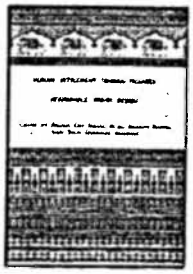
affordable urban design

1. Introduction

I. INTRODUCTION

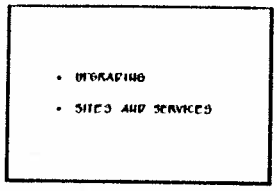


1 This presentation is part of a comprehensive set of training materials prepared through the cooperative efforts of the Vastu-Shilpa Foundation, Ahmedabad and the Centre for Minimum Cost Housing of McGill University, Montreal.

2 The slides that you are about to see present ideas and concepts for affordable urban design that have been recently implemented in a township plan in the city of Indore. This training material is intended to assist planners, engineers, and architects involved in designing new housing neighborhoods.

3 Until recently, efforts by government agencies to provide low-cost urban housing in India were aimed at supplying ready-built dwelling units. This approach has shown itself to be unsuitable for three reasons:

(1) It takes too long to build complete houses.
(2) The price of complete houses is too high for low income people.
(3) The number of units that can actually be built is insufficient due to the limited resources available.



4 As a result, public authorities have adopted two new approaches to housing: first, improving and upgrading existing slum areas, and second, providing serviced sites for new housing developments. Both strategies have been widely used throughout India.

5 Upgrading existing slums is one of the most cost effective ways to increase the housing stock. The provision of secure tenure encourages householders to improve their own homes.

6 Nevertheless, new sites for housing must also be opened up. The so-called sites and services approach provides subdivided plots, and an infrastructure network; the actual construction of the dwelling is left to the owners.

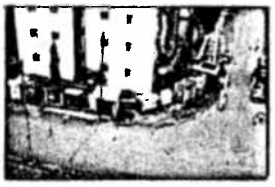
7 Although planning a sites and services project implies primarily plot subdivision and infrastructure layout, these purely technical decisions have an important effect on the success or failure of the final physical environment.

8 In this sites and services project, the design of the public spaces leaves much to be desired. Large open spaces have remained empty, which represents a waste of land, and a lost opportunity for effective planning.

9 Even small spaces, if they are not integrated into housing neighborhoods, will be isolated and unused.

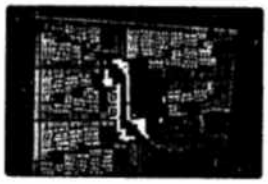
10 Gridiron street layouts produce a monotonous environment that lacks a clear and comprehensible structure. They do not encourage a wide range of rich and supportive human activities.

11 Housing planned as rows or blocks, rather than as groups or clusters, reduces the sense of identity and belonging of the inhabitants.



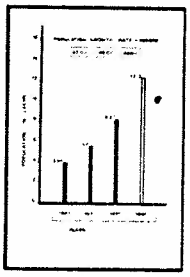
12 If provision is not made for small shops and stalls within housing areas, these activities will invade street spaces in a disruptive manner.

13 The location of the service core on a plot is an important decision. In this example, the toilet cores were placed next to the front entrance of the house, which is a wasteful use of street frontage, and does not accord with local tradition.



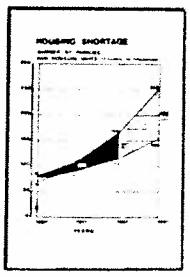
14 The Aranya township plan, designed by the Vastu-Shilpa Foundation, is an example of an attempt to overcome some of these problems within realistic economic constraints. It demonstrates that effective planning and reduced costs are not exclusive, but indeed go hand in hand.

15 The new township is located in the city of Indore, an important manufacturing centre. Over the years, the establishment of many industries has attracted workers to Indore, not only from the surrounding rural areas, but also from the neighboring states.



16 Indore registered a population growth of over forty percent during the decades of 1961-71 and 1971-81. According to the 1981 census, the population of Indore was 827,000; assuming the same growth rate, it could reach over one million by the year 1991.

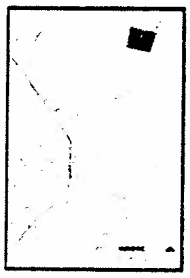
17 The municipal authorities have been unable to cope with the rapidly growing need for housing and related infrastructure. This has increased pressure on the housing stock in the central areas of the city which is old and needs immediate repair.



18 Housing shortages are staggering. During the decade of 1971-81, housing production by both public and private agencies was about 25,000 houses, compared to a new demand for over 50,000 new dwellings.

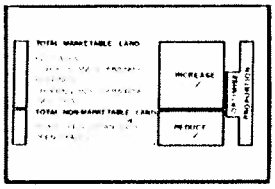
19 This rapidly growing housing deficit has led to increasing numbers of slums and squatter settlements. The number of households living in slums according to a recent estimate is 60,000. Many of these are in low-lying areas along the river banks, and prone to flooding during monsoon.

20 Such a large problem requires large initiatives. The Aranya township is planned as an integrated development for a population of over 65,000 persons.



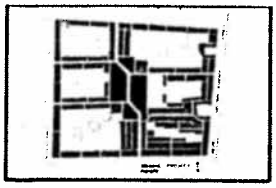
21 A large plot of land, about 1 km square, was acquired by the Indore Development Authority on the Agra-Bombay national highway six kilometers north of the city centre.

22 The site is suitable in terms of transportation linkages. Existing suburban growth has reached the southern boundary of the site, and pockets of light industries have sprung up along the highway; both provide employment opportunities.



23 Marketable land is defined as income-generating property such as individual plots and commercial sites; non-marketable land is made up of spaces such as roads and open spaces. In the Aranya township, the proportion of marketable to non-marketable land is high, in order to keep the recurring expenditure of maintaining public spaces to a minimum.

24 Although 60 percent of the plots are reserved for the Economically Weaker Section the balance is made available to more prosperous buyers. The mix of several different income categories is based on existing income distribution in the city of Indore. This is a departure from conventional housing projects in which only one or two types of income categories are combined.



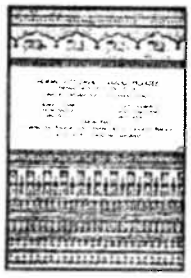
25 There are economic as well as social advantages to combining different income groups. The cost reduction of plots sold to Economically Weaker Section buyers is offset by surplus generated from the market price charged for higher income plots and commercial sites.

26 The slide presentations that you are about to see are a detailed description of the design of the Aranya township and are divided into two parts:

1. Site Planning, and
2. Infrastructure Design.

27 The section on Site Planning describes the design principles that were adopted, and how these affected the planning process.

28 The section on Infrastructure Design explains in detail how significant cost reductions were achieved in road design, sewerage and water layout, site drainage, and electrical networks.



29 This training package has been prepared with the support of the Canadian International Development Agency. For further information please contact the Vastu-Shilpa Foundation, Ahmedabad, or the Centre for Minimum Cost Housing, McGill University, Montreal.

LAND DISTRIBUTION
ARANYA AREA DEVELOPMENT PROJECT, INDORE

Particulars		Area Hectares		Percentages
Net Planning Area		86.24		100.00
Marketable				
Plot Area		50.17		58.17
Shopping				
1) Commercial Centre	1.68		1.95	
2) Shopping (main roads)	0.58	2.80	0.67	3.25
3) Internal Shopping 1/2 double slots	0.54		0.63	
Industrial		0.14		0.16
School and Community		5.81		6.74
Non-Marketable				
Road Area		20.29		23.52
Open Spaces				
1) Public area	5.89		6.83	
2) Single service slots	0.65	7.03	0.76	8.16
3) 1/2 double service slots	0.49		0.57	
Overall Land Distribution				
Total Marketable		58.92		68.32
Total Non-Marketable		27.32		31.68

NUMBER OF PLOTS IN EACH INCOME CATEGORY
ARANYA AREA DEVELOPMENT PROJECT, INDORE

Income Category	Number of Plots	Monthly Income (Rupees/month)	Percent of Plots	Plot area m2
EWS I,II,III	4,262	350	65.1	35
LIG II,III	799	450	12.2	55
LIG I	296	600	4.5	92
MIG II	626	1,100	9.5	139
MIG I	265	1,800	4.0	223
HIG II	180		2.7	325
HIG I	75		1.1	474
Flats	40		0.6	
Total	6,543			

affordable urban design

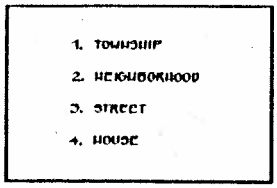
2. Site Planning

II. SITE PLANNING

1 This presentation is part of a comprehensive set of training materials prepared through the cooperative efforts of the Vastu-Shilpa Foundation, Ahmedabad and the Centre for Minimum Cost Housing of McGill University, Montreal.

2 This series of slides describes site planning concepts used in the design of the Aranya township in Indore.

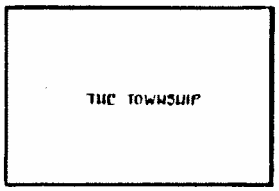
3 Special efforts were made by the architects, planners and engineers of this project to develop a physical environment that represented an appropriate response to the way of life of the urban poor.



4 The township was planned at four levels, each related to a different physical scale:

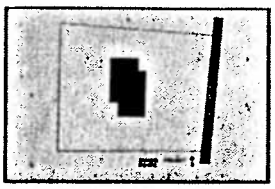
1 The Township
2 The Neighborhood
3 The Street, and
4 The House

Now, let us see how the design concepts are incorporated in the design of the Aranya township.

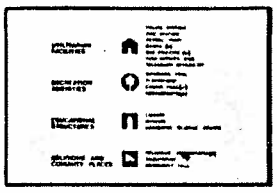


5 PLANNING THE TOWNSHIP

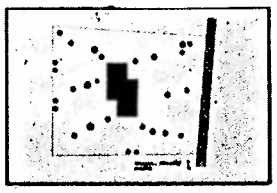
6 For a community to function as a cohesive unit, it is necessary that there be a major activity area similar to a town centre in a city.



7 In the Aranya township, an area for commercial, community and recreational activities is located at the centre of the project.

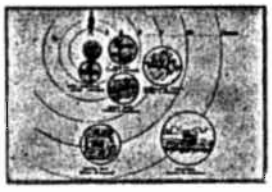


8 The public amenities in this central area include: utilitarian facilities such as post offices and bus stations; recreational amenities that include playground and cinema halls; educational structures; and other community places such as religious institutions.

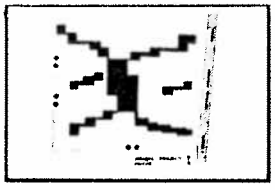


9 For a township with a projected population of about 65,000 persons it is not enough to concentrate all the facilities in one place; many facilities require to be located closer to neighborhoods. These decentralized facilities are indicated here by small red dots.

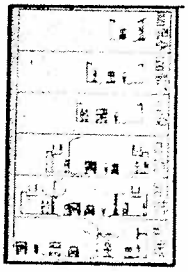
10 For their effective use these neighborhood facilities should be well integrated with other public amenities and with open spaces, and they should be linked by a pedestrian network, and be in close proximity to homes.



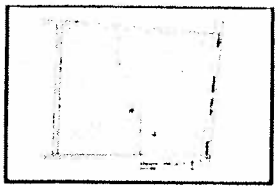
11 Accessibility in terms of walking distances from home is also used to locate other facilities in the township.
-work areas (under 1 minute)
-community squares with small shops (under 2 minutes)
-central shopping facilities (under 7 minutes)



12 Linked open spaces, shown in green, are combined with community and institutional facilities at all levels of the township, and are connected to the town centre.



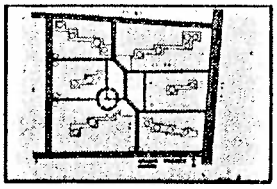
13 For the streets to become active and useful spaces, the road network should have its own well-defined hierarchy reflecting the intensity of use, the mode of transport, and the kind of activities that are performed along the edges.



14 The road network in the Aranya township follows an ordered hierarchy. The hierarchy of major roads is as follows:

-a 60 m wide national highway connecting the site with the city
-30 m wide peripheral roads, and
-a 15 m wide main shopping street with bus stops and car parking.

The main shopping street is staggered along its length to prevent vehicles from building up speed and to inhibit traffic on perimeter highways from taking short cuts through the site.

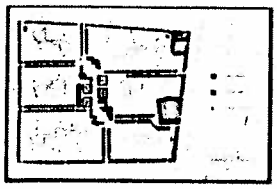


15 The next order of hierarchy consists of 12 m wide neighborhood roads and 9 m wide collector streets. The major traffic intersections between neighborhood roads and other streets are made safer by the use of T-junctions, instead of cross-roads.

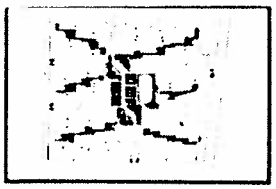
16 Commercial areas should be located where most pedestrian and bicycle traffic would occur. They should be planned as linear bazaar streets, typical of old cities, and not as isolated shopping centers. Such shopping streets have a higher commercial value and do not require additional infrastructure.

17 Land-use efficiency increases by combining various functions in the same space. Such mixed use also supports a way of life in which institutional, working and living activities are integrated.

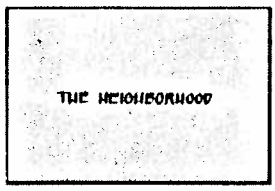
18 There should be a hierarchy of commercial areas coinciding with the street hierarchy. Major commercial activities occupy wider streets while informal shopping areas occur along narrow streets and open spaces throughout the settlement.



19 In the Aranya township, plots along the main shopping street and at major road intersections, coloured black, are for formal shops and offices. The hatched strips along edges of the neighborhood roads accommodate small shops. Kiosks and stalls for local shopping, are indicated by black dots, and are scattered throughout the settlement in small squares.

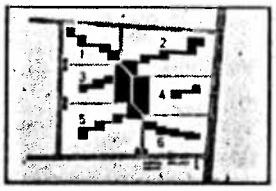


20 Neighborhood facilities in the township are located within the common green spaces which are joined together to form continuous pedestrian areas. School grounds are used as play areas, dispensaries and open markets combine or overlap and form part of the green space.



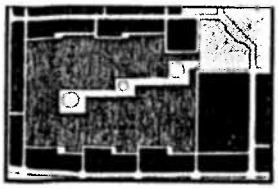
21 PLANNING THE NEIGHBORHOOD

22 Traditional Indian towns are a collection of self contained "villages," where people live, work, play and socialize within easy walking distance from one another. Similarly, the new township is planned as an agglomeration of several autonomous neighborhoods.



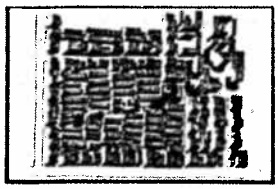
23 The township is divided into six neighborhoods. The size and organization of each neighborhood incorporates all the neighborhood facilities such as schools, medical centres, shops, workshops, and open spaces, as well as housing plots in sufficient numbers and varied sizes to sustain community life.

24 At the neighborhood level there must be a good economic mix of various income groups; this fosters mutual interdependence.

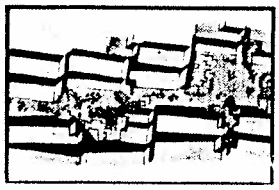


25 In the new township, housing for different income groups is arranged in concentric rings, however, care has been taken to avoid mixing of extremes. Only the groups with similar incomes are combined to prevent any social friction.

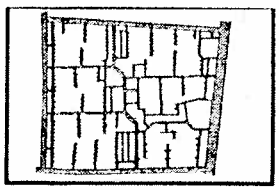
26 Low-rise, high-density development provides direct contact with land. This encourages social interaction and supports a way of life that is traditional among the poorer sections of society.



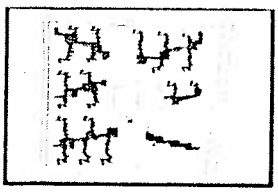
27 The high density of the Economically Weaker Section housing is relieved by the adjacent green spaces, which are everywhere accessible by pedestrian pathways.



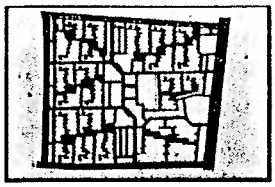
28 These type of green spaces encourage human activity and will be put to intensive use. They have a better chance of being maintained and self-policed against illegal encroachment and vandalism.



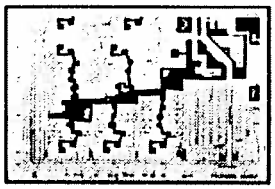
29 Using the formal street network, vehicular traffic in the township is directed outward to the perimeter roads.



30 At the same time, pedestrian traffic on walkways and green spaces flows in the opposite direction, independent of vehicular interference.

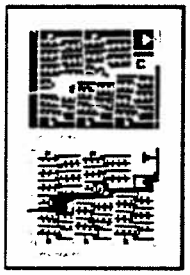


31 This achieves a clear and safe segregation of slow and fast moving traffic.



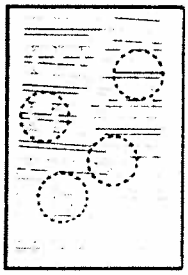
32 Pedestrian circulation along the green spaces connects all parts of the township to community facilities and to the main shopping street in the town centre.

33 PLANNING THE STREET



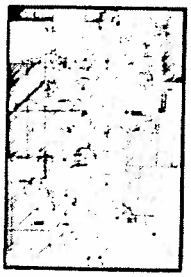
34 Non-rectilinear planning offers an alternative to the monotony of repetitive streets, and without higher costs. A less formal street layout, with varying widths and a range of open spaces, can accommodate a livelier mixture of human activities.

35 Like the mohallas and dead-end streets of traditional towns, small open spaces form groups of dwellings of manageable size and human scale.



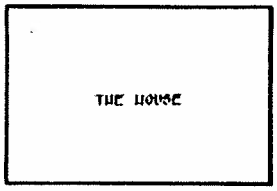
36 The plots are arranged to create short streets and around service slots, small squares and public open spaces. These spaces are connected by informal walkways.

37 Streets should maintain their own individual character and give a sense of identity and belonging to the inhabitants. Well designed streets also help to define territories and develop a feeling of community.

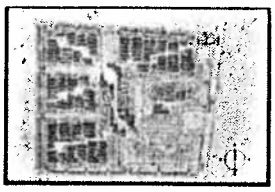


38 Spaces ranging from large public squares to small open areas offer places for commercial activities, festivities or just informal chats.

39 Groups of houses are formed around open Service Slots--land required for piped connections. This space promotes interaction among neighbors, and can accommodate a variety of income-generating activities such as workshops, small cottage industry, or hawker stalls.

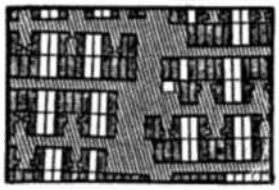


40 PLANNING THE HOUSE



41 Plots are oriented north-south and arranged as row-houses so that a minimum of incident solar radiation will be absorbed by the walls.

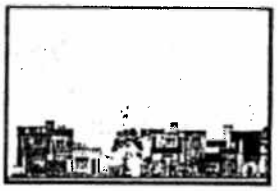
42 It is desirable to have more than one side of the house accessible from the street. This allows for more choice in locating doors and windows, producing better light and ventilation, and more convenient access if the house is subdivided for commercial purposes or for room rental.



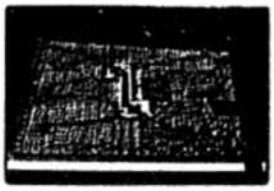
43 In Aranya more than 50% of plots shown in yellow can be entered from more than one side; this is achieved through short street lengths, and intermediate service slots.

44 Individual service cores are provided for each plot. These cores are located at the back of the plot, and economy is achieved by clustering groups of four.

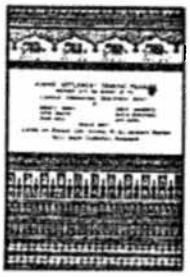
45 In sites and services projects owners usually design and build their own homes. Nevertheless, it is useful to develop plans that can assist builders in their work. In this suggested house plan, the veranda is followed by living area and a service core consisting of kitchen, toilet and a wash area.



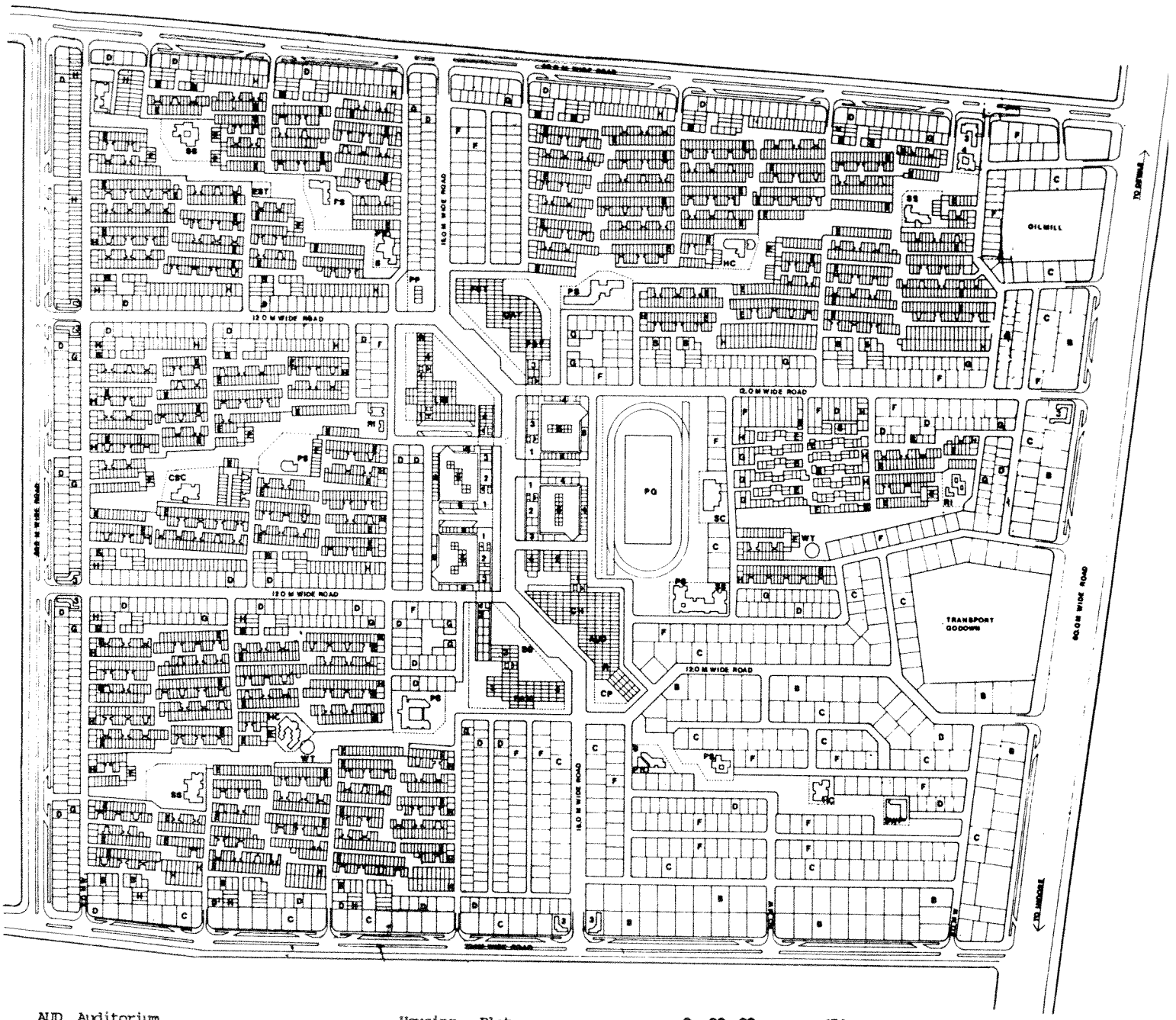
46 With variations in house extensions, platforms, entrances, staircases, verandas and balconies, each house can develop an individual character.



47 These planning concepts will ensure that the Aranya township will develop into a responsive environment that will foster a sense of community among its inhabitants.



48 This presentation has been prepared with the support of the Canadian International Development Agency. For further information please contact the Vastu-Shilpa Foundation, Ahmedabad or the Centre for Minimum Cost Housing, McGill University, Montreal.



AUD	Auditorium
B	Bank
BS	Bus Stop
CSC	Community Science Centre
CCU	Central Complex Unit
CH	Community Hall
CP	Car Parking
EST	Electrical Substation
FAM	Folk Art Museum
FST	Fire Station
HC	Health Centre
LIB	Library
OAT	Open Air Theatre
PG	Play Ground
PP	Petrol Pump
PS	Primary School
PST	Police Station
PTO	Post and Telegraph Office
R	Restaurant
RI	Religious Institution
SC	Sports Club
SS	Secondary School
SWP	Swimming Pool
WT	Water Tank & Children's Park

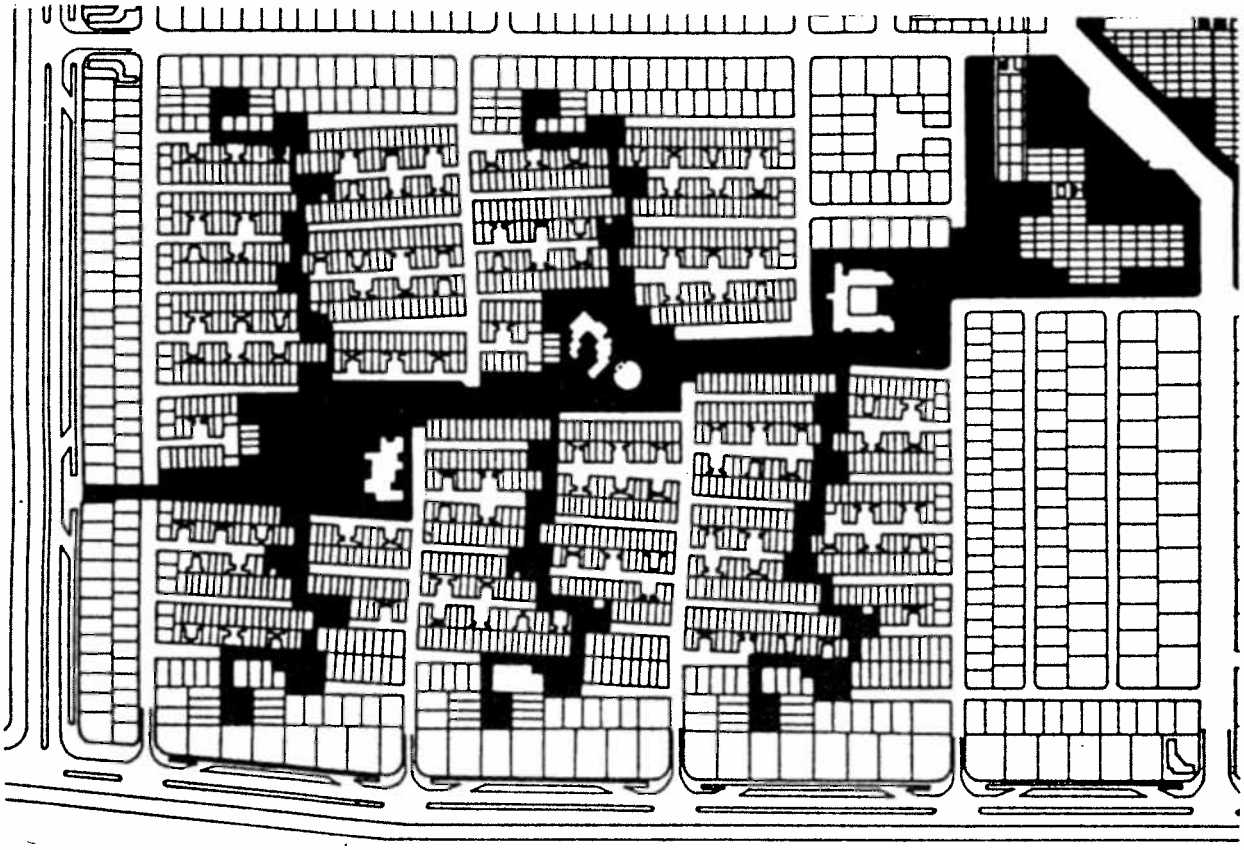
Housing Types	Plot Area M2
A	613
B	474
C	325
F	223
D	140
G	93
H	56
E	35

1	Apartments
2	Offices
3	Large Shops
4	Medium Shops
5	Hawker Stalls
6	Workshops

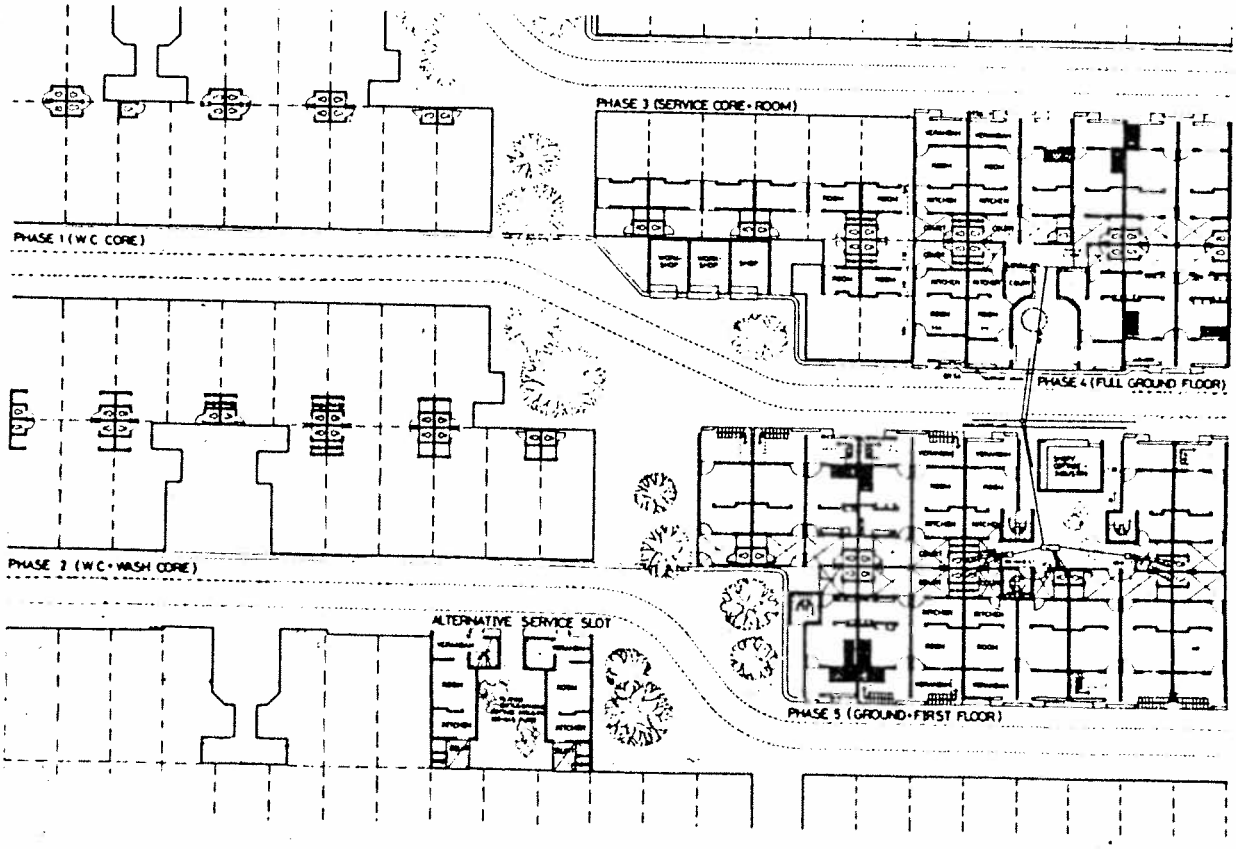
0 30 60 150m

ARANYA NAGAR : INDORE

TOWNSHIP LAY-OUT



THE NEIGHBOURHOOD



THE STREET

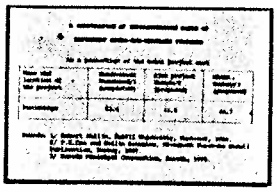
affordable urban design

3. Infrastructure Design

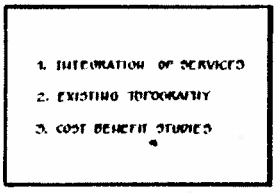
III. INFRASTRUCTURE DESIGN

1 This presentation is part of a comprehensive set of training materials prepared through the cooperative efforts of the Vastu-Shilpa Foundation, Ahmedabad and the Centre for Minimum Cost Housing of McGill University Montreal.

2 The series of slides that you are about to see describes the concepts that influenced the infrastructure design of a new township in Indore.

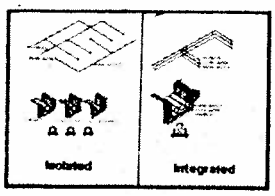


3 In previously completed sites and services projects in Ahmedabad, Baroda and Bombay, roads and utilities constituted nearly half of the total project cost. This is a prime area where efficient design can have a major impact on costs.



4 The Aranya township has achieved a 15 percent cost reduction through effective infrastructure design according to the three following principles:

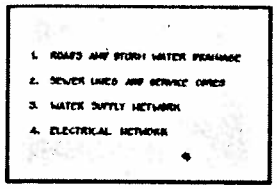
1. The integration of services,
2. The employment of existing topography, and
3. The use of long-term cost-benefit studies.



5 Instead of planning each infrastructure component in isolation, the engineers have taken care to integrate them whenever possible.

6 The existing topography of the site is a major determinant in planning roads, storm water drainage, sewer system and water supply network. The maximum use of gravity-flow reduces excavation and hence cost.

7 Several infrastructure layouts were studied before arriving at the final design. These alternatives were analyzed for their initial cost, maintenance costs, and adaptability to phased construction. The final choice was made on the basis of overall cost-benefits.

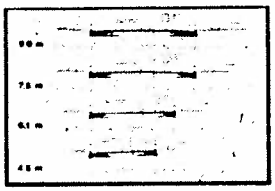


8 The infrastructure components include:

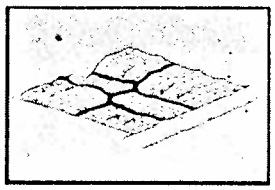
1. Roads and stormwater drainage
2. Sewer lines and service cores
3. Water supply network, and
4. Electrical network.

Let us look at them one by one.

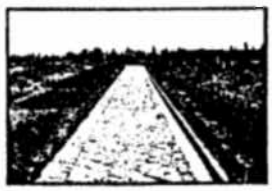
9 ROADS AND STORMWATER DRAINAGE



10 Each house is individually accessed from a road, however, based on volume and mode of traffic, roads follow an ordered hierarchy in terms of their widths and construction.



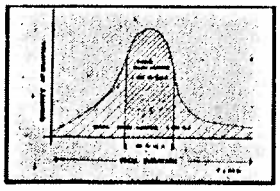
11 The road network follows the natural slopes of the site. This reduces cutting and filling costs, and facilitates gravity drainage of stormwater.



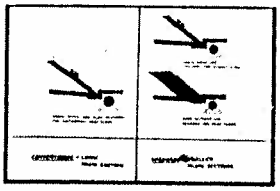
12 The 4.5 m wide streets in the Economically Weaker Section housing areas are the narrowest; they are not subject to heavy loads and are surfaced with sandstone pavers. Paving blocks are easily repaired and will adjust to any uneven settlement which may occur.

13 Roads wider than 4.5 m and intended for vehicular traffic are surfaced with asphalt.

14 Underground stormwater drains are provided for reasons of hygiene, to avoid maintenance of open ditches, and the traffic problems which could result because of flooding during monsoon.

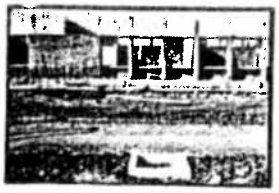


15 The data on rainfall in Indore showed that the peak fall, accounting for 50 to 90 percent of the total rainwater, lasts only a few minutes. A drainage network for these peak flows requires large and expensive pipes.

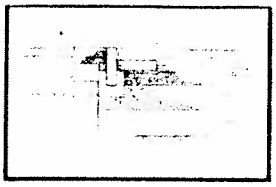


16 To reduce the size of pipes and decrease the cost of stormwater drainage, excess stormwater is allowed to overflow onto the roads until the peaks are reduced. By controlling these peak flows, the cost of the underground drains is reduced by almost 20 percent.

17 The narrowest streets do not have underground drains. These streets are designed as open troughs to drain water to the end of street where inlets to underground drains are provided. The water that accumulates on these streets is restricted by limiting their length.



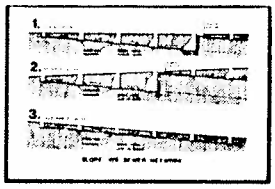
18 Manholes for stormwater are not circular but square, and are located with one side flush to the road curb.



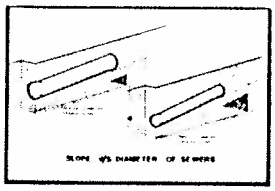
19 The provision of curbs reduces erosion and water logging of road sides as well as the washing of roadside soil onto the carriage way.

20 THE SEWER LINES

21 Underground sewer connections are provided to all the plots of the township. Economically Weaker Section housing is provided with a service core on the plot while higher income group plots will have an inspection chamber on the street from which house owners will make connections.



22 When sewers do not follow natural slopes, as in Diagrams 1 and 2, they require deep manholes as well as expensive pumping stations. The third diagram shows how the sewers in the Aranya township minimize excavation and avoid the need for pumping stations.

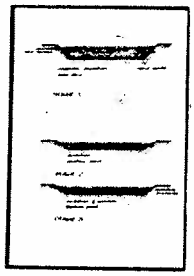


23 Sewer pipes with smaller diameters require greater slopes, and hence more excavation; larger diameter pipes require flatter slopes. The trade-off between slope and pipe diameter was analyzed with the help of computers; this produced the most cost-effective solution.

24 The reinforced concrete sewer pipes are designed without a supporting bed. This cost reduction is achieved by using flexible joints which can adapt to uneven settlement.

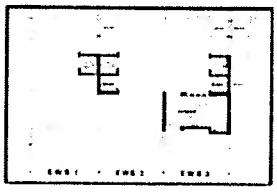
25 Manholes open onto the street and are subjected to heavy loads. Circular manholes, which can be built out of brick, have sufficient structural strength at considerably lower cost.

26 Oxidation ponds are used for the treatment of sewage for several reasons. Ponds require less investment in mechanical equipment, the maintenance cost is low, and they can be operated without expert technical skills. Taking into account the natural slopes and prevailing wind direction the ponds were located in the north west corner of the site.



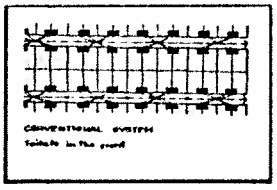
27 Oxidation ponds are organised in 3 consecutive stages.
-Stage 1 consists of a deep pool where sewerage is collected, allowed to settle, and is anaerobically digested.
-Stage 2 is a shallow pool that ensures penetration of sunlight to the bottom for oxidation of effluent from stage 1.
-Stage 3 is a pool which collects clear effluent from stage 2. It discharges into irrigation channels.

28 THE SERVICE CORES

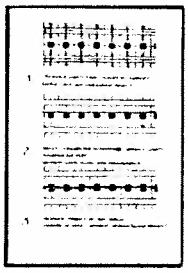


29 Service core are provided to each Economically Weaker Section plot. However, there are different types of service cores for different cost plots.

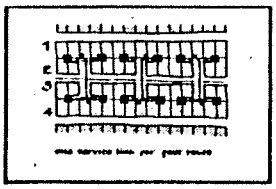
1) WC only - EWS I
2) WC + Wash Area - EWS II
3) WC + Wash Area + Kitchen - EWS III



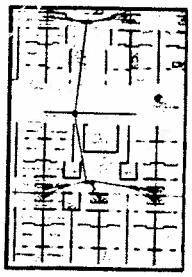
30 Locating the core, shown in red, at the front of the plot reduces pipe lengths, but a toilet beside the entrance runs counter to cultural and social norms. Moreover, a street lined with rows of service cores creates an uninviting public environment.



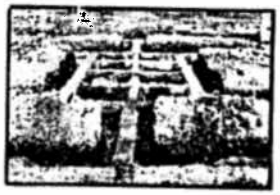
31 There are other alternatives. Number one illustrates toilets located at the back of the plot, and connected to the street with pipes running under the house; these pipes add extra cost. Number two shows the toilets connected to common service lines running through the backyards; this creates problems of accessibility for repairs and maintenance. The third option avoids this problem by providing a service lane; however, this requires considerable extra land.



32 The design option that was finally chosen, clusters several cores around a so-called Service Slot, through which connection is made to a sewer line in the street. Because of the Service Slots, a single sewer line can serve up to four rows of houses, and sewers are required only on alternate streets. This reduces the cost of sewer infrastructure by 30 percent.

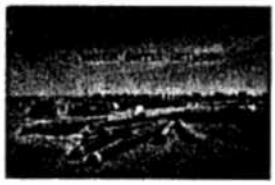


33 The service cores of 8-10 dwellings discharge their waste into gully traps and from there into a common inspection chamber located in the Service Slot. The inspection chamber is linked to the sewer line in the street.

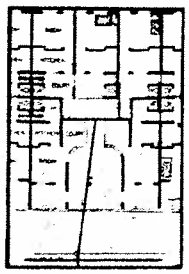


34 Service cores are built in groups of four to maximize common walls and minimize superstructure and foundation costs.

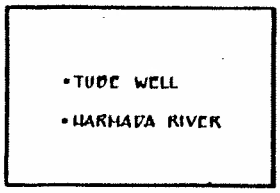
35 The site has black cotton soil which swells and shrinks with humidity and needs special foundations. The core is supported on reinforced concrete piles which are tied with plinth beams. The space below the beam allows for laying of service lines and will permit repairs without disturbing the operation of the adjoining toilets.



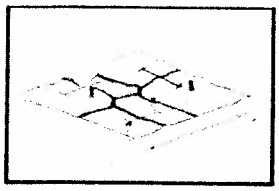
36 THE WATER SUPPLY NETWORK



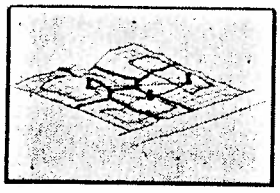
37 Individual water connections are made to each plot through the service slot. The water for higher-income plots is metered, while for Economically Weaker Section plots charges will be based on the total hours of water supply.



38 The initial source of water supply is a tube well, however, provision has been made for utilising water from the Narmada River.



39 Decentralized, smaller reservoirs reduce pipe diameters and minimize pressure inequalities. The water supply network is organised around three water towers, each serving two neighborhoods, and located at the highest points on the site.



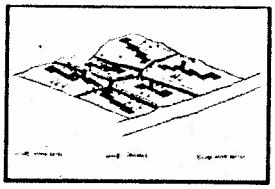
40 The water supply network follows the road geometry using gravitational forces for the flow of water. Looped systems are used for pressure equalization of water from each reservoir. These are inter-connected, so that in case of closure of any one reservoir, water can be drawn from the other two.

41 THE ELECTRICAL NETWORK

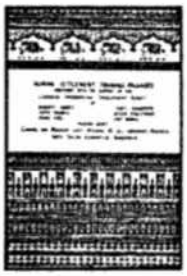
42 Overhead wiring for high density housing with narrow streets can be unsafe.

43 In the Economically Weaker Section areas, low tension lines are buried, which is not expensive, and also reduces maintenance costs. The peripheral roads serving higher income group housing, utilize overhead high tension lines. The overhead system is combined with street lighting for economy in the number of poles.

44 All underground pipes are buried before road construction begins. This avoids expensive excavation later.



45 Through the efficient use of the existing site conditions, the integration of various infrastructure components, and the extensive study of different layout alternatives, the new township provides an affordable package of services.



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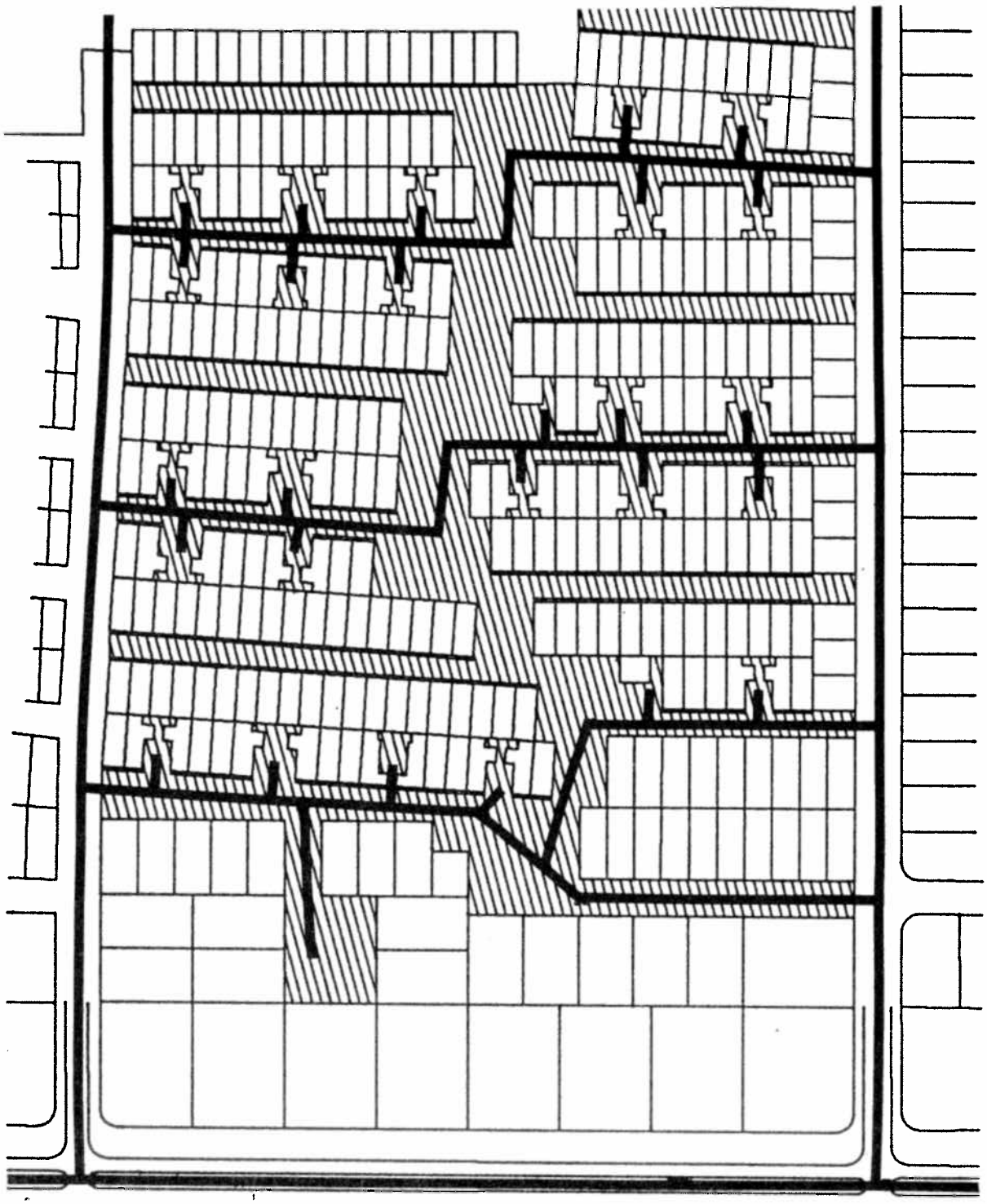
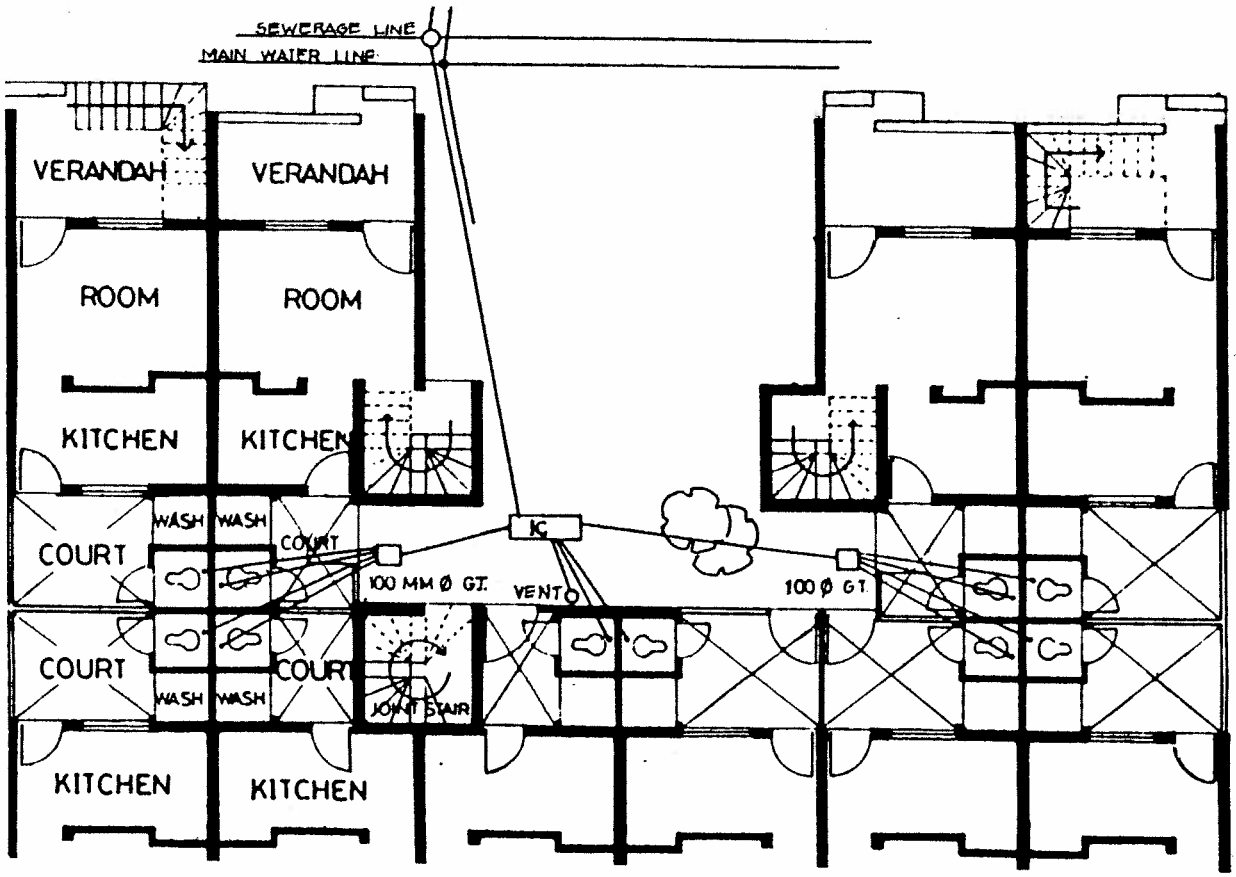
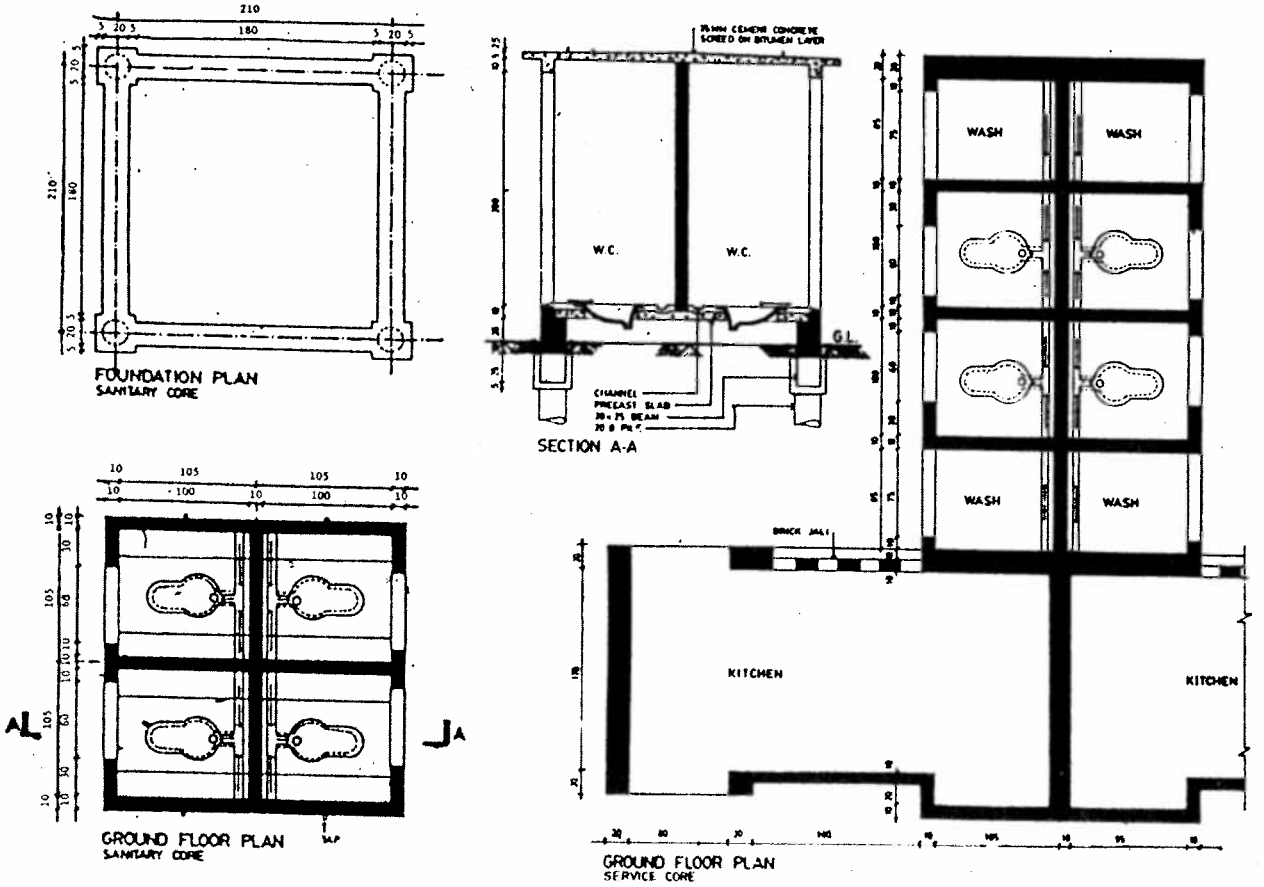


THE USE OF THE SERVICE SLOTS MAKES IT POSSIBLE TO SERVE FOUR ROWS OF HOUSING WITH A SINGLE SERVICE LINE.



THE SERVICE SLOT (Sewerage connection)



THE SERVICE CORE