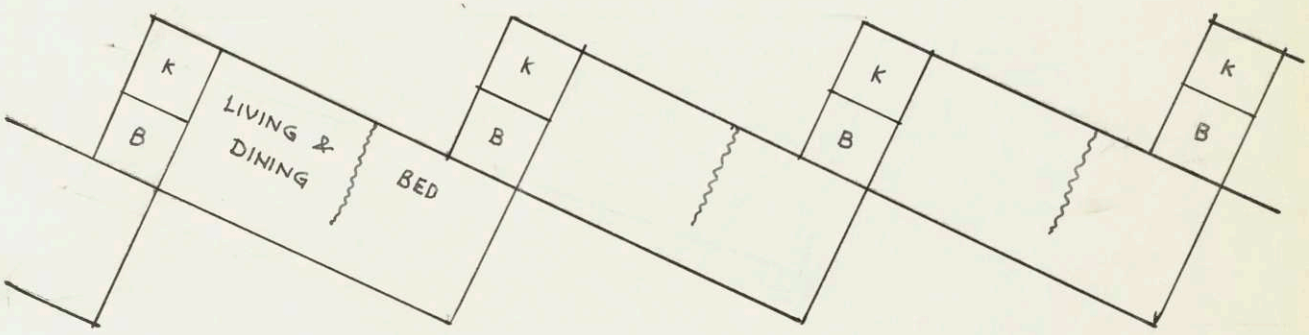
Kitchen The kitchen is adjacent to the living and is little over 55sq. ft. There will a coke burning stove built of brick. This stove may be removed when gas or electric stove will be cheaper. A sink made of precast cement is provided, and there is a working table and a built in shelf. A chimney and a large window will carry away the smoke and smell of the spieces.

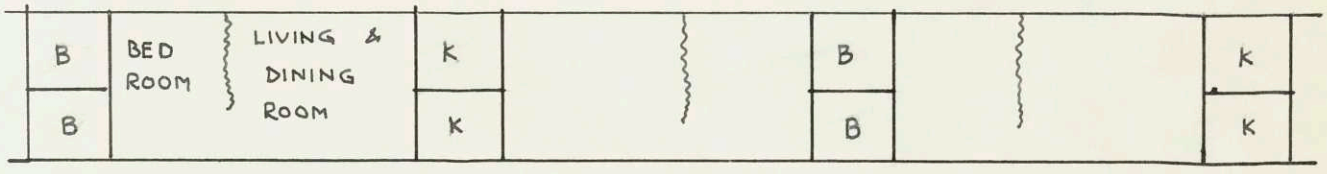
Bath Room the shower and water closet are separated by partition. The bath room is reached from all the rooms through a corridor, one side of which is practically open. Laundry is a paved area just behind the neighbour's kitchen.

Type No. 2. Unit for couples without children

In this type two kinds of plan has been suggested. One is the same as in the previous case but with only one bed room and a smaller living room. The partition between the bed and living room is removable.

In the other plan the units are joined in the conventional straight line method. The bath room and kitchen arrangement is slightly changed in this design. There is no great advantage in this plan except that it may be a little cheaper and will give variety in the housing layout.





Type No.3. Unit for bachelors

For the bachelors dormitory type plan is suggested. Each unit will consist 8 to 12 single bed rooms with common bath room and kitchen, and a common living and dining room. The number beds per units is kept low for better messing arrangement and social life. Food willbe prepared by different members every day and the dishes will be done in the same way.

A two storied scheme is chosen for this type of unit. All the bed rooms are on the second floor, arranged in a sngle row for cross ventilation. There is a running verandah in front of the rooms will be usedas a sleeping porch in hot weather.

The bath room, kitchen, living and dining rooms are on the first floor. Thereis a laundry space near the shower room. There will be a gang shower room and separate toilets. A few lavatories are in the second floor verandah.

Each unit will have a small front garden and a small back laundry yard. The arrangement of the units will depend on the land available and topography. Two to three units together is desireble.

S T R U C T U R E

Locally the only building materials available are red brick clay, bamboo and wood. Steel and cement are also very popular. The timber value of the tropical forests is not very great because the variety of species is so great that frequently there may be only one tree of a type to the square mile, and even the quality of the brands varies so much that the only use for the tropical forests is for firewood. The .sal tree is one of the better woods found locally. Teak is also used but it is quite expensive.

Now a days brick, steel and cement are extensively used in Calcutta. Buildings of brick wall and concrete floor have proved to be reasonably cheap and suitable for the climate.

For the above reasons brick is considered the most suitable for the dwelling units.
Exterior walls is to be of first class brick with cement mortar. The outside joints should be made water proof.
The partition walls is to be either of brick on-edge or cinder blocks and plastered. The walls inside the rooms is to be painted with washable paint.
The floor and the roof is to be of reinforced concrete, roof should be insulated with tar and gravel. Precast concrete beam is used in the roof.
Basement in this region is not desirable because of heavy rainfall and dampness. The plinth is made 2' high.

Doors and Window.

All the door and window frames are of Sal wood. The inside doors are of plywood with Sal wood frames. The windows in the bed rooms have glass at the top and venetian shutter at the lower portion. The windows are protected from sun and rain by over hangs.

Plumbing Fixtures

All the plumbing fixtures provided are made in India. Bath rooms and kitchens are coupled together for economy of plumbing. Pipes for roof drainage are taken through the bath rooms. There is no hot water or heating system, as they not necessary in such a climate.

Electical wiring

All the units are to fitted with electrical wiring. Care should be taken for thorough insulation from damp. Though most of the electrical gagets were used to be imported before the cost of instalation was quite cheap. The Kilo Watt Hour unit in Calcutta is only about 5cents.

Sewage

As all the cities have efficient sewage system, it has been assumed that any new developed area should be provided with modern sewage system.

E C O N O M I C

Prewar prices of building materials[1]

Brick(1st class)	Rs. 20	Per 1,000
Timber (teak)	Rs. 3	Per C.ft.
" (sal)	Rs. 2/4	Per C.ft.
Cement	Rs. 3/8	Per Cwt.
Steel(for construction)	Rs. 6	Per Cwt.

[1] supplied by Indian Government Trade Commissioner in New York.

Cost of construction

Brickwork (material and construction)	Rs. 30	Per 100 C.ft.
Reinforced Concrete (ditto)	Rs. 55	Per 100 C.ft.
Pannel door 3'6". 6'6' (complete with frame)	Rs. 25	

These were the average cost in 1937.
As a rough estimation brick built single story.house with R.C. roof used to cost 4 to 5 rupees per square ft. of covered area. This included cost of plumbing and electrical wiring.

Cost per Dwelling Unit.

Assumming Rs.5 the cost of construction per sq. ft. of covered area, a rough estimate of cost of each unit can be made.

Unit No.1	700 sq.ft	Rs. 3500
Unit No.2	450 sq.ft.	Rs. 2250

If these units are built with government subsidies or by the employers and housing authorities a rent of 10 and 6 rupees will bring an interest of 2%. If the cost of land is considered this profit will be slightly reduced, as the cost of land outside the cities is very low. Besides in the begining housing schemes should be run on a nonprofitable basis, otherwise the housing condition of the worker will never improve. It is exceedingly stupid to erect some sort of shelter, (with the sole purpose of large profit) which in no time turns into a blighted area.