INTEGRATION OF PEDESTRIAN NETWORKS INTO THE FABRIC OF INDIAN CITIES

A THESIS

Submitted in fulfilment of the
requirements for the award of the degree
of
DOCTOR OF PHILOSOPHY
in
ARCHITECTURE AND PLANNING

By

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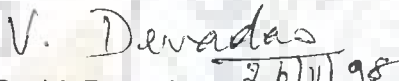ROORKEE-247 667 (INDIA)
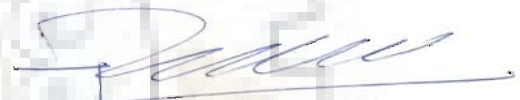
NOVEMBER, 1998

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled Integration of Pedestrian NetworksInto The Fabric Of Indian Cities in fulfilment of the requirement for the award of the Degree of Doctor of Philosophy submitted in the Department of Architecture and Planning of the University is an authentic record of my own work carried out during the period from August 1996 to November 1998 under the supervision of Prof. (Dr.) Najamuddin and Dr. V. Devadas.

The matter embodied in this thesis has not been submitted by me for the award of any other degree of this or any other University.

Santosh Kumar Misra

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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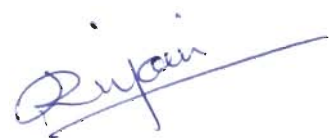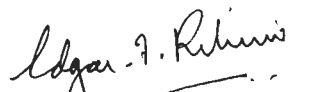The Ph.D. Viva - Voce examination of Santosh Kumar Misra, Research Scholar, has been held on 24 -5 - 99 at the DEPARTMENT OF ARCHITEC-TURE AND PLANNING, University of Roorkee. The Thesis is recommended for award of the Ph. D. Degree.

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ABSTRACT

The most exhilarating urban experience is to take a walk along the city's great boulevards and majestic streets which have ample accommodation for the pedestrian or through the narrow and winding pathways of the ancient towns which are steeped in history. Regent street in London, Princess street in Edinburgh, Boulevard St. Michael in Paris, Via Condotti in Rome are all places where the best to offer is displayed and large sidewalks are provided for the pedestrian. Often cars have been eliminated altogether, but at least the pedestrian is accorded generous protected space. The other is the equally fascinating experiencing of walking through the narrow and winding pathways of the ancient cities, which are steeped in history. Oxford and York in England and Venice in Italy are examples of this most enjoyable urban experience. Therefore, appropriate facilities for the pedestrian to walk, together with the other associated needs such as trees, kiosks, benches, toilets, drinking water, cafes are the essential character of the urban necessity for a collective public life. Indian cities do not provide appropriate accommodation for the pedestrian and this may stem from a general lack of concern for the welfare of the collective individual. While many cities have lavish commercial developments, the benefits these provide end at their property line. What extends beyond that is a squalid realm of the street or rather the road, where animals and humans alike spread filth, creating an environment whose standards of sanitation have not been seen in the West since the middle ages.

In India, there are a large number of historical towns with pedestrian networks, but these networks were subsequently put to vehicular traffic. Further,

excepting in one or two cases, the new towns of India built in the 1940 \ 50s were not provided with any significant grade separated pedestrian network. Besides the value of a good urban experience, there are several other reasons for which this country should take up pedestrianisation in its urban settlements. Primarily, India has a very large population and this will continue to grow till the middle of the 21st century. This very large segment of the Indian population has been totally neglected by the physical planners and administrators of this country. Therefore, all our cities and towns lack even a semblance of pedestrian facilities for the general walking public.

Secondly, the country is also economically in a developing condition and hence cannot provide personal or collective motorised transport to most of its citizens, even by the next century. India would save immensely by providing pedestrian networks in its human settlements. It would reduce the dependence on motorised public and private transport and thereby help the country to save expensive fossil fuel. These factors can be considered as the two most important factors that justify the introduction of pedestrian networks into our towns.

Besides the above two very important factors, if proper grade separated pedestrian facility is provided in the towns and villages, the rate of road accidents would be reduced and would consequently save on providing emergency health services, it would also relieve the people from the socio - psychological trauma associated with such accidents. Pedestrianisation would improve the health of the general population through exercise and by way of a pollution free environment and the benefits of having a healthy population would accrue to nation. Pedestrianisation will be an appropriate and convenient

mode of movement in view of the generally salubrious climate of the Indian subcontinent.

Finally, pedestrianisation is "sustainable" and "environment friendly" and therefore it is necessary to investigate and find out how pedestrian networks could be integrated into the fabric of Indian cities and towns.

The global thinking today is to look forward to economic development based on ecological principle like environmental harmony, economic efficiency and resource conservation.

An important issue in this context is the sustainable development of the transport and communication system since this is the key to the movement of goods, people's information and ideas.

Priorities should be given to reduce unnecessary travel, developing policies that emphasise on mobility attentive other than the automobile.

The aim of this research is to evolve a methodology for pedestrian planning in the various land uses in the Indian cities and suggest its upward integration into the overall traffic network of the city. The study provides guideline to architects, planners and administrators, and solved cases as a support system for taking policy and design decisions.

The research was started by carrying out a detailed literature survey followed by interviews with people in the field. Open questionnaires were also sent out to specialists in the area of planning. This provided an outline for the type and direction of research to be taken up. It also helped to establish the current desires and aspirations of the world population and the Indian people.

Efforts were made to find out if pedestrianisation would be particularly useful to the Indian people considering their social and economic conditions.

The historical development of pedestrianisation in the world and in the Indian sub-continent including the development in contemporary history of India has been documented so that the accrued knowledge from history can be used for pedestrian planning.

A theoretical base has been developed for pedestrian planning. This functions as a depository of knowledge on the pedestrian himself and the physical planning aspects of pedestrianisation.

A working theory has been developed to establish models for rationalisation between the pedestrian movement and the movement of vehicular traffic; this helps to upwardly integrate the pedestrian system with the overall transport network of the city and subsequently to the transport system of the region. The other model developed looks into appraisal, programming and design recommendations for the pedestrian spaces in cities and towns.

The country cannot be considered for a uniform pedestrian policy because it has different geophysical, climatic and cultural compositions, the factors which affect pedestrian planning in a major way. Therefore the country has been divided into different "National Pedestrian Zones" in the same way in which the seismic and cyclone zone have been formed for the country.

Certain criteria have been developed for the selection of the case studies to be taken up at the city level and for the areas within these cities. The two cities taken up as case studies are Patna and Lucknow. Areas within these cities have been evaluated in regard to their performance. From these studies, a list of potentials and constraints have been drawn up which help to finalise a strategy for pedestrian planning.

Integrative analysis is done with the pedestrian information from the information

base titled as "Theoretical Back-up" and the "Indian Orientation" obtained from various sources but particularly from the case studies.

Important findings along with the recommendations are then placed for the use of all who are keen to use the research for making pedestrian plans in their respective towns and cities. Lastly, the recommendations made are applied on the town of Roorkee as a "test application". The model developed for overall integration of transport networks with the pedestrian network is utilised here to exemplify the procedure.

The investigation reveals that pedestrian is the most appropriate mode of movement in the Indian cities of the future. This is because they are basically environment friendly and sustainable. The motorised and other rapid transport modes must provide upward accessibility and integration of the pedestrian areas since cities have grown beyond the size of pedestrian accessibility alone.

ACKNOWLEDGEMENTS

which I could complete my thesis.

I thank my wife, Ratnamala and my two children Somu and Mumu for standing by me all through the two years during which I remained away from home at Roorkee. Besides taking care of the house, Ratnamala, who is a professional architect planner herself, read through the whole manuscript and made necessary suggestions and corrections prior to its final preparation. For this, she deserves my utmost thankfulness.

Since there have been a large number of persons who have helped me with this effort and I have not been able to name them personally in this formal acknowledgement, I have done so in a separate section placed in Appendix -E of this report.

Santosh kumar Misra

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GLOSSARY OF TERMS

Aryan: A member or descendant of people who settled in India around circa 1500 BC and spoke Indo-European language.

Auto rickshaw: A motorised three wheeler used for carrying passengers in Indian cities.

Avadh: Name of 17th century Indian state in northern India.

Bazaar: Market

Bullock cart: A cart (generally wooden) drawn by a pair of bullocks.

Chaturmukha: Having four faces.

Chikan: Traditional embroidery work of Lucknow

Chowk: A crossroad, which developed naturally as a market

Cycle cart: A cart pulled by a cycle used for carrying goods.

Cycle Rickshaw: A small three-wheeled passenger vehicle with cycling arrangement operated by one man.

Dakshin: South

Dandi: A contraption usually wooden to carry one person up a hilly track

Darwaza: Gateway

Dravidian: A member of an Australoid race occupying most of southern India.

Ekka: A small carriage drawn by a single horse.

Foot Traffic: Traffic on foot

Gally / Gully / Gali: A lane/ By-lane

Ganj: An area

Ghat (1): Steps leading to a water body

Ghats (2): Low mountain ranges

Green Mode: Mode of traffic which does not consume fossil fuel and does not create pollution such as pedestrians, bicycles, and animal drawn carriages.

Handcart: A cart on two wheels pulled/ pushed by a man.

Hatti: Elephant

Hawkers: Persons selling their wares by shouting on the roadsides or going peddling from door to door.

Horse carriage: A carriage drawn by one or a pair of horses

Imambara: Basically a place where the relics of any one of the twelve Imams

are kept (A religious congregation place of Shia Muslims).

Jains: Believers of Jainism

Jama: Congregation

Jhama: Over burnt brick

Jheel: Large lake

Khoa: Broken pieces of brick

Kutcha Road: Crude imperfect or temporary road without proper final surfacing.

Lakh: A number denoting 1,00,000

Lakshman: Brother of Rama, the hero of the great Indian epic Ramayana.

Langur: Monkey

Maidan: Large field.

Mandir: Temple

Masjid: Mosque

Modal split: Split of travelling population in different modes of transport.

Mohalla: Neighbourhood

Moped: Motor driven cycle

Multi modal transport: Many methods/ ways of travelling.

Nagar: Town

Nanda varta:

Natya Shasta: Sacred book of Hinduism on dance

Nawabs: A viceroy or deputy governor under the former mogul empire in India.

Padmaka: Lotus shaped

Padya: Foot-track

Pagdandi: Foot-trail

Panchayat: Council

Paschim: West

Path: Indian word for road

Pedestrian mesh: An interwoven structure with evenly spaced uniform openings in between which is hexagonal in shape having its largest dimension as 1 km (the distance coverable by a human being at one go)

Pedestrian Network: A continuous network of access available only for pedestrian movement.

Purab: East

Quilla: Fort

Rama: The hero of the great Indian epic Ramayana.

Rasa: Flavour, Sentiment or emotions regarded as one of the fundamental qualities of Hindu classical dance, music and poetry.

Rishis: Sages

Sarvato bhadra:

Sheikhs: Muslim chief or headman

Shia: Name of one of the two Muslims sects

Shilpa shastra: Sacred book of Hinduism on art and sculpture

Sikhs: Believers of Sikhism.

Squatter: One who settles on public land without title or right.

Stalls: Small shops like kiosks

Sunni: Name of one of the two Muslims sects

Swastika: Cross with four equal arms, each bent in a right-angle extension

Traffic calming Method of reducing the various impacts of traffic by physical control as well as by policy decisions.

Uttar: North

Vastu shastra: Sacred book of Hinduism on architecture

Vedic: Pertaining to the Vedas.

Vest- Pocket Parks: Small sized parks tucked into neighbourhoods.

Dedicated to the memory of my friend
SAURASTRA RANJAN DAS
who passed away in a road accident on
Ninth April, 1998, while walking across a
street in Bhubaneswar. Orissa.

CHAPTER 1: THE RESEARCH CONTEXT

1.1 INTRODUCTION

Pedestrians comprise the greater part of humanity. It is they who built cities, erected multi-storied buildings, laid sewerage and water lines, paved streets, and illuminated them with electric lights and created the civilised world. And when every thing was all set and ready for habitation, the motorist appeared on the scene [26].

It must be noted that pedestrians invented the automobile itself but the motorist forgot this and became a dangerous killer. Streets created by the pedestrian for himself were taken over by the automobile. Cities became totally chaotic; congestion, traffic conflict, pollution and accidents became the order of the day. It was under these circumstances that during the middle of the 20th century many towns across Europe fell back on the pedestrian mode of intra-city travel. Large sections of city roads were gradually cut-off from automobile traffic, and redesigned for the pedestrian.

Historically, pedestrian networks were found in all ancient cities of the world. This was because of the fact that walking was the most common mode of transportation but subsequently with the introduction of horse-drawn carriages and finally the motor vehicle, the roads were modified to facilitate movement of vehicles and the pedestrian mode was given little importance.

In India there were a large number of historical towns with pedestrian networks, but these networks were subsequently put to vehicular traffic. Further, the new towns built in India during the 1940 - 50s were not provided with any significant

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grade separated pedestrian network, excepting in one or two cases.

Presently, India has a very large population and this will continue to grow till the middle of the 21st century. India cannot provide personal or collective motorised transport to most of its citizens, even by the next century, since it is economically quite weak. These factors can be considered as the two most important factors that justify the introduction of pedestrian networks into our towns.

There exists a large walking population in India that is in millions and it would grow in the future, and this very large segment of the Indian population has been totally neglected by the physical planners and administrators. Therefore, all our cities and towns lack even a semblance of pedestrian facilities for the general walking public.

From the point of view of economy, India would save immensely by providing pedestrian networks in its human settlements. At first, it would reduce the dependence on motorised public and private transport and thereby help the country to save expensive fossil fuel. Secondly, if proper grade separated pedestrian facility is provided in the towns and villages, the rate of road accidents would be reduced, and consequently it would save on providing emergency health services, and relieve the people from the socio - psychological trauma which are associated with such accidents. Thirdly, it would improve the health of the general population through exercise, create a pollution free environment, and the benefits of having a healthy population would accrue to the nation.

Besides the above, pedestrianisation would be an appropriate and convenient mode of transport in view of the generally salubrious climate of the Indian

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subcontinent.

Finally, pedestrianisation is "sustainable" and "environment friendly", and therefore, it is necessary to investigate and find out how pedestrian networks could be integrated into the fabric of Indian cities and towns.

In this investigation " Pedestrian Network" would mean a lattice, screen, mesh or web of pedestrian walkways and pedestrian spaces. Then the "Fabric of the City" would mean the structure and substance of the city that would include the infrastructural, political and cultural circumstances of the city. Integration of the " Pedestrian Network" into the "Fabric of the City" would connote the synthesis of the two into a comprehensive whole.

1.2 RESEARCH DESIGN AND METHODS

1.2.1 Objectives

The new out look of the world to day is economic development based on ecological principles like environmental harmony, economic efficiency, resource conservation, local self- reliance, and equity with social justice leading to a situation of sustainable development.

Sustainable development of the transport and communication systems is an important issue since they are the key factors for the movement of goods, people, information and ideas, both within and between settlements.

Managing traffic in human settlements should be done in a way that promotes good access for all, to place of work, social interaction and leisure. This should be done by reducing the negative impacts of the present transportation systems on the environment. Priorities should be given to reduce unnecessary travel by developing policies that emphasise on mobility alternatives

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other than the automobile, developing alternative fuels and alternative fuel vehicles and improving the environmental performance of existing modes of transport.

Having the above as the premise, a set of objectives have been framed for the present investigation. The following aspects have been looked into and it is proposed to provide a decision support system for pedestrianisation in Indian cities.

A) To examine the various facets of pedestrianisation and their impact on the users.

B) To improve the design and the environment of the existing pedestrian areas in the Indian cities.

C) To suggest a procedure to integrate the pedestrian network upwardly into the overall traffic network of the city and then the region.

D) To come up with policy guidelines for efficient pedestrianisation systems in the existing and future cities in India.

E) To prepare a design guide based on traditional design ideas for the reference of the architects and urban designers and others involved in pedestrianisation.

1.2.2 Scope

Keeping in view, the tremendous opportunities and prospects of pedestrianisation in the Indian cities, it is necessary to identify the factors that negate the progress of pedestrianisation and cause dis-satisfaction amongst the pedestrian population. On identification of the negating factors, steps could be taken to overcome these problems and encourage the pedestrians to use

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the existing facilities. The present study makes a beginning in the following direction.

A) It adopts a pedestrian-centric approach for the reorientation of the city traffic.

B) It would find ways and means to pedestrianise whole existing cities keeping in mind the improvement of the quality of the urban environment.

C) It would provide a solution for accessibility in existing towns and cities that are mostly congested with a high-density development and hence the possibility of providing separate cycle tracks is minimal. Again availability of existing road space is fixed and cannot be increased without disturbing the city's fabric, and this limited space has to be shared between all the different types of road users. It may be noted that the pedestrian is calculated as 0.25 passenger car units while the cycle is 0.75 passenger car units. This means that one cycle takes up the space that could be used by three pedestrians. Hence, in view of the congestion, cycles are not being considered in the congested, high-density areas. Provision for cycles facilities have been considered in the newer areas of existing towns, which have no congestion.

D) Design of Pedestrian systems in cities without considering the overall design of the urban spaces is impossible. Therefore, the present investigation drifts into the design of urban spaces, on several occasions, during the course of the research.

E) The investigation will record information available from the practical and theoretical exercises carried out by the developed countries of the world, with this the knowledge gained from the Indian situation will be put together, and recommendations shall be made for incorporation in the proposed and existing

Indian towns and cities.

1.2.3 Methodology

Indian cities do not fully provide appropriate accommodation for the pedestrian and this may stem from a general lack of concern for the welfare of the collective individual. While many cities have lavish commercial developments, the benefits these provide end at their property line. What extends beyond that is a squalid realm of the street or rather the road, where animals and humans alike, spread filth, creating an environment whose standards of sanitation have not been seen in the west since the middle ages.

It was under these circumstances that a research project to investigate the city's transport network, the city environment and the city administration with an emphasis on pedestrianisation was taken up.

The present investigation has several plausible steps. These have been mentioned below.

A) Data Collection: Survey of available literature on pedestrianisation, interviews and survey through open questionnaires sent to informed personnel on the subject.

B) Identification of the desire of the world population in general and the Indian people in particular on pedestrianisation.

C) Importance of pedestrianisation in India considering the social and economic conditions of the people.

D) Analyse the historical development of pedestrian movement systems in settlements in India and abroad.

E) Formulate an Information base on pedestrians and pedestrianisation.

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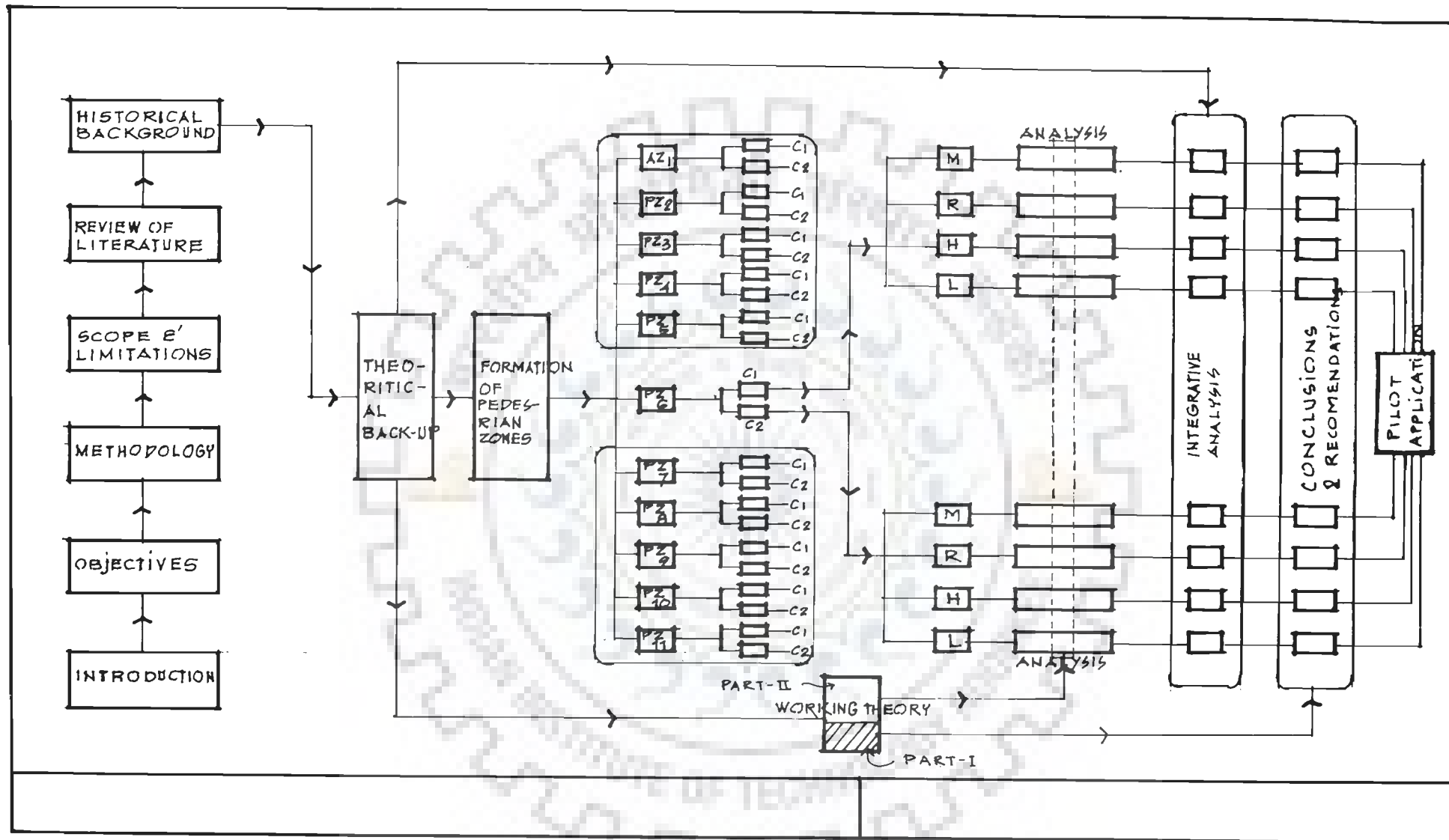
GRAPHIC REPRESENTATION OF RESEARCH METHODOLOGY | FIG.NO. 1 | | PAGE NO:- 7

F) Evolve a suitable method for rationalisation of the pedestrian, movement and the movement of vehicular traffic.

G) Investigate if pedestrianisation concepts and designs would be uniform for the whole country.

H) Analyse the foot traffic and the local area environment of selected cities in two Indian cities and look for the Indian Orientation in them.

I) Integrate appropriate pedestrian data from the "Data Base" with the information from the case studies.

J) Develop a network for upward integration of the pedestrian zones with the overall traffic network of the city.

K) Prepare a set of recommendations for pedestrianisation at national and regional levels, and use zone levels of the Indian cities.

L) Employ the recommendations for best application in a selected town.

The overall research strategy and has been presented in the graphic form in [Figure 1].

1.2.4 Data Collection

Two types of data have been collected for the present investigation. They are from secondary sources and from primary sources.

Data was mainly collected from the existing literature on the subject and from the case studies. These two sources are very important because research on town planning and urban design depends to a large degree on accrued knowledge and experience gained over the passage of time.

A) Secondary data have been collected from sources, such as, books, pamphlets, reports, newspapers and manuscripts that are documented over the

years. This is a very important source of knowledge for this study and has therefore, been presented in a separate chapter.

B) Primary data has been collected through schedules, interviews, discussions, observations and case studies.

1.2.5 Tools and Techniques

1.2.5.1 Selection of Case Study Areas

City planning and Urban design does not give an individual human being an opportunity to carry out an experiment and achieve results for immediate use. This is because experiments in these areas of study take hundreds of years to form and respond. Hence the existing cities and areas themselves, are test-houses for experimentation in town planning and urban design.

A very important method of investigation in the area of city planning and urban design is the " Case study " approach. This is regarded as best suited for tracing the evolution and growth of human settlements. This tool is especially useful in developing countries where varied social institutions interact mutually and where basic data is difficult to obtain.

The case study examines the complex situations and combination of factors involved in a city or urban space so as to identify the causal factors, so that, appropriate action can be adopted to remedy the situation.

Selection of cities for the investigation has been done by using the winnowing technique. The criteria for selection of the case study area has been developed by a detailed study of the factors that contribute to the making of a liveable city. The selection of urban spaces within the cities have similarly been finalised

through a winnowing method, though no mathematical evaluation has actually been done. The area selection has been done by using professional judgement.

1.2.5.2 Tools Used for Data Collection

Questionnaire and schedules were used to conduct the investigation; these were developed on the basis of the theme of the investigation.

1.2.5.3 Execution of The Survey

The questions were framed in line with the control parameters that would also form the objectives of the exercise. Enumerators with a background of architecture were used for the filling up of the schedule and giving scores out a maximum of ten, since many of the questions in the schedule need the explanation of a person trained in architecture/ urban design prior to getting a response.

The questionnaires and the schedules were pre-tested through dry runs to check for errors.

1.2.5.4 Scaling Technique

Based on the evaluation done above the potentials and constraints for the areas were identified for direct and easy translation into physical design or appropriate management decision. The factors that received in the range of 1 to 3 in the 10-point scale were taken as a constraint. Factors receiving 4 to 6 were considered as normal or inconsequential and were not reviewed. The factors that scored in the range of 7 to 10 in the above scale were considered as potentials.

1.2.6 Analytical Procedure

The present investigation can be said to be of a theoretical - practical nature. There is a substantial theoretical development which has been validated experimentally in the growth and construction of towns and cities all over the world. The research contains two major sections; one deals with the existing theory, that is theoretical developments and theoretical predictions and the other deals with the ongoing experiments carried out in the towns and cities of the world over for the last few hundred years along with the results. The theory and the results are also compared in the investigation.

The data has been analysed with optimal statistical tools and techniques such as the Triad theory and the multi-criteria evaluation.

The Investigation, itself, was based on the triad theory, which reflects a deliberate attempt to give equal emphasis to the three elements of a designed product, that is, function, form and economy. The first broad divisions of the proposed control parameters of an urban area were arrived at on the basis of the Triad Theory. Subsequently, systems analysis was used to develop the detailed parameters that constitute the urban system.

Multi-criteria evaluation methods serve to investigate a number of choice possibilities in the light of multiple criteria and conflicting priorities. The hard core of this evaluation approach consists of a two dimensional matrix, where one dimension expresses the various alternatives and the other dimension the criteria by which the alternatives must be evaluated.

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1.2.7 Selection of case study areas

1.2.7.1 Selection of National Pedestrian Zone for Investigation

In the present investigation the whole country has been divided into eleven National Pedestrian Zones. Of the eleven National Pedestrian Zones formulated, Pedestrian Zone 2 (PZ -2) has been taken up for detailed study due to the following factors.

(A) This region is one of the most populated regions of the Indian sub-continent.

(B) It provides one of the most interesting cultural-mixes in the country.

(C) The terrain and the climate are most appropriate for pedestrianisation.

1.2.7.2 Selection Criteria of Cities for Case-Studies

The selection of the cities for case studies were done based on the important parameters that contribute to the positive and negative attributes of the cities. Since the cities under study have to be compared with one another and statistically appropriate recommendations arrived at, the type of cities taken up should be, more or less, of the same generic conditions to enable a better comparison. The criteria considered for selection of the cities is mentioned and elaborated upon in the subsequent paragraphs.

Historicity

Urban Design and particularly human settlements have been the result of accrued experience over generations. Therefore, a city that has been in existence for more than 300 years has allowed itself to absorb the traditions and historical changes and the same can be seen in its urban fabric. This is an

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important criteria since the search is for urban design - pedestrian related elements which reflect the tradition and culture of that particular region.

Appropriate size of city based on population.

A city is a community of families. The number of families should be large enough so that they support the existence of collective facilities. However, if the city becomes too large, there may be duplication of collective facilities while at the same time administration of the town becomes difficult. From the Indian experience, which is burdened with a larger population than most countries of the world, the city with a population size ranging from 10 to 20 lakhs would be appropriate and can provide good facilities to its inhabitants while at the same time allowing for better city administration.

Regional Importance of the City.

If the town has a wide regional importance, and then it can be expected that there will be a large floating population moving in and out of the city. This would be an important factor for conducting the study at the district and regional levels.

Infrastructure of the Town.

This head covers the standards of public utilities such as water supply; drainage; refuse disposal; electricity; gas; telephone; television; postal service; street lighting; public transport and others that are available to a city.

Availability of Amenities.

Availability of facilities such as schools, health and welfare centres, community buildings, government and administrative buildings, commerce, industry and

employment all indicate the well being and vitality of a settlement.

Open Space Configuration.

The open spaces are the lungs of the city, if there are adequate number of parks, play grounds, and other kinds of open spaces the city is expected to have a balanced atmosphere.

Interesting Dwelling Mix and Population structure.

A good dwelling mix and an appropriate population structure of different age groups, income groups and a balanced male-female ratio represents a healthy lifestyle of the people and a healthy status of the city.

Cultural Importance of the City.

A city that has cultural value has an underlying tradition of art, music and literature. This tradition will be manifest in the nature of the inhabitants and would have also influenced the city's built form.

City Aesthetics.

The aesthetics of the city and its component parts be should be interesting so that the study will deal with some sensitive aspects and come out with proposals of aesthetic sensitivity.

1.2.7.3 Selection Criteria of Urban Spaces Within the City

To select specific areas for study within the identified city, it is necessary to formulate certain guidelines. Many of the criteria stipulated for city selection will also apply for local area selection. The criteria, which will remain common, are reiterated here for reference.

(A) Historicity, (B) Availability of Amenities (C) Open space configuration

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(D) Cultural importance of the area (E) Area Aesthetics.

Besides the above-mentioned aspects, there are some other considerations that must be taken care of while selecting a site at the area level.

From the historical studies of settlements in India it may be deduced that settlement patterns changed according to the race, religion, political intent and other background of the rulers. It has also been seen that new cities were seldom built by the rulers and most of them added on new segments to existing cities. Therefore, most Indian cities, which are more than 500 years old, reflect the planning concepts of the Hindus, Muslims and the British, in different segments of the same town. This aspect must be examined while taking up an area study in a town.

Since there is no area in any of the Indian cities which can be called a clear-cut pedestrian area, it becomes necessary to record the parameters on which a certain area will be considered as a pedestrian area for further studies and investigation in the matter.

In this research it is proposed to assume an area to be pedestrian if it fulfils the following conditions:

A) Areas with roads which are two narrow for four wheelers may be considered as pedestrian areas.

B) Roads and areas where the large pedestrian population on the roads has predominantly thrown out the vehicular traffic may be taken as pedestrian areas.

C) Roads or pathways, which are too steep for vehicles, may be assumed as pedestrian routes.

D) Paths and areas in which the surface layer is too rough or incapable of

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taking vehicle loads may be declared as pedestrian areas.

E) Certain areas in the Metropolitan towns have been provided with footpaths along the side of its important roads. These are the only truly pedestrian dedicated movement routes in urban India.

1.2.8 Recommendations

A set of policy guideline has been prepared on the basis of the findings of the investigation. These guidelines have been recommended for implementation at different planning levels.

A small town has been chosen and attempts have been made to show the way in which the pedestrian problems can be approached.

A set of drawings titled "Design Guide" has been prepared based on the design features found locally. This will be a ready reference for pedestrian planners designing pedestrian facilities.

1.2.9 Limitations

A) Pedestrian movement as an aspect of the cityscape comes last as it encompasses all other aspects of the built city. The way a scheme is perceived as one walks through, depends on how the other elements are assembled; buildings, walls, plantations, roads, play and parking areas, forming spaces and defining territories. It also depends on our understanding, as designers, of the way people observe and use the environment.

B) The thesis is an extensive and intensive work on pedestrianisation. This has been done as there exists very little research work on the pedestrians in India and therefore a broad study is the present need while providing working

information for execution of pedestrianisation projects. However there is no serious attempt to study the fundamental features of human movement and human behaviour. Further study at this level is now being done in the developed countries and other researchers may do the same on the Indian pedestrian, subsequently.

C) The conclusions and recommendations offered in this research are for cities within broad physio-climatic and cultural regions, it therefore, does not cover the micro-climatic, micro-physiological and micro-cultural variations of individual towns and cities.

D) The study does not look into aspects of pedestrianisation within individual buildings. Its scope is delineated from the entrance of individual buildings to the outer boundaries of the town.

E) The outlook of this study is basically pedestrian-centric because of the large advantages associated with the pedestrian mode of travel.

F) The emphasis of this study is on the redesign of existing, in other words, inherited towns and cities, rather than on the design of new towns. This has been done because the increasing urbanisation in India is being achieved through the up-gradation and expansion of existing towns and cities rather than by building new cities.

1.2.10 Organisation of the work

The study consists of ten chapters devoted to various aspects of pedestrianisation. A brief description of the salient features deliberated is highlighted in the following paragraphs.

The first chapter introduces the subject and gives an overview. It deals with the

importance, scope and objectives of the study. Besides these, it spells out the methodology that has been adopted. This chapter forms the basis on which the subsequent analysis and research have been carried out.

The second chapter covers the review of the relevant literature on the subject. Most of the literature is of the West. However, special attention has been paid to identify literature related to India and to review it so that an Indian orientation to the research is achieved.

Chapter three deals with pedestrianisation in the historical context. It covers the historical aspects of pedestrianisation in the west, its history in India, and special section on the history of pedestrianisation in the towns of contemporary India.

In Chapter four a knowledge base on the subject has been put together. This is the central source of information based on which all the subsequent chapters have been developed.

In Chapter five a working theory has been developed. This working theory is in two parts. The first part provides for a model by which the existing city is broken up into a cellular fabric, to form the pedestrian environment areas, while at the same time an arrangement is made for an integrated multi-modal accessibility in the city. The second part is a model based on systems analysis, which allows for an easy investigation of designated pedestrian areas in a city.

In Chapter six the country has been divided into pedestrian zones based on the physiological, climatic, and cultural composition of the country.

The identified case study cities and case study areas have been investigated in chapter seven. Evaluation of these areas is then made, leading to the establishment of a list of potentials and constraints for the respective areas.

In chapter eight, the inferences, conclusion and data collected from the studies and placed on a chapter wise basis have been analysed and synthesised.

Chapter nine presents the major findings and lists out a series of recommendations for the convenience of those who may be interested in designing and executing pedestrian networks in their cities. The recommendations have been grouped together under the heads of A) Recommendations at the planning and designing levels and B) Specific recommendations for important pedestrian use zones in the cities; this makes referring to them easy.

In chapter ten, test application of the findings and recommendations is carried out on the town of Roorkee to check the applicability and the appropriateness of the whole exercise.
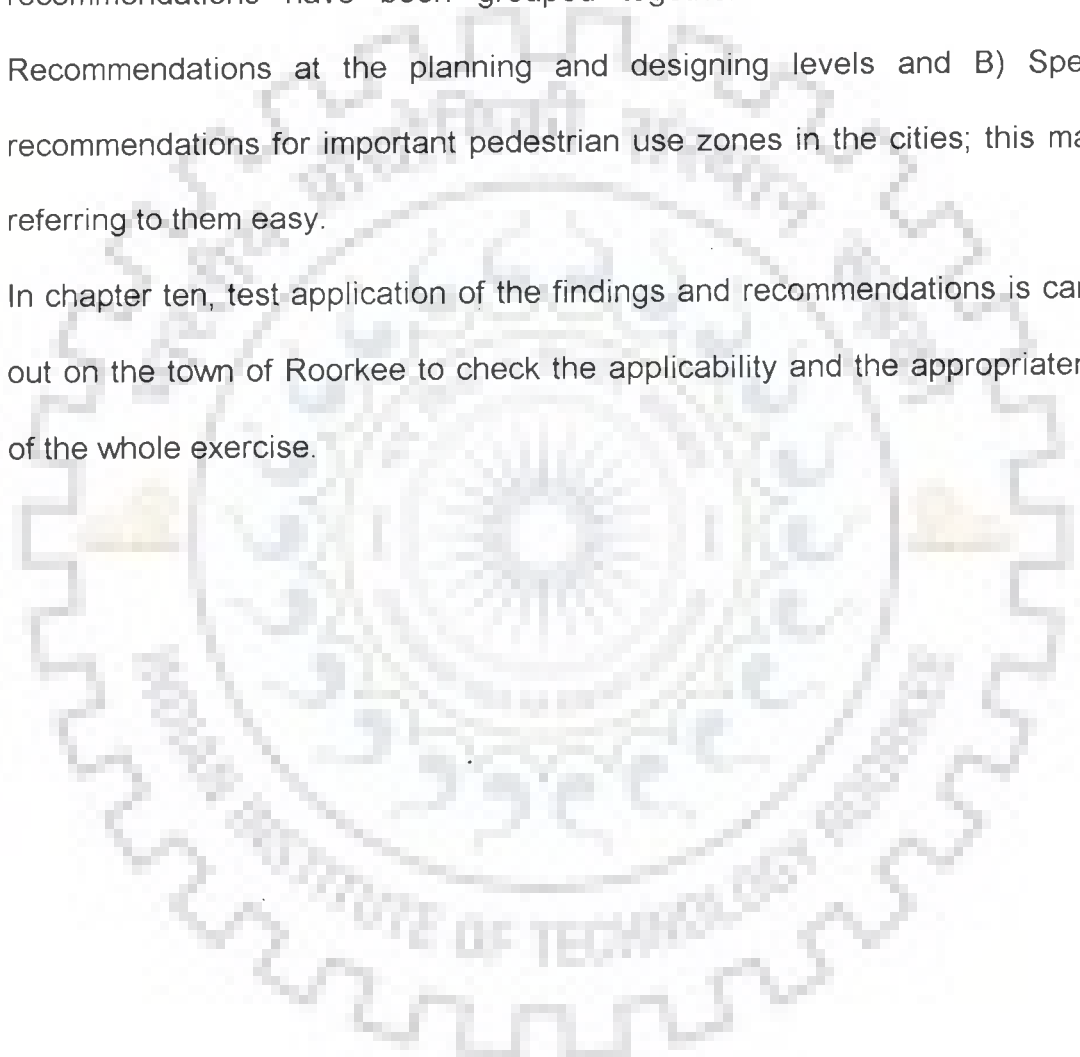
CHAPTER 2: REVIEW OF LITERATURE

2.1 INTRODUCTION

In this chapter an attempt has been made to briefly present the research that has been undertaken by institutions and individuals, in the field of pedestrianisation. This survey has been of immense value and help in shaping the structure and design of the present investigation. This is in spite of the fact that almost all the available literature on the subject is from studies based in foreign countries. Some research work in this area has been undertaken in this country very recently. Literature review becomes an important aspect in this study because of the fact that most of research work on the area of city planning and urban space design depend on accrued knowledge and experience gained over generations and through the passage of time. Therefore, documented information in the form of existing literature becomes an important source of data.

2.2 REVIEW OF RELATED LITERATURE

2.2.1 Evaluation Techniques

Literature on the various techniques of evaluation were identified and reviewed so that knowledge regarding assessment of the cities and urban spaces could be obtained. Voogd (1983) has noted how projects which have large number of variables can be evaluated by giving weightages and also elaborated on the various types of procedures that can be used for evaluating qualitatively indeterminate proposals and plans.

Preiser and others [1988] [53] have discussed the method and uses of Post - Occupancy Evaluation, and are of the opinion that the knowledge thus gained forms a sound basis for creating better designs in the future.

2.2.2 Aesthetics

Licklider [1965] [42] has analysed the details and importance of physical scale, proportional systems, human scale, large and small scale, etc. pertaining to architecture and urban design.

Parmar [1973] [49] has discussed about the aesthetic theory of architecture. He opined that creativity is founded on knowledge of the obvious and the typical, and it is only by passing through the discipline of the commonplace that the unique is achieved. He strived to establish the principles that govern the typical, for these will of necessity be embodied in the creative.

Ching [1979] [12] wrote that form is the primary tool of the designer. It serves to lay out and classify for analysis and discussion basic forms and organisations of spaces and their generic transformations in a methodological manner.

Smith [1979] [61] opined that during the last fifty years there has been an uncertainty in the value system particularly in the sphere of aesthetics. He attempts to identify an aesthetic value system, not as a pattern of personal preference, but as something fundamental to the operation of the human mind.

Saxena [1982] [60] discussed the Indian aesthetic theory with reference to Hindustani music and dance. The Rasa, which is perhaps the most important concept of Indian traditional aesthetic theory, is also referred to in his writings. Saxena states that the philosophy of Bharata (2nd Century A. D.), which propagated the doctrine of Rasa in the Natyashastra has been debated,

discussed and developed by the great Indian philosophers like Kalidas, Bhoja, Rudrata and others. And that the aesthetically qualities codified by Bharata and others for the Natyashastra have latter been adopted into music, sculpture, iconography and paintings.

2.2.3 Social Sciences

The meaning of Architecture, Urban Space Design and City planning has undergone many changes during the progress of human civilisation. Earlier, it was considered to be an art and then, art and technology, but today it involves a considerable amount of social sciences. Over the years, different aspects, such as, sociology, psychology, economics, geography and history have all become important contributors to the organisation and development of settlement planning. In view of this several books and other published material were reviewed for information.

Lefton [1982] [41] generally discussed about psychology but covers a section on environment psychology. He argued that Environmental Psychology is the study of how physical settings affect human behaviour, and that how people change the environment to make it comfortable and acceptable to them. In summary, environmental psychology is the study of the relationship between human behaviour and the environment.

Bhan [1987] [71] dealt with the psychological and social implications of the high rise apartment buildings. He has identified a list of heads under which the psychological and social environment can be investigated. This list of heads is quite comprehensive and can also be used for the investigation of other types of built environments.

Hakim [1986] [29] presented an insight into the concepts of planning in the Arabic- Islamic cities. Though he does not refer directly to Islamic city planning in India much of the information is applicable to the planning process in the Indian context also.

Das [1991] [18] documented the architectural history of Lucknow and through it passes the social and cultural message of the city.

Prakash [1983] [50] reflected on the planning, building and functioning of Chandigarh. Prakash had himself worked as an architect during the times of Le Corbusier and is therefore able to give to the reader very intimate details about the town.

Thomson [1991] [65] tries to put road accidents into their correct perspective. Beginning with an appraisal of the true scale of the problem, he examined the factors that make children vulnerable road users. He then goes on to assess the extent to which current educational counter-measures help to overcome their deficiencies.

Chapman et. al. [1982] [9] edited a number of articles and compiled them to form a book on pedestrian accidents. It provides a multidisciplinary perspective by integrating behavioural, educational, environmental, legal, social, and engineering aspects of road safety. The main chapters of the book are divided into three sections, focusing in turn on the pedestrian, the driver, the vehicle, and the environment.

Maitra et al. [1997] [81] have made a compilation of the international initiatives on sustainable human settlements. Considering that the welfare of humanity and the environment is universal, the world community represented through the forum of the United Nations that has been debating and formulating strategies

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to achieve a sustainable future. The degradation of the environment and the unacceptable level of consumption of natural resources have become important issues for all the member nations. This compilation provides abstracts of the deliberations and resolutions of four such conferences, providing ready reference for formulating action programmes.

2.2.4 Equity

The Ministry of Welfare, Government of India, [1995] [87] had made a compilation of the programmes and concessions for the disabled persons through the opportunities provided by the Central Government.

The QIP centre of the Roorkee University [1997] [94] has published a souvenir (1997) in which a number of papers have been published on the various aspects of training to the handicapped. It has also reproduced the act passed by the Government of India titled "The persons with disabilities (equal opportunities, protection of rights and full participation) act,1995", which gave effect to the proclamation made by the Economic and Social Commission for Asia and Pacific during the meeting held at Beijing in 1992.

2.3 CITY AND TRANSPORTATION PLANNING

2.3.1 City Planning

The research on pedestrianisation is mostly a work, which can be placed at the urban space design scale, and therefore city and transport planning are its immediate higher level. The immediate lower level is architecture. Hence, investigation of the literature on city and transport planning area become important.

Gibbs [1961] [27] grouped together readings selected to acquaint the beginner with methods for the study of demographic and ecological aspects of cities and urbanisation.

Claire [1973] [14] edited the handbook on urban planning, and gives information in a simple but comprehensive manner. The growing importance of urban planning has brought the need for a wider spectrum of scientific disciplines to understand the subject and engage in the work as support professionals. This book is organised for their easy understanding.

Rangawala [1974] [56] in his elementary book on town planning treated the subject matter in a step-by-step and systematic manner. He had made an attempt to explain briefly the general principles of the subject so that one can have an insight into the geneses of the issue.

Dutt [1977] [22] made a thorough investigation into the traditions of town planning in ancient India. In his book, he has drawn a great deal from the ancient books of the vedic period, the shilpa shastra and the vastu shastra, and enumerated in detail the origin and growth of Indian cities, the selection of sites for the building of cities, the boundaries of the cities in context to the type of fortification and type of gates, the lay out of the streets within the city and their sizes. Other aspects, such as, expansion of towns, village planning, building byelaws have also been detailed out. There is a lot of reference to the pedestrian mode of movement and it is also possible to infer regarding pedestrianisation in the towns from the description of its town planning, since planning also concerns the layout of roads and pathways to a large extent.

Whittick [1975], [68] describes the urban planning activities from historic times till the present day in the various countries of the world.

Ramachandran [1989] [55] elaborated on urbanisation in India.

Correa, et al. [1988] [16] have discussed a broad range of policy interventions necessary to bring about more humane and efficient urban settlements, keeping in mind the urgency of generating rapid economic growth with equity and social justice. Urbanisation, in their view, is a phenomenon of unique scope and dimension, one, which is going to change fundamentally the nature of our lives. From it will emerge the central, political, human and moral issues of our times, precipitated by the expectations of the millions upon millions of our people who want to find a better future.

2.3.2 Traffic Planning and Engineering.

Buchanan's [1963] [8] explained the long-term development of roads and traffic in urban areas and their influence on the urban environment. He looked at urban areas as a whole and in a general way. The recommendation made are not of the small scale variety since these cannot provide lasting benefits and will be overtaken by the increase of traffic almost as soon as they are finished. The proposals made are large scale, involving considerable expenses and great physical complexities of architecture and engineering, since these will ensure beyond any doubt that they will discharge the role for which they are designed. The report comes up with broad outline of a comprehensive nature to the problems raised by traffic in towns.

Kadiyali [1978] [37] has given the subject a multi-disciplinary coverage, with a bias towards traffic conditions existing in India. It has covered the topic in fourteen sections which consists of an introduction and is followed by traffic surveys, analysis and interpretations of traffic studies, geometric design,

parking, traffic controls, traffic regulations, traffic safety, street lighting, traffic management, highway capacity, theory of traffic flow, transportation planning and transport economics.

Agarwal [1996] [1] critically examines almost every important aspect of urban transport with particular reference to the Indian context and the emerging national scenario. He has given a lot of latest data on urban transportation, which is very useful.

Altshuler [1979] [2] has elucidated the ways in which political, cultural, economic, and technological factors have combined to shape the American system of urban transportation. He has particularly discussed the problems of energy, air quality, safety, equity, congestion, land use and urban development.

Banister's [1994] [5] has made an well-organised presentation of the transport scenario in the western world. He has concentrated on the processes by which analysis links with policy and the changes that have taken place in the last 30 years. Most emphasis was placed on passenger transport (public and private) and on land based modes. Attention was also given towards the new transport technologies, the environment and important policy issues, such as, market and planning failures.

Ministry of Urban Affairs and Employment [1996] [86] has published the report of the working group on urban transport and has made recommendations on:

- Preparation of transport development plans for large cities.

- Constitution of transport cell.

- Constitution of unified metropolitan transport authorities.

- Creation of special fund for transport projects.

In the section dealing with the transport plans for large cities the working group

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is of the opinion that the transport plan should indicate the need for developing 'green' modes like bicycle, walking, provisions of pedestrian paths and cycle tracks especially in new development areas of larger cities and small and medium towns which should be integrated with the transport network and land use.

In the recommendations the group is of the view that there is a need to study further the role of intermediate passenger transport (IPT), slow moving vehicles and pedestrians which have not been deliberated in detail by the working group in view of the terms of reference though it was felt that these modes will play a very useful role in mitigating traffic problems as supporting modes to improve mobility as well as accessibility.

Department of Housing and Urban Development, [75] Government of Orissa (1994) has published a report on the development of a transport network for the twin cities of Cuttack and Bhubaneswar. The objective of the study was to formulate improvement schemes relating to traffic and transportation, which can be implemented over short, medium and long-term phases. The key methodology adopted for the study was the traditional four-stage transport planning process consisting of trip generation, trip distribution, modal split and trip assignment. The horizon year for the plan is 2011.

Various recommendations, such as, new links, widening of existing roads, priority junctions for grade separation etc. have been worked out on the basis of travel demand assigned on the network.

Sriramulu et. al. [1977] [63] presented the debate on transportation engineering, which covers in detail the important aspects of road, rail, and water and air transport systems.

Babkov [1975] [4] has opined that there were a number of factors, which simultaneously contribute to road safety. He has also looked into the specific aspects of road safety as affected by the road conditions assuming a situation where the motor vehicle runs and the drivers work.

2.3.3 Planning Data

Institute of Town Planners, India, [1996] [36] has prepared guidelines for the formulation and implementation of urban development plans for small, medium and large cities, incorporating efficient implementation mechanism and innovative techniques for promotion of planned socio-economic and spatial development of urban centres. It also has sections, which simplifies the development promotion regulations and amends/ restructures the town planning laws.

Master Plan Report of Lucknow [1961] [83] gives us the master proposal of Lucknow till the horizon year 1995. It provides information on the growth and origin, its regional setting, the demographic base, industries, business and commerce, housing condition, community facilities, open space and recreation, medical facilities, traffic and transportation, public utilities and services, zoning and sub-division regulations, financial implication of the plan, and its planning administration and enforcement.

Kumar [1996] [79] has prepared a dissertation on the physical and infrastructural development along river Ganga in Patna. This report is based on the master plan of Patna, and gives special emphasis on the river front development.

2.4 SITE PLANNING AND URBAN SPACE DESIGN

Hass-Klau [1990] [32] in her book titled "The pedestrian and city traffic "presents the following; at the outset it gives a historical review of the development of ideas for safeguarding the pedestrians; and secondly it gives invaluable suggestions as to how one should proceed. Although reference is made to the practice in France and the United States, special contributions by the Author has been made to compare the approaches between the German and British methods. Besides, the segregation of pedestrian from the automobile traffic and its various implications, the Author makes detailed references to the concept of " Traffic Calming ". The author is of the view that at times it is not possible to totally segregate the modes of traffic and in such situations an attempt should be made to mix the different transport modes and create a form of peaceful coexistence between them. Making appropriate modifications in the overall transport policy concept, which includes, apart from a reduction of average motor vehicle speed in built-up areas, a strong promotion of the pedestrian, public and bicycle transport can do this. It also involves road pricing and parking restriction. The Author defines " Traffic calming" as a bundle of transport policies intended to alleviate the adverse environmental, safety, and severance effects motor vehicles have been and will be creating.

Prasad [1989] [51] argued that birth and death is natural to all living organisms. This is true of human beings as well as of human settlements. The city is a living organism and, therefore, it has a life cycle of birth, growth and decline. Decline of city warrants action by the policy makers and planners to provide a living environment to the humans.

Spreiregen [1964] [62] looked into the heritage of urban design, the roots of the modern concepts, visual surveys, principles and techniques, urban aesthetics, designing parts of the city, circulation and a comprehensive role for urban design.

Antoniou [1971] [3] tried to put into proper perspective the factors involved, while suggesting relevant techniques and examples of implementation. He made a vehicle-centric approach and solutions to the problems of the central areas of the cities.

Tetlow [1965] [64] has written with the theme that the welfare of man is the true object of planning; his health, happiness and convenience, the primary aim. But through the process and intricacies of planning the real purpose of planning tends to be forgotten. He has traced the present-day environment in Britain and the pioneering ideas for its improvement. The growing dominance of the motor vehicles and its impact on society are studied in detail: the planning experiences of the last twenty years in urban renewal, town centre redevelopment and new towns are described, and the lessons learnt from them considered.

Mackie [1978] [80] and Alastair Methven have prepared a desk manual showing a step by step process through the analysis of quality and character in what exists to the derivation of well based urban design rules, aimed at controlling new development so that the end product is sympathetic to its surroundings and acceptable to the public at large.

Evans [1978] [24] has covered the following aspects, such as, town planning and architecture, objectives in town planning, constraints in town planning, the city conceived as a whole, principal sub-divisions of the city, the elements of

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the city, the size of the city.

Broadbent [1990] [7] opined that urban design has become increasingly important, as cities continue to expand and pressure on existing structure and open spaces grow. He provided a clear analysis of the nature of many of today's design problem, identifying their causes in history and suggesting a rationale for co-ordinated solution. The work provides a critique of the 'rationalist' and 'empiricist' tendencies in modern architecture, relating them to parallels between philosophical thought and design theory through the ages.

Puskarev's [1975] [52] provided qualitative methods of proportioning pedestrian space in downtown in relation to the adjoining buildings, which is very useful. It can also be considered as a text on theory and application, and therefore, useful to professionals like architects, planners, engineers and others.

Brambilla [1977] [6] has dealt with the planning, design, and management of traffic-free zones, and has given reasons for pedestrian zoning, functioning of these zones, and the experience in Europe and North American.

Organisation for Economic Co-operation and Development [90] (1995) had conducted a conference at Paris on "Better Towns with Less Traffic". Several important papers related to parking, traffic limitations, cyclists and pedestrians, priorities for public transport, para-transit, planning, financing and implementing urban transport policies, and economic and energy issues were presented.

Metropolitan Association of Urban Designers and [84] Environmental Planners (1974) had conducted a Seminar on "Bicycle/Pedestrian Planning and Design" and papers were presented on the following issues:

- Role of Government.

- Pedestrian planning and Design.

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- Research in Pedestrian and Bicycle safety.

- Construction and maintenance of Bicycle Facilities.

- Pedestrian Design and Analysis.

- Getting the Job Done.

- Bikeway Planning and Design.

- Pedestrian/Bicycle safety and Health.

- Mobility.

- High Rise Buildings, Pedestrian and Pedestrian Safety.

- People Movers - Pro or Con.

- Bicycle Theft and Registration.

- Laws, Ordinance and Enforcement.

- Criteria for Development of Bikeways.

Lynch [1971] [45] has published generally about site planning covering all the important aspects, such as, the art of site planning, analysing a locality, organising place and action, site form and site ecology, social and psychological analysis, movement systems, design and management of site, housing and special types of site planning like shopping centres, industrial districts, institutions, open spaces and urban renewal.

Marcus [1990] [47] has brought together the findings of many studies on people and environment interaction, and made them available in one single book, which includes information on seven types of urban spaces, urban plazas, neighbourhood parks, mini-parks, vest-pocket parks, campus outdoor spaces, housing and outdoor spaces for the elderly, day care outdoor spaces, and hospital outdoor spaces.

Bhattacharjee [1979] [72] has looked into the pedestrians as apart of the urban

traffic, pedestrian behavioural characteristics, human characteristics, norms and standards for pedestrian facilities, conceptual planning, goals and objectives for planning for pedestrian in India, policies and made some recommendations.

Mittal [1982] [88] opined that commercial areas in metropolitan cities are major traffic attractions on account of their land use and activity configuration. Most commercial activities are still concentrated in the city core and in other congested areas which have an informal road network and this leads to serious conflict between pedestrian and vehicular movement. Apart from the conflict, problem of congestion and degrading environmental quality pose serious threat to the areas. The Author has also demonstrated the utility of pedestrianisation as a technique in alleviating the pedestrian-vehicular conflict and revitalising degraded environments in commercial areas.

2.5 PEDESTRIAN MOVEMENT AND STANDARDS

Hillman [1979] [34] has made an attempt to explain aspects, such as, attitudes towards pedestrian travel, the pattern and safety of walking, patterns of walking in the population, density and accessibility, school journeys, journey to walk, shopping, personal business and leisure journey.

Predtechenskii [1966] [52] intended to acquaint the technical community with the problems of foot traffic and its present state of development in terms of knowledge. The Author has prepared a handbook to aid in the design of large public buildings for large flows of foot traffic. It has many detailed and solved examples so that complex calculations can be attempted by the user.

2.6 DETAILING AND CONSTRUCTION

Chiara [1984] [10] has made an attempt to prepare standards for site planning. It provides basic design criteria, analytic methods, and construction details for all phases of site development. It starts with the pre-design stage of data inventory, environmental considerations, and ancillary surveys; continues through the analysis of site conditions; and finally deals with the design stages of plan alternatives through specific site details.

Chiara [1995] [11] has prepared standards for housing and residential development. The material is strongly weighed towards the more technical and practical. The sections on general planning and neighbourhood organisation, site considerations and site planning, subdivision and land planning and community facilities are of importance for pedestrianisation, particularly in connection with housing areas.

Littlewood [1984] [43] has produced a handbook to meet the needs of landscape architects, architects and other professionals who are responsible for the production of drawn details for landscape works.

Downing [1977] [21] has gathered information pertaining to a variety of aspects of construction while at the same time emphasises on the reasons for the development of construction methods and also on the actual forms they have taken. Factual information is provided on site investigation, earthworks, drainage, surfacing, construction of simple structures and water features.

Clouston [1981] [15] has elaborated on trees in towns and the maintenance and management of the same. It covers very fundamental information needs of those who deal with horticulture in towns and, provides information on the following aspects:

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- The trees and the city.

- Physical problems caused by trees.

- The care and repair of trees.

- Tree diseases and disorders.

- The impact of the law.

- Managing the landscape of towns.

Handisyde [1976] [30] has documented the properties, choice and use of clay or calcium silicate brickwork.

Tsuru's [1989] [66] has described the total concept of urban signage design stressing on the relationship between "humans" and "objects" through signs. The signs have been grouped under two heads of concept and the role of the signs. The varieties of roles of signs have been distributed under use zones such as roads and bridges, parks and historic sites, transportation networks and others.

2.7 INFERENCES

The review of the related literature provides important information, which can be used, for the finalisation of a strategy for pedestrianisation of Indian cities. It also gives valuable information that helps in the formulation of the policy guidelines at the end of the investigation. The inferences have been places in the same order as the review for easy cross-reference.

1. In order to evolve designs with better performance standards, it is essential to cross- examine, and obtain feed backs, based on either completed or existing projects.

Appraisal, Programming and Design are three linked activities in creation of

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architecture, urban spaces including cities. In the present times, appraisal of the design is the major missing link in the design process. It is, therefore, necessary for the designer to evaluate the performance of existing urban environments prior to making proposals for new ones. Multicriteria evaluation is one of the appropriate methods for appraisal of existing projects.

2. Of all the various views on aesthetics and particularly architectural aesthetics, those expressed by Ching (1979) are the most organised and logical. In his work he has translate some of the ideas initially expressed by Parmar(1973) in a meaningful and logical way which can be understood and appreciated by all interested in architectural aesthetics. Saxena's work is very useful for the Indian orientation towards aesthetics.

The studies have clearly analysed the factors, which constitute or make an aesthetically sensitive environment, and are very useful for urban design.

3. The material reviewed provide and identify the list of heads under which the applied social sciences can be used, and the existing built environment, that is, architecture, urban spaces and cities can be investigated. This literature survey provides the basis for determining the components of urban space.

4. The United Nations Conference on Human Settlements [habitat II), 1996, has made note of the various recent global transformations and the resulting need to define partnership processes to ensure viable, supportive, safer, and healthier, human settlements. It states the following guiding principles:

- The town is the pivotal human settlement, around and within which economic growth and sustainable development, the invention of our future, and a renewed vision of human progress, amongst other important goals, will be determined.

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- The future of our towns and cities must be conceived and organised around the concept of sustainable development.

- Towns and cities must be made more aware of the concepts of sustainable environmental management.

- The problems of congestion and pollution caused by the growth of traffic in towns must be overcome.

- Towns and cities must invigorate, rather than impoverish, rural areas.

- Towns and cities must give more attention to social integration and the struggle against exclusion.

- Sustainable human development must be conceived and enacted at the local level.

- Decentralisation should be the favoured approach in promoting sustainable human development and the good governance of human settlements.

- Decentralisation policies should acknowledge the strategic role to be played by local authorities.

- Local authorities must have adequate powers and resources to undertake their responsibilities.

- Local authorities must establish stable and sustainable means of financial, social, technical, and cultural co-operation among human settlements.

5. The world bodies have discussed and decided that there should be social integration and the struggle against exclusion must be continued. As a consequence the government of India has passed the "The persons with disabilities (equal opportunities, protection of rights and full participation) act, 1995" and now it is up to the executive bodies of the country to ensure that the handicapped are given the facilities due to them.

6. The urban areas are the largest contributors to the national gross domestic product.

7. Most of the books on planning ratify the fact that there is a close interrelation between the type of land use and the need for transportation facilities.

8. Many of the books give information on the fundamentals of town planning which is useful for understanding the basic ideas and concepts of town planning.

9. History of settlements in India was available in the various texts on town planning. This is of particular interest because it gives us an insight to the pedestrian movement patterns in the ancient times.

10. In the Indian context, creation of new towns is not necessary. It has been suggested that the containment and decentralisation of existing metropolitan and large city agglomerations is essential. Crash programmes of accelerated infrastructural development in fast growing medium sized cities should be carried out for strengthening employment generation. Employment generation and priority development in medium sized cities is inevitable since they can reduce the problems, which are aggravated in the major cities. Enlargement of the medium size city network through accelerated development of next-lower-order urban centre. It has been advocated to develop and strengthen the existing small towns by locating public sector industrial development in relationship to existing small towns and to develop a system of mutual dependence. Establishment of multi industry townships rather than single-industry townships are also recommended. Diversification of the economic base of existing towns and the reorganisation of their urban management systems to enable them to emerge as viable regional centres so as to take

fuller advantage of the large public investments that have been made in them. The whole emphasis is to work on the existing towns and cities and make them more viable.

11. The decay and degradation of services and the increasing pauperisation of the existing urban centres should be immediately reversed.

12. The growth of population in the existing urban centres would increase considerably in the future, hence these centres should be ready to accommodate and absorb them.

13. An urban planning process is suggested for the urban-area level where the present emphasis is on the statutory powers of the long-range vision of the city. This should be shifted to short term management of the urban system. The organisation of this planning process is based on a two fold strategy --- one that is concerned with a policy which focuses on the performance goals for the urban area in a long-term horizon; and the other with programming that focuses on achievement of goals for specific functional activities of sectors or the subject areas that are of concern to the urban area for short and medium terms.

14. Comprehensive provisions for area conservation must be explicitly recognised as an integral part of the town planning process, that is of the land use plan, building regulations and development policies.

15. The National commission on urbanisation has recommended that long term and capital intensive plans for transportation should give way, to the extent possible, to low-cost transportation plans. Indigenous planning models, which take into account socio-economic conditions, should be devised.

16. Integration of the traffic network of the city, both upward from the regional, district and local level and downward to the neighbourhood and right up to the

building is stressed in many of the literature on transport planning. The modal changes become important in these circumstances.

17. Journey to work and back accounts for more than 50 percent of trips. The demand for transport can be reduced substantially by locating work place in the proximity of residential areas.

18. Most of the literature expresses the fact that motorised traffic is the biggest polluter of the environment. Some of them are of the opinion that it should be cut off, particularly from the central business district and from the residential areas.

19. Pedestrianisation and bicycles seem to be the favourite modes, for movement within cities.

20. Non of the literature have suggested total pedestrianisation of the city and complete removal of vehicular traffic from it in view of the circumstances that most of the cities have grown beyond the size of a persons walking capacity.

21. The research work pertaining to planning discourage personalised motor transport and encourage mass transport systems.

22. Most of the Indian towns have mixed traffic consisting of motorised and animal drawn vehicles. This makes the movement of traffic quite inefficient. It creates congestion, accidents and precipitates wastage of energy while at the same time degrading the environment.

23. The future of transport systems planning and design offer good scope for decentralisation and de-congestion of population and activities through the emergence of a dispersed yet functionally knit pattern of settlements. This could be articulated at the regional level in the form of clusters of mono and multi-functional centres around a core city linked by fast-movement corridors.

At the metropolitan and large city level, the articulation could come through a 'town within town' concept wherein self-contained and manageable functional communities are identified within the metropolitan fabric.

24. Urban transportation is the most important single component instrumental in shaping urban development and urban living.

25. Encroachment of the right of way and pedestrian paths should be removed and protected against such acts.

26. In the last 50 to 60 years the concept of having certain areas in the city, which will be free of motorised traffic have come up as a result of the automobile onslaught. Some of these concepts are:

- The neighbourhood planning

- The theory of 'precinct' planning put forward by Sir Alker Tripp in 1942

- The 'environmental area' propagated by Sir Colin Buchanan.

- The traffic free zones.

- The conservation areas.

27. There are several studies that have been made regarding pedestrianisation in residential areas, shopping areas, leisure areas and in historic areas in foreign publications. However, there are almost no publications on the Indian pedestrian and the Indian orientation.

28. Coherent urban-form requires a controlled streetscape, one in which mandatory building lines are clearly specified. And the building envelope is according to the prevailing building volumes.

29. Where appropriate, an arcade should be mandatory, so as to provide a shaded promenade which is very appropriate to the Indian climate.

30. Pedestrian precincts, integrated with clusters of otlas for licensed hawkers, should be introduced in Indian city centres. Properly landscaped with trees and benches, these precincts could make a qualitative difference to urban life in India.

31. Car parking should be severely restricted and discreetly placed away from the centre, so as not to destroy the intrinsic architectural or spatial qualities of the chowks and plazas of the cities.

32. Existing open space should be preserved zealously and new ones created in the cities.

33. Public promenades [e.g. along riversides, waterfronts, etc.] should be developed as space intensive, cost- effective urban amenities, useable by the entire spectrum of age groups.

34. Important civic buildings should be treated as urban 'events', giving identity and imageability to different neighbourhoods and generating a greater sense of civic life, thus allowing the city to expand, not as an amorphous undifferentiated mass of built-form, but with a coherent rhythmic syntax.

35. The reports have made proposals for pedestrianisation in specific areas of different towns. They have considered many of the factors that contribute to the improved design and organisation of these basically, traffic free zones. However, they do not deal with the pedestrianisation of the town as a whole.

36. Particular reference has been made to details regarding the anthropometrics and ergonomics of the human being. The movement patterns, space required, slopes, etc. have been also identified.

37. Information on 'detailing and construction in Pedestrianisation' is totally foreign. Further, very little reference material is available.

CHAPTER 3: THE HISTORICAL BACKGROUND

3.1 INTRODUCTION

Civilisation is possible when human kind has reached beyond the level of scratching a bare existence and freed from the day to day struggle for survival. Man, then develops qualities of thought and feeling, ideals of perfection in reasoning, in justice, in physical beauty, and so on.

Therefore, if one is to understand the nature of cities and the design of its urban spaces it is necessary to study the history of civilisation.

City planning and urban design being a creative subject is founded on the knowledge of the obvious and the typical, and it is only through the discipline of the commonplace that the unique is achieved. Therefore, it is essential to find out the principles that govern the typical, for these will be embodied in the creative [49]. This knowledge of the typical is abundantly available in the historical documentation of cities and urban areas.

Hence, this chapter makes an attempt to investigate and record the historical aspects of pedestrianisation in the cities of Europe and India.

3.2 PEDESTRIAN FACILITIES IN ANCIENT EUROPE

3.2.1 The Very Early Period

Historically, roads and streets were developed mainly according to the need of overland travel. The existing geography and the seasons played a major role in the form and route that the roads would take. In most European countries

serious road building had started during the Roman period. Over the centuries that followed the Roman roads were neglected and only tracks and paths remained. Overland travel was either carried out on horseback or on foot.

Within the settlement areas, walking was the usual means of moving about. However, the rich sometimes used sedan chairs or carriages and horses but these were generally used for travel of longer distances. Only a few incidences of conflict between pedestrians and wheeled traffic are known, for instance the congestion of the streets in Rome which led Julius Caesar to ban carts and chariots from the city between sunrise and sunset [32]. The Forum of Pompeii could only be used by pedestrians and the streets leading to the Forum ended as cull-de- sac roads.

The most splendid example of separation between traffic and pedestrian can be found in the city of Venice, which developed from the fifth century onwards. The dredging of canals was used to fill in the land, and boats known as gondolas became the most important transport means. Besides an independent pedestrian network was also provided for the city. This network negotiated the canals by footbridges. Even today, Venice is the most perfect example of a city in which transport modes are separated [32].

3.2.2 The Industrial Revolution and Its Impact on Transportation

The industrial revolution which started around the 1750 brought about many dramatic changes in the lives of people and the way their cities developed.

The industrial system was dependent upon the transportation of raw material to the factories and finished products to the consumers and, therefore, a lot of effort was put into the development of a convenient mode of transport.

At first goods were hauled in wagons and towed in river barges. Then, with the invention of the steam engine the transport of man and materials was carried out on water bodies by the steamboat (first used in 1809) and on the land by steam railroad (first used in 1825).

The cities began to get crowded along with the prosperity of the industrial revolution. In the beginning, the horse-drawn carriage trundled the people leisurely in the streets. Subsequently, the Voiture-omnibus for passenger transportation was also introduced in Paris in 1819 and was adopted as the horse-car in New York city in 1831. Then came the horse-car on rail lines to be replaced by the electric street railway, which became the principal urban transport of the period. Then in the year 1891, the electric railway went underground to become the subway system of today.

All these efforts failed to solve the traffic and transportation problems and these infact aided and abetted congestion. Over the years, the cities spread, population grew, and transportation only intensified concentration in the urban centres [26].

3.2.3 The Era of the Automobile

Traffic congestion was further increased by two major inventions: firstly, the bicycle, which was in common use from 1895 onwards, and secondly the automobile.

The bicycles were mainly used by the young and lower income groups of the society, and they became popular in Britain and in many other European countries.

In the year 1885, the internal combustion engine was invented and in the year

1895 only four automobiles had been registered in the United States. Subsequently the number of automobile increased in such large numbers that they split the city open at the seams, and till today we are desperately trying to hold it together with patches on a worn-out fabric.

Over the years, the automobile, along with all the other modes of travel, made striking progress in terms of increased speed and mobility for millions of people. In the mean time city planners and administrators were confronted with a paradox. On the one hand they struggled to design a circulation system to accommodate vast changes in the speed of transportation; and on the other, they searched desperately for a place where these vehicles could park. The automobile was trapped in the old street systems of the cities and when the planners created more and wider roads more traffic occupied them.

Congestion was not relieved. Slow-moving and short-haul traffic mixed with vehicles destined for more distant points, left turns occurred at all intersections, truck and passenger vehicles vied for parking and loading space along the curbs, vehicular and pedestrian traffic conflicted. Unlimited ingress and egress flowed from abutting property into the traffic lanes, frequent intersections impeded movement, and the multitude of commercial distractions along the streets brought chaos to the city.

The pedestrian at this point of time was the most affected and the least cared. The efforts to provide the pedestrian with some facility started with the movement to create open spaces as a necessity for his well being. The open space movement was also connected with the struggle to obtain the rights of public footpaths. The landscape architect became an important initiator of the concept of segregation between wheeled traffic and footpaths, at first, they

used this concept in the parks and later in the newly designed housing estates. These were only isolated attempts and the general situation of chaos continued unabated in most cities of the world.

A greater issue than the chaos was that the automobile had become a weapon of murder as millions were being killed by it every year [26].

3.2.4 Emergence of Grade-Separated Pedestrian Facilities: 1920 Onwards

Through out the entire period of contemporary history, many different devices and ideas were used to cope with wheeled and later motor traffic. The most common form consisted of suggesting or actually planning the separation of different transport modes. This was carried out in the form of pavements, or in more sophisticated ways such as arcades. Upper-level walkways were frequently suggested but were too expensive to implement. Appropriate solutions could not be found and the problem of congestion, pollution, chaos and traffic accidents burdened the city planner, administrators and the general public.

The Neighbourhood Idea.

The word neighbourhood seems to have been used for the first time in connection with a competition in Chicago in 1916, the first full statement of the idea appears in Clarence Perry's monograph titled 'The regional Survey of New York' published in 1929. The underlying principle of his concept is that an urban neighbourhood should be regarded both as a unit of a larger whole and as a distinct entity in itself. He laid down the fundamental elements on which he intended the neighbourhood unit should be based: size, boundaries, open

spaces, institutional sites, local shops and internal road systems. One of Perry's major objectives was a special street system; main arterial streets were to be designed to carry heavy through traffic and this was to be discouraged within the neighbourhood unit. Here the purpose of streets was to make local circulation easy; even after eliminating through traffic, pedestrians should be segregated from moving vehicles, and underpasses constructed where necessary.

Subsequently, there has been much discussion on what a neighbourhood is. Physical planners, designers, and geographers have concentrated on the physical dimensions of the neighbourhood, describing it in terms of boundaries and areas.

On the other hand, sociologists and social planners have stressed with equal singularity the social dimensions of a neighbourhood. They view the neighbourhood in terms of its symbolic and cultural aspects, and emphasise shared activities and experiences, the resulting social groupings, and common values and loyalties. The physical environment is taken for granted.

A few planning theoreticians have pled for a unified definition that combine both the social and physical aspects of a neighbourhood.

The Radburn Idea.

This was an improved neighbourhood unit pattern, which incorporated new features aimed at solving the traffic problem. 'The City Housing Corporation', a private company acquired about two square miles of irregular land, in Radburn, near New York. It was their intention to build an American 'Garden City' with a population of 25,000 in three neighbourhoods [33].

Clarence Stein and Henry Wright have prepared the plan for this project. The

general planning of the neighbourhood units closely follows Perry's idea. It was based on the school as a community centre; through traffic was channelled on the main roads of the town, and shopping centres were located on these roads. A logical system of specialised one - purpose roads were devised - arterial roads linking with the surrounding area, main town roads, main estate roads and service roads for houses. The main estate roads enclosed 'superblocks' - areas of 30 to 50 acres within which were the houses and the cul-de-sac that served them. Large areas of open space were left in the centre of the 'superblocks' providing a backbone of continuous park, towards which the houses faced, and through which ran footpaths, underpasses and footbridges across traffic roads linking the 'superblocks' together. There was to be infact complete segregation between the pedestrian and the motor car but Radburn not be totally completed due to the depression in America

The Precinct.

The theory of 'precinct' planning was put forward in 1942 by Sir Alker Tripp, then Assistant Commissioner of the Metropolitan Police. He pointed out that road traffic conditions had rendered the all-purpose highway obsolete - a road could no longer fulfil the function of a main route together with that of an access to building along its frontage.

Environmental Areas [64].

The Buchanan Report, published in 1963, was a significant step in dissecting the problem of traffic in towns and laying open the malady as it exists today. One of the concepts developed in the report is of the 'environmental area'. The environmental area is an area having no extraneous traffic, and within which considerations of environment predominate over the use of vehicles. Access to

2A8357

these areas should be planned in such a way that traffic does not degrade the environment and the pedestrian is dominant. This implies that the environmental areas should be tied together by the interlacing network of distributor roads, into which all longer movements should be canalised without choice.

The Environmental Area deals in simple and fundamental terms with the essence of the problem of the motor age. It re-establishes the primacy of the scale of values of man on foot; at the same time it calls for changing social conditions and environment to suit the new needs of the motor age - to utilise the advantages of greater mobility without surrendering the mastery to the machine [8].

Pedestrian planning in new towns of the 1950s.

In the planning of new towns in the advanced countries, the intention was to separate the pedestrians from the automobile traffic and to allow the pedestrians to move about in the towns, or in certain segments of the town, without the fear of being run-over by an automobile. The social scientists were primarily responsible for this reconsideration in thinking and this was rather a people's movement.

In many of the new towns designed during this period, the concept of complete segregation between the automobile traffic and the pedestrian movement was ensured. The "Radburn layout " was used in whole cities and the walking public was given priority over the automobile [64].

Pedestrian zones of the 1960's.

In the middle of the twentieth century, a radical transformation started to occur in the central areas of existing cities. Large tracks of city roads were gradually

cut off from the main automobile traffic, and redesigned for the pedestrian. Streets were paved, sidewalks were widened, street side retail areas were encouraged, and many amenities and facilities, such as, seating, bandstand, sculpture and other outdoor facilities were provided to make the new pedestrian areas welcoming to the city dwellers.

3.3 PEDESTRIAN FACILITIES IN ANCIENT INDIA

3.3.1 The Indus Valley Period

Pedestrian facilities in ancient times were synonymous with town planning and road layouts because the basis for moving about in the town was walking and possibly by using animal drawn carts. But it must be noted that the animal drawn carts were mostly used for agricultural purposes and moved to and from the agricultural fields to the settlement. The size and scale of the settlement was as per the access range of the human beings or at best the access range of the animals that used to draw the carts.

The two cities of Mohenjadaro and Harappa represent the climax of urban development attained during the Indus valley culture. These towns represent the typical urban morphology of the settlements in the Indus valley civilisation. Each is located on a navigable river and the city proper consisted of two component parts: (A) a citadel built on high ground and (B) a lower city, where a vast majority of the population lived.

The citadel consisted of a large number of major buildings surrounded by fortification walls. This was where the nobles and high priests resided. The lower city, or the city proper, was built on a gridiron pattern, where the streets

were aligned east-west and north-south. A three level hierarchy of streets is observed, the largest being 14 metres wide and the smallest around three metres. The city had elaborate drainage system, where the main drain channels along main streets were fully covered. Residential buildings of the ordinary citizens varied in size indicating different levels of income and social status. A feature of the houses was their windowless outer walls and the doors opened onto the narrow lanes rather that than onto the main streets. This was for the purpose of privacy from the passing pedestrians; the lighting and ventilation of the residences were done through internal courtyards.

The two cities extended over an approximate area of more than two square kilometres (the lower main city proper was about one square kilometre) and therefore was well within the pedestrian range and scale.

3.3.2 The Vedic Period

After the Indus Valley civilisation, the first information of ancient India is from the Vedic texts and early treatises describing a well-developed science of village planning (Grama-Sannivesa) and town planning (Nagara-Sannivesa). Ancient treatises, such as, Viswakarma Vastusasthra, Manasara, Mayamatam, all dating from before 3000 BC, contain clear directions regarding the location and planning of villages, towns and cities as a part of general town administration.

The plan of a Vedic town fairly reproduces the plan of a Vedic village, which in turn corresponds to the plan of a temple. In all these there are two central roads dividing the settlement into four quadrants and the whole surrounded by
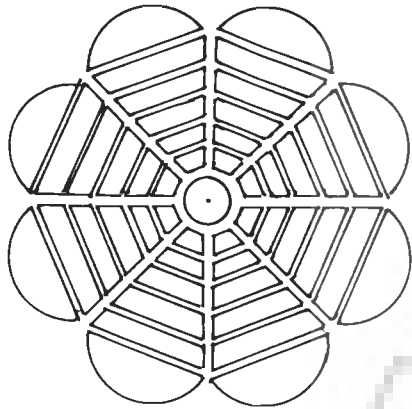
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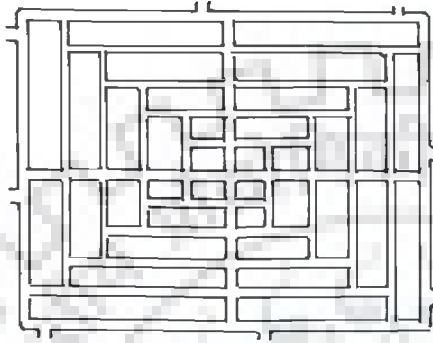
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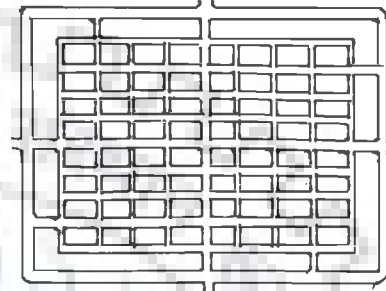
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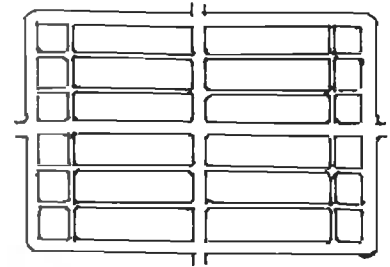
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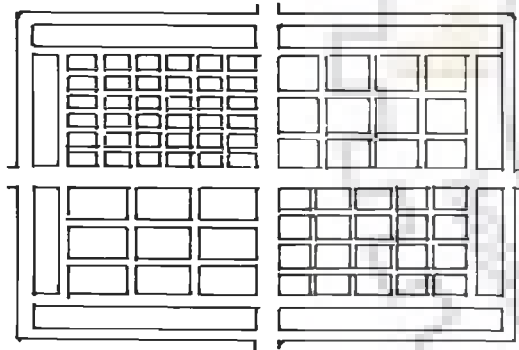
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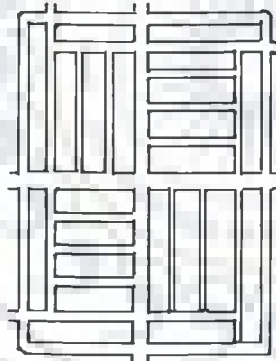
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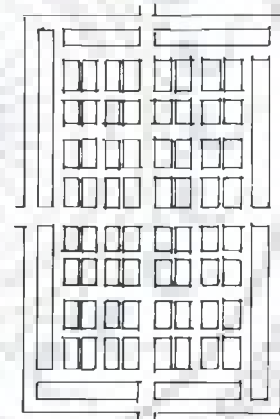
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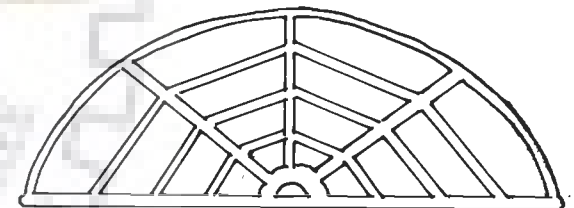
KARMUKA

NORTH;	SCALE: NTS.

FIG. NO:- 2	PAGE NO :- 54	TITLE: VEDIC TOWN PLANNING CONCEPTS.

a peripheral road. The quadrants were then divided into wards by a chessboard system of roads and the wards were allocated to the people based on their profession and social status. These major central roads formed the central axial roads of the towns and continued up to the main highways of the empire. The ancient books stated that width, length and direction of the thoroughfares should be such that adequate light and ventilation would reach the houses that abut these roads. Besides, the width of the thoroughfare must be commensurate with the volume of traffic that would move through them. The important, ancient Indian roads were designed to provide access not only to the people, horses and carriages but also for elephants. Pathways, meant only for pedestrians, were known in ancient times as " Padya" and were provided in the minor quadrupeds within the towns. Besides, padyas were provided to give access to gardens, groves and forests [22]. The classification of settlements has been documented in the Manasara. [Figure 2]

3.3.3 The Muslim Period

The history of India became associated with the Muslim rulers from the sixth century AD. There were successive invasions and endless strife between the different rulers. The kingdoms established by Harsha, Kanishka, Mohammed of Gazni, and Mohammed of Ghori were followed by a series of Muslim dynastic rulers in the north of India. During these times urban development was confined to the establishment of well-fortified capital cities.

Each of these fortress towns had a citadel where the residence of the ruler, his place of worship, administrative offices, treasury, and arsenal were located and well guarded. The ordinary people lived partly inside the fortress or just outside

THE WALLED CITY

MEGHWAL PROL.

AMARSAGAR PROL.

KISHEN GHAT PROL.

TO AMARSAGAR.

DORA ROAD

ROAD TO JODHPUR.

ROAD TO BARMER.

GARISAR PROL.

PALACE COMPLEX

GARISAR RESERVOIR
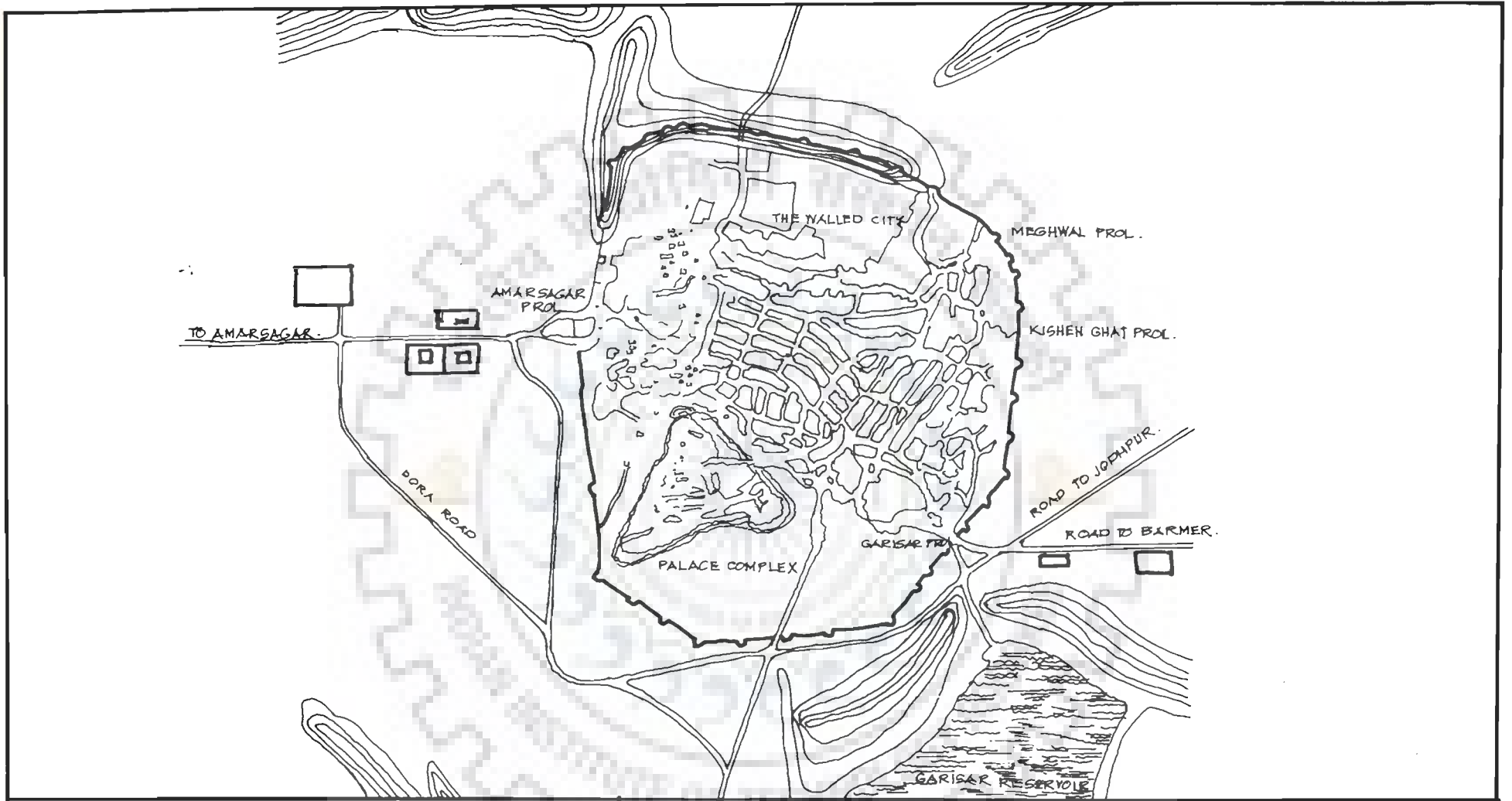
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FIG.NO:- 3	PAGE NO :- 56	TITLE: PLAN OF JAISALMER, THE WALLED TOWN.

and were protected by the ruler.

Jaisalmer in Rajasthan and Golconda in the Deccan are good examples of towns built during this turbulent period.

Jaisalmer has two lines of fortification: one inner wall around the fort on the hill and an outer wall encompassing the town outside and the fort. The walled town covers about five square kilometres and the fort covers about 0.7 square kilometres. The main road run east-west and the entrance to the town is through three gates located on the east, west and south sides of the walled town. Close to the main gate there are town squares used for the resting of camels as the caravan enter the town. The main road is narrow, paved with stone blocks and takes twists and turns and opens into a series of squares - Junadi Chowk and Gopa Chowk - as it negotiates the contours.

As a result of the development of trade and commerce, a number of market squares or chowks came into existence within the walled town and each specialised in a particular trade, such as, jewellery, grains, or cloth. The palace square is used for religious and public functions. The haveli or residences of the ministers or wealthy traders were important landmarks. The distribution of the population in the city was on the basis of ones occupation [68] [Figure 3]

Golconda, founded as a capital by Sultan Quli in 1518, stands on a boulder-strewn hill in the Deccan plateau commanding extensive view of the surrounding countryside and enclosed by an elaborate system of fortifications, walls, and moats. There are three lines of fort walls; the outer encompassing the town; the second is within the first and surrounds the citadel; and the third, higher and within the second, protects the king's palace. There are eight massive gates that lead into these fortresses and the approaches to these

gates are winding, narrow and in the pedestrian scale. [Figure 4]

The Mogul period stands out as a high watermark of urbanisation in India. The country attained a high level of political stability and economic prosperity under the Moguls for a period of 300 years. The contributions of the Moguls to urbanisation came in the form of revival of existing cities rather than the building of new ones.

Invariably, the capital city was the largest and most impressive and the Mogul capitals were no exception. The three capital cities built by the different Mogul Emperors were Agra, Fatehpur Sikri and Shahjanabad. A major characteristic of the mogul cities was the building of forts in which the entire royal entourage lived. The city of the ordinary people lay outside the fort often surrounded by a wall as in the case of Shahjanabad in Delhi.

The city of Shahjanabad was located on the banks of the Yamuna River and protected by massive fortifications and it could be approached by seven gates from the north, south and the west. The river was located on the east side [Figure 5].

The royal palace was located inside what was called The Red Fort. The second most important element was the mosque known as the Jama Masjid and was located in the middle of the regular city; this was the cultural focal point of the Muslim residents of the city. The Chandni Chowk , the great bazaar of the orient, was laid out in front of the main entrance to the Red Fort to form a central axis ending at the eastern gate of the Fatehpuri mosque. However, the rest of the city was like every other mogul city with a haphazard internal structure with overlapping residential, commercial and industrial land-use. The entire area of the city was closely built and divided into mohallas or localities

GARDEN

[F]

ANYA QILLA

NEW TOWN
(1724)

NAYA QILLA
GARDEN

HAY
MAHALLA

CITADEL

PALACE

MAIN TOWN
(1530)

DIMOND
MARKET.

NORTH:

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FIG·NO:-4

PAGE NO:-
·59

TITLE:

PLAN OF GOLCONDA·FORT

FATEH PURI

AJMERI GATE

MORIGATE

KASHMIRI GATE.

TURKMAN GATE

QUARTERS E' GARDENS OF ENGLISH PEOPLE

JAMA MASJID

CHANDNI CHOWK

JAMUNA RIVER

ZIMATUL MASJID GATE
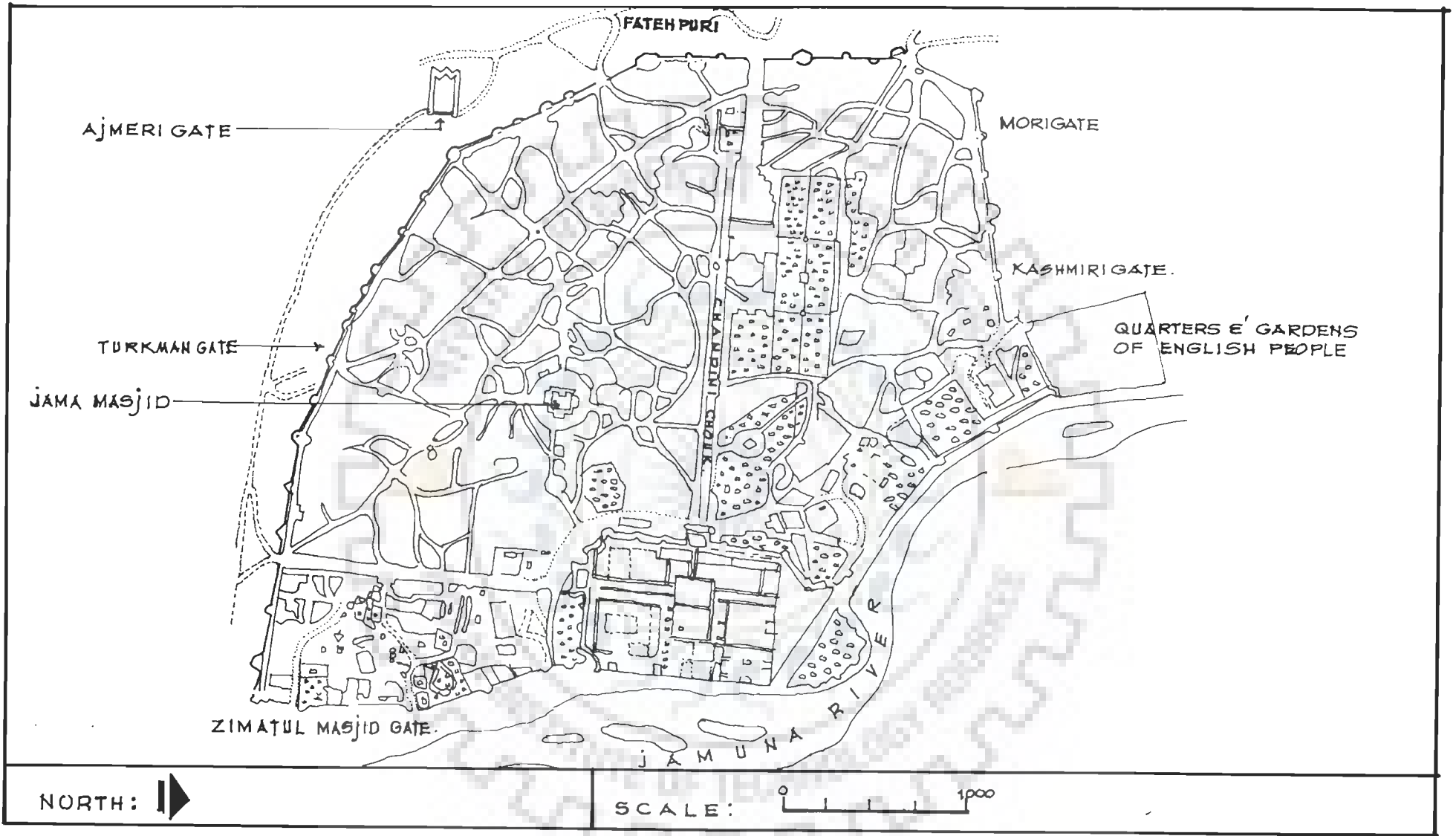
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| FIG. NO: 5 | PAGE NO:-
60 | TITLE:
PLAN OF SHAHAJANABAD IN 1700 A·D |

having a very high density of population. The residential streets were narrow and meandered past the houses; this was probably to protect the people from the scorching summer sun and the biting winds of the winter. It may be noted that the size of the town was about 1.1kilometres by 1.75 kilometres and therefore within the pedestrian walking range. However, a large population of about 5 lakhs was accommodated in the city by providing high-density development [68].

3.3.4 The Colonial Period

The Portuguese, the Dutch, the British, the French and the Danish all arrived in the east in the late fifteenth and early sixteenth centuries to break into trade which was the monopoly of the Arabs at those times. Of all these countries, the British were the most successful and they left a strong impression on the urban fabric of India. The British widened the scope of the economy from basic trade to the production of capital crops and semi-processed goods that were suitable for the European market. This called for the provision of a comprehensive network of roads and railways as well as the establishment of cities throughout the country.

The British regime constructed three types of towns; cantonments, hill stations, and provincial capitals. The provincial capitals were located mostly at the ports, such as, Calcutta, Bombay, and Madras. The capitals of inland provinces were located on the trunk routes like Allahabad, Lahore, and Nagpur. These were administrative and commercial centres that subsequently developed into industrial centres also. In these towns the residential areas for the white population were clearly separated from those for the native population, and the

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areas reserved for the white population were distinctly better in regard to the layout, amenities, entertainment, and commercial activities. These areas were planned with the Horse-carriage as the usual mode of transport. However, special areas known as esplanades were designated for the white population to walk around and socialise. The native areas were allowed to grow without much direction, under the supervision of the local bodies as they had existed before, without any provision for legislation, taxation, or policing. These areas continued to grow with the pedestrian as the mode of movement and the scale was within the reachable limits of walking.

Cantonment towns were established along the main routes in all parts of the country and at strategic places. These were permanent army camps, planned on the gridiron pattern with a small civil population to serve them. These cantonments were laid out with wide roads convenient for the movement of wheeled horse drawn vehicles. Special pedestrian areas called Malls were provided in these towns where shops and places of entertainment were located for the use of the army personnel.

Hill stations were developed both in the north and south of India, examples being Simla, Dalhousie, Nainital, Darjeeling, Ootacamund and Kodaikanal. These stations were primarily places where the governors of provinces, the administration, and the white population could spend their summer months away from the hot plains, and they developed into centres of social activities. These picturesque hill stations were laid out with spacious bungalows, parks, and wide roads and avenues. The residential areas for the native population were at the lower levels, generally crowded, with narrow streets and little or nothing in the way of sanitary facilities [55].

3.4 CYCLE AND PEDESTRIAN ROUTES IN CONTEMPORARY HISTORY OF INDIA

There have been only a few attempts to pedestrianise in the Indian towns in recent history. Most of the efforts were at "spot improvement" or "spot pedestrianisation". Many studies for pedestrianisation have been conducted by different agencies but none of them have been implemented. Segregated pedestrian networks and cycle tracks were provided for the first time in India as a part of the overall city plan in Chandigarh, in 1951. An attempt for separate pedestrian pathways has been made in the plan of Gandhi Nagar, the capital of Gujrat. Other efforts at spot pedestrianisation have been made in Bombay and New Delhi.

3.4.1 Chandigarh

The pedestrian had lost all his right in the settlements of India at around the 1950s, and was not getting his due share of consideration in urban planning. The Government, the administrators and the city planners were emphasising on providing wider and better roads for the motor transport. There were hardly any separation of the motor vehicles and the foot traffic except in the metropolitan cities where footpaths were provided along the side of the roads in important areas.

The first effort to provide adequate facilities for the pedestrian was made in the plan of Chandigarh, the capital of then Punjab.

Le Corbusier in the design of Chandigarh adopted two very different planning ideas of his times, in combination, to achieve very good results in the over all city plan. It was believed at that time that the grid Iron type of plan was not suitable for city planning because it provides access without limit, to the motor

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vehicle, to every part of the city or neighbourhood. The view was that if the neighbourhoods were to be kept free from through traffic then the ' tree type' of plan would be appropriate as it ensures that the motor vehicles stay on the roads designated for them without any choice. Le Corbusier designed Chandigarh having neighbourhoods or sectors on a gridiron format but discouraged free access to the sectoral roads by making them discontinuous, wavy and smaller in width.

The roads have been planned in six categories that i.e. from V-1 to V-6. The hierarchy has been worked out considering their function and the overall network of roads in the city. A completely independent pedestrian system has been planned as the V-7 which runs through all the residential sectors providing inter-sectoral linkages and also connecting the residential areas to the community facilities in the sector [48] [Figure 6].

Though an integrated pedestrian net work was attempted, it has failed to maintain the desired continuity of flow. The facilities have been worked out at the sectoral level to some extent but inter-sectoral continuity is lacking.

Upgrading of the overall network has not been regularly done and therefore some of the pedestrian routes have been destroyed or need maintenance and reorganisation.

The pedestrian facilities in the residential sectors vary from sector to sector depending on the architect who worked on the sectoral plans. The pedestrian arrangement of sector 22 is one of the best amongst the residential sectors.

The pedestrian facilities in the leisure valley and near the lake area have been further upgraded and probably these are some of the best facilities to be seen anywhere in India. The areas have not only been provided with continuous

HARYANA RAJ. BHAWAN

HIGH COURT.

SECRETARIAT

LAKE

TO KALKA/SIMLA

TO KALKA/SIMLA

NEHRU HOSPITAL.

PUNJAB UNIVERSITY.

RAILWAY STATION

TO AMBALA

INDUSTRIAL AREA

TO AMBALA/PATIALA.

TO KHARAR LUDHIANA BHAKRA/NAGAL.

TO AIR-PORT.
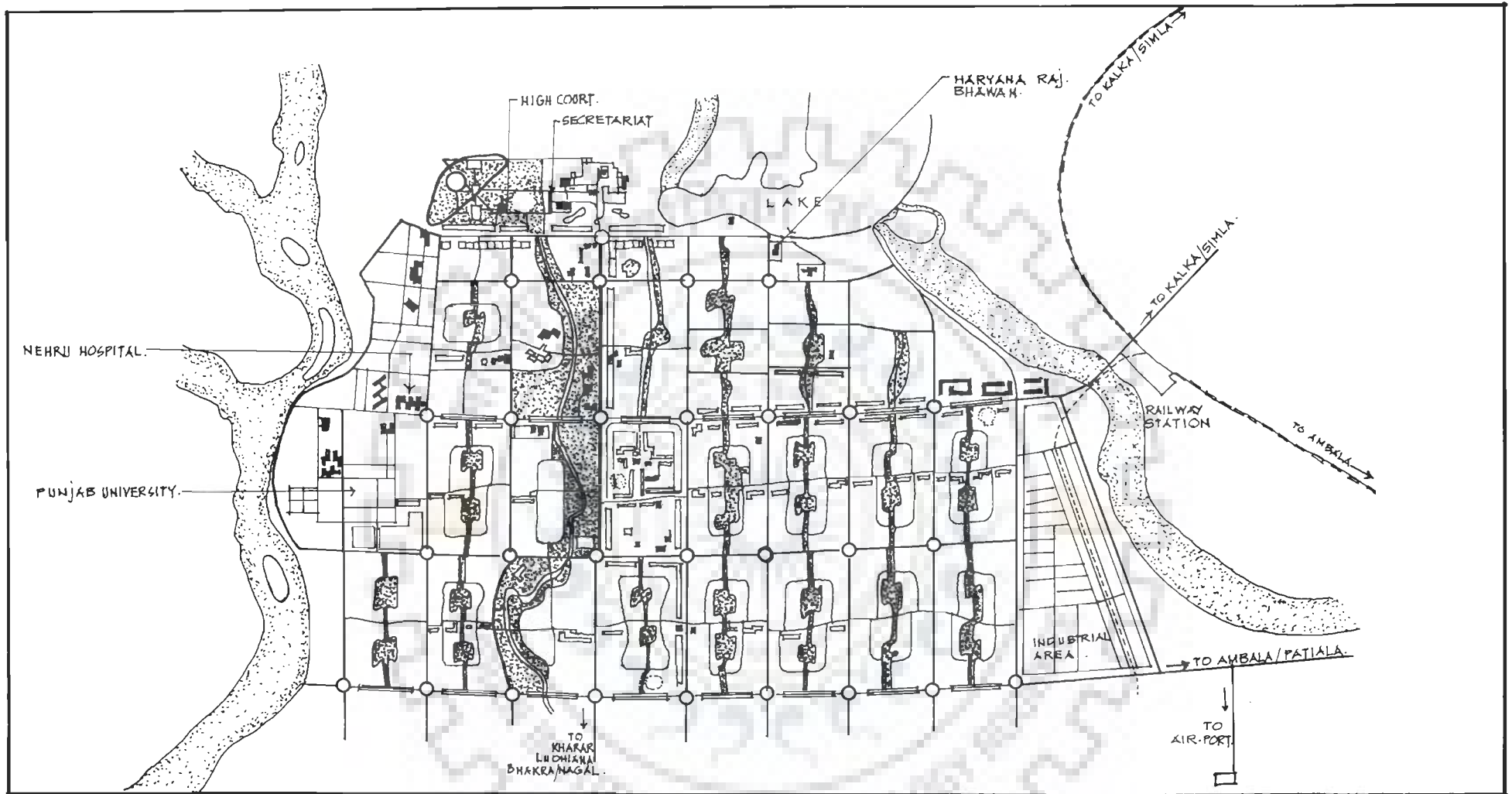
NORTH:

| FIG·NO: 6 | PAGE NO:- 65 | TITLE: MASTER PLAN OF CHANDIGARH SHOWING PEDESTRIAN ROUTES |

Figure 7 Pedestrian Facilities in Chandigarh.

pedestrian routes but also with beautifully laid out parks, jogging tracks with music all along the routes, exercising areas, active sports facilities like tennis courts, stadiums, sculpture parks, rose gardens and all such facilities. These facilities are being well maintained by the Chandigarh administration and enjoyed by the residents of Chandigarh.

Another major pedestrianisation effort has been in sector 17, the commercial centre of the city. The shopping, the offices, three cinema halls, restaurants are all placed around a central pedestrian plaza. The sector has the main bus terminal of the town at the southern corner and the police station and treasury at the western corner. The whole area is interconnected by a pedestrian arrangement. The plaza is very successful and is being upgraded to accommodate the changing requirements of the present times [Figure 7]. However, the pedestrian link between the plaza and the bus terminal is in a dilapidated condition.

It will be fair to conclude from the Chandigarh experience, that when the desire is there it is possible to have pedestrian facilities, teach the people to use them properly with care and enforce its correct usage in the Indian cities. Another aspect is that there are no experts in the area of working out the pedestrian arrangements amongst the town planners or the architects. The area of pedestrian design and planning are considered as too negligible for the town planners who feel that their work involves the upper scale of town planning while the architects are limiting their work to only individual buildings and contribute little to the access arrangements between buildings.

3.4.2 Bombay

The British Council in Bombay held an exhibition and conference on pedestrians in 1982 and considerable public interest was generated by the press and television coverage. Group discussions were held with interested parties leading to the formulation of an ACTION PLAN aimed at improving pedestrian movement at the two major rail terminals Churchgate, Victoria Terminal and a square between the two-Flora Fountain [Figure 8]. The solutions adopted were also designed to improve bus operation and were to be implemented quickly and at low cost on an experimental basis and if found satisfactory to be made permanent   Figure 9].

Churchgate Station is situated at a busy street junction, widened in the past to facilitate turning traffic, and crossed by 70,000 commuters at peak hours. Previously 35% were obliged to cross by footbridge, 5 abreast which took 5 minutes, 45% crossed by subway and 20% crossed at surface level. The proposal was to eliminate turning traffic and tighten the junction with the traffic light interval modified to allow 90% of the pedestrians to cross at surface level and only 10% to use the subway. Accidents have decreased by 27% and noise levels reduced from 80 to 68 dB.

Victoria Terminal was built in 1878 and is considered as one of India's great buildings; it generates around 75000 commuters at peak hours. Local buses previously loading at the side of the station on a congested main road were moved to a new terminal in front of the station formed by closing a traffic roundabout. This has resulted in a better dispersal of pedestrian movement from the station.

Flora Fountain is situated in a large square linked to Victoria Terminal by D. N. Road with arcades on either side. These arcades were previously filled on the south side with over 1000 hawkers and stalls forcing pedestrians to walk on the road. These hawkers were removed and the arcades used solely by pedestrians. Flora Fountain, which was previously a traffic roundabout and a car park, was turned into a pedestrian plaza with the parking cut to half. This scheme took about 12 months to implement [121]. However, as per the latest reports of 1996, some of the pedestrian proposals have been modified to suit the needs, such as, the very useful underground pedestrian subway which encloses the entrance gate of the Churchgate Station and thereby making the pedestrians move directly to the other side of the road. Other minor modifications have been made over time, but this scheme has basically failed due to the continued pressure from the hawkers [Figure 10].

3.4.3 Nainital

The picturesque surroundings of the Himalayas, along with the beauty of the lake, its proximity to the plains and a salubrious climate led to the selection of Nainital as a health resort by the British in 1841. With the turn of the century, it witnessed a phenomenal increase in local population and also visiting tourists. This resulted in a rise in construction activities, new hotels, commercial and the administration, attempts have been made to restore the pristine beauty and grandeur of the town [Figure 11].

CHURCH GATE
STATION
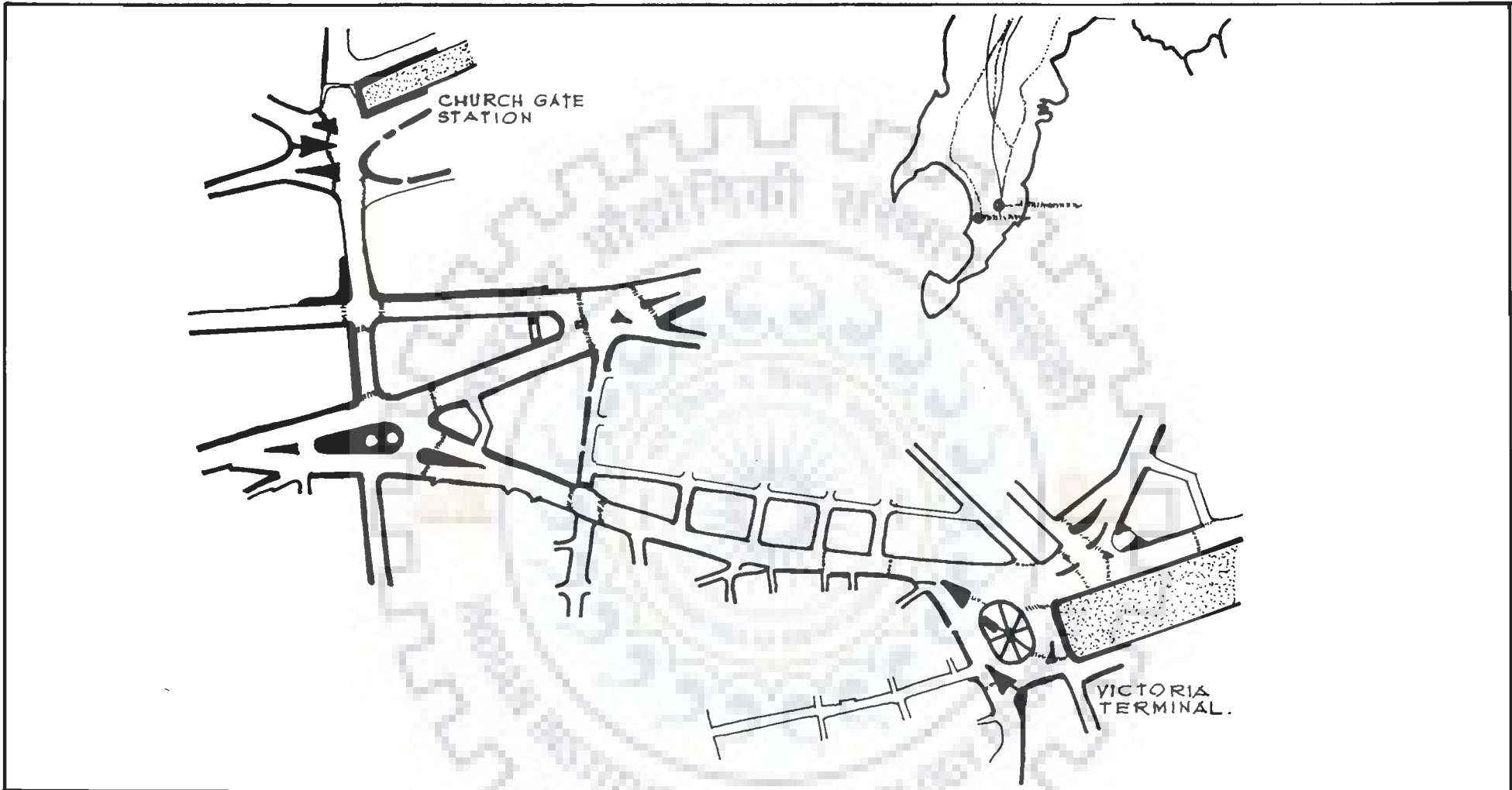
VICTORIA
TERMINAL.

NORTH:

TITLE:
PEDESTRIAN LINK BETWEEN CHURCHGATE
AND VICTORIA TERMINAL . (EXISTING.)

CHURCHGATE
STATION

FLORA FOUNTAIN

D.N.ROAD

VICTORIA
TERMINAL.
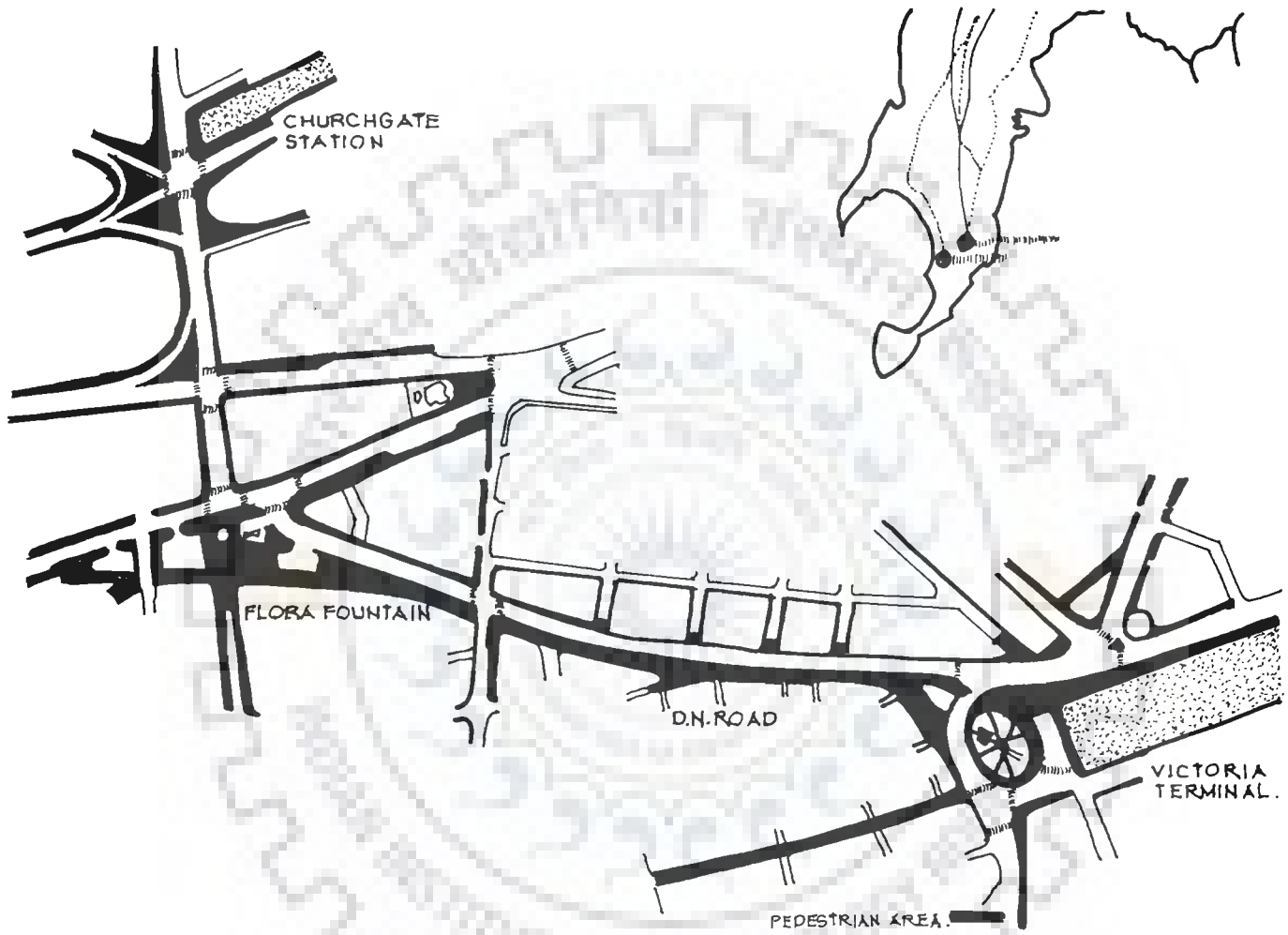
PEDESTRIAN AREA.

NORTH:

| FIGURE NO.-9 | PAGE NO:- 71 | TITLE: PEDESTRIAN LINK BETWEEN CHURCHGATE AND VICTORIA TERMINAL. (PROPOSED). |

Figure 10 Pedestrian Facilities Between Churchgate-Victoria Terminal.

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Some of the recommendations that have been suggested are as follows:

- Reverting and lining of the Ballia Ravine which is in a precarious condition should be done on a war footing.

- Cleaning and maintenance of the drains on the hill slopes and other areas within the hill station.

- implementation of measures to prevent further landslides.

- Removal of rubble from the Cheena Hill owing to the previous landslides and cleaning of the lake.

- Tapping of new sources for portable water.

- To prevent vehicular traffic on the Mall Road and within Nainital.

- Prevention of noise pollution.

Efforts have been taken to look into all these aspects by the administration but the note worthy area is the traffic reorientation and management [57].

Roads in Nainital are primarily for the pedestrians; therefore vehicular traffic needs to be restricted as far as possible. This has been achieved very effectively by the present administration. Here one can find the good results of traffic calming through the methods of pricing.

- Entry of out station vehicles into the town is allowed on payment of rupees fifty at the city entrance.

- Parking lots have been provided at appropriate places and parking charges of rupees twenty is made every time a car is parked.

- The police do not permit parking of vehicles at any other place.

- Bollards have been used effectively to manage traffic.

Pedestrian plazas have been created at appropriate locations and the whole area is generally pedestrianised.

73
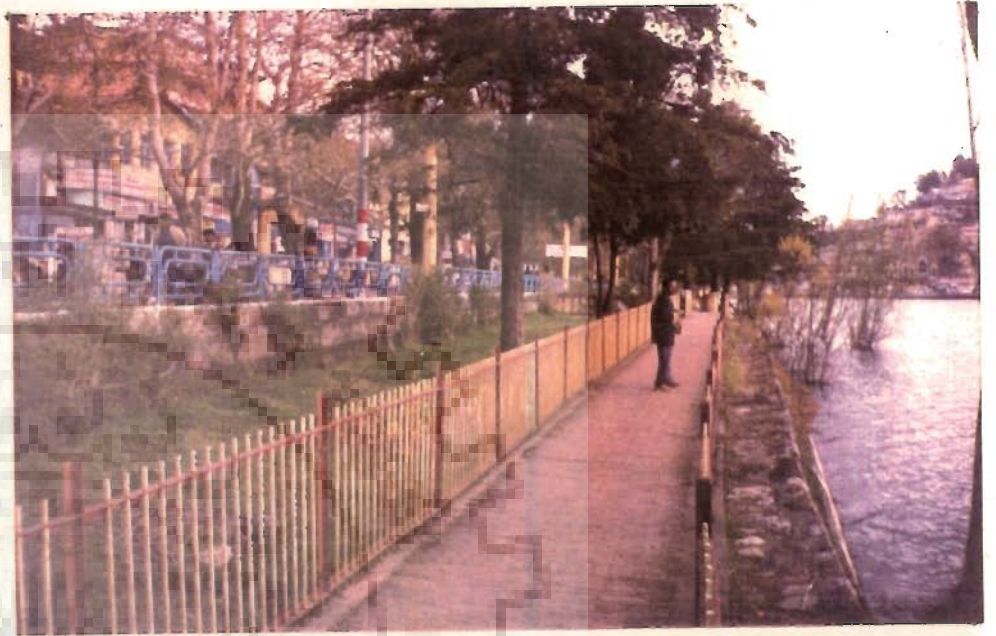
Figure 11   Pedestrian Facilities in Nainital.

The pedestrianisation efforts in this town shows that, if there is a will then, even in India, it is possible to manage the cities to achieve good results which make the cities clean, convenient and liveable.

3.4.4 Pune: Cycle Network Project

Cycle Network Project for Pune was prepared in 1981 as part of the comprehensive Traffic and Transportation plan for Pune Corporation area [86] [Figure 12]

To segregate the cycle traffic from the fast vehicles, the following measures were proposed:

A) Segregation by way of setting aside and reserving part of the carriage way on wide roads exclusively for the use of cyclist and pedestrians.

B) In the congested parts of the city, the segregation can be done by developing an independent cycle network by selecting lanes functioning mostly as access lanes to abutting properties and providing separate signals for cyclists or developing subways below the major road intersections.

C) On roads having width less than 80ft. and having cycle traffic in both the directions, priority should be given by providing cycle tracts on both sides and introducing one way system for fast vehicles with contra-flow for public transport buses. On such routes, both cycles and mass transport system would get priority over other fast vehicles.

D) On roads of inadequate width having considerable cycle traffic, separate cycle tracks should be provided in both the directions while fast vehicular traffic including buses should follow one way system.

E) Exclusive lanes may be constructed only for cycles and pedestrian traffic in

the new extension areas and should be integrated with the other transport networks.

During the preparation of the report in 1981, it was estimated that there were 6.00 lakh bicycles bring used in the Pune Corporation Area. Of the total vehicular passenger trips, about 27 to 28 percent trips were performed by cycles. It was assessed that bicycle traffic was occupying more than 50 percent on the road network.

However, today in the year 1998, there has been a reduction in the use of cycles. There has been a marked increase in the number of motorised two wheelers, such as, motorcycles, scooters and mopeds. The cycle tracks are now occupied by these two wheelers which are very fast moving and susceptible to accidents.

Incomplete and discontinuous tracks is also another reason for the failure of the cycle track network.

Pedestrian ways and pedestrian facilities have not been worked out for the city in a comprehensive manner. Piece-meal provisions have been made for pedestrian movement. There are footpaths along the cycle tracks having width of about 3 to 4 feet. But these are totally inadequate and do not fulfil any useful purpose.

Figure 12 Cycle Tracks in Pune.

3.5 INFERENCES

A) Many of the cities of India have been built over the years and they reflect the planning style of the various types of rulers. The Principles of the Vedic period, the Moguls, the British and the ideas of modern independent India may be found in the different areas of the same settlement. Therefore, the morphology of the city should be recognised and dealt with according to their origin.

B) The portions of the city with Vedic origin will be formal consisting of two central axial roads with its orientation in the east-west direction, the size of the roads being as per their importance and the anticipated volume of pedestrian and animal drawn traffic of those times.

C) The portion of the city built during the Muslim period, that is pre-Mogul period -there would be a fortification around the city. The streets would be narrow, paved, with twists and turns and with a number of town squares. This was to ensure that the intruder was confused during the periods of war.

D) In the towns built by in the colonial period the residential areas of the white population were clearly separated from those of the native population. The white areas where developed with the horse-carriage as the usual mode of transport and therefore these areas could be reused by the automobile in subsequent period. However the native areas were allowed to grow with out much direction under the supervision of the local bodies. These areas developed mostly as pedestrian areas and within the human scale.

E) The British developed very interesting pedestrianised urban spaces in their cities and towns. They consisted of the Esplanades and Malls besides the entertainment and commercial centres.

F) The 'Pedestrian Environment Area' adopted in this study has been derived from the concepts of the neighbourhood which is extensively used in city planning, the theory of 'Precinct' planning put forward by Sir Alker Tripp in 1942 and the concept of the 'Environmental Area' propagated by Sir Colin Buchanan.

G) It would be fair to conclude from the Chandigarh experience that when and where there is a desire, it is possible to have pedestrian facilities, teach the people to use it properly with care and enforce the correct usage of these pedestrian systems in Indian cities.

H) Another aspect is that know-how is lacking about pedestrianisation and there are no experts in the area for working out the pedestrian arrangements amongst the town planners or the architects in this country. The area of pedestrian arrangements are considered as too negligible for the town planners who feel that there work involves the upper scale of town planning while the architects are limiting there work to only individual buildings and cannot contribute to the access arrangements between buildings.

I) The introduction of cycle tracks has not been a success as in the case of Poona City.

J) Bollards have been used effectively to manage traffic and pedestrian areas in the town of Nainital.

K) Calming of traffic through pricing has also been effective in the town.

L) Hawkers are the biggest problem of pedestrian areas as can be seen in the case of Bombay.

The arcades provided in the pedestrian routes of Bombay are useful protection during inclement weather.

CHAPTER 4: THE THEORETICAL BACK-UP

4.1 INTRODUCTION

Pedestrian planning is a science as well as an art. The type and variety of knowledge required for a pedestrian planner is considerable, spanning from the very technical to the most creative. The subject does not have its own theoretical base and therefore, much has to be borrowed from related subjects to form a basis for its investigation. Knowledge on the subject is scattered and available in bits and pieces in several different books, articles and sometimes verbatim. Therefore, it is essential to create a knowledge base or theoretical backup, which will provide the principles for better understanding and dealing with the subject.

4.2 ACCESSIBILITY

For more than 3000 year man's mode of transportation was by foot or horseback. Then came the Industrial revolution and mechanisation, steam for rail and water travel, the internal combustion engine for automobile and aeroplane, and the beginning of space travel.

Satellites in outer space make instantaneous audio-visual communication possible on the global scale. Spaceships carry men to the moon, and television is projected into our living rooms from all over the world. Information technology is the science of today. All these are the facilities for accessibility in today's world, yet there has been no significant change in the movement of earth bound persons in cities [26].

Figure13 Types of Vehicles used in Indian Cities (A). 81
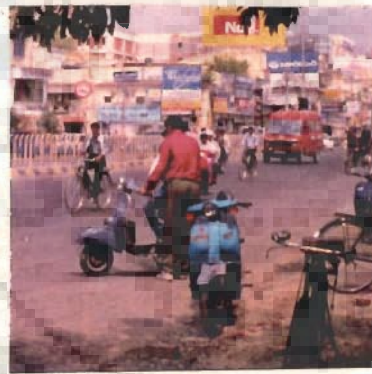
Figure14 Types of vehicles in Indian Cities (B) .

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Therefore, for the purpose of settlement planning, accessibility can be described as the "ease of travel" or as the measure of the physical proximity between to points. It is subject to the factors of distance, cost, time and the quality of transport service [122].

4.3 TYPES OF ACCESSIBILITY

Physical accessibility as apart from electronic communications is of prime importance to the planning of the physical entity of the city. To this physical entity, the various mechanical modes of travel contribute a great deal [Table 1]. Of course, the need to travel has been reduced to a large extent because of the telephone, the fax machine and the e-mail facilities but all this has not been able to totally neutralise the need for physical movement of the human being at least at the neighbourhood level or the city level.

Table 1 Speed and capacities of Vehicles In Indian Cities.

Vehicle Type	Average Speed. Km / hour.	Capacities.
Auto - Rickshaw.	20	two persons
Bicycle.	12	one person
Bullock - Cart.	2.5	600kgs to 1000kgs
Bus.	30	60 persons
Car.	60	four persons
Cycle - Cart.	4	225kgs
Cycle -Rickshaw.	10	two passengers
Hand - Cart.	4	300kgs to 900kgs
Moped / Scooter / Motor Cycle.	25	two persons
Pedestrian.	15	one person
Train	80	770 persons

Accessibility, as per its usage and applicability to settlement planning, is possible through various means. It could be simply through walking or by means of bicycle, motor cycle, automobile, or by trams and trains. Types of Vehicles used in Indian Cities [Figure 13] [Figure 14]

The modes of physical accessibility available to the individual and for movement of goods in the Indian city, along with their speed and carrying capacity, is elaborated here for information and reference

4.3.1 Pedestrian Travel

There are two basic phases in the cycle of movement of the pedestrian. One is the single support, when the person makes contact with the surface with one foot and the other is the twin support when the foot which is propelled forward makes contact with the surface while the foot trailing behind has not yet left the surface. With an increase in walking speed the twin support period becomes shorter and shorter and ultimately disappears altogether. From this moment walking changes to running. While designing pedestrian routes it must be borne in mind that at the time of walking the pressure on the support, due to the dynamic nature of the process, can exceed the weight of the person by as much as 25 percent.

The speed may vary within wide limits. The maximum speed attained by man is about 600m per minute (They travel at a speed of about four to five kilometres per hour). Walking speed can reach 220m per minute (achieved in 20km walking race). Under normal conditions the average walking speed is about 60 metres per minute. Pedestrians in normal circumstances can travel for distances of up to 1km in one go [52].

4.3.2 Bicycle Travel

The factors that contribute to the popularity of cycles in intra city travel are the size of the city and the distances between the various parts of the city. It also depends on the efficiency of the public transport facilities available in the city, in the cities where there is a good public transport system the use of cycles is less. Ownership of cycle is not an issue because the price is low and if found necessary even the poor in India can purchase one.

4.3.3 Cycle -Rickshaw

The cycle- rickshaw serves as a cheap on-hire mode for short distance random trips. The demand for this vehicle is dictated by factors like convenience and necessity which consequently depends on the living standard of the people, the concentration of the population and the location and concentration of bazaars, cinema halls, schools, hospitals, bus stops and railway stations.

4.3.4 CYCLE - Cart, Hand - Cart and Bullock - Cart

Cycle-carts, hand-carts and even bullock-carts are used for intra city goods movement in most north Indian cities specially when the consignment is small and the fare is less than that of the competing faster modes. There is a relationship between the fares charged for slow moving goods vehicles and those for faster modes in the sense that whenever the latter increase their fare for any reason, the former also correspondingly increase their fares, though at every level there is a tendency for the slow-moving vehicles to under bid the fast moving types [23].

4.3.5 Moped, Scooter and Motor cycle

A moped is a bicycle propelled by a motor. This vehicle comes in many variations but most do not have provision for gear change. The vehicle is provided with a pedal system like the bicycle. The have engine capac ties from 45cc to about 65cc. In India these are very popular with the students in the 15 to 20 age groups since they are economical covering about 70 to 80 km per litre of petrol.

A Scooters consists of a low foothold with two wheels at each end and a raised handlebar for steering, it has a seat for one rider and a pillion and is propelled by a motor. This vehicle is convenient for the female sex because it does not require the lifting and stretching of the leg during embankment and dis-embankment as in the case of a motor cycle. It has an engine capacity ranging from 100cc to 150cc and covers about 45km to 55kms per litre of petrol. It is very popular in India, particularly with young couples from the middle and lower-middle income groups who have one or two small children. They use the scooter as a mode of movement for the whole family.

Motor cycle is a two-wheeled vehicle like a bicycle propelled by a 100cc to 700 cc engine. It is quite heavy in its construction and is popular with young men, the police, the armed force and other such services.

4.3.6 Auto Rickshaw

The Auto rickshaw is a three wheeled vehicle similar to the cycle rickshaw but more robust in its construction. It is powered by an engine and there is a canvas roof, which provides good protection during rains and inclement weather. There is one seat for the driver in the front and two seats for

passengers at the rear. This is a cheap mode of public transport, and is very popular in the cities of India.

4.3.7 Car and Bus

Cars and Buses powered by internal combustion engines have been in use through out the twentieth century, Since its invention, the cars and buses have progressed from being a mode of transport exclusively for the rich to the single most important form of transport for the ordinary people all over the world. Its speed and mobility has revolutionised the lifestyle of millions of people.

A typical motor vehicle consists of four major systems: the engine, the source of power; the transmission, which feeds the power to the road wheels; the electrical system; and the body, including the steering, breaks and suspension.

4.4 ACCESSIBILITY MODES AND THE CHARACTERISTICS OF CITY FORM

4.4.1 Impact of Pedestrian Accessibility on City Form

The urban settlement during its formative days had " man" as the basic element for its development. The city size, pattern of street and spaces were geared consciously or unconsciously to meet the requirements and characteristics of the pedestrian.

The main mode of intracity transport was by walking. Though other modes of transport like horses, animal driven carts, and even boats on waterways were used but these were normally resorted to while commuting large distances particularly between settlements.

The core of the town was invariably the oldest part of the original settlement. The size of the settlement was small and people could walk to any part of the town. The widths of the streets were narrow but suitable for pedestrian movement. The irregular alignment of the access- ways suited the pedestrian movement and infact added to the visual interest of the townscape. This was also useful for purposes of defence at the time of war. This part of the town had the highest population and commercial density.

With the progress of civilisation and the consequent urbanisation the population of the towns increased. And to provide them with accommodation new but similar development was added on to the existing core. Nevertheless the size of the settlement remained small enough for the people to walk to any part of the town.

However with the passing of time and the development of civilisation the population of the world increased manifold. The rate of increase was not sharp at the earlier stages but with coming of the Industrial Revolution there was a steep increase.

The situation in India was the same as the rest of the world till the twentieth but at the turn of the century there was a tremendous change in the rate of growth of the population India [Table 2].

Table 2   **Growth Of Pedestrian Population In India**

Year	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991
population in millions.	225	250	250	275	325	350	435	565	680	825

Today it is the second most populous country in the world and it is expected to

become the most populous country by the middle of the 21st century. According to the 1991 census, the population of India is about 82.5 crores. This is about 16 percent of the world's population. This population is growing at the rate of 2.1 percent per year. In 1901, the persons living in per square kilometre area in India were 77. This proportion has now increased to 267 in 1991.

The distribution of population is uneven. 66 percent of the people live on 33 percent area in the country. This means, there is a high concentration of population in some parts while many other parts have low population. The state of Uttar Pradesh has the highest population in the country followed by Bihar, Maharashtra, West Bengal and Andhra Pradesh. These five states together have more than 50 percent of the total population of the country. Jammu and Kashmir, Himachal Pradesh, Assam, and other north - eastern states have very low population.

In India 26 percent of the people live in the cities and the rest in the rural areas. During the last 20 year there has been an influx of population from the rural to the urban areas. People are attracted to the urban areas, due to the development of new industries, growth of new occupation and services and a craze for city life.

The age structure of the population gives us the number of persons in each age group and since the walking capacities of the various age groups are different we are in a position to decide the amount of attention that should be given to a particular age group in context to the pedestrian facilities.

The population between the age group of 0 to 14 years is 40 percent. The population between the age group of 15 to 60 years is 53 percent. The

population between the age group of 60 years and above is 7 percent [46].

Heavy Pedestrian movement is expected in areas with high densities of population such as the cities in a country. But within a city also there are some land uses which generate more pedestrian traffic than others.

The concentration of population inside the settlements is an important factor that will affect pedestrianisation. This is because population means pedestrians and where there is a higher population there will exist a larger number of users for the pedestrian facilities.

High pedestrian movement is normally found in the central business district of a town. People usually commute to the C.B.D. by railway or buses and perform the remaining part of their journey by foot. This results into very high pedestrian flows, especially in the evenings when people come for shopping also.

Residential areas in the city are also very much pedestrian oriented. In these areas there are a lot of children and old people who do not have access to motor vehicles and also prefer to remain as pedestrians.

Historic areas of the town are mostly pedestrian dominated because these areas are not normally designed for vehicular traffic and access has to be on foot. Further, the local authorities try and keep the vehicular traffic away so as to keep the area pollution free, and allow the people to see around the places safely.

Leisure areas are mostly pedestrianised, these areas are for physical fitness or for passive recreation and in both cases vehicles are not necessary.

4.4.2 Impact of Vehicular Accessibly on City Form

With the increase in industrialisation towns became big and crowded and from

the purely pedestrian mode of movement within the town, people started to use public transportation facilities like the Horse-Carriage in 1831, then the horse-car on rails to be replaced by the Electric Street Railway and subsequently the electric railway which went underground in 1891 to become the subway system. However, the city size finally exploded with the invention of the automobile in the 1885 and onwards. Suburbs were added to the edges of the older built-up areas. Ribbon development was strung along the main roads; nearby small towns and villages were swallowed up or invaded as outlying dormitory areas.

The increased mobility provided by the automobile resulted in the growth of new areas known as suburbs, In the new suburbs there were large housing estates accommodating the working class. Communities grew up, as large as fair sized towns, almost exclusively of people of one class. But they had no real centre that may have created a unified civic life.

Architecturally the results were appalling. The mass housing was normally designed well internally, but externally they looked monotonous.

The flood of automobiles made the gridiron street pattern, which formed the frame work for urban real estate for over a century, as obsolete as a fortified town wall. The checkerboard pattern made all streets equally inviting to through traffic. The quiet and peaceful repose disappeared along with safety.

Besides making the city large and sprawling the automobile entered into those inner town areas which were previously pedestrian in scale.

The whole world organised itself to facilitate the movement of the automobile. In the new areas of the town which were developed, the street sizes, alignment and surfaces were designed to achieve convenient movement of motorised vehicles. In the old inner town areas the access ways were broadened and

their irregular alignment straightened out for the convenience of the automobile [26].

The situation in India followed the pattern of the developed countries except, that there was a time lag of about fifty to seventy-five years.

There has been a very large growth in the number of vehicles in India. The total number of vehicles in India, which include trucks, buses, cars, taxis, jeeps, two-wheelers and others was 2.08 crores in the year 1991, it increased to 3.14 crores in the year 1996 and is expected to be 4.95 in the year 2001. (Refer table no.1) This will be a 238 percent increase on the 1991 figures. As per the 1991 data there is 21.1 vehicles per kilometre of road surface in India [1]. The concentration of vehicles in India has been in the urban areas particularly in the metropolitan cities [Table 3].

Table 3 Motor Vehicles Per Lakh Of Population In India

Year	Population In Lakhs	Types Of Vehicles			
		All motorised Vehicles	Cars, Jeeps, Taxis	Two Wheelers And Others	Buses And Goods Vehicles
1951	3610.9	84.74	44.03	8.59	32.12
1961	4392.3	151.4	70.58	29.6	51.22
1971	5461.6	340.23	124.42	136.09	79.72
1981	6833.3	757.03	163.46	493.9	99.66
1988	8039.8	2076.29	308.59	1582.25	185.45
1991	8443.2	2528.72	345.49	1976.14	172.61

The [Table 4] shows the growth of vehicles in the important cities of India from the year 1981 to 1991 [1].

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Table 4   Vehicles In Metropolitan Cities In India (In Thousands)

Metropolitan Cities	Years		
	1981	1986	1991
Ahmedabad	103	201	374
Bangalore	175	307	577
Bhopal	NA	NA	212
Bombay	307	480	629
Calcutta	NA	339	475
Cochin	NA	NA	119
Coimbatore	NA	NA	66
Delhi	536	961	1813
Hyderabad	89	237	581
Indore	NA	NA	214
Jaipur	48	143	266
Kanpur	56	99	169
Lucknow	53	106	216
Ludhiana	NA	NA	202
Madras	120	228	544
Madurai	NA	NA	38
Nagpur	45	86	167
Patna	NA	NA	NA
Pune	107	183	280
Surat	NA	NA	136
Vadodara	NA	NA	162
Varanasi	NA	NA	112
Visakhapatnam	NA	NA	11

The average peak hour traffic speed   in Delhi is 10 to 15 km per hour, in

Bombay it is 15 to 20 km per hour, and in Calcutta it is 14 km per hour. It may noted that the pedestrian walks at a speed of 4 km per hour, while the direct energy per person used is only 1/5 of an average car.

The average travel distance in the metropolitan cities of India increased from 9 km in 1961 to 27 km in 1996 [108].

4.4.3 Impact of Composite Accessibility on City Form

The present day cities all use the pedestrian and the vehicular mode of movement in a composite way. However in certain circumstances there may be more area under the purely pedestrian access while in some other cases there may be more area under the accessibility of the automobile. However in most cities in the developing world there is no clarity in the use of either mode and there exists a multi-modal use of the roads in the cities. Both the pedestrian and the automobile use the streets.

The population of the cities increased dramatically while at the same time there was a considerable increase in the growth of vehicles in every town. The immediate problem that faced the society was how to deal with this very large increase of motor vehicles that came on the roads. However the real problem was of a different dimension needing a totally different solution.

The problem can be simply stated. Assuming that it is impossible for all activities to be performed by men in motor vehicles, there must surely always be men on foot. Even the most inveterate drivers have to be pedestrians for a large part of the time. In urban conditions this produces a clash, which is becoming more and more difficult to resolve, as the number of motor vehicles increases. Man as pedestrian must obviously take precedence over man as

motorist. This may not be readily accepted but we all have to, and indeed want to, be walkers for a substantial part of our lives. Many people may want to walk even more if some of the present dangers and unpleasantness of moving about our towns and cities could be reduced. Though this was a universal phenomenon its particular impact on India is recorded and dealt with below. There is tremendous conflict between pedestrians and vehicles.

Despite the very important facets of walking and its acknowledged importance in the functioning and vitality of the city, the vehicle today dominates the urban centres. The motor vehicle appears to be the dominating parameter in urban areas or ensuring mobility. But this results into a conflict of interest at four levels:

4.4.3.1 The Spatial Conflict

The underlying causes of all pedestrian accidents are the competition of the pedestrian and vehicle for urban space. Vehicles need large amount of space for their movement and parking. The space demand of the vehicles affects the urban form. Pre-emptive traffic priority for vehicle has resulted in extensive and expensive traffic signalisation in which pedestrian is given little consideration. In fact the pedestrian must share his crossing phase with speeding vehicles, offering a continuos threat to human safety.

4.4.3.2 The Environmental Conflict

Vehicles undoubtedly cause many profound affects on the quality of urban life. Vehicles have a drastic impact on the urban environment by creating air pollution, noise pollution, visual pollution and pollution through vibrations.

4.4.3.3 The Social and Psychological Conflict

Absence of properly designed pedestrian areas alienates one social group from the other. The streams of vehicles along the streets create physical barriers between different areas and consequently the people who live there.

4.4.3.4 The Economic Conflict

This also has a tendency to segregate the different economic groups. The richer ones who have personal vehicles do not get an opportunity to interact with the poorer neighbours. It also compels the poorer ones to spend more on purchase of motor vehicles.

4.4.3.5 Points of Modal Change and Link Between Pedestrian Zones

Every citizen desires to have a total continuity of movement, And due to this desire to seek continuity, automobiles were invented, It provide total continuity but with its over use and increase in numbers came the demerits and negative side effects which have by now overshadowed the positive sides of the facility. However to maintain a balance between the continuity of movement and the demerits of the automobile, it should be ensured that the continuity is maintained through alternative means by having convenient facilities of modal change.

City plans which has been worked out based on two-way multi-modal transport system must give adequate thought to the various types of modal interchanges that will be required for the smooth functioning of the overall transport network. In the Indian context primary modal interchanges can placed under the

following heads: (A) Bus Stops. (B) Taxi Stands. (C) Rickshaw Stands. (D) Parking Lots. And the secondary modal interchanges placed under the heads of (A) Bus Terminals. (B) Railway Station. (C) Dockyard. (D) Airport.

However, in pedestrian planning for cities the primary modal interchanges are of immediate concern and therefore these have been elaborated upon in the subsequent paragraphs.

Off street parking can provide a satisfactory solution to the needs of modal change in the various areas of the cities. The types of off-street facilities commonly used are:

- Surface parking
- Multi-storied parking
- roof parking
- Mechanical parking
- underground parking

There are some basic considerations that govern the location of these facilities. Obviously, the prime consideration should be the nearness to the place of usage by the prospective customer.

The facility should be located so that the entry or exit is more than fifty metres away from any traffic intersection.

These types of off-street parking can be used for the modal interchange facilities for Taxi Stands, Rickshaw stands, Motor cycle or scooter stand, cycle stand or simply for the cars [37].

However, Shelters for the taxi drivers, Toilets, Drinking water and other essential facilities should be provided near the Modal interchange.

Bus Stops should not be sited where their use might unreasonably interfere

with the flow of traffic or where they might interfere with visibility of traffic flow.

Bus stops should be located in conjunction with pedestrian subways and bridges.

Queue shelters should be erected at busy bus stops not only to give shelter but also to encourage orderly queuing.

The location of bus stops must be decided in parallel with the footpath system in order to achieve the best arrangement of both. Footpaths should be planned to radiate from bus stops.

Professor Garel Rhys, Director, Centre for Automotive Industry Research, University of Wales, U. K. Is of the opinion that public transport should be the priority of any country to improve the quality of life. The large number of cars and two wheelers one sees in the cities of the developing world are not signs of prosperity but of the low incomes of the country. The urban Motor vehicle population only shows that the country has a low tax base and that the government has not been able to finance roads, railways and mass transportation through public expenditure. The Government, in a sense hides behind the individual, leaving him to find his own means of going to work. [105]

4.4.4 Accessibility of the Physically Handicapped

To create a barrier free built environment for the handicapped is an important aspect that is being looked into by modern society. It is an issue to which very little attention has been paid in our country. However in the year 1995 the Government of India has passed the act titled "The persons with disabilities (equal opportunities, protection of rights and full participation) act 1995" which gives the disabled a lot of statutory rights.

Accessibility aspects in planning of human settlements are one of the prime considerations for the disabled. Planning and building bye-laws should incorporate rule to ensure improved access to educational institutions, employment, health care, leisure, sports, transportation and public places like parks etc. It is essential to carefully select the critical items that, with relatively low expenditure, will offer the greatest improvement to accessibility. The critical design elements are ramps, width of doorways, toilet sizes, elevator size, parking facilities etc.

Accessibility for the disabled can be improved only through awareness amongst society. It is essential to integrate the building and area design elements with the needs of the disabled to make their lives meaningful [87].

4.5 PEDESTRIANS AND THE FUNCTIONAL ASPECTS OF URBAN AREAS

4.5.1 Pedestrian and The Land

A major objective of a plan proposal is the provision of adequate and convenient physical facilities, as well as improvement of the living conditions, for the existing and future citizens with in the community. Among the important factors that should be considered are (a) availability of vacant land that is available for expansion and development (b) Compactness of the core area of the core area of that particular land use (c) objectionable uses with in the existing land-use (d) topography of the land to recognise the slopes for walking, drainage and construction (e) Geology or soil conditions for civil construction and for growth of foliage (f) location of water bodies and forest land for contribution to the micro climate.

4.5.2 Pedestrian and The Population

Since the pedestrian plan is for the people some of the important information needed in regard to the population is (a) population density (b) Age (c) Religion. (d) Sex. (e) Marital Status. (f) Size of household. (g) Annual Income.

One has to see is if the settlement is high density and low rise, high density and high rise, low density and low rise or low density and high rise so that an assessment of open land available can be made. This will give us an idea about the land to be developed for pedestrian facilities. Matters such as location of pedestrian chowks (plazas), location of community vehicular parking, entry for cycles and cycle rickshaws, the type of services to be developed for the area and the methods of routing them through the access ways, can be decided based on population information. In areas where the population densities are high the need to pedestrianise is greater because there will be a greater number of users. In the high-density areas it may not be possible to allow the entry of even cycles and cycle rickshaws.

Trends in the age groups must be carefully considered in the preparation of the pedestrian plans. The facilities proposed in the pedestrian plans should be related to the several major age groups. Children must have play areas and schools, young boys and girls should have organised sports facilities and places for interaction like clubs, the old should have walk ways, resting places and places for interaction.

The various religious groups should have places for warship, appropriate community facilities, and communal harmony between the religious groups.

A good male to female ratio means a healthy social life. Further, appropriate

facilities need to be provided based on the sex break-up. Marital status is also an indicator of the social well being of the community.

Size of household and the proportionate accommodation available is an indicator of the quality of living, besides the income level also gives an idea of the living standard.

4.5.3 Pedestrian and Shelter

The pedestrian in the open continues to be a pedestrian inside the building or the automobile driver becomes a pedestrian when he wants to enter his house. Therefore the interface between the access and the shelter becomes an important aspect in the plans to pedestrianise (77). To understand this aspect one should have information on (a) the size and type of accommodation available, (b) the type of use and size of the place (c) the occupancy (d) the condition of the buildings (e) aesthetics of the facade, and (f) functionally up to date and harmonious if they are.

The sanitary conditions of the buildings is important. Particularly , if there are adequate toilets and whether they are clean and well maintained.

Use supportive buildings are also important. Buildings , such as, banks, post offices, medical centres and other similar buildings are necessary for effective communities.

4.5.4 Pedestrian And Accessibility

Pedestrian and accessibility has three important aspects namely;

- Rate of walking.

- Acceptable walking distances.

- Pedestrian density Criteria.

Besides the above three aspects, urban areas should also be checked for the following internal and external access conditions:

- Internal Access.

(a)Congestion (b) circulation (c) parking (d) conflict at traffic intersection (e) loading and unloading conflict (f) adequate foot paths.

- External Access.

(a) access to the rest of the town (b) Public transport routes to town (c) access for trucks (d) adequate parking.

4.5.5 Pedestrian And The Utilities

Pedestrians are very much affected by the utilities. Firstly they provide useful services to the people for their well being and secondly they physically pass through the inter-building spaces which are also used by the pedestrians to move about in the area.

Therefore, a good settlement has to ensure that there is adequate utilities for the residents while at the same time the inter-building spaces should be devoid of the obstructions and inconveniences created by the utility lines.

The essential utilities that provide useful services but obstruct in the inter building spaces used by the pedestrians are namely, (a) water supply, (b) sewerage (c) garbage disposal (d) telephone (e) electricity (f) area lighting (g) cable T.V. (h) fire fighting (I) post and telegraph (j) police (k) emergency medical assistance.

4.5.6 Pedestrian And Government Policy

Paradoxically, at all levels of government, central, state and local, no single agency has the authority, powers or institutional frame work to ensure planning, co-ordination, budgeting, programming and phasing of urban transportation projects, pedestrianisation or traffic control.

The National Transport Policy Committee in 1980 recommended strengthening of transport facilities in the cities and towns, and considered issues like traffic management, institutional set-up, multi-modal system, environment and energy conservation. The National Transport Committee also recommended the establishment of The National Transport Commission and unified urban transport authorities. Without exception, the inevitable need for a unified urban transport authority has also been identified in every city development plan but no concrete action has been taken to this end. In the absence of an integrated policy and co-ordinated approach, urban transportation along with pedestrianisation has grown in response to demand in a haphazard manner, without any realistic goal or perspective.

From 1987 the Ministry of Urban Development has been entrusted with the responsibility for urban transportation. The ministry, however does not have the necessary expertise to direct urban transport planning.

Pedestrian, as an entity, does not come under any specific area of administration and therefore it has none to project its case with the government and hence very little policy making, which is directly related to it, has been done by the government.

However, the traffic and transportation professionals have at times felt the

importance of pedestrianisation and have made reference to the need to pedestrianise in the cities to sort out the present traffic chaos in the urban areas of the country.

The report of the 'Working Group On Urban Transportation' in the ministry of Urban Development, Government of India, published in February 1996 states that there is need to look into the role of intermediate public transport, slow moving vehicles and pedestrians which has not be done in the report due to the terms of reference of the Working Group. However, the Group was of the opinion that the transport plan should indicate the need for developing 'green' modes like bicycle and walking. It suggests that provision of paths and cycle tracks should be integrated with the transport network and land use.

A few cases of pedestrianisation have been attempted in some of the cities but most of these have been police actions and crisis management efforts. Police being a state item in the constitution of India, it lies under the control of the state government, and therefore, the attempts to pedestrianise depend on the desires and whims of the government in power.

In Bombay the area between Victoria Terminus and Churchgate Station was pedestrianised in 1982; with the major initiative being taken by the police and the British Council in India.

In Patna the Patna Development Authority from the funds available to the Members of the Parliament built some footpaths recently in the important areas of the city. However, these are in parts and there is no overall integrated footpath system.

In Calcutta the footpaths had been totally occupied by the hawkers till the recent concerted Government action. The mounted police are doing a good job

of protecting the "maidan", the main open space in the city, against misuse.

In Nainital, a hill station in northern Uttar Pradesh the police are doing a good job of calming traffic and maintaining vehicular traffic and pedestrian segregation.

During the religious festivals in the various parts of the country large areas are cut off from vehicular traffic by the police but these are temporary attempts to pedestrianise.

As of today, fragmentation and overlapping of responsibility and authority has made planning and management of urban transport and pedestrianisation a complex task.

4.6 PEDESTRIANS AND URBAN AESTHETICS

Biologically the human being is designed to use his five senses to perceive the environment while sitting, standing and walking through it. His sense of visual perception is mostly used while understanding and enjoying the manmade or natural environment. So if settlements are to be for the human beings, for their happiness, for their enjoyment, then the settlements should be designed with an inclination towards the pedestrian.

The perception of the environment depends on three aspects; the solid form, the space between the solid forms and the human being who perceives it.

Urban shape, size, colour, texture, proportion, orientation and visual inertia are primarily aspects of solid form. Building facades and the city floor moulds the formation of spaces in the city.

It is estimated that the visual area that a man can feel to be his own territory lies with in a circle of 500 metres in diameter.

Apart from other things the quality of the environment is closely associated with the freedom of pedestrian movement.

4.6.1 Form

Form is the primary identifying characteristic of a volume. The shapes and interrelationship of the planes that describe the boundaries of the volume determine it.

As the three dimensional element in the vocabulary of aesthetics of the built form, a volume can be either solid, space displaced by mass, or void, space contained or enclosed by planes. The visual properties of form consist of the following:

Shape - Size - Colour - Texture - Position - Orientation - Visual Inertia.

Shape is the principle identifying characteristic of form; shape results from the specific configuration of a forms surfaces and edges.

Size is the real dimensions of form, its length, width, and depth; while these dimensions determine the proportions of a form; its scale is determined by its size relative to other forms in its context.

Colour is the hue, intensity, and tonal value of a form's surface; colour is the attribute that most clearly distinguishes a form from its environment. It also affects the visual weight of a form.

Texture is the surface characteristics of a form; texture affects both the tactile and light - reflective qualities of a form's surface.

Position is a form's location relative to its environment or visual field.

Orientation is a form's position relative to the ground plane, the compass points, or to the person viewing the form.

Visual Inertia is the degree of concentration and stability of a form; the visual inertia of a form depends on its geometry as well as its orientation relative to the ground plane and our line of sight.

4.6.2 Form and Space

Space constantly encompasses our being. Through the volume of space, we walk, see forms and objects, hear sounds, feel the breeze in our hair, smell the fragrance of a flower garden in bloom. It is a material substance like the earth or the trees. Yet it is inherently formless. Its visual form, quality of light, dimensions and scale depend totally on its boundaries as defined by the elements of form. As space begins to be captured, enclosed, moulded, and organised by the elements of form, physical entities such as architecture, urban areas and cities come into being.

- The unity of opposites.

Our visual field normally consists of heterogeneous elements, subject matter that differ in shape, size, colour, etc. To better comprehend the structure of a visual field we, we tend to organise the elements within it into two opposing groups: positive elements that are perceived as figures, and negative elements that provide a backdrop for the figures.

Our perception and understanding of a composition depends on how we interpret the visual interaction between the positive and negative elements within its field.

In all cases, however, we should understand that figures, the positive elements that attract our attention, could not exist without a contrasting background. Figures and their background are more than opposing elements. Together they

form an inseparable reality, a unity of opposing elements. Together they form an inseparable reality, a unity of opposites, just as the elements of form and space together form architecture, urban spaces and cities.

- Form defining space.

Any three dimensional form will articulate the volume of space surrounding it and generate a field of influence or territory which it claims as its own. Horizontal and vertical elements of form, which are always available in the urban setting, define specific types of space depending on their configuration.

- Defining space with horizontal and vertical elements.

Horizontal planes defining space can be either in the form of a base, elevated, depressed, or as an overhead plane.

Vertical forms are generally more active in our visual field than horizontal planes, and therefore, instrumental in defining a volume of space and providing a strong sense of enclosure for those within it.

- Quality of architectural spaces.

The qualities of urban spaces are much richer than those formed by the arrangement of just horizontal and vertical planes as stated above. These spatial qualities of form, proportion, scale, light; etc. will ultimately depend on the following properties of the enclosure of a space.

On the dimensional property will depend the qualities of proportion and scale. Similarly, on shape and configuration will depend form and definition; on the properties of surfaces and edges will depend the qualities of colour, texture and pattern; the properties of the openings will give the qualities of enclosure, light and view.

- Openings in space defining elements.

The size, shape and location of openings or voids within the enclosing forms of a space affect the quality of the enclosure. The form of the space is dependent on the degree of enclosure in other words the openings or voids in the enclosing planes. The lighting of the enclosed space and the focus of the space also depends on these openings or voids.

4.6.3 Ordering Principles of Form and Space

Order with out diversity can result in monotony or boredom; diversity with out order can produce chaos. Hence the ordering principles are the visual devices that allow the diverse forms and spaces of the urban setting to co-exist perceptually and conceptually within an ordered and united whole[12].

Axis - is a line established by to points in space and about which forms and spaces can be arranged.

Symmetry - The balanced distribution of equivalent forms and spaces about a common line (axis) or point (centre).

Hierarchy - The articulation of the importance or significance of a form or space by its size, shape, or placement, relative to the other forms and spaces of the organisation.

Rhythm / Repetition - The use of recurring patterns, and their resultant rhythms, to organise a series of like forms or spaces.

Datum - A line, plane, or volume that, by its continuity and regularity, serves to collect, gather, and organise a pattern of forms and spaces.

Transformation - The principle that an architectural concept or urban organisation can be retained, strengthened, and built upon through a series of discreet manipulations and transformations.

4.7 PEDESTRIANS AND THE HUMAN COST ASPECTS

4.7.1 Pedestrian and The Social Environment

The social environment in the footpaths and pedestrian areas are important because it is a place where a number of social activities take place. A good social environment implies the existence of a good emotional health, the capacity to enjoy, to live and make others life enjoyable. After investigation and study of the existing social environment, it is possible to make appropriate design modifications in order to achieve certain social objectives[71].

Some of the aspects that contribute to the social environment are mentioned below:

4.7.1.1 Social Contact on Pedestrian Routes

- Popular use of Pedestrian areas by the inhabitants.

- Standing and watching on the pedestrian ways.

- Pedestrian areas are popular for sitting around.

- People walk with company on the pedestrian routes.

- Pedestrian areas are popularly used to stand with company and eat, watch or talk.

- Benches on the pedestrian areas are used for sitting with company.

- Friendship is developed while standing, sitting or walking on the pedestrian areas.

4.7.1.2 Socialisation and Circulation

- While walking to work, market, etc. footpaths are use for socialisation.

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- Points of modal change like bus stops etc. are used to socialise.

4.7.1.3 Children and Their Activity on Pedestrian Area

- Children are comfortable using the footpaths.

- Children play on the pedestrian areas.

- Children make friends on the pedestrian areas.

- Children are safe on the footpaths and pedestrian areas.

4.7.1.4 Social Environment for Elders on The Pedestrian Areas

- Elders are comfortable using the pedestrian areas.

- Elders spend time on the pedestrian areas sitting, reading or talking with company.

4.7.1.5 Family Behaviour on The Pedestrian Areas

- The families as a whole use the pedestrian areas.

- Families as a whole socialise with each other on the pedestrian areas.

4.7.2 Pedestrian and The Psychological Environment

The psychological environment for the user of pedestrian networks and areas, in cities, is of grave importance. Ignoring this aspect while planning pedestrian areas may lead to frustrating situations amongst the users and may affect the popularity of such an important accessibility system. Therefore, feelings like irritation, tension, anxiety, fear, likes and dislikes and other such psychological feeling should be accessed and provided for in the design of pedestrian networks [71].

In pedestrian networks there are many factors which contribute to the above

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mentioned feelings some of which are noted below. The reaction of the users may be assessed and appropriate recommendations made for application in the design of the pedestrian systems.

Factors contributing to psychological behaviour on the pedestrian areas:

4.7.2.1 Feeling of comfort or Irritation

- Crowds on the footpath.

- Surface unevenness of the footpath.

- Filth and unpleasant surroundings.

- Inclement weather.

- Discontinuity of flow while walking.

- Hawkers on the pavements.

- Beggars on the pavements.

4.7.2.2 Feeling of Tranquillity or Tension

- With the disorganised traffic moving about near or inside pedestrian areas.

- With antisocial elements hanging around.

- The noise.

- While walking alone.

4.7.2.3 Convenience and Inconvenience

- Adequate public conveniences like toilets, drinking water, dustbins etc. available.

- Adequate security available in your locality.

- Enough lighting for convenient late night movement.

4.7.2.4 Likes and Dislikes

- Enjoy the entertainment on footpaths.

- Like to watch people moving about on the footpath.

- Enjoy interacting with opposite sex on footpath.

- Enjoy eating on the footpath.

- Enjoy the quite environment on the footpath when available.

- You like locations, which are purely pedestrian.

4.7.3 Pedestrian Systems and The Costs of Its Construction and Maintenance

While comparing costs of construction and maintenance of pedestrian systems with vehicular road systems, it may be noted that the load carrying capacity and the physical width of the systems become important deciding parameters.

The total load of four to six persons would be around 250 Kg. while the load of a vehicle carrying an equal number of persons will be about 1000 Kg. or more. Therefore the proportion of load between the two cases works out to 1:4.

While considering width of carriageways, for carrying two pedestrians walking side by side, it requires 1 Mt. of width. In case of two persons sitting side by side, in a motorised vehicle, the width required is 1.5 Mt. or more. Therefore the proportion between the two cases works out to 1:1.5.

From the above two situations, it may be concluded that pedestrian systems are cheaper by 2.25 times. This is only a conceptual view point, since the actual cost differences can only be worked out after detailed estimate.

The area of surface required for pedestrian ways being less than the motorised

transport, the cost of and effort required for maintenance is expected to be less in the former case.

4.7.4 Pollution

4.7.4.1 Air Pollution

Although percentages vary significantly from one town to another, automobiles account for at least 80 percent of carbon monoxide (CO) and lead, about 70 percent of the hydrocarbons (HC) and about 50 percent of nitrogen oxide (NO_2) emissions in most areas in large towns. The degree to which emissions are translated into ambient air pollution in any region depends on a wide variety of factors. The size, density, topography, and climate of the area, the nature and extent of non-automotive emissions, and the degree to which auto use is concentrated in an area, corridor, and / or time of the day all contribute to ambient air pollution. Thus ambient air quality varies widely among and within areas in towns. Further there is wide room for debate about what level of ambient air pollution should be viewed as constituting problems.

4.7.4.2 Noise Pollution

Doctors are of the opinion that a noise level of more that 30 decibels is enough to disturb a deep slumber causing change in the biorhythm. Indiscriminate use of loudspeakers, pressure horns and sirens in motor vehicles are amongst the major contributors of noise pollution.

The recommended and standard level of noise in areas where heavy traffic plies is 65 decibels. However traffic at the cross-roads generate more than 74.23 decibels during the daytime and strangely 75.52 decibels at night. (97).

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In Delhi, commercial areas like Connaught Place generate 70.03 decibels during the daytime.

In Calcutta, Park Street and Chowringhee Crossing generate 86.9 decibels in the evenings. Esplanade generates 74.8 decibels in the evening.

The Calcutta High Court has passed an order on the 24 February 1997 that the city should be divided into sound zones based on the land use map of the city. There is to be four sound zone: industrial, commercial, residential and silence zones [132].

Sound levels in industrial zones must not exceed 75 decibels in the day and 70 decibels in the night. Decibel limits stipulated for the other zones during daytime and at night, respectively, are - commercial 65 and 60, residential 55 and 45, silence 50 and 40.

4.7.4.3 Vibrations

A vehicle moving on a road surface induces vibrations in the surroundings. On narrow streets flanked by buildings, the air contained between the buildings is vibrated when vehicles move on the street. These vibrations cause annoyance to the residents of the neighbourhood.

4.7.4.4 Visual Intrusion

To attract the attention of motorists numerous signs, signals and billboards have sprung up all along the streets, marring the beauty of the surrounding landscape, historical monuments and architectural masterpieces. Service stations, garages and petrol filling station have sprung up along the roads and added their mite to the degradation of the general scene.

4.7.5 Safety

The statistics do not mislead. One study shows that accidents in India have risen by 461 percent between 1957 and 1980. Although the accident rate is only 10 percent higher than in developed countries, the number of people killed is 20 times more; from 4500 in 1960 to 50,000 now [102].

In 1993 the number of road accidents in India was estimated to be 23.8 percent of all types of accidental deaths. This was followed by 11.6 percent in fire accidents, 11.4 percent by drowning, 8.7 percent in railway accidents, 6.8 percent by poisoning and 2.5 percent by snake bites.

Unskilled drivers, ignorance or deliberate disregard for traffic rules, worn-out or overloaded vehicles, badly engineered roads, encroachment, poor traffic management and inadequate trauma care facilities are mainly responsible for the large number of fatalities on the Indian roads [98].

4.7.6 Health and Fitness

 "The sovereign invigorator of the body is exercise, and of all the exercises walking is best." - Thomas Jefferson.

In everyday speech 'fitness' and 'good health' mean suitability or adaptability or being in good condition. From prehistoric times through antiquity and the renaissance and right into the early 20th century, basic human postures - lying, sitting, standing and running - have remained the same. Even today, the basic human movements have not changed radically, except in the case of walking. We not only walk less than our ancestors, we have almost eliminated the need

to walk. Locomotion has become mechanised - from remote control devices on our televisions to, of course, automobiles and scooters.

Systematic physical activity can change body composition in a characteristic way. Under these conditions the proportion as well as the absolute amount of lean body mass increases significantly at the expense of fat. This applies to the growing children, the adults and to the aged. In Bi-pedal locomotion of the human being, the bones play the role of levers; muscles exert the force and joints act as fulcrums.

The walking limb is the leg and to maintain balance, the hands move too and fro. Legs are attached to the pelvic girdle with ball and socket joints. Thigh muscles help in the lifting and lowering of the legs. Knee joints help in folding of leg while muscles contract. Ankle joints help in the movement of feet.

Most of the population particularly in the city is relatively inactive due to the increased automation and computerisation in the society today. This is expected to increase in the future with the advancement of science and technology. The only easy way to remain physically fit is through walking which can be co-ordinated into our general living through organised pedestrianisation.

There are several reasons why walking is considered to be a good way of keeping fit. They are noted below for information:

- Walking is easy and safe.

There are many reasons why walking can be considered a classic exercise. There is no refuting that walking is easy. We rarely experience any exertion during normal walking. Walking is usually injury-free.

- Walking is aerobic.

There is a rhythm in walking. Without perceiving it, one has to do a fair amount of balancing during walking. Rhythm and balance are the basics of aerobic exercises. Aerobic exercises help, but walking may be a better and easier alternative.

- Walking is inexpensive.

Walking does not need any expensive gadgets. What one needs is pair of comfortable walking shoes and even bare footed walking is possible provided the walking track is clean and the surface even.

- Even the old can exercise.

Everyone in the family can do this exercise. Age, sex and diseases are no deterrents to walking. Old and young alike can walk to remain in shape. All can walk together. Regular walks together with the family not only keeps the family in shape but also increases family bonds.

- Walking reduces weight.

Walking is a good exercise to burn out fat and reduce weight. It is not as hectic as swimming or running; hence can be done over a longer period of time with better results.

- Walking improves muscle power and tone.

During walking one has to carry ones own weight and maintain a standing posture. There is an unconscious need for a balancing effort. The muscles of the leg, buttock, abdomen, back and upper limbs are all put to work. Due to this overall exercising effort, the complete body becomes fit, toned and trim. Muscle flexibility also increases.

- Walking relieves stress.

Walking is an ideal way to relieve stress. It relaxes and reactivates our

tormented nerves. A slow walk in a pleasant environment, especially accompanied with ones friends, can definitely alleviate the effects of an exhausting day at office or at home.

The world health Organisation (WHO) endorses walking as a good exercise. According to the WHO, "A walker loses weight, lowers cholesterol, reduces conditions associated with hypertension, slows down the ageing process, increases strength. Flexibility and balance, strengthens bones and increases stamina."

4.7.7 Energy and The Foot Traffic

Automobiles account for about 25 percent of oil consumption and 12.5 percent of total energy consumption in the developed countries. According to the planning commission estimate the annual growth rate of energy consumption has increased from 7.5% in 1979-80 to10% 1987-88. The vehicle population, which was around 20 lakhs in the early 70's, crossed 170 lakhs in 1993 and is expected to touch 200 lakhs by the turn of the century.

According to independent surveys in Delhi and Calcutta there is a big loss of fuel due to the poor management of urban traffic. A whopping 3.22 lakh litres of petrol and 1.01 lakh litres of diesel is wasted every day in Delhi due to idling of vehicles at the various traffic signals [128]. In Calcutta, the hawkers on the footpaths force the pedestrians to spill on to the roads and choke the carriageway. In some parts of the city hawkers have encroached on the carriage way too, causing further shrinkage of road space for motor cars. The encroachment by hawkers on the roads and pavements causes fuel wastage to the tune of rupees 50 lakhs per day [104].

It is true that India can save 20% of the energy used in the transport sector by conservative measures. Unfortunately, conservation is no long-term solution. Eventually the non-renewable energy sources like fossil fuel will die out. The only solution is to tap renewable and non-conventional energy sources, while applying conservation methods simultaneously. Our energy and power systems must be overhauled. We must call an end to the fossil fuel economy.

Time and fuel are running out. India's appetite for energy will lead it to buy more energy and thereby affect the national economy. Hence, energy saving by well-worked out pedestrian system in its cities will be an adequately justified objective.

4.8 TRAFFIC-FREE ZONES AND THE MEANS OF SEGREGATION

4.8.1 Traffic- Free Zones

These are urban areas where the private motor vehicle has been banned and priority given to the pedestrian movement and public transportation. Public transport is normally organised in the peripheral areas of such traffic zones for smooth movement of people to the other parts of the town. Private automobiles can also be parked at designated parking lots in the peripheral areas. Some of the important reasons for which this concept of traffic- free zoning has become attractive in the advanced countries are recorded below.

- To attract people. More people mean more opportunity for shopping, socialising, business and fun. More business means more money for both the citizens and the city.

- To provide a sense of place that strengthens community identity and community pride. This improves community relations and reduces feelings of

- Avoiding alienation, while creating a place for all types of people to congregate.

- To reduce noise and air pollution.

- To provide a safe and attractive environment in which children can play and the elderly citizens can meet and rest.

- To improve the visual environment. Signs, lights, spaces, colours, and textures can be designed to relate to the person on foot, rather than the person on the wheel.

- To promote urban conservation, environmental preservation, building restoration and renewal.

- To increase property values and consequently the city's revenue from real estate taxes.

- To special right-of-way to be reserved for bicycles and public transportation vehicles. This improves mobility through the city centres and helps save energy.

- To decrease the number of vehicles related to accidents, saving lives, police work and judicial time.

- To promote citizens participation in the inception, management, monitoring and improvement of the pedestrian area. Thus the project becomes a lively instrument for public education in urban life.

There are various types of traffic-free zones. The important ones are described below [6]:

4.8.1.1 Pedestrian Districts

Eliminating vehicular traffic over a unit for architectural, historic, or commercial

reasons creates pedestrian districts. European cities have often adopted this type of traffic-free zoning because it suits the physical condition of historic central areas.

4.8.1.2 Pedestrian Streets

Pedestrian streets are isolated individuals streets from which traffic has been eliminated. Emergency vehicles, however, have access and service and delivery are allowed during restricted hours. The term 'Pedestrian Street' is synonymous with pedestrian mall. "Mall" is widely used in North America to describe areas where all vehicular traffic has been banned from a central street.

The pedestrian mall concept emerged in new commercial shopping centres that were developed in suburbs after the Second World War. Urban pedestrian malls are an attempt to create favourable inner city shopping conditions analogous to those offered by suburban shopping malls.

In most pedestrian streets or malls, the entire roadway is filled to grade between curbs for convenient pedestrian - oriented amenities and movement. An emergency lane is always incorporated into the design, allowing access for police vehicles, ambulances, and fire trucks.

4.8.1.3 Transit-Ways

Transit-ways are pedestrian precincts that restrict but do not totally ban vehicles. Some transit-ways are also called malls. Private cars are usually prohibited, but buses, trams, taxis are often allowed subject to pedestrian priority. Motor routes are narrowed to one or two lanes of the roadway to the maximum, while the rest of the street and side walk area repaired and furnished

for the pedestrians. This works well for streets with medium level of pedestrian activity that are too wide for successful pedestrian malls.

4.8.1.4 Semi-Mall

Semi-mall are very similar to transit ways in their design. However private traffic is not prohibited. Access may be limited and severe speed limits are normally imposed for through traffic. Semi-malls are sometimes an interim step forward a larger traffic ban. They may also be considered as partial improvements for pedestrian improvement, with goals similar to those of mini parks, small urban plazas or pedestrian concourses.

4.8.1.5 Enclosed malls

Enclosed malls are city streets that have been totally enclosed and climatised. They offer physical conditions similar to those of suburban shopping centres. Their design is very complex and cost is almost prohibitive, placing them out of smaller cities. However, enclosed malls have particular application in colder climates.

4.8.2 Market

The location of markets is a crucial factor in their success. The aspect that is of prime concern to us in the study of pedestrianisation is the location vis a vis generation of population movement. It should be noted that markets are extensively sensitive to flows and concentration of pedestrians and traffic and most successful location are therefore in close proximity to larger generations of population movement. Markets therefore operate most successfully in central business districts and other formal commercial agglomerations, industrial

concentrations, around public transport terminals like bus terminals, train stations, taxi stands and particularly where two or more of these terminals are located together. It is from these nodal points that the pedestrianisation leading to the market starts.

Markets have many physical forms however, their performance is affected by "spatial marginalisation" and depends on "length of selling runs" and "width of circulation space"

The most common problem that is directly related to physical layout is that of "spatial marginalisation". This concerns with areas in a market in which stalls are unused or abandoned, areas where stalls are generating low profits and areas that tend to be avoided by customers. The diffusion of pedestrian flow across a market is primarily affected by three factors, which are mentioned below.

- The first is the selling environment, different uses or shop-types have a strategic relational alignment with other uses and shop-types, and this aspect can be used to "draw" customers throughout the entire market area.

- The second factor affecting pedestrian flow is the orientation of the shops to the dominant pedestrian circulation patterns.

- Third is visual contact. The propensity for a part of a market to be used is strongly related to the degree to which it is observable from other parts of the market.

The "length of selling run" significantly affects market performance. Two issues are central to this. The first is that unbroken runs must be long enough to facilitate comparative buying and to create a sense of activity. When the runs are too short activity levels are reduced and comparative buying is not

possible. Conversely when the runs are too lengthy, the ability of the customer to switch between runs is impaired. When the run is excessively lengthy, commercial dead spots tend to occur towards the centre of the run.

The "width of circulation space" affects how markets operate. The optimal situation occurs when the purchasers are able to engage vendors on both sides of the circulation channel in the process of product selection. When the circulation space is to wide, consumers operate on one edge of the channel only.

Infrastructural facilities for the pedestrians are an important aspect of a good working urban market. Facilities such as cleanable floor surfaces, water supply, electricity, public toilet facilities, shelter, selling and display area, storage, cleaning and garbage disposal are essential to a working market.

Administration is an all encompassing phenomenon. Good administration makes things work well and keeps the system moving in an orderly manner. Pedestrians in the markets will be positively benefited by good general administration.

4.8.3 Residential Areas

The pedestrian systems in the residential area should be segregated from the vehicular network so that the residential areas remain safe for the children while at the same time keep the pedestrians protected from the pollution created by the motor vehicle. There are a number of ways by which residential areas have been planned so as to make segregation between the access for vehicles and the pedestrians as mentioned below.

(A) The most common type is to have footpaths along side of the vehicular roads so that the cars and the people enter the house from the same direction. In this system the footpath is regularly interrupted by the access way to the garages and therefore continuity of walking is disturbed and the floor level of the footpath changes at the intersection of the vehicular entrance into the house.

(B) Keeping the cars in community garages at a distance from the houses and providing access to the houses by only pedestrian ways has also been tried out in several housing schemes.

(C) Some schemes have been designed by providing vehicular access to the houses from an outer peripheral road while pedestrians have been provided entrance through an inner or central pedestrian route.

(D) The reverse of the scheme described in the paragraph above has also been tried in several housing projects. That is an outer peripheral pedestrian path way is provided for pedestrian access into the houses while vehicles get entry to the houses through a central or inner road.

(E) In some of the schemes there is only one access for both cars and the pedestrians but these accesses have been assigned a pedestrian priority. This means that the car driver is to be held responsible in case of any accident in these pedestrian priority areas. The car driver is made aware of this pedestrian priority through signage and change in the texture of the road surfaces.

(F) Footpaths should lead the way that people will want to go, taking people to their destination in an unforced way. The design of the routes should not manipulate pedestrian movement unnaturally.

(G) Pedestrian routes in residential areas be designed with sensitivity considering all emotional factors.

4.8.4 Historical Areas

In historical areas archaeology would be the determinant of the development proposals. Historic buildings can be divided into two groups; firstly the grand individual buildings and the other are the historic settlements.

As far as possible, pedestrian ways and plazas will have to be conserved as per the ancient layouts or if new ones have to be laid-out, they should comply with the following aspects:

Pedestrian circulation around Grand Individual Historic Buildings.

Existing ancient gardens and path layouts should be conserved. Material to be used should be same as those used earlier. Soft landscaping may be done with plant material used historically.

In cases where the original landscape is totally lost, a new landscape may be developed based on the traditional landscapes derived from other such similar buildings. The pedestrian ways should be carefully done to avoid damage to archaeological remains and should not be visually obtrusive.

The pathways should be organised so that the pedestrians can have long views and also close views of the monuments. The pathways should allow the pedestrians to see the monuments from the side and rear also.

4.8.5 Parks and Leisure Area

Park and leisure areas are primarily for the enjoyment of the people. The enjoyment can be placed under the heads of active leisure, passive leisure and

cultural leisure. Pedestrian routes may be utilitarian linkages between activity areas and other support facilities or between different activity areas themselves. In these cases the walking is incidental to the use of the facility. However, in the case of nature walks, hiking trails, and jogging paths, the pedestrian routes themselves are directly activity related. Walks and trails channelise foot traffic along a selected corridor. This protects fragile vegetation and limits user impact to a specific management zone.

Pedestrian routes can conveniently direct walkers through interesting but potentially hazardous zones in parks. Well-designed trails offer access to scenic vistas overlooking from cliff tops or other attractions. Trails should be designed in size and scale to accommodate evening strollers or the backpacking hiker with stamina and experience. Not all pedestrian routes should be planned for a common (participant) denominator.

Each park has a pedestrian circulation system just like a vehicular circulation system used for access from distant places. The three major components of the walking system are walks, trails and paths. These are distinguishable by their design, surfacing, type and amount of use and the expected maintenance.

Walks are usually utilitarian support routes servicing parking lots, restrooms, community buildings, and other intensive development. Walks are most common in urban parks. Use is possibly heavy, surfacing durable and impervious. Walks are obviously designed with well-defined edges, direction and pattern. The landforms are often modified to accept the engineered pedestrian structure. Walks are usually suitable for use by the handicapped. Park walks are expected to be clean, free from leaves or other litter, and are often trimmed to keep growing over the edges.

Trails are activity-directed facilities for hiking. Trail use is a major part of the resource-based park experience. Trails are constructed of indigenous materials (usually pervious). Trails are designed to land characteristics. A wide variance of development criteria is applied to fit the natural circumstances. Trail width is flexible, surfacing often blends into the adjacent land without a distinctive edge. Heavy use has a direct deteriorating impact on the trail. Leaves and other natural litter are acceptable on trails.

Paths are the compromise between walks and trails. Paths are planned for either utility or activity. Their design is informal and not completely resource controlled; surfacing may be pervious or impervious. Handicapped people can use many of the paths. Path maintenance is related to the surrounding area maintenance standards and expectations [13].

4.8.6 Means of Segregation

The pedestrian movement network should be segregated from the vehicular network as far as possible [78].

All means of segregation can be broken down in to three types: -

A) Parallel

B) Horizontally Displaced

C) Multi - Level

4.8.6.1 The Parallel Grid

The ordinary sidewalk is the most common of the parallel grid. It has grown out of thousands of years of common use of streets by vehicles and pedestrians.

Parallel grid systems for pedestrians are considered to be satisfactory under following conditions:

- Necessity for frequent interchange at curbs between vehicles and pedestrian.

- Low volume of vehicular traffic.

- Adequate pavement width to insulate pedestrians from excessive noise and exhaust fumes.

The parallel grid is as inefficient for the pedestrian as for the driver. The pedestrian has direct access only to one side of the street, and at intersections, usually the largest generators, one has direct access to the corner. Four crossings are required for maximum utilisation, and those that are most intense are usually the widest.

4.8.6.2 The Displaced Grid

Of all existing sidewalks were removed from streets and taken through the centres of blocks, the result would be two overlapping circulation systems for vehicles and pedestrians, interesting at mid-block .The resulting circulation pattern would be far more efficient for both pedestrians and drivers.

Advantages to the pedestrian include: -

- Direct access to both sides of the walkway.

- Enclosed space at the intersections.

- Safer, controlled crossings at mid - block where pedestrians need look only one way without being harassed by turning movements.

- Complete freedom from noise, odours and visual obstructions by cars and trucks.

- Vehicular advantages include :

    Direct access to parking and servicing at rear of buildings.

    Less congestion at intersections.

    Easily visible, controlled pedestrian crossings.

    The disadvantages include :

    The necessity for double frontage.

    Lack of immediate availability of public transport.

(However these can be corrected through limiting the walking distance to bus and taxi stops ,and the provision of transit along walkways, which can be grade separated or at grade). Double frontage can be turned into an advantage through more efficient use of pedestrian frontage uninterrupted by garages, parking lots, and service areas.

4.8.6.3 Grade Separation

This has advantages in high traffic intensities. They are of three types:

a) Under pass   (i -Across the street, ii -Along the street/sidewalk)

b) Over pass

c) Combined method

Under pass

Advantages and Disadvantages:

- May be at a height of only 2.4-m - 3.0 m below ground level.

- Does not interfere with the building facade.

- May be directly connected with the underground rapid transit system.

- For long stretches, walking underground may disorient people.

- Expensive.

Over pass

Advantages and Disadvantages:

- Construction of an overhead walkway is less expensive then subway.

- Reluctance of people to climb up; hence may not be used.

- May interfere with the building facade.

- Require a clear height of at least 6.0-m to permit the passage of vehicles (Double-Decker buses) below it.

Combined method

A total approach to the design of a movement network for pedestrian will necessarily involve all the three methods, i.e. parallel grid, displaced grid and grade separation. This will take into account the several linkages between vehicle, pedestrian and land- uses. The vehicular capacity of some thoroughfare of fixed width may be intentionally limited in order to provide sufficient pedestrian capacity. Thus the entire transportation network may be rationalised into a hierarchical web of limited capacity arteries. Such a system may be broken down into the following sections.

- Major arteries - highways and expressways, no traffic lights.

- High intensity arterial (100 - 200 ft.) Right of way, 1000 - 3000 pcu / hour.

- Low intensity arterial (50 - 60 ft.). Right of way, 100 - 500 pcu / hour.

- Local access street (50 - 60 ft.). Right of way, 0 - 100 pcu / hour, restricted to those vehicles doing business on the street only.

- Closed street restricted to pedestrian and emergency and service vehicles only.

4.9 STANDARDS FOR PEDESTRIAN DESIGN

4.9.1 Anthropometrics Dimension

Basic information on pedestrian is useful in circumstances where spatial standards do not exist or where existing standards are inapplicable. In these situations reference can be made to the physical characteristics of the human body itself in order to make rational decisions about required dimensions of organised space and other details of a proposed pedestrian environment.

The size of people varies according to their physique, age and dress. The width is taken at the shoulder and the breath at the chest level. The shape of the horizontal projection is taken as an ellipse whose axes correspond to the width and breath of the person.

4.9.2 Forward Spatial Bubbles

The [Table 5] shows The Forward Spatial bubbles (the extent of unobstructed forward vision while walking) considered to be psychologically comfortable for the average pedestrian under various circumstances [31].

Table 5   Size Of Spatial Bubble

Public event.	6 feet	1.8 metre
Shopping	9 to 12 feet	2.8 to 3.6 metre
Normal walk	15 to 18 feet	4.6 to 5.5 metre
Pleasure walk	35 feet plus	10.6 metres plus

This information on spatial bubble is useful while calculating how much clear space is required to accommodate expected number of people in various situations, if the intent is to maintain a reasonable degree of psychological comfort for those involved.

4.9.3 Walking Rates

The average walking rate of a pedestrian will decrease when pedestrian density on a walkway increases and / or the clear space ahead of the pedestrian becomes less than approximately 5 Mt. Pedestrian walking rates are not significantly altered by grade changes of 6 percent or less, but intersections, stairways, and turnstiles will slow down average walking rates. [Table 6] shows the average walking rates.

Table 6   Average Walking Rate Of Pedestrians

type	ft / min	Mt. / min	Km / hour
Average adult	260	72	4.3
Elderly (75 years)	215	67	4
Bunching	200	61	3.7
Stairways (going Down)	152	46	2.8
Stairways (going up)	113	34	2

4.9.4 Acceptable Walking Distances and Time

A lot of important work is done on foot. About one journey per person each day and over one in three of all the journeys that people make on average. This is

slightly less than that for car travel, and far higher than for all other methods of travel, including public transport. Almost three-quarters of all walk journeys are less than one mile long, Journeys under one mile by all travel methods account for about one-third of all journeys, and almost 90 percent of them are made on foot. Refer [Table 7].

Table 7   Mode & Distance Covered In Miles As Percent Of All Journeys

Mode	less than 1 mile	less than 2 miles	more than 2 miles	all distances
walk	25	8	2	
car		10	30	
bus / trains				11
others				4
Not available				10

The average lengthy of walk journey will be about 4/5-mile (34). Therefore, a fully pedestrian scale town will be about 2.4 square miles.

Although journeys on foot are much shorter in distance than those by other travel methods, there is less variation among methods in terms of travel time because of the much slower speed of walking. [Table 8] shows this. The figures suggest perhaps that people are somewhat less inclined to spend time on a walk journey compared with a motorised one, in all likelihood because of the physical effort involved, and because an extra few minutes walked makes little difference to the range of opportunities reached, unlike an extra few minutes travelling in a car. In fact, the average (mean) time spent on walking journey about 24 minutes (34).In common with calculations of mileage travelled in the

NTS, calculations of time spent travelling are subject to some inaccuracy as time intervals of fifteen minutes are employed -and the first of these encompasses half of all walk journeys. If the mid-point of each interval is taken as the average, however, an approximation of total time travelling can be calculated, showing that people travel for about one hour daily of which one quarter is spent walking [34].

Table 8   Time Band And Percentage Of Journeys by Travel Mode

Travel Time	Per cent of walk journey in each time band.	Per cent of journey by other methods in each time band.	Walk journeys as percent of all journeys in each time band.
Less than 15 minutes	53	37	45
15 to 29 minutes	33	34	36
30 to 44 minutes	10	16	28
45 to 59 minutes	2	5	17
60 minutes or more	2	8	12
All times	100	100	37

4.9.5 Pathway Width

The width of walkways depends upon the expected flow of pedestrian and could be calculated or fixed with the help of guidelines given in the Table 9, subject to a minimum width of 1.5m.

For walkways in shopping areas, the width should be increased by 1.0 m. that is treated as the "dead width". In other situations where walkways pass adjacent to buildings and fences, the dead width can be taken as 0.5 m. For areas of heavy pedestrian activity, such as, bus stops, railway stations and recreational areas, the width of the walkway should be suitably increased to account for accumulation of pedestrians.

Table 9   Capacity Of Walkways

Width of walkway. (Metres)	No. of persons in one direction in one hour.	No. of persons in both directions in one hour.
1.5	1200	800
2.0	2400	1600
2.5	3600	2400
3.0	4800	3200
4.0	6000	4000

In purely residential areas, and special cases like shopping centres and industrial or office complexes, different principles will apply to walkway designs than the capacity considerations given in the above table. Calculation of walkway width by formula is shown below.

Minimum width for a pedestrian walkway can be determined by mathematical calculation as a function of expected pedestrian volume, acceptable density, and desirable rate of movement. The number of pedestrians (volume) passing a stationary point on a pathway is expressed by unit measurement of time, such as, "pedestrian per minute" or "pedestrians per hour". Density refers to personal buffer zones, expressed in terms of square feet per pedestrian. Given these criteria, pathway width can be calculated using the standard flow theory.

In this theory and the subsequent formula arrived at, pedestrian volume (V) refers to the number of pedestrians that are expected to pass any one point on the pathway each minute. Space module (M) typically ranges from a minimum of 5-ft square per person to 35 ft square per person or greater. Walking speed (S) typically averages about 260 feet per minute, but of course can vary significantly depending on the predominant activities in the area, the type of pedestrians, etc.

Expected loads of pedestrian traffic are determined through observation of similar projects in other areas, formal studies and personal judgement[31].

Pathway Width = (V M) / S

Where V= Volume, pedestrian / minute

M= Space Module, ft square per pedestrian

S= walking speed, feet per minute.

4.9.6 Walkway Slope Criteria

Longitudinal slope criteria are based on user ability and design objectives, and cross slope criteria are based on the need for positive drainage (depending on paving material). Porous paving, for instance, does not require as much of a cross slope for drainage as does a non-porous paving material. The slope requirements are as tabulated in [Table 10] and [Table 11].

Table 10   Longitudinal Slope

Preferred Slope	0 to 3 percent.
Maximum Slope	5 percent
In climates without snow.	5 to 10 percent

Table 11 Cross-Slope

cross-slope minimum	1 percent
cross-slope typical	2 percent
cross-slope maximum	3 percent

4.9.7 Stairways

Minimum width for stairways should be 1.5 m. Minimum width for private stairways should be 1.1 m. For ease of ascent or descent, and for safety reasons, tread-riser ratio are always held constant within any particular stairway or set of stairways.

Outdoor stairways should be made easier to ascend or descend than interior stairways since people tend to move at greater rates outdoor than indoors. Inherent to a particular tread- riser ratio is the ease at which the staircase can be ascended or descended, and the sense of rhythm to be enjoyed by the pedestrian.

Single steps in a walkway are very dangerous and should never be specified. At least two steps, but preferably three, should be specified, and their presence should be announced conspicuously with railings, planting, lighting, and such similar features.

Risers for outdoor stairways should be a maximum of 11.2 cm. And a maximum of 17.5 cm. The treads should be sloped down grade 2 percent for drainage.

CHAPTER 5: A WORKING THEORY

5.1 INTRODUCTION

Social and behavioural scientists are of the opinion that theoretical formulations in an area of knowledge have considerable utility, and that systematic theories and theoretical models are highly desirable, particularly for research and if maximum productivity and progress are to be attained.

A pedestrian planning theory is necessary so that the pedestrian planning activity could be taken up in a systematic and organised way. Two major aspects come to the forefront while looking at the pedestrian problems of the existing Indian cities. Firstly, that the cities have already become too large for purely pedestrian movement alone, and therefore require solutions which envisage the integrated use of foot-traffic, motor vehicle traffic along with the railways and other inter-city travel modes. The second aspect is the detailed design solutions that are required for areas declared as pedestrian zones.

The theory provides two separate models, the first applicable for integrated Multi-modal accessibility in the town and the other for Appraisal, programming and designing of pedestrian environment areas.

5.2 PART- I : INTEGRATED MULTI-MODAL ACCESSIBILITY MODEL

Today, it is not possible to have a settlement which is based on totally pedestrian movement. This is because most cities of the world have grown beyond the accessibility limits allowed by pedestrian travel alone. It would also be unwise not to use the advancement in technology which is available to us

today in the form of motorised transport. Besides this, the society of today wants to use the motor vehicle to the maximum extent, while, at the same time, it looks for a healthy environment which offers a healthy life.

Therefore, in this theory, it is proposed to use the combination of both, the pedestrian and the motorised modes so that they compliment one another. Presently, the two modes are not rationalised and they are impediments to one another, particularly in the Indian cities.

5.2.1 Mode Of Travel And "Access Range Size"

Each mode of travel has its own access range which is named here as the "access range size" which means the minimum and maximum distance moving objects (People, cycle, car, bus, etc.) can travel.

5.2.1.1 The highest level.

The highest level of the " Access Range Size " is worked out on the basis of the average between the distance that the object can travel with one energy loading (one tank filling) and the number of hours multiplied into its speed, (giving distance), that a human being can travel comfortably in that mode of transport.

The highest level of the "Access Range Size" of the Maruti 800 is as calculated below:

Total distance it can travel with one energy loading = 25 litres x 17 km per litre = 425 km.

Total distance a human being can travel comfortably in it = 7 hours x 65 km per hr = 455 km.

Therefore the highest level of its " Access Range Size " = 425 km + 455 km = 880 / 2 = 440 km.

For example, the highest level of the " Access Range Size " of the scooter is as calculated below:

Total distance it can travel with one energy loading   = 5 litres x 40 km per litre = 200 km.

Total distance a human being can travel comfortably in it = 2 hours x 45 km per hr = 90 km.

Therefore the highest level of its " Access Range Size " = 200 km + 90 km = 290 / 2 = 145 km.

For example, the highest level of the " Access Range Size " of the bus is as calculated below:

Total distance it can travel with one energy loading   = 200 litres x 4 km per litre = 800 km.

Total distance a human being can travel comfortably in it = 8 hours x 65 km per hr = 520km.

Therefore the highest level of its " Access Range Size " = 800 km + 520 km = 1320/2=660 km.

5.2.1.2 The lowest level.

The lowest level of the " Access Range Size " is worked out as the closest a moving object can reach to his place of work or the rest room of a human being. Two factors govern the lowest level and those are the size of the access and the load carrying capacity of the access. In other words the width and height of the access (passage, pathway, road or street.) and the type and strength of the load carrying capacity of the paving material of the access (passage, pathway, road or street.).

The load carrying capacities and size of the access ways have been assumed under the following categories:

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(A) Corridors in buildings. This includes Footpaths, Pagdandies and Kacha roads

(B) Roads which includes Residential streets ,Collector or feeder streets , Sub arterial, arterial roads, Highways and Freeways

(C) Railway lines.

Calculation of the lowest level of various modes of the transport

Lowest Level of Railway Transport

L = is maximum length of one side of the country in square form

N = number of grids to be arranged in the country square form

I = the size of the minimum range of railway grid

R = Railway length in the country = 1,09,143 Km

A = Area of the country = 29,30,000 Km^2

Refer fig number....

$L(n+1) + L(n+1) = R$

$\Rightarrow Ln + L + Ln + n = R$

$\Rightarrow 2Ln + 2L = R$

$\Rightarrow 2L(n+1) = R$ ....(a)

But $L^2 = A$

$\therefore L = \sqrt{A}$

But A = Area of the country is 29,30,000 Km^2

$\therefore L = \sqrt{29,30,000} = 1711.724$ Km

Substitute the value of the L in the equation (a)

$\therefore 2 \times 1711.724 (n+1) = 1,09,143$

$\Rightarrow (n+1) = 31.88$

$\Rightarrow n = 30.88$

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∴ l = L / n = 1711.724 / 30.88 = 55.43 Km

Lowest Level of Road Transport

L = maximum length of one side of the country in the square form

n = number of grids to be arranged in the country in square form

l = the size of the minimum range of road grid

R = road length in the country = 21,03,230 Km

A = Area of the country = 29,30,000 Km^2

Refer fig number....

L (n+1) + L (n+1) = R

$\Rightarrow$ Ln + L + Ln +n = R

$\Rightarrow$ 2Ln + 2L = R

$\Rightarrow$ 2L (n+1) = R ....(a)

But L^2 = A

∴ L = $\sqrt{A}$

But A = Area of the country is 29,30,000 Km^2

∴ L = $\sqrt{29,30,000}$ = 1711.724 Km

Substitute the value of the L in the equation (a)

∴ 2 x 1711.724 (n+1) = 21,03,230

$\Rightarrow$ (n+1) = 614.36

$\Rightarrow$ n = 613.36

∴ l = L / n = 1711.723 / 613.36 = 2.79 Km

Lowest Level of Foot Transport Through Building Corridors

As per 1981 census, the total number of buildings in India located in urban

areas which include residence, shop cum residence, workshop, factories,

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business houses, places of entertainment, places of worship, and other non residential uses are 520.4 lakhs.

The area of all these buildings taking an average of 30 mt^2 per building

= 520.4 lakh x 30 mt^2

=15612 lakh mt^2

Assuming corridors to be at an average of 15 percent of the total built up area, then the total corridor space would be

= 15612 x 15 / 100

= 2341.8 lakh mt^2

Assuming corridor width to be 1 Mt. wide at an average, then the length of the total corridor would be

= 2341.8 lakh Mt. = 2341800 km

Now.

L = is maximum length of one side of the total urban area of the country in the square form

n = is the total number of grids to be arranged in the total urban area in square form

l = is the size of the minimum corridor grid

R = is corridor length in the urban areas = 2341800 Km

A = is Area of the total urban area of the country = 52564 Km^2

L (n+1) + L (n+1) = R

$\Rightarrow$ Ln + L + Ln +n = R

$\Rightarrow$ 2Ln + 2L = R

$\Rightarrow$ 2L (n+1) = R ....(a)

But $L^2 = A$

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$\therefore L = \sqrt{A}$

But A = Area of the total urban area in the country is 52564 Km^2

$\therefore L = \sqrt{52564} = 229.27$ Km

Substitute the value of the L in the equation (a)

$\therefore 2 \times 229.27 (n+1) = 2341800$

$\Rightarrow (n+1) = 5107.08$

$\Rightarrow n = 5106.08$

$\Rightarrow \therefore l = L / n = 229.27 / 5106.08 = 0.04489$ Km or 44.89 Mt.

5.2.1.3 Access range size of different modes of travel

The pedestrian has a " Access Range Size " from 0 kms to 1 km;

The scooter from .045 km to 120 km (say 0.5 km to 120 km) ;

The car from 0.045 km to 440 km (say 0.5 km to440 km) ;

The buses from 2.79 km to 595 km (say 3 km to 600 km)

The train from 55.43 km to 2000 km (Judgmental)(say 50 km to 2000 km) ;

And the aeroplane from 300 km to 8000 km (Judgmental) [[Figure 15].

5.2.2 "Access Range" Conflicts

The problems and conflicts in accessibility is particularly excessive in the overlapping areas between the " Access Range Size " of two different modes of travel [[Figure 15]. Nobody can think of reaching to one's doorstep using a train or an aeroplane, nor can one think of going to one's bedroom in a scooter or a car because at the concerned distances there is no overlap of the " Access Range Size ". However, when one wants to go to the neighbourhood market

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ACCESS RANGE SIZE

- PEDESTRIAN 0-1 KM.
- CAR/SCOOTER 0.5-30 K.M.
- BUS 3-300 K.M.
- TRAINS 50-2000 KM.
- AIR-PLANE 300-8000 KM.
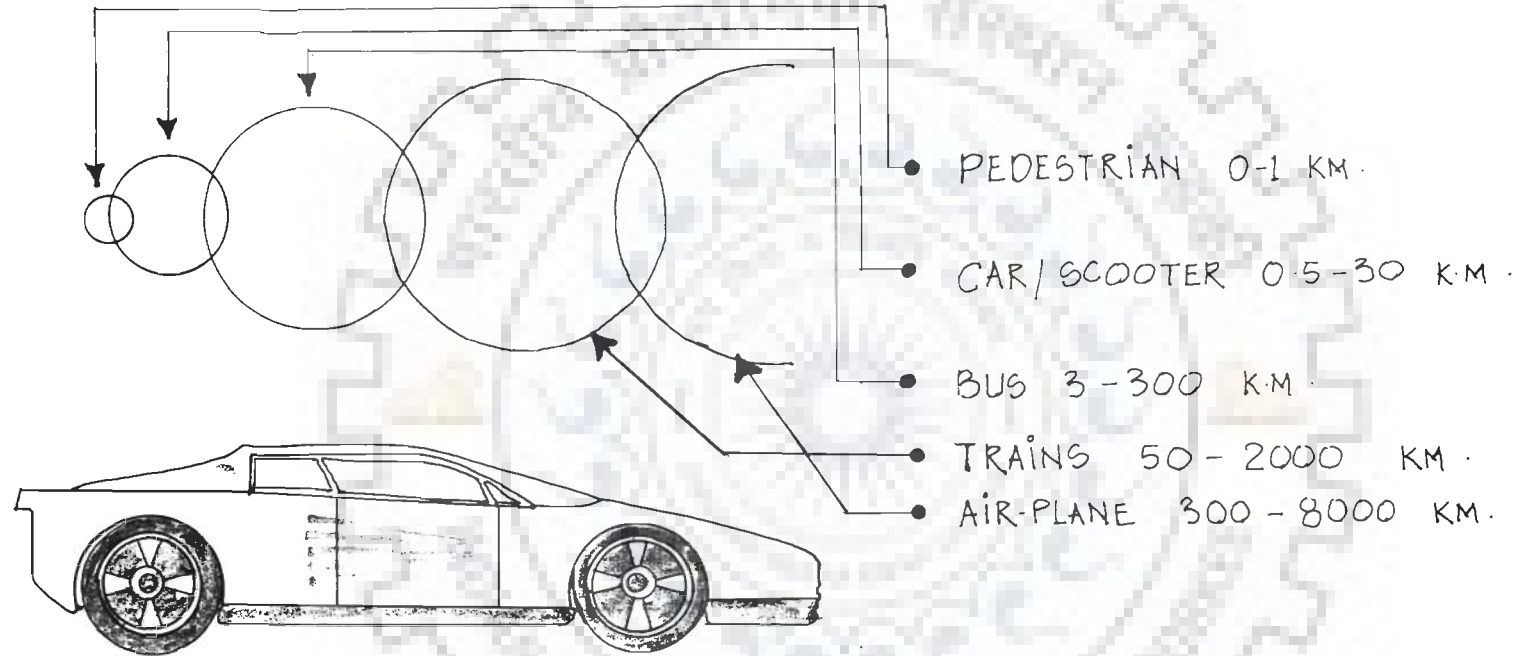
DRG. NO:- 15	PAGE NO:-	TITLE:-
	147	ACCESS RANGE SIZE BY MODE

which is about one kilometre from the home, one may walk, use a cycle or take a rickshaw.

This is because the " Access Range Size " of the pedestrian, the cycle, the rickshaw, the scooter and the car all overlap, if the distance falls within one kilometre, but it may be observed that the " Access Range Size " of the train does not overlap at this distance, and therefore, nobody uses it.

Therefore, while moving between the home and the neighbourhood market that falls within one kilometre distance, one has to face the conflicting situation of deciding the optimal mode of travel. The competition for usage of urban space between the different modes of transport, particularly, the pedestrians and the vehicles lead to spatial conflict, environmental conflict, social, psychological and economic conflicts. As a result there are several adverse impacts. Different types of pollution are generated which lead to the decrease in the quality of living, alienation of one social group from the other, accidents, creation of fear, tension, irritation, wastage of energy and time.

5.2.3 Maximising the "Access Range Size"

The pedestrian mode of travel has many advantages and reasons to be given a priority over the other modes of travel. Some of them are enumerated below:

(A) India has a large and growing population and therefore, an increase in the walking population.

(B) The Indian economy is not capable of supporting personalised motor transport for a majority of its population (In 1991 there were only 2321.63 cars and two wheelers for every lakh of Indian Population). In other words 2.32 percent of the population owned some kind of motorised transport).

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(C) It is pollution free. Walking does not create any environmental pollution like air pollution, noise pollution or visual pollution.

(D) It encourages the social well being of the people. While walking people mix and interact with one another and thereby they create a healthy community. It also acts as a unifying factor between different economic and social groups.

(E) Walking saves the nation from the import of expensive fossil fuel.

(F) It improves the general health of the population.

(G) Pedestrianisation is accident free. The people are saved from the trauma that accompanies motor vehicle accidents and also from the accompanied medical expenses.

(H) Biologically, human being is designed to use his five senses to perceive the environment while sitting, standing and walking through it. His sense of visual perception is mostly used while understanding and enjoying the manmade or natural environment. So if settlements are to be for the human beings, for their happiness, for their enjoyment, then the settlements should be designed with a pedestrian-centric orientation.

(I) Finally, pedestrianisation is highly sustainable, considering every angle of sustainability and the present day opinion on the matter. In the major International Initiatives taken in the recent times on topics of environment, settlements or shelter the following important guiding principles related to sustainability have been suggested.

Agenda 21, adopted by The United Nations Conference on Environment and Development on 14 June 1992 mentions, in the section 1, chapter 7, regarding the promotion of sustainable human settlements. Three points are highlighted in this section, firstly it states that adequate shelter should be provided for all,

secondly it suggests that there should be improvement in the management of urban settlements and finally the promotion of sustainable land-use planning and management. The World Assembly of Cities and Local Authorities, in the Habitat- II Final Declaration, makes recommendations to ensure viable, supportive, safer, and healthier human settlements. It has the following points to make:

- The future of our towns and cities must be conceived and organised around the concept of sustainable human development.
- Towns and cities must be made aware of the concepts of sustainable environmental management.
- The problems of congestion and pollution caused by the traffic growth in towns must be overcome.

The several reasons mentioned in the previous few paragraphs establish adequately that the pedestrian mode of travel should be used when ever possible for the well being of the citizens. Keeping this in view, the strategy proposes that the pedestrian access range size should be 0 km to 1-km distance, which is the minimum and maximum range for walking, while pushing out the " Access Range Size " of other modes from the overlapping areas.

5.2.4 The "Pedestrian Mesh"

The most appropriate form for a pedestrian range will be a circle because it has a centre point and a locus and in a free situation the pedestrian has the choice to move in any direction from the centre to the locus. However, it will not be in-order to create a mesh of circles since this mesh will have areas, which are not covered or lie unattended between the circles of the proposed mesh. The

second best option for the mesh is the hexagon (beehive) because it is closest to the circle and at the same time leaves no unattended areas in between as in the case of the circular mesh.

The proposed hexagonal or beehive mesh size will be equal to the " Access Range Size " of the pedestrian which is 0 km to 1 km. The lines of the mesh would be the vehicular access and the space they surround taken as pedestrian area. [Figure 16].

5.2.4.1 Application to New Towns and Cities

New Towns can be easily laid out based on the "pedestrian mesh" created out of the pedestrian " Access Range Size " and access for vehicles allowed at the edge of the hexagons. This may be similar to the concept of the neighbourhood but it should be recalled that the neighbourhood was intended to be a community having a population of about 6000 to 10000 people with an elementary school and some other community facilities, and it may, have only at times, related itself to the pedestrian scale. But with the application of the pedestrian mesh for the design of the new cities the basic module of the city will be totally pedestrian-centric.

5.2.4.2 Application to Inherited (Existing) Towns and Cities

It can be seen that in the world today very few new towns are being built. In fact, most existing towns are being made to accommodate the increasing population by increasing the size of the town. This is also true in the case of India. Therefore, the major problem is to incorporate pedestrianisation into the fabric of our inherited cities.

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THE PEDESTRIAN MESH

PEDESTRIAN ACCESS RANGE
(MOST APPROPRIATE FORM IS THE CIRCLE)

AREAS ARE LEFT UNATTENDED

HEXAGON IS CLOSE TO THE CIRCLE IN FORMATION.
NO UNATTENDED AREAS.
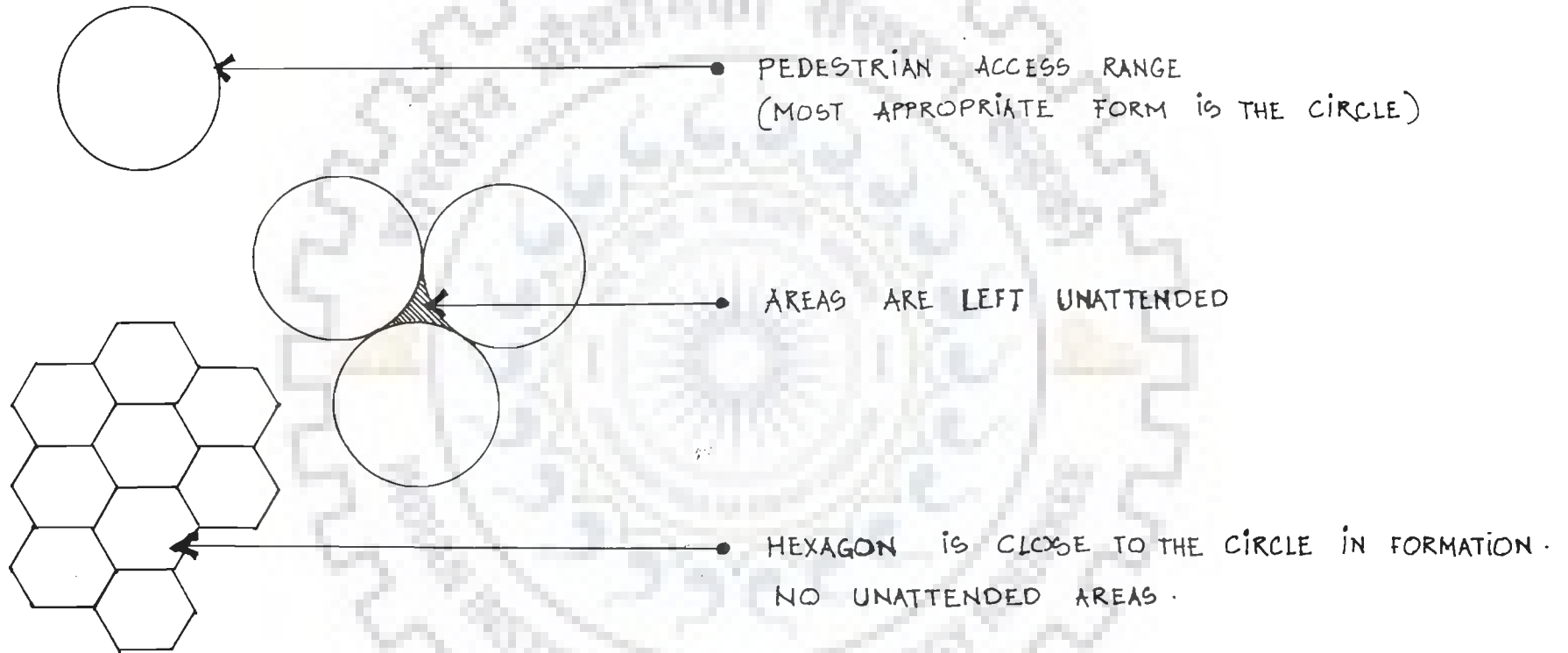
DRG. NO:- 16	PAGE NO:- 152	TITLE:- THE PEDESTRIAN MESH

5.2.4.3 Strategy to Incorporate the "Pedestrian Mesh" Onto The Inherited Towns and Cities

The strategy to incorporate the pedestrian mesh onto the inherited city has been made based on general knowledge of town planning and the possibility of easy application.

(a) Take the inherited road network plan of the city under consideration.

(b) Mark the roads as per their access hierarchy, namely, arterial and sub-arterial roads at the town level, collector roads and feeder roads for neighbourhoods, etc.

(c) Overlay the land-use resources and the cultural resources on the city plan.

(d) Overlay the "Pedestrian Mesh" on the city plan.

(e) The "Pedestrian Mesh" should be "bent-on" to the inherited road network of the city as per convenience [

(f) Figure 17]. Care should be taken to ensure that the arterial roads and other important roads are integrated with the mesh lines and proposed as the vehicular access roads of the town. As far as possible, the neighbourhood and local roads should not be used for movement of vehicles within the town.

(g) The cutting across should not disturb land-use resources and cultural resources by vehicular roads.

(h) Action must then be to improve the road networks to cope with the reorganised vehicular traffic. This should be done without affecting the aesthetic qualities of the buildings on both sides of the roads.

5.2.5 Planning Of the "Pedestrian Environment Area"

The areas surrounded by the vehicular roads or the pedestrian module may be referred to as the "Pedestrian Environment Area". In the beginning, development work for pedestrianisation should be done in the "Pedestrian Environment Areas" which encompass the important market areas, historical areas, residential areas and leisure areas of the town. Other areas of the town should be taken up subsequently [Figure 18].

5.2.6 Relationship of "Pedestrian Environment Area" and "Traffic Zone"

In this theory the "Pedestrian Environment Area" is to be considered as a traffic zone for making transport calculations. This assumption may be made because the criteria for delineating a traffic zone and the criteria for establishment of the "Pedestrian Environment Area" are compatible to one another. The criteria for the delineation of the traffic zone are noted below for comparison and cross-reference.

A zone should have homogeneous characteristics of land use.

(A) Complete urban villages may be retained as one zone.

(B) Town planning schemes may form a zone.

(C) Complete Municipal wards can form zones.

(D) Census wards can be made into zones.

(E) Areas earmarked for future development are identified as separate zones.

(F) Zone boundaries are desirable to be located along existing roads.

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OVERLAY OF PEDESTRIAN MESH ON INHERITED CITY

HEXAGONAL PEDESTRIAN MESH TO BE "BENT-ON"
TO THE ROAD NET-WORK OF THE INHERITED CITY.

ROAD NET-WORK OF
INHERITED CITY / EXISTING CITY.
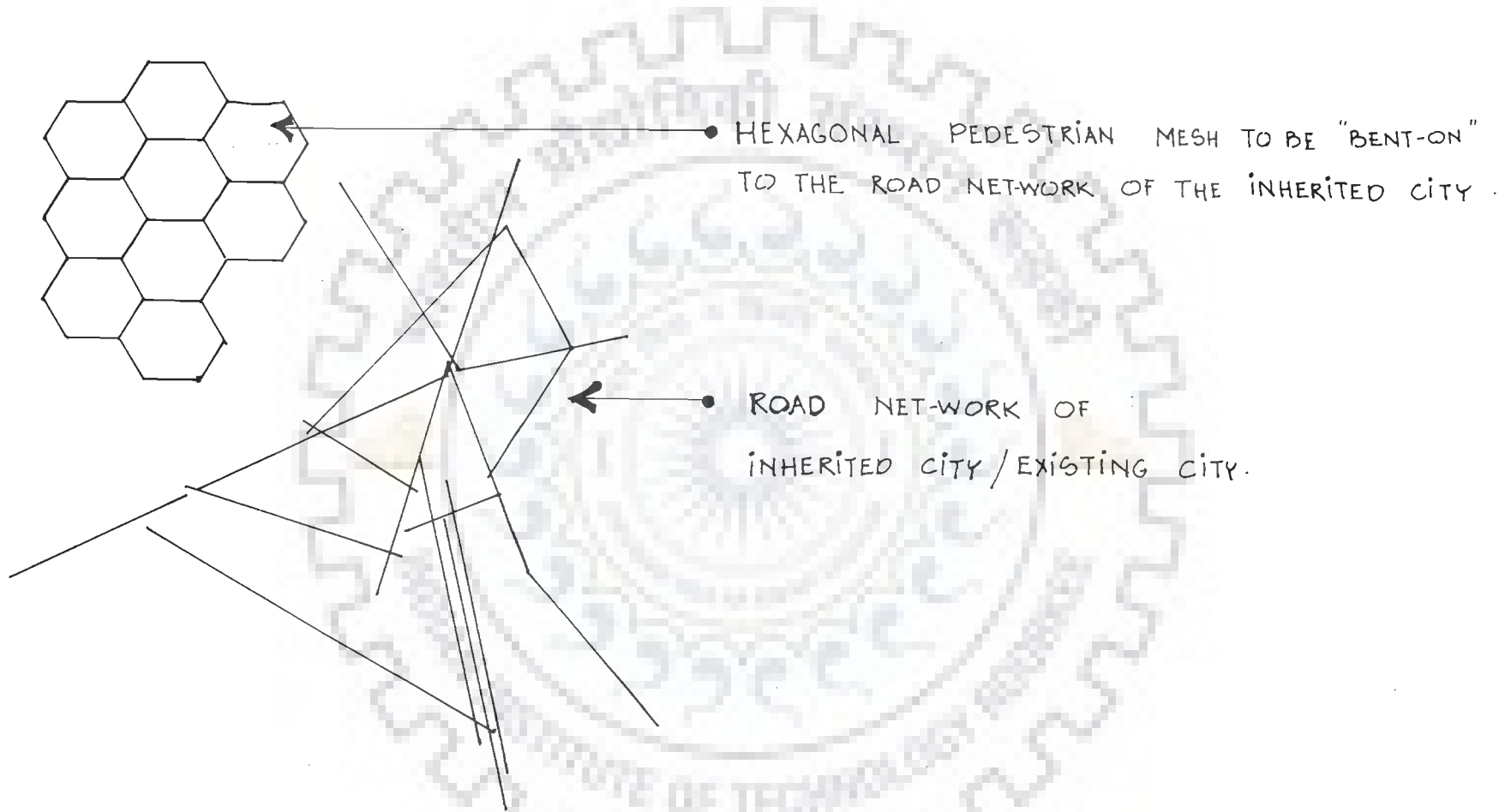
| DRG. NO:- 17 | PAGE NO:-
155 | TITLE:- | OVERLAY OF PEDESTRIAN MESH ON
INHERITED CITY |

PEDESTRIAN ENVIRONMENT AREA (PEA)

- PEDESTRIAN ENVIRONMENT AREA (PEA)
  (ONE "PEA" CAN BE ONE TRAFFIC ZONE)

- OPEN AREAS MAY CONSIST OF
  FIVE "PEAS" AND MAY MAKE
  ONE TRAFFIC ZONE.
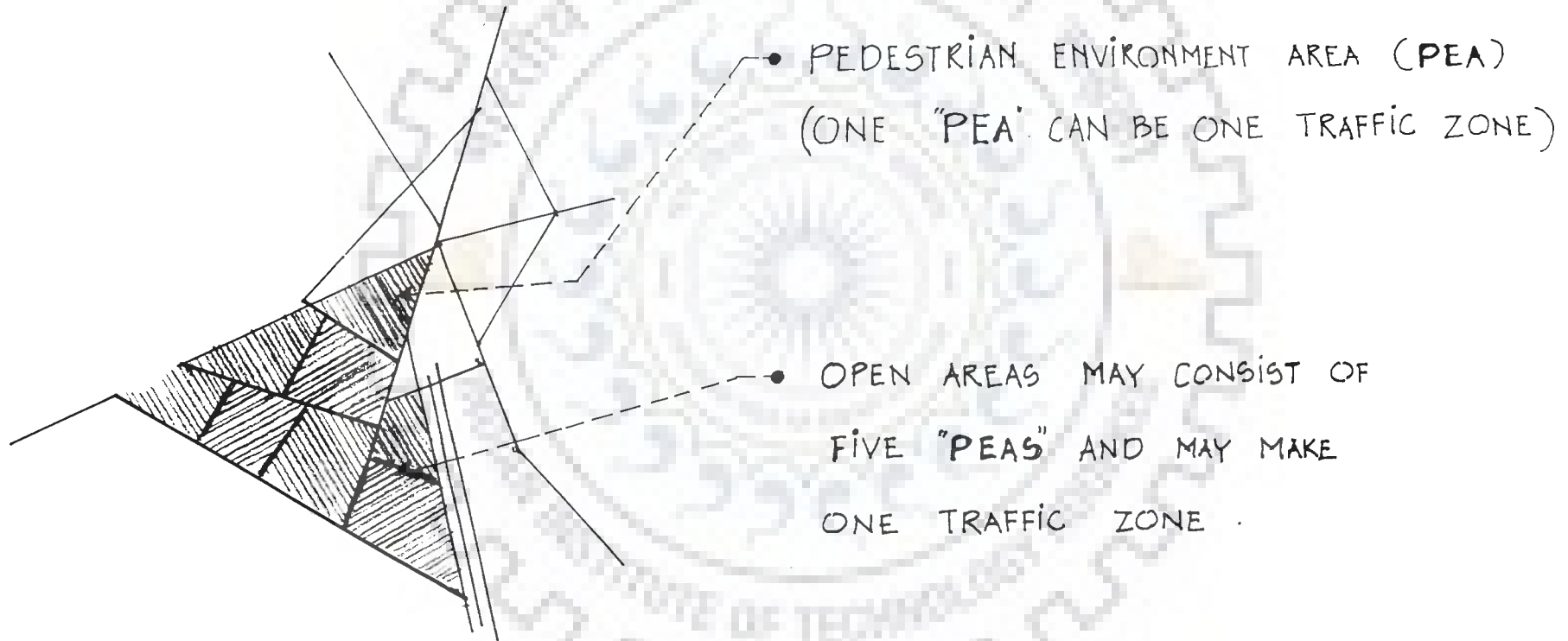
DRG. NO:- 18	PAGE NO:- 156	TITLE:- PEDESTRIAN ENVIRONMENT AREA.

The guiding factors for delineation of the "Pedestrian Environment Area" is the land use resources and the cultural resources which more-or-less follow all the above criteria of zone delineation in its ambit.

5.2.7 Transport and Pedestrian Network for the Over All City

The traditional four-stage transport planning process may be used for working out the road improvements and the pedestrian linkages between the different "Pedestrian Environment Areas". The transportation model is divided into four main stages.

(A) Trip Generation.

(B) Trip Distribution.

(C) Modal Split.

(D) Trip Assignment.

5.2.10.1 Trip Generation

The generalised trip generation equation can used as under:

$$Y = A + BX$$

Where Y = Trips produced or attracted.

X = Independent variable.

A = Constant term.

B = Trip rate to be determined from least- square analysis.

5.2.10.2 Trip Distribution Sub-Model

Trip distribution deals with the choice of destination. The primary aim of this phase is to distribute the total number of trips originating in each zone amongst all destination zones. This can be accomplished by using the gravity models.

Gravity model formulation:

$$T_{ij} = \frac{P_i \times A_j \times F_{ij} \times k_{ij}}{\Sigma [\, A_j \times F_{ij} \times K_{ij} \,]}$$

where

T_{ij} = Trips produced in zone i and attracted to zone j.

P_I = Total trips produced in zone I.

A_j = Total trips attracted to zone j.

F_{ij} = Empirically derived travel time factor (one factor for each one-minute interval time) that is a function of the spatial separation between the zones and expresses the area wide effect of spatial separation of trip interchange.

K_{Ij} = Specific zone to zone adjustment factor which allows the incorporation of the effect on travel patterns of defined social and economic linkages, not otherwise, accounted for in the gravity model formulations.

The travel time factor F_{ij} is developed in an iterative procedure which is continued until the modelled trips calculated for each trip length interval closely match the survey trips reported for the same intervals. Any convenient set of travel time factors may be used to start the iteration procedure.

5.2.10.3 Modal Split Sub-Model

The most important stage in transportation planning process is modal split model. Many factors influence the modal choice behaviour of the residents in any study area. The factors are as follows:

(A) Economic characteristics

- Vehicle ownership

- Monthly income

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- Social standing

(B) Journey characteristics

- Length of journey

- Time of the day the journey is made

- Purpose of the journey

(C) Transportation characteristics

- Travel time involved

- Cost involved

- Accessibility to user

- Comfort

It is difficult to develop the modal choice model because several influencing factors are responsible. However, the modal split in favour of mass transport and foot traffic may be taken considering that most of the towns are occupied by the middle and lower middle income groups of people.

5.2.10.4 Trip Assignment Sub-Model

For the purpose of assignments of intra - city passenger trips onto the network the ' Shortest path Algorithm'; with "All or nothing" assignment may be used.

5.3 PART- II: MODEL FOR APPRAISAL AND PROGRAMMING OF PEDESTRIAN SPACES

The appraisal and investigation of existing pedestrian dominated spaces should be done according to some defined and logical lines so that all aspects that contribute to the overall product, in this case the pedestrian environment, may not be missed out. At this stage it is necessary to make it clear that there

is a distinction between the "Pedestrian Environment Area", of the earlier section, and the "Pedestrian Space" being mentioned in this section. Here the "Pedestrian Space" refers to the inherited or existing pedestrian areas of the town.

Therefore, to identify the control parameters, which constitute the pedestrian space, the procedure of systems analysis was used. (Systems analysis may be described as a synthetic discipline; it is a collection of viewpoints and techniques. Systems analysis can be called a way of looking at problems.) The help of published material and several rounds of discussion with specialists in the field and outside were carried out to arrive at the control parameters.

An attempt was made to identify the central parameters applicable to a pedestrian space and then breaking them down to their fundamental components. For example the central parameter of a urban pedestrian space can be functionality, which in turn can be broken up into the sub-parameters of having good roads, water supply, electric supply and so on. However, it was also realised that breaking up of an aspect to a very great detail may lead to the loss of its qualitative contribution to the original product. Hence, the procedure of systems analysis has to be used carefully and with understanding [Figure 19].

The first broad division of the Pedestrian space was arrived at on the basis of the "Triad Theory" which has a logical approach to evaluate projects. The "Triad Theory" reflects a deliberate attempt to give equal emphasis to the three elements of a designed product, that is, function, form and economy.

This theory has given the triangular scale known as the "Triangle in Equilibrium". For the purpose of this investigation the triangle was calibrated

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with on a 10-point scale where 5 was considered fair and 10 considered as excellent [Figure 20].

Hence, a 10 - 10 - 10 triangle will have an area of 129.89 (assume 130) and was considered as an absolute and designated as the "Triangle Of Perfection". The location of the centroid of the triangle formed by the product indicates the tendency of the product towards function, form (aesthetics) or human cost aspects (economy / social / Psychological) (84).

However, the realms of perfection lies in the mind of the assessor and the assessors being informed specialists in the field and since they belong to India, they will make the assessment as per the highest standards attainable in India keeping in mind the economic limitations of this country. This will help to achieve realistic goals and will not be biased by the expensive methods and techniques used in the developed countries [Figure 19].

5.3.1 The Control Parameters

In the pedestrian space, the components of function, form and human cost aspects were sub-divided into several control parameters as given below:

5.3.1.1 Functional Parameters

- Pedestrian and the land.

- Pedestrian and the population.

- Pedestrian and shelter.

- Pedestrian and accessibility.

- Pedestrian and the utilities.

- Pedestrian and Government policy.

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5.3.1.2 Aesthetic Parameters

- Pedestrian and the urban form.

- Pedestrian and, the form and space.

- Pedestrian and the ordering principles of form and space.

5.3.1.3 Human Parameters

- Pedestrian and the social environment.

- Pedestrian and the psychological environment.

- Foot traffic systems and the costs of its construction and maintenance.

- Health-fitness-safety-pollution and the pedestrian.

- Energy and the Foot traffic.

5.3.1.4 The Sub-Parameters of the Three Broad Parameters are shown On the Spread Sheet

The first spread sheet/ [Table 12] shows the break-up of the functional component.

Table 12   Spread Sheet Of Functional Components

Functional	land	land area
		topography
		geology
		foliage
		micro climate
	population	density

	age
	religion
	sex
	marital status
	size of H.H.
	annual income
shelter	built-up area
	occupancy
	condition of building
	sanitary facilities
	promotional efforts
access	internal access
	external access
utilities	water supply
	sewerage
	garbage
	telephone
	electricity
	lighting
	cable T.V.
	fire fighting
	post and telegraph
	police
	emergency/medical
govt. policy	public awareness

The second spread sheet / [Table 13] shows the break-up of the aesthetic component.

Table 13   Spread Sheet Showing Aesthetic Component

aesthetics	form	shape
		colour
		texture
		position
		orientation
		visual inertia
	form and space.	unity of opposites
		Form defining space
		Definition of space by horizontal and vertical planes.
		quality of architectural spaces
		openings in space
	ordering principles	proportions
		scale
		axis
		symmetry
		hierarchy
		datum
		rhythm
		repetition
		transformation

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Third spreadsheet /[Table 14] shows the break-up of the human components.

Table 14   Spread Sheet Showing The Human Cost Components

Human Cost Aspects	social	family structure
		social contacts
		Socialisation & circulation.
		Children &activities
		social environment for elders
		family behaviour on pedestrian routes
	psychological	feeling of irritation
		feeling of tension
		fear & inconvenience
		likes & dislikes
	health & fitness	
	safety	
	pollution	
	energy	availability
		consumption
		future

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Figure contents:

- SELECTION OF STUDY AREAS.
- MARKET. RELIGIOUS. TRAILS. HISTORIC. LEISURE. RESIDENTIAL.

- FUNCTIONAL
  - LAND → 1. LAND AREA 2. TOPOGRAPHY 3. GEOLOGY. 4. FOLLIAGE. 5. MICRO CLIMATE 6. WATER BODIES/DRAINAGE CHANNEL
  - POPULATION → 1. DENSITY & LOCATION OF POPULATION. 2. AGE. 3. RELIGION 4. SEX 4. SEX 5. MARITAL STATUS 6. SIZE OF HOUSEHOLD. 7. ANNUL INCOME.
  - SHELTER → HOUSING. FACTORIES. PLACE OF WORK. COMMUNITY & EDU. SANITARY FACILITIES. BUILT UP AREA.
  - ACCESSIBILITY
  - UTILITIES → ACCESS EXTERNAL ACCESS INTERNAL.
  - GOVERNMENT POLICY → WATER SUPPLY. SEWERAGE. TELEPHONE. FIRE FIGHTING. POLICE. EMERGENCY. LIGHTING. PET. MEDICAL. EARLETY.

- AESTHETICS
  - FORM → GOVT. POLICIES. PUBLIC AWARNESS. PROMOTIONAL EFFORTS ETC. EXAMINE LEGAL RIGHTS OF PEDESTRIANS AND DRIVERS.
  - FORM AND SPACE → SHAPE, SIZE, COLOUR. TEXTURE POSITION. ORIENTATION. VISUAL INERTIA.
  - ORDERING PRINCIPLES → UNITY OF DEPOSITES. FORM DEFINING SPACE. QUALITIES OF ARCHITECTURAL SPACE.

- COSTS
  - SOCIAL → PROPORTIONS & SCALE. AXIS. SYMMETRY. HIERARCHY. DATUM. RHYTHM & REPETITON. TRANSFORMATION.
  - PSHCHOLOGICAL
  - ECONOMIC
  - HEALTH-FITNESS SAFETY-POLUTION → FAMILY STRUCTURE. SOCIAL CONTACTS IN PEDESTRIAN SYSTEMS. SOCIALISATION & CIRCULATION. CHILDREN & THEIR ACTIVITIES ON PED SYSTEMS. SOCIAL ENVIRONMENT FOR ELDERLY FAMILY BEHAVIOR ON PED/ROAD SYSTEMS.
  - ENERGY.

Bottom boxes:
- 1. AVAILABILITY 2. CONSUMPTION 3. SENARIO OF THE COMING YEAR
- 1. HEALTH 2. FITNESS 3. SAFETY 4. POLUTION
- 1. CONSTRUCTION 2. MENTAINANCE
- 1. FEELING OF IRRITATION 2. FEELING OF TENSION IN PEDESTRIAN SYSTEM. 3. FEARE' INCONVINIENCE IN PED. SYSTEM. 4. LIKES & DISLIKES IN PED & TRAFFIC SYSTEM.

Right columns:
- PERFORMANCE EVALUTION
- OPPORTUNITIES & CONSTRAINS.

| FIG. NO. 19 | PAGE NO:- 166 | GRAPHIC REPRESENTATION OF MODEL FOR APPRAISAL & PROGRAMMING. |

FORM
10

10 — ECONOMY.

FUNCTION
10

10-10-10 IS THE TRIANGLE OF PERFECTION.

FORM.

FORMALISM.

EXPRESSIONISM

a

b — ECONOMY.

c

FUNCTIONALISM.

FUNCTION.

THE POSITION OF CENTROID INDICATES TENDENCY.

10

5

0

POTENTIALS

SATISFACTORY

CONSTRAINTS

| PERFORMANCE APPRISAL OF DETAILED STUDY AREAS BASED ON TRIAD SCALE | FIG NO:-20 . | PAGE NO:- 167 |

5.3.2 Evaluation of the Study Areas

The existing pedestrian spaces, which are selected on the basis of certain established criteria, within the identified cities, are evaluated for purposes of appraisal and programming.

The purpose of this post construction evaluation of the urban pedestrian spaces, is to provide relevant feed back to the designers and the users so that they may learn from them and make an effort to improve on the designs of the new or the renewal projects that may be taken up in the future.

Particularly in towns and cities where the gestation period is several hundred years, it is not possible to experiment, as per the normal understanding of this term, and draw out findings. Therefore, it is for us to find out information from ongoing experiments in the existing towns, which continue to evolve even today.

Post construction evaluation shall be done on the basis of short, medium, and long term plans. These have been noted down below on a point wise basis.

5.3.2.1 Short -Term Benefits

- Identification of and solution to the problems in the area.

- Proactive facility management responsive to area user values.

- Improved space utilisation and feedback on area performance.

- Improved attitude of the local residents through the active involvement in the evaluation process.

- Informed decision making and better understanding of the consequence of design.

Over the short term, successes and failures in the performance of an area is identified and recommendations made for appropriate action required for resolving any problem. Additional study may be needed to understand the identified problems fully, in which case further in-depth evaluations may be undertaken.

Another short-term benefit of the evaluation pertains to the budget cutting that is common in the fiscal planning phase of the development of an area. Reducing a project's cost often results in inferior quality, which in turn can negatively affect the well being of the residents in the area. Evaluations can help to show the implications of various design alternatives devised to meet lowered budget, enabling the achievement of the best level of quality and performance within these constraints.

5.3.2.2 Medium -Term Benefits

- Built -in capability for facility adaptation to organisational change and growth over time, including recycling of facilities into new ones.

- Significant cost savings in the building process and through out the areas life cycle.

- Accountability for design performance by design professionals and the local residents.

Over the medium term, the evaluation can provide the justification and information base for adaptive reuse, remodelling, or major additions in order to resolve problems identified in the existing areas. Recycling old lofty buildings into apartments, installation of new wiring, or building additions to accommodate the changing space needs of the area are examples.

5.3.2.3 Long -Term Benefits

- Long -term improvements in the area performance.

- Improvements of design database, standards, criteria, and guidance literature.

- Improved measurements of area performance through quantification.

Long term benefits result when the lessons learned from the failures and successes of area performance are applied to the design of future areas. The time frame for long term benefits to come to fruition can range from 20 to 30 years. This is particularly relevant to generic type of areas, such as play fields, landscaped areas and open spaces.

5.3.3 Formulation of the Schedule

A well-designed schedule was prepared, pre-tested and finalised for the programme. The schedule was constructed along the lines of the control parameters that have been drawn up in the previous paragraphs and with intent to investigate each of the control parameters in detail. The questions asked during evaluation have much in common with the construction of a list of objectives. Enumerators with a background of architecture are to be used for the filling up of the schedule since many of the questions in the schedule need the explanation of a trained person in architecture and urban design prior to getting a response from the respondents.

5.3.4 Techniques Used for Identification of the Potentials and Constraints

"Scaling Technique" and the "Weight Index Methods" are used for

understanding and identifying the strengths and weaknesses of the case studies.

Based on the evaluation done earlier the potentials and constraints for the area may be enumerated for direct and easy translation into physical design or appropriate management decision. The factors that have received in the range of 1 to 3 in a 10-point scale will be taken as a constraint. Factors receiving 4 to 6 will be considered as normal and will not be reviewed. The factors that come under the range of 7 to 10 in the above scale will be considered as potentials.
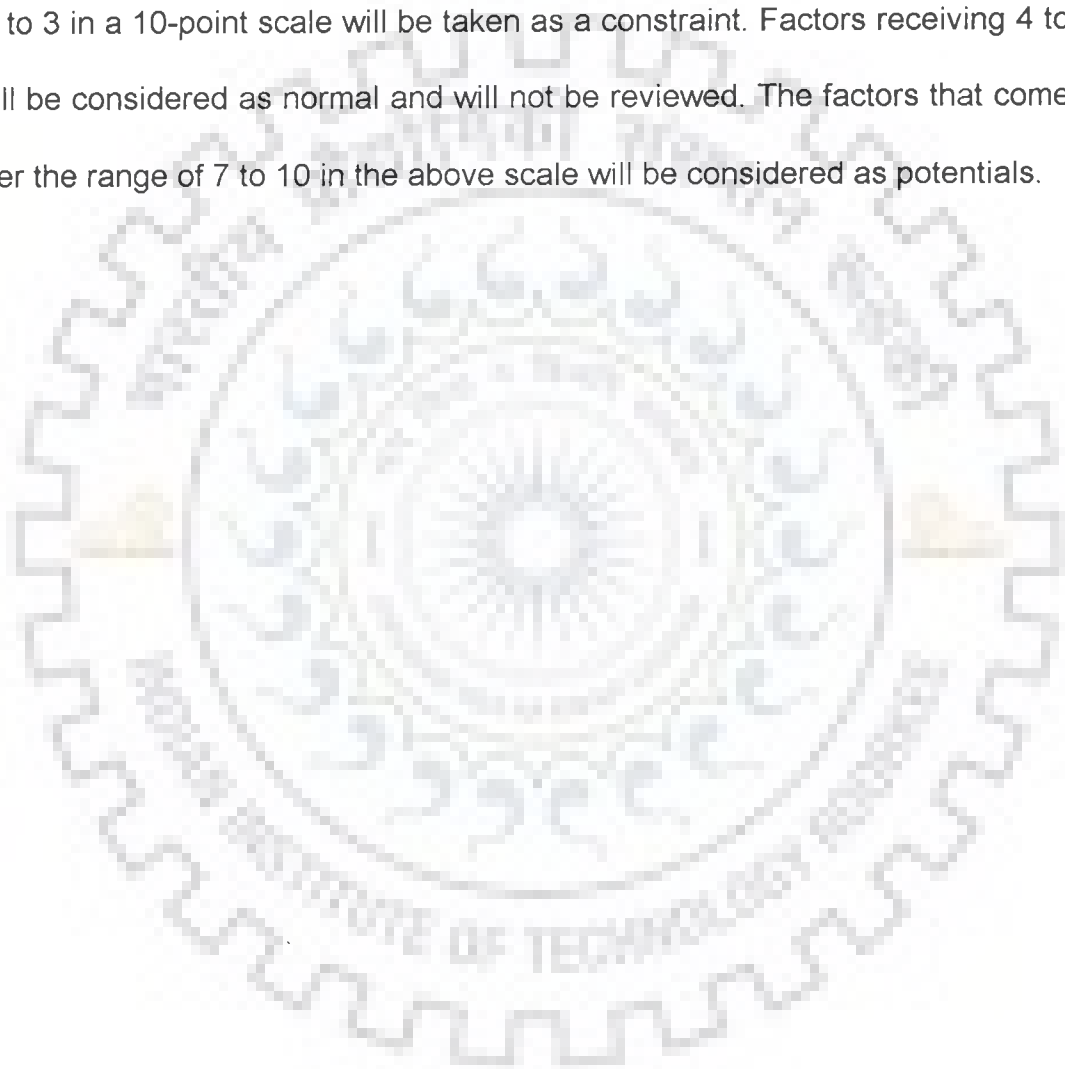
CHAPTER 6: NATIONAL PEDESTRIAN ZONES

6.1 INTRODUCTION

India is a vast country with a divergent Geographical, physical, climatic and cultural setting. Geo-Physically it has high mountains, deserts, rain forests, tropical islands fertile river valleys and an extensible coastline. Climatically it has weathers ranging from the very hot to the very cold and the very rainy to the very dry. The cultural scenario of the sub-continent is even more complex. There are people of many religions speaking 14 languages and nearly 600 dialects.

The geo. -physical, climatic and the cultural resources are the major factors that affect pedestrian planning. The land form or topographic structure of a site gives an insight into the location of roadways and pedestrian routes besides revealing the spatial configuration of the site. The physiographic conditions, such as, earthquake faults and flash flood zones seriously restrict pedestrian related activities

Overall precipitation and temperature variations affect the site and the pedestrians, as do winds, cloud cover, and seasonal changes. It is important to consider both small scale and large-scale climatic phenomenon [11].

Under the head of cultural resources is placed the distribution of the people based on religion, language, population and race. This aspect affects the way people live and how they use their open spaces in and around their houses and in public open spaces.

Keeping these in view an attempt has been made to form the country into

different pedestrian regions and make recommendations accordingly. This will exhibit the regional variations required for pedestrianisation.

6.2 PHYSICAL ASPECTS OF THE INDIAN SUBCONTINENT

India has an area of 32,87,263 square kilometres and is the seventh largest country in the world. Its maximum north-south distance is 3200 kilometres and the east-west distance is 3000kilometres. The country is marked by a great diversity of physical features and land forms. It may be divided into four distinct physical areas, which are dis-similar in geographical history, surface configuration, and potential utilisation. They are the mountain wall of the Himalayas and other encircling ranges; the low land plains drained by the Indus, Ganges, and Brahmaputra rivers; the plateau in the peninsular to the south and the narrow coastal plain region that lie to the east and west of the Indian plateau[46] [Figure 21].

6.2.1 The Northern Mountainous Region.

The lofty Himalayas are spread over the northern borders of India. They are the highest mountains in the world and stretch from the eastern boarders of Pakistan to the western boarders of Myanmar. The Himalayan range is about 2500 kilometres (1550 miles) long and 150 to 400 kilometres (94 to 250 miles) wide.

The mountains can be further divided into three parallel ranges that are interspersed with large plateaus and valleys. The three ranges are the Siwalik foothills or the Outer Himalayas; the Lesser or Middle Himalayas; and the Greater or Inner Himalayas.

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The Inner Himalayas are the high, snow-clad peaks like Everest, Kanchenjunga, K 2, Nanda Devi, and others, their average elevation being more than 6000 meters (16452 feet). To the south of them lie the Middle Himalayas with a mean elevation of about 5000 meters (13710 feet), and in this range are found many hill towns and the famous hill stations of Simla, Nainital, Mussoorie, and Darjeeling. The outer Himalayas or the Siwalik Hills, with an elevation of 1000 meters (2742 feet), are not a continuous range like the other two but are foot hills created by sediments brought down by the great rivers originating in the Himalayas. These are densely forested, in some parts it is ill drained, and till recently malaria-ridden [46].

The Himalayas is also divided along its east-west axis and given regional names to identify these divisions. These divisions are known as the Kashmir Himalayas, Punjab Himalayas, Kumaon Himalayas, Nepal Himalayas and the Eastern Himalayas.

From the south to the north, in the Kashmir Himalayas, we come across serially the Siwalik, Pirpunjal, Zasker, Ladakh and Karakoram ranges. They run parallel to each other. The K 2 peak (8611 meters) in the Karakoram range is the highest in India and the second highest in the world. In these ranges the towns of Shrinagar, Anantanag and Leh are located.

The Punjab Himalayas stretch to the north-west of the river Satluj. The Kumaon Himalayas are in the north of Uttar Pradesh and the rivers of Bhagirathi, Ganga and Jamuna have their sources in these mountains. The highest peak of this range is the Nandadevi. A large number of small and medium towns are located in these areas. The Nepal Himalayas stretch to the east from the Kumaon Himalayas.

The Eastern Himalayas extend from Sikkim to the Bramhaputra river in the east. These ranges are in Sikkim, West Bengal, Arunachal Pradesh and Assam states. One of the ranges of the Eastern Himalayas turns southwards and stretches in the form of hills into the eastern states of Meghalaya, Nagaland, Manipur, Tripura and Mizoram.

6.2.2 The North Indian Plain Region.

The North Indian Plain Region also known as the Indo-Gangetic plain is 2414 kilometres (1500 Miles) long and 241 to 321 kilometres (150 to 200 miles) wide. It is a featureless alluvial plain, remarkably homogeneous in character and formed by the three distinct river systems, the Indus, the Ganges, and the Brahmaputra. Geologically it is a geosyncline (a sag in the earth's crust formed during the buckling of the mountains) which has been filled by huge deposits of silt carried by the rivers. This plain stretches from Rajasthan to Assam.

The North Indian Plain is divided into three parts namely the Western Plain, the Central Plains and The Eastern Plains.

The Western Plains has on its southern parts an arid desert and to the north a fertile alluvial plain. The arid desert is known as the Great Indian Desert. Because of its location in the western part of the country it receives very low rainfall. However, the northern part of this plain is very fertile due to the water from the river Sindhu and its tributaries. This plain covers the states of Punjab and Haryana.

The Central Plain is formed due to the silt deposits by the rivers Ganga, Yamuna and their tributaries. It occupies the states of Uttar Pradesh and is very fertile.

NORTH

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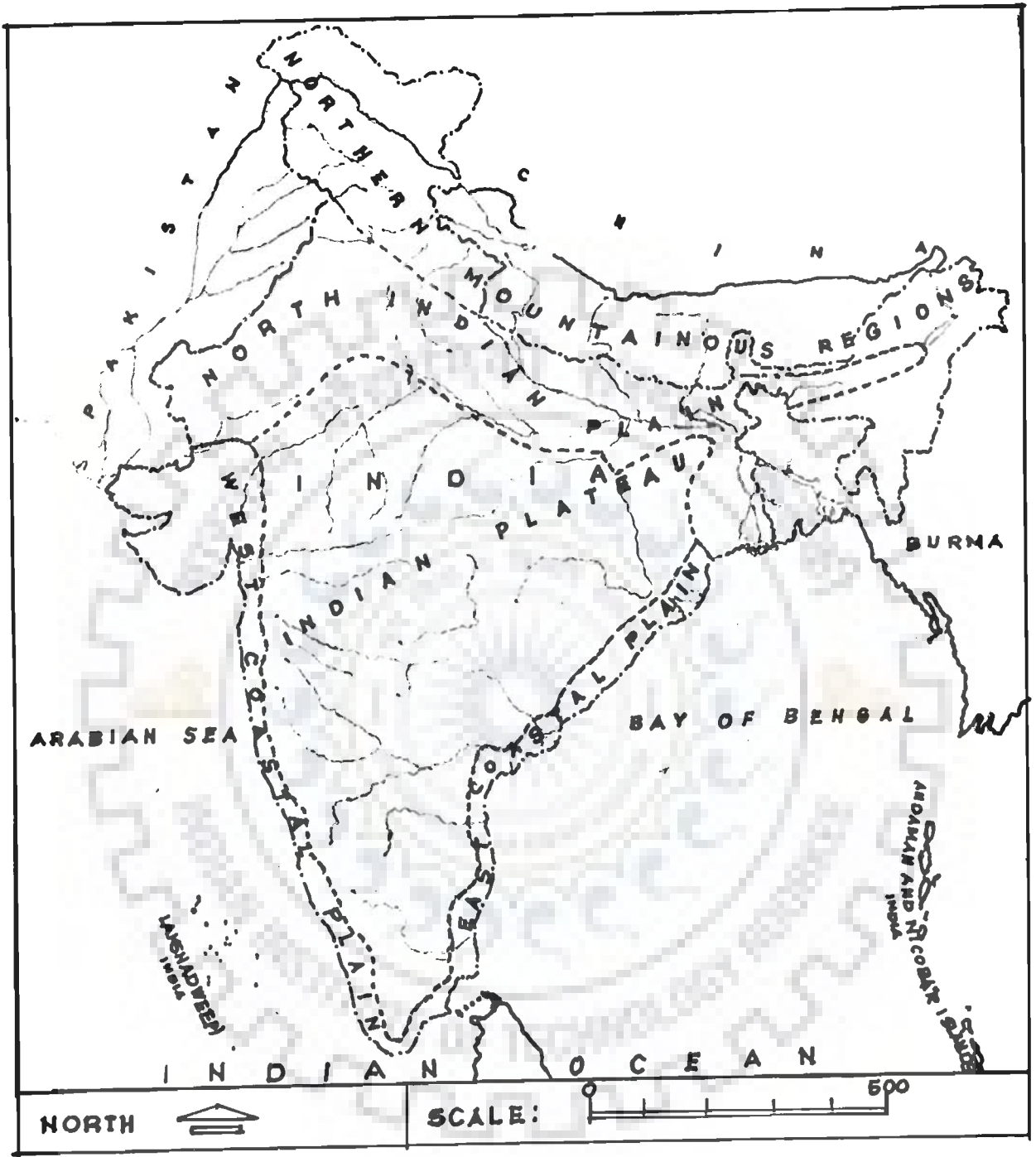
FIGURE NO: 21	TITLE:
PAGE NO:- 176	PHYSIOGRAPHIC SUB-DIVN. OF INDIA

The Eastern Plain comprises of the states of Bihar, the Ganga delta in West Bengal and the Brahmaputra plain in Assam.

6.2.3 The Indian Plateau Region.

The Indian Plateau is a triangular shaped landmass and is flanked by the Aravali hills in the north-west, Rajmahal hills in the north-east, and the Nilgiris in the south. Similarly to the east are the broken ranges of the Eastern Ghats and to the west are the Western Ghats. This plateau has an altitude ranging between 300 metres and 900 metres from the sea level. The Narmada rift valley divides the Indian Plateau into two parts namely, the North Indian Plateau and the South Indian Plateau.

The North Indian Plateau stretches from the Aravali hills in the west to the Rajmahal hills in the east and to the south of it are the Vindhya and Maikal ranges. The river valleys and hill ranges have divided this plateau into different small plateaus. Mount Abu is the famous hill station in the Aravali range and Gurushikhar (1722 metres) is the highest peak.

The Vindhya ranges and the basins of the Narmada and Tapi river lie between the north and south Indian plateaus. The Vindhya mountain ranges are spread in the east-west direction and their average altitude is 300 metres.

To the south of the Vindhyas lies the Narmada river valley, followed by the Satpura mountain ranges and the Tapi valley.

The South Indian Plateau is also known as the Deccan Plateau. According to regional locations and characteristics, this plateau is sub-divided into the Maharashtra Plateau, the Karnataka Plateau and the Telangana Plateau.

6.2.4 The Coastal Plain Region.

The Coastal Plain Region consists of the narrow coastal plains that lie on either side of the Indian plateau . They are known as the Eastern Coastal Plain and the Western Coastal Plain.

The Eastern Coastal Plain extends from the river Subarnarekha in the north to Kanyakumari in the south. It comprises of the coastal areas of Orissa, Andhra Pradesh and Tamil Nadu. The East Coastal Plain is comparatively extensive and wider than the Western Coastal Plain. It is also relatively flat. This plain consists of the delta areas of Mahanadi, Godavari, Krishna and Cauvery. The sea is shallow near the coast and therefore sandbars and beaches have formed. The Chilka, Kolleru and Pulicat lakes are also situated in this region.

The Western Coastal Plain extends from the Rann of Kutch to Kanyakumari and is a narrow plain. As compared to the East Coast, the West Coast is a little more indented and the sea there is deep. The western Ghats are very near the coast and appear like a wall from the western side. The swift west-flowing and length-wise short rivers have dissected the plain at a number of places. The coastal areas of the states of Gujarat, Maharashtra, Goa, Karnataka and Kerala are included in this plain [46].

6.3 CLIMATIC ASPECTS OF THE INDIAN SUBCONTINENT

Broadly, India is a monsoon country with a pronounced seasonal rhythm of rainfall. However, within the country there is a striking variety of meteorological conditions. The Indian year can be divided into four principal seasons: cold weather season from December to February; hot-weather season from March to May; south-west monsoon season from June to September; and retreating

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monsoon season from October and November.

However, climate influences various aspects of human life and activity in different ways; therefore, climate classification has relevance only in respect of the purpose to which it is intended to be put. A particular combination of climatic elements may be significant for agriculture and vegetation, another for human health and comfort and quite a different one may be for industry, commerce and engineering.

The classification of climate for settlement planing and building design implies this to be an aid to the functional design of settlements and dwellings. This would mean zoning the country into different climatic regions such that the differences in climate in each region are capable of being reflected in design that warrants some special provisions.

The classification of climate for the purposes of settlement planning and dwelling design is based on two atmospheric factors which dominantly affect human comfort, that is, air temperature and humidity. Accordingly the country is divided into four major climatic zones namely: hot dry; warm humid; cold and composite [Figure 22].

6.3.1 Hot Dry Climate.

Summer is the dominant season with very high day time temperature which ranges from 40*c to 45*c and comparatively cool night time temperature varying from 20*c to 30*c. Solar radiation is intense (700 - 800 Kcal / sq. mt / hours), skies are cloudless for most part of the year, with dust haze most of the time. Relative humidity is very low, that is from 25% to 40%. The light coloured barren land, which is devoid of any vegetation, and the painfully bright sky are

a source of intense glare during the daytime. Dust laden winds blow during the latter half of the day and early nights with isolated whirlwinds. Radiant heat emanating from the ground and all other objects around, during the afternoon and early night is a source of much thermal discomfort.

The winters are cold to warm during the daytime, maximum temperatures range between 15*c and 25*c. Nights can be cold to very cold with the temperature ranging between 0*c and 10*c.

6.3.2 Warm-humid Climate.

High humidity together with moderately high summer temperatures ranging from 30*c to 35*c which is the dominant aspect of the type of climate. Diurnal range of temperature is small, resulting in high night time temperature from 25*c to 35*c. Relative humidity during day and night is high at 70% to 90%. When the sky is not overcast, the solar radiation is very intense. Diffused radiation from the atmosphere is strong during summer months. Rainfall is generally high during the year. Winds blow from one or two prevailing directions. The ground is generally covered with green vegetation, and hence there is no glare.

Winter daytime conditions are also warm, temperatures range between 25*c and 30*c, whereas, night time temperatures is somewhat mild, ranging between 20*c and 25*c. There is a perennial need for air-movement indoors.

6.3.3 Cold Climate

In this climate, winters become the dominant aspect. The temperatures remain around and below freezing during the months of December, January and February. Daytime conditions may be pleasant when there is bright sunshine

Map labels:
PAKISTAN
COLD
CHINA
COMPOSITE
HOT-DRY
WARM HUMID
BURMA
WARM-HUMID
ARABIAN SEA
HOT-DRY
BAY OF BENGAL
WARM-HUMID
LAKSHADWEEP INDIA
ANDAMAN AND NICOBAR ISLANDS INDIA
INDIAN OCEAN
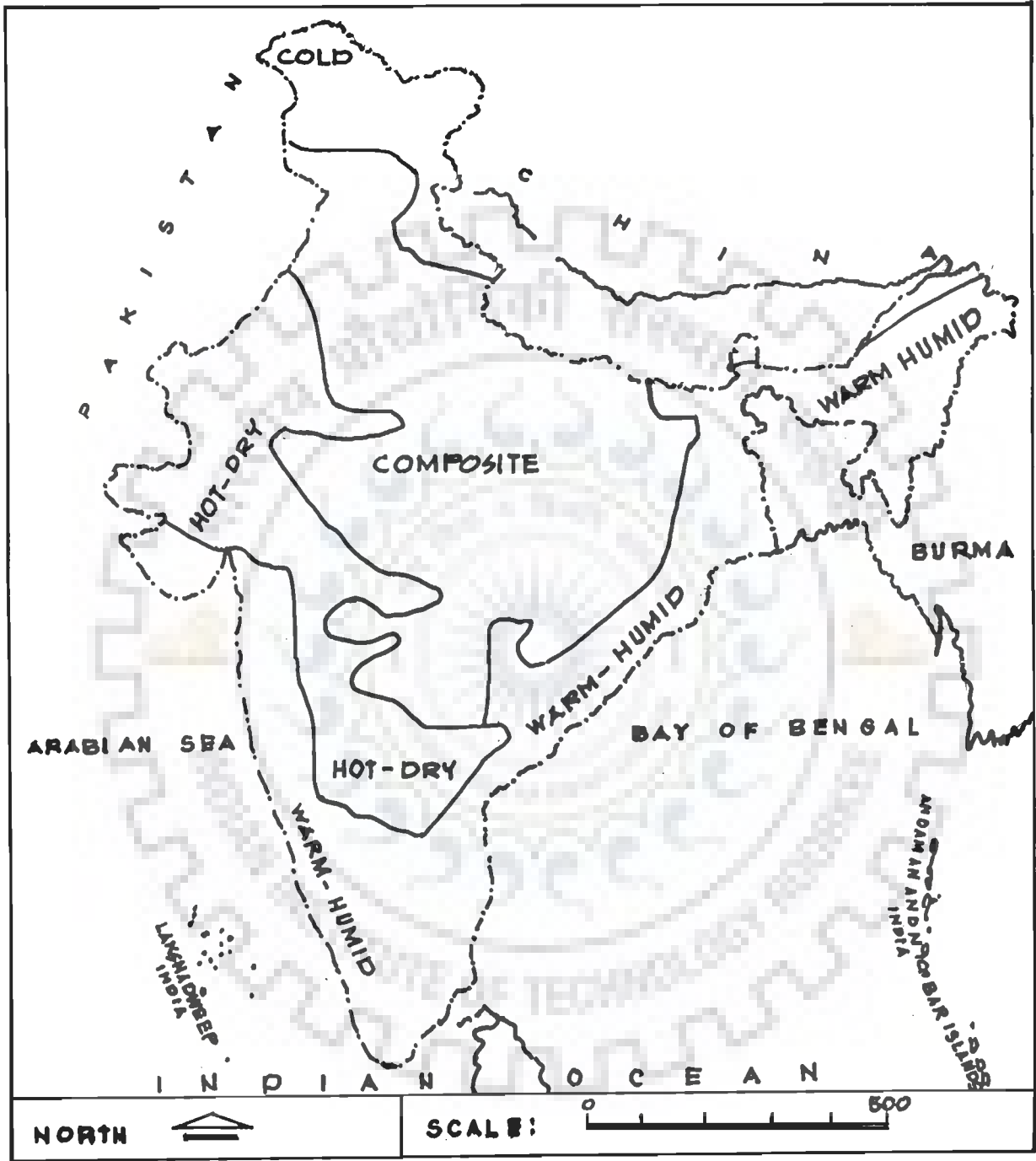
| NORTH | SCALE: 0 ____ 500 |

| FIGURE NO: 22 | TITLE: SUB-DIVISION OF INDIA IN |
| PAGE NO:- 181 | TO CLIMATIC ZONES. |

but night temperatures are extremely low. Solar radiation is welcome in both winter and summer. Snowfall is common during the intense winter. The temperature fluctuations may vary between 5*c and 10*c depending on overcast or clear sky conditions.

Daytime temperature during clear days in summer are pleasant with maximum temperature, sometimes, reaching 30*c. However, nights are cold. Rainfall is moderate. Relative humidity varies between 70*c and 80*c. Winds are generally intense and driving rain is a characteristic feature.

6.3.4 Composite Climate.

The dominant feature of this climate is the changing hot-dry, warm-humid and cold seasons during the year with in-between periods of temperate climate. The conditions are hot dry during late April, May and June; warm-humid during July, August and early September; cold during December, January and February; and temperate for the rest of the year. The relative intensities of hot-dry and warm-humid periods are generally of comparable magnitudes. Vegetation grows seasonally according to availability of water [123].

6.4 SOCIO-CULTURAL ASPECTS OF THE PEOPLE AND THEIR DISTRIBUTION

6.4.1 The People.

The people of India show great diversity in their ethnic makeup and cultural life. In skin colour Indians range from very light to very dark, with an equal wide range in height. This is because India has been a melting pot of races since the

dawn of civilisation. It is believed that the original inhabitants of India were the Dravidians and were mostly settled in the south of the Indian peninsular. They were black in colour, short of structure, and broad-nosed. The Indo-Aryans, who came to the country from Europe through the many passes in the Himalayan range, settled in the northern parts of India. They are thought to belong to the Caucasian race, were light in complexion, long nosed, and tall. These two groups mixed in the course of time. To this mixture were added other racial groups, such as the Mongoloid who came from Tibet and Burma[40].

6.4.2 The Languages.

There are 14 Indian languages and hundreds of dialects spoken in India. The two major groups are the northern (which includes Hindi, Gujarati, Bengali, Oriya, Assamese, Sindhi, Punjabi, and Urdu) and the southern (which includes Tamil, Telugu, Kannada and Malayalam). English is an associate language of the Indian Nation[40].

The population distribution in India is very uneven, nearly one-third being concentrated in about one-tenth of the land area, living in mainly high-density area of over 290 persons per square kilometre. The areas of high concentration are:

(A) The North Indian Plain Region from Punjab in the north-west to the Ganges delta in the east, an extensive and contiguous belt of high density.

(B) Areas to the south of the line connecting Madras and Mangalore, here the Kerala coast plains have relatively higher densities.

(C) The Gujarat plain from Surat to Ahmedabad.

(D) The deltas of Krishna, Godavari and Cauvery rivers in the east coastal plains.

(E) The concentration of urban population is along the above-described lines; the high-density areas have multiple urban clusters and a high degree of urban scatter. In the Indus and upper Gangetic plains, the major clusters are at river junctions. In other parts of the country, urban centres have developed as nodes in the network of railways, being either junctions on routes traversing the Deccan plateau, or linking the plains to the ports of Bombay, Calcutta and Madras [Figure 23].

6.4.3 Religions.

One of the most important elements in Indian life is religion. Hinduism is professed by about 85 percent of the people. Muslims form about 10 percent while the Christian are 2.5 percent of the population. The balance 2.5 percent is made up of the smaller communities of Buddhists, Jains, Sikhs, and Jews.

(A) Both Hinduism and Islam have been great forces in the cultural history of India. They have been sources of spiritual strength and social cohesion for their followers. It is also true, at least in some aspects, that some of their practices have tended to obstruct social and economic modernisation. The cast (B) system and its institution of untouchability have divided Hindu society into fragments. This has made economic and social co-operation on a large scale difficult. The Hindu idea of the sacred cow has led to an excessive cattle population, which is a burden on the economy. Untouchability has been the most objectionable feature of Hindu society. It condemns millions of Indians to a permanent social inferiority and economic degradation from which there is little escape. Similarly, the general inferior position of woman in Muslim society

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Map labels:
PAKISTAN

CHINA

BURMA

ARABIAN SEA

BAY OF BENGAL

LAKSHADWEEP INDIA

ANDAMAN AND NICOBAR ISLANDS INDIA

INDIAN OCEAN

NORTH

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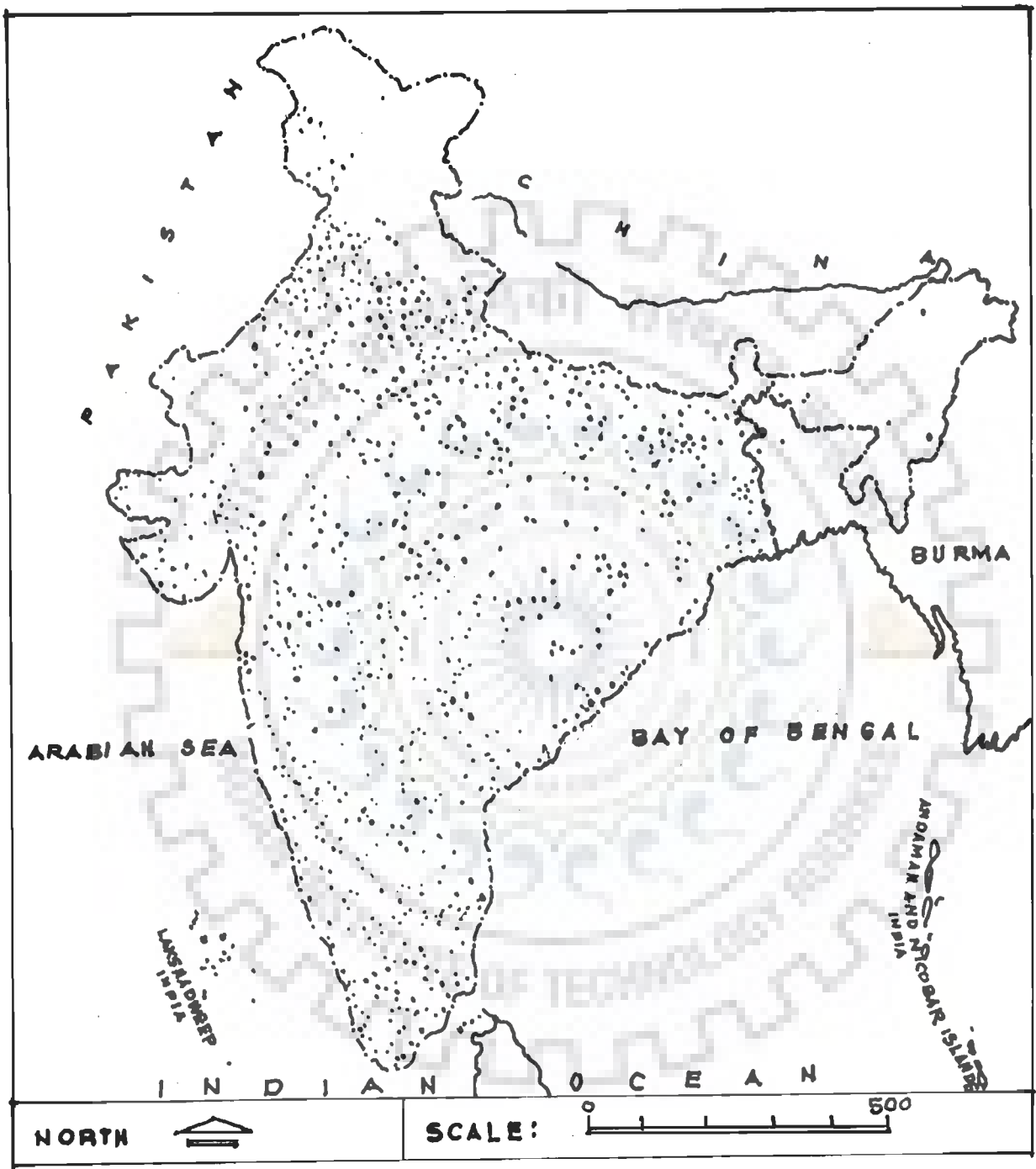
| FIGURE NO:- 23 | TITLE: LOCATION OF URBAN CENTRES IN INDIA. |
| PAGE NO:- 185 | |

has crippled their social and cultural development. This is especially true in the custom of veiling (purdah). Poverty is rampant in the Indian society, and a part of the explanation of poverty of the Hindus and Muslim masses, lies in their social structure, ritual concepts, and rigid traditions.

6.5 FORMATION OF NATIONAL PEDESTRIAN ZONES

There are, perhaps, only a few countries in the world, which are characterised by such a large variation, in altitude, type of rocks and slopes and general formation as in India. The physical formation of India is can be divided into four broad physical divisions based on their origins.

1. The Northern Mountain Region Or The Himalayan Region,
2. The North Indian Plain Region Or The Indo-Gangetic Plains,
3. The Indian Plateau Region Or The Deccan Plateau, and
4. The Coastal Plain Region.

The climate of India is the monsoon type. This climatic type which is found in south and south East Asia is a distinct type. However, the high mountain ranges in the north, the tropic of cancer passing through the country and the Indian Ocean to the south create a variety of climatic conditions within the country. For the special purpose of settlement planning, and considering that climatic classification has relevance only in respect of the purpose to which it is intended to be put, the whole country has been divided into four broad climatic zones.

1. Hot Dry Climatic Zone,
2. Warm Humid Climatic Zone,
3. Cold Climatic Zone, and

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4. Composite Climatic Zone.

The cultural classification of India is a very difficult task. Considering that the Indian Civilisation is almost 5000 years old and considering the tremendous variety of cross-cultural interaction, the cultural regions of the country can be made into several hundreds. However, in order to make a working classification, the cultural aspect can be reflected in the proposals to be made for pedestrians in the human settlements, the following broad regions have been formed.

1. Mongoloid-Buddhist region,

2. Aryan-Hindu-Muslim region,

3. Dravidian-Hindu-Muslim-Christian Region, and

4. Mixed Aryan-Dravidian-Hindu Regions.

6.5.1 The National Pedestrian Zones

To finalise the pedestrian regions for the purpose of this investigation an overlay of the Physical region, the climatic region, the concentration and distribution of the population and cities, and the cultural regions, are made.

The following National Pedestrian Zones have thus been formed [Figure 24].

National Pedestrian Zone -1

(Cold climate - Himalayan - Muslim / Buddhist - North Indian - Low Population.)

National Pedestrian Zone -2

(Composite climate - Indus / Gangetic Plain - Hindu / Muslim - North Indian - High Population)

National Pedestrian Zone -3

(Hot Dry Climate - Indus / Gangetic Plain - Hindu / Muslim - North Indian - Low Population)

National Pedestrian Zone -4

(Composite Climate - Hills / Plateau - Hindu / Muslim - North Indian - Medium Population).

National Pedestrian Zone -5

(Warm Humid Climate - Indus /Gangetic Plain - Hindu / Muslim - North Indian - High Population).

National Pedestrian Zone -6

(Warm Humid Climate - Hills - Hindu / Christian / Tribal - Mongoloids - Low Population).

National Pedestrian Zone -7

(Warm Humid Climate - Coastal Plain - Hindu / Muslim / Christian - South Indian - High Population).

National Pedestrian Zone -8

(Warm Humid Climate - Hill / Plateau - Hindu / Tribal - North Indian / South Indian - Medium Population).

National Pedestrian Zone -9

(Hot Dry Climate - Mountain / Plateau - Hindu / Muslim - North Indian / South Indian - Medium Population).

National Pedestrian Zone -10(Warm Humid Climate - Hill / Plateau - Hindu / Muslim / Christian - North Indian / South Indian - Medium Population)

National Pedestrian Zone -11

(Warm Humid Climate - Coastal Plain - Hindu / Muslim - North Indian - Medium Population).

Map labels:
PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, PZ-6, PZ-7, PZ-8, PZ-9, PZ-10, PZ-11

PAKISTAN
CHINA
PZ-1
BURMA
ARABIAN SEA
BAY OF BENGAL
LAKSHADWEEP INDIA
ANDAMAN AND NICOBAR ISLANDS INDIA
INDIAN OCEAN
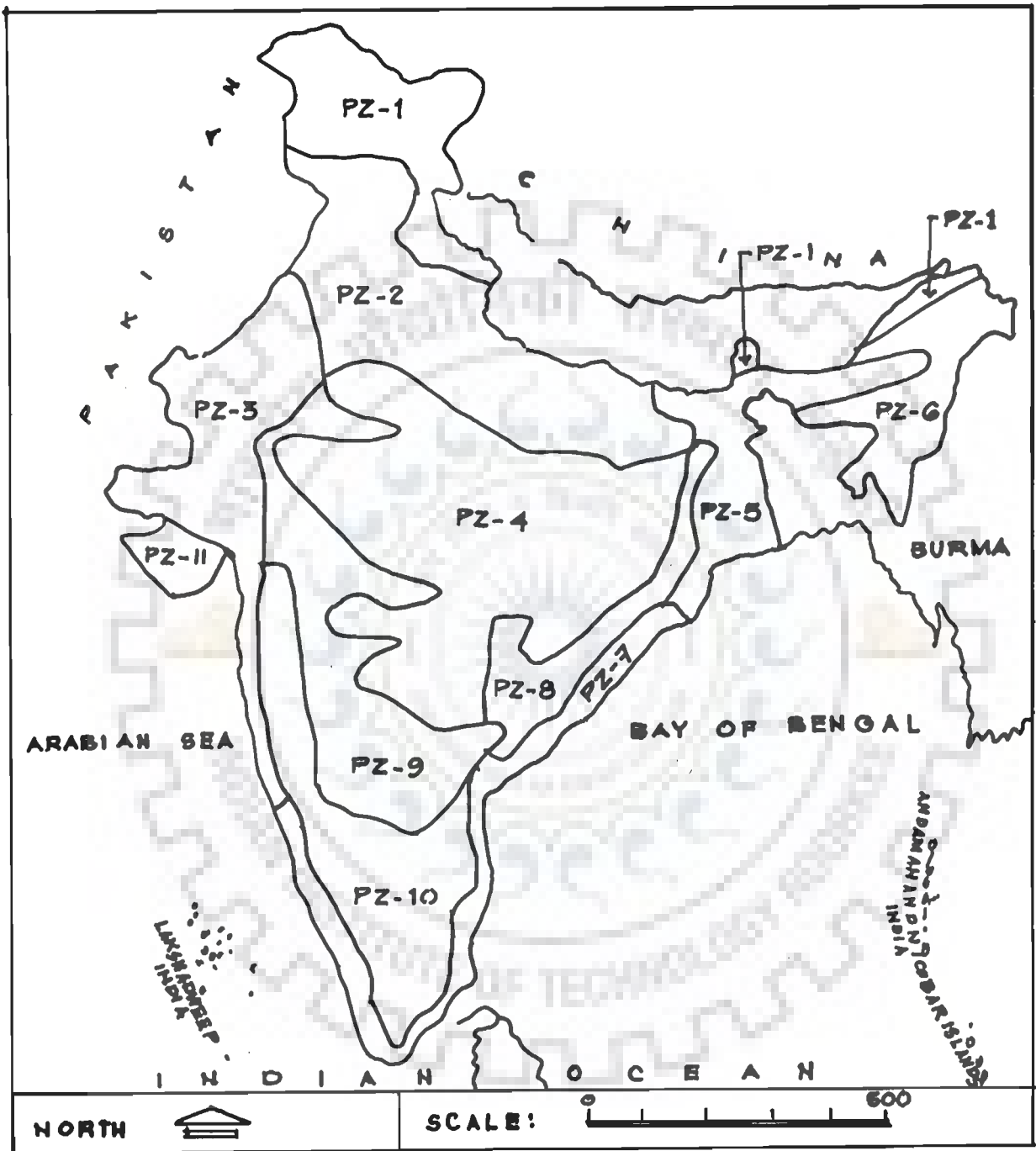
| NORTH | SCALE: | 0 | 500 |

| FIGURE NO:- 24 | TITLE: SUB-DIVISION OF INDIA IN TO PEDESTRIAN ZONES. |
| PAGE NO:- 189 | |

CHAPTER 7: THE CASE-STUDIES

7.1 INTRODUCTION

The cities of Lucknow and Patna were selected on the bases of criteria established in the methodology of the research. The market areas, the residential areas, the historic areas and the leisure areas for detailed study within the towns were also finalised on the basis of criteria fixed in the research methodology.

7.2 LUCKNOW

Lucknow is a city fabled for its culture, tradition, warmth and hospitality. It is a monument of human art and has a unique character of its own [Figure 25]. Historically no account can be given of Lucknow 's origins but tradition asserts that it was originally called Lakshmanpuri after Lakshman, the brother of Rama, who built it as a fort for the defence of his capital[18].

The earliest historically marked settlements in Lucknow are those of Muslims around the 13th century. They were the Shaikhs who ruled Lucknow till the 17th century to be followed by the sultans of Delhi and then the moguls. Not much was added to the city during this period. Two monuments of this period like the Akbari Gate and the Aurangzeb Mosque still stand in the city.

Considerable changes took place when the Avadh dynasty took over Lucknow in 1728 after the death of Aurangzeb and Lucknow became a city of Nawabs. Most of Lucknow was built during this period.

The Nawab of Avadh made Faizabad his capital and Lucknow was more or less

ignored politically but it made tremendous progress in trade and commerce, thus becoming wealthy and affluent. Thus the nobles of Lucknow boasted their newly acquired status by patronising art, culture and architecture. The third Nawab, Asaf-ud-daula, finally moved his capital from Faizabad to Lucknow and gave the city its much admired monuments, culture and wealth. This culture developed during the Nawabi days and ended in the early twentieth century.

7.2.1 Hazratganj Market Area

Asaf-ud-daula was particularly fond of the new style houses of the British and at the start of his reign in 1775 asked the British Resident at the court of Lucknow to procure for him a plan of a house in the European style. This was prepared for him and subsequently constructed in the area presently known as Hazratganj, by Captain Marsack who was in charge of one of the Nawab's battalions stationed at Lucknow. His successor Saadat Ali Khan, during whose time some of the greatest Lucknow houses were built, was responsible for making Hazratganj, one of the most splendid streets [Figure 26].

Hazratganj, which is today the main commercial centre of the city, presents to the visitor the colonnaded European architecture, its spacious feel, and its automobile traffic, and its somewhat western ambience. This area has attracted many of the important corporations and government institutions to set-up office. It provides a lot of opportunity for entertainment by way of the cinema halls, such as, Mayfair, Sahu, and the Capitol, plus a number a hotels and restaurants are also located in the area. Public Institutions located here are the Town hall, Municipal Corporation Office building, Civil Hospital, and General Post Office. Some religious buildings like the Amjad Ali Shah's Imambara, a

HISTORIC AREA

GREEN SPACE
ALONG THE
RIVER GOMTI.

PLAN OF LUCKNOW SHOWING
AREAS FOR DETAIL INVESTIGATION

RESIDENTIAL
CHOWK

MARKET
CHOWK

GOMTI RIVER

AMINABAD
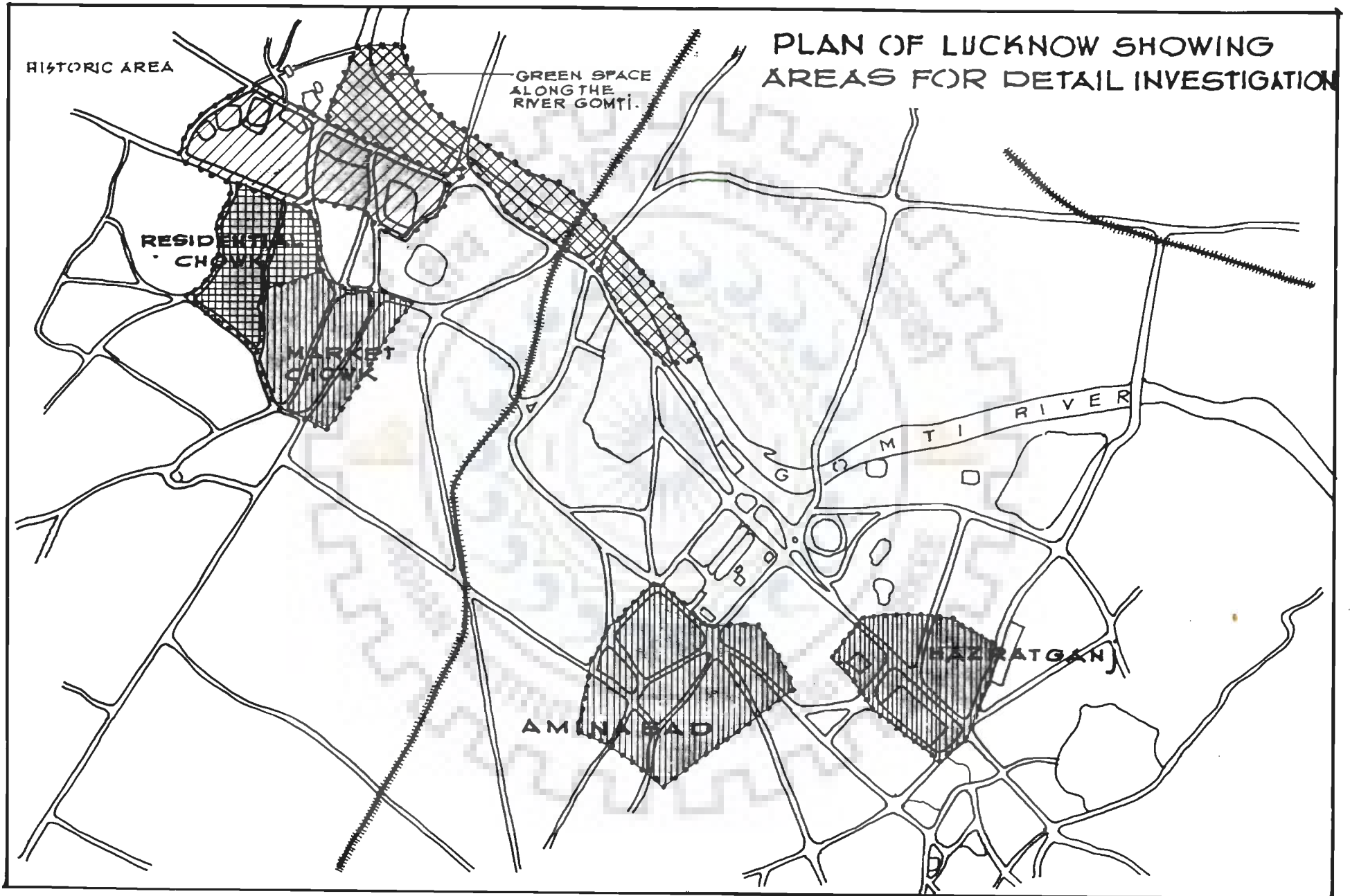
HAZRATGAN

Figure 25 Plan of Lucknow Showing Areas for Detailed Investigation .

Map labels: GOMATI RIVER, STADIUM, HAZRATGANJ, TO DILKUSH, POST OFFICE, QAISERBAGH, VIDHAN SABHA
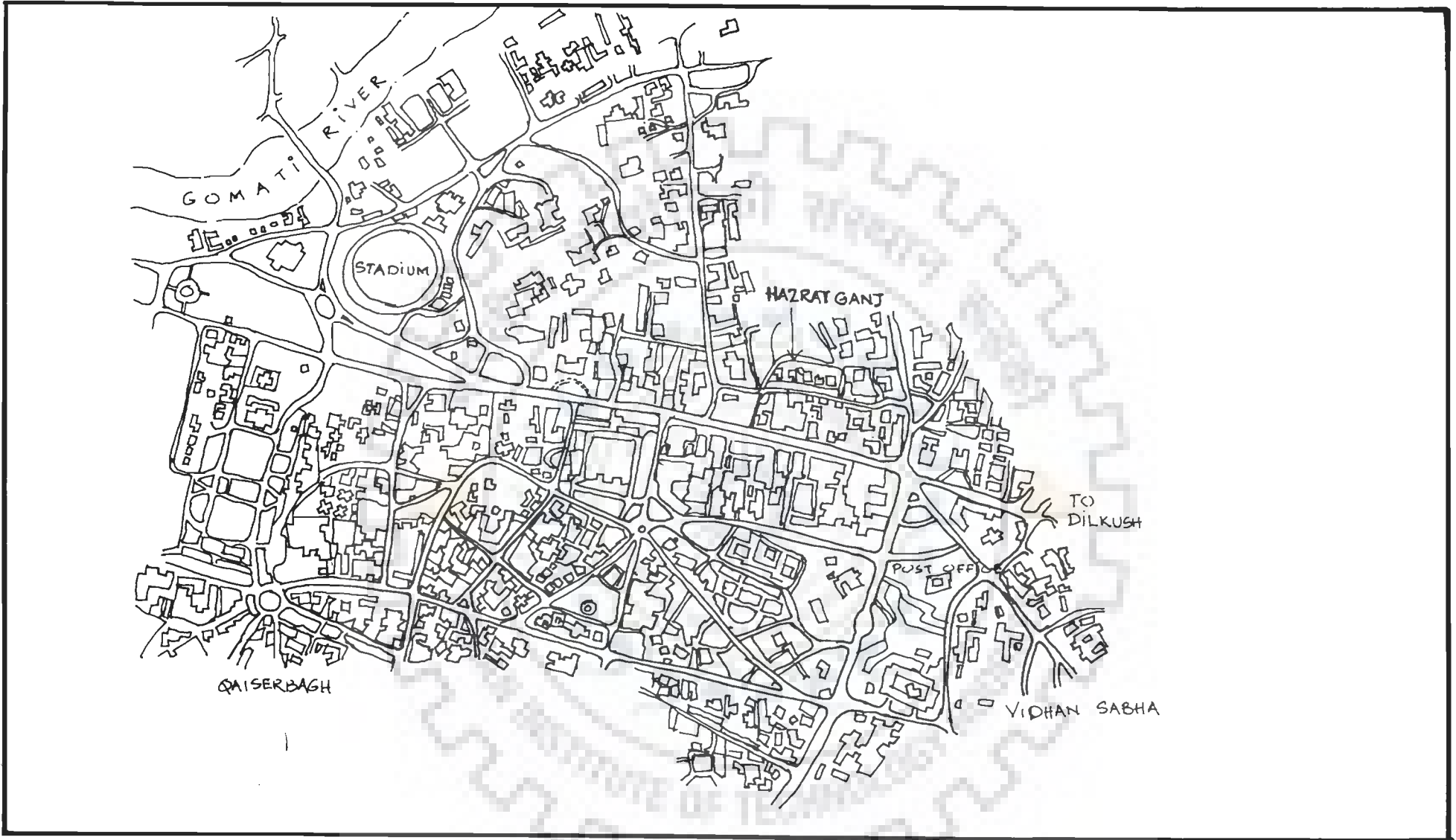
FIG NO:- 26		TITLE :-
PAGE NO:- 193		LOCATIONAL MAP OF HAZRATGANJ AREA
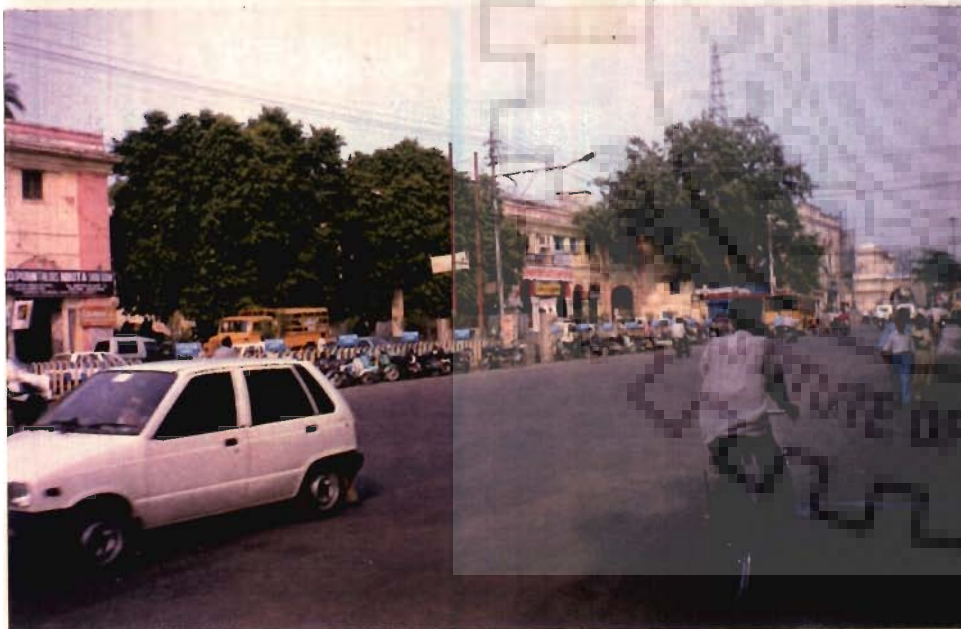
Figure 27 Photographs of Hazratganj.

church and a famous Hindu "Hanuman" temple are also situated here [44] [Figure 27].

The straight and wide stretch of the street allows for distant views while at the same time permitting easy entry of motor vehicles into the area. The shops are large with a colonnade and a side walk between them and the street. Hazratganj attracts people who come to enjoy its vibrant urban feel. As a matter of fact, 'Ganjing' or promenading is an activity in itself, particularly indulged in by the young who come to see and be seen [126].

7.2.2 Chowk Market

The Chowk is the oldest part of the town of Lucknow [Figure 28]. It is likely that the Chowk, which means the space at the crossing of roads, existed as a linear market place before the beginning of Nawabi rule in Lucknow. Lying on the trade routes, which linked it with other towns in Avadh-Kanpur and Faizabad, the street was a natural place for commerce and grew spontaneously, as did the city itself. The Chowk besides being the centre for commerce was also considered as a centre for religion and learning and most interesting of all, houses of courtesans known as kothas. Exotic goods such as gold and silver lace, ornaments and perfumes were sold here. [Figure 29], [Figure 30].

Today the Chowk Market still exists even though parts of it were demolished in the aftermath of the first war of India independence in 1857. However, the half mile stretch of the street between two gateways of Gol and Akbari darwaza has become symbolic of old Lucknow selling even today the traditionally crafted goods and exotic delicacies.
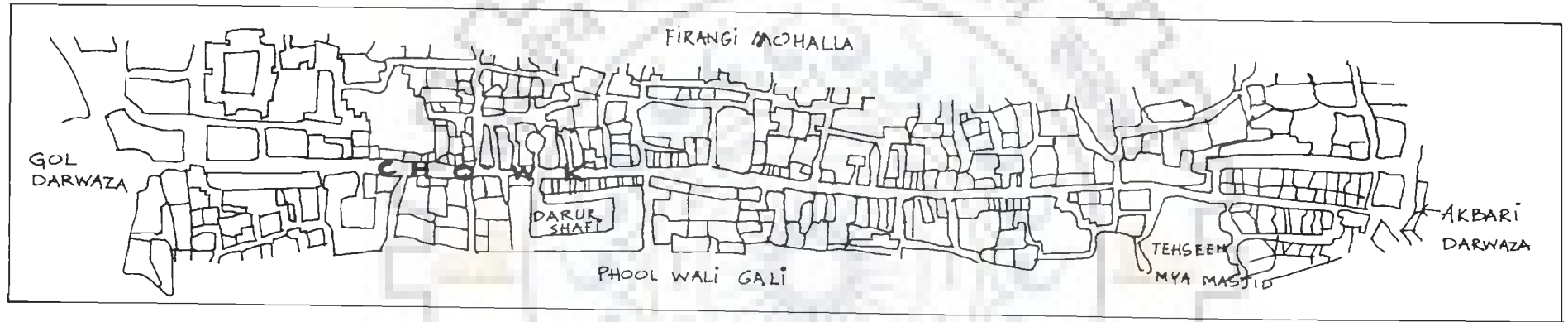
PLAN OF CHOWK MARKET

| FIG.NO:- 28 | | TITLE :- | |
| PAGE NO:- 196 | | PLAN OF CHOWK MARKET | |

CHOWK BAZAAR.

Figure 29 Photographs of Chowk Market (A). (PAGE :- 197)

Figure 30 Photographs of Chowk Market (B).. (PAGE NO:- 198)

CHOWK BAZAAR.

7.2.3 Chowk Residential Area

Besides being the ancient commercial centre the Chowk area has also developed as a residential area for the local population and the less privileged. The rulers being Muslims, the dominant character of the urban genre are of Arab-Islamic descent where the urban form derives from closely knit structures organised in definite hierarchical order of spaces [44] [Figure 31].

The residential areas are known as mohallas which are predominantly occupied by people of a single religion, Hindu or Muslims, but the physical characteristics are always Islamic. This was because the rulers were Muslims and the impact of their traditions was always imparted to the subjects. However, the identity of the mohalla is transformed into Hindu or Muslim, by the presence of a temple square complete with a pipal tree and well or a mosque and the size and nature of the streets and the activities therein. The whole settlement is finely knit together to form a homogeneous whole and the boundaries of the mohallas are by streets or natural barriers. There is no enmity between the Hindus and Muslims particularly in these areas, however there are, sometimes, fights between the Shias and the Sunnis [Figure 32].

The area taken up for the present investigation is broadly known as the Sarai Male Khan. It is a Hindu Mohalla surrounded on one side by the Napier Street, and on the other, by a large drain. One interesting aspect of this area is that there are no dead end roads. Each Mohalla has its own green space, and most of which are now in a poor state of maintenance.
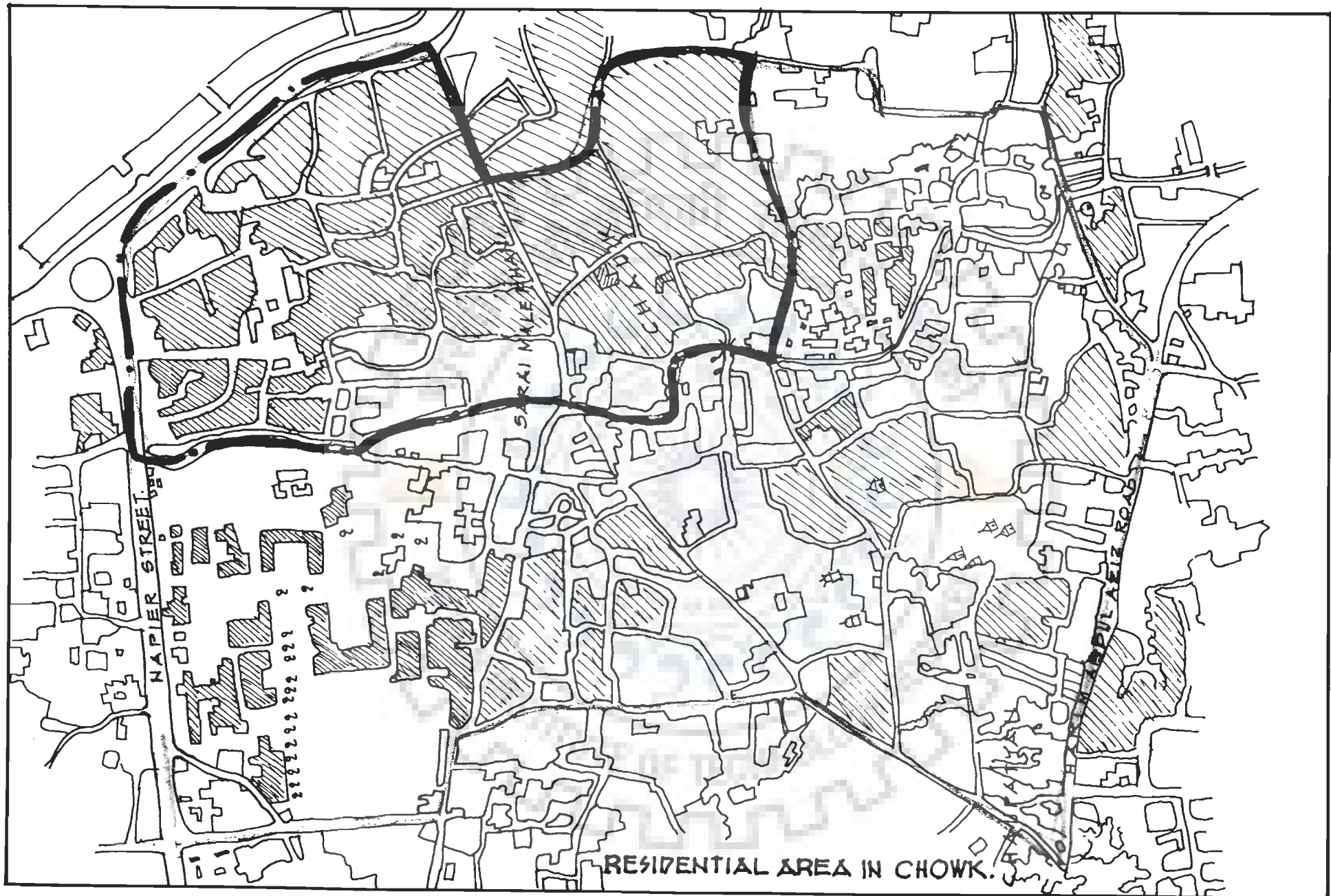
Figure 31 Plan of Chowk Residential Area.

RESIDENTIAL AREA IN CHOWK.

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Figure 32 Photographs of Chowk Residential Area.

7.2.4 Hussainabad Heritage Area

Lucknow city is endowed with beautiful palaces; havelis and well laid out gardens. There are about 52 monuments and historical sites in the city which have been declared as 'protected monuments' under the Ancient Monuments and Archaeological sites and Remains Act, 1958. Many of these monuments are mainly concentrated along the right bank of the river Gomti. Since the new developments taking place around these sites are not in conformity with the architectural character of the historic buildings, and further, incompatible activities, such as, workshops and shops are being put up in the immediate vicinity of these important buildings. Town and Country Planning Department of the U.P. Government has formulated a master plan for the city which, besides making planning proposals for the general development of the city, and makes specific recommendations to protect the monuments [83] [Figure 33].

The majority of the monuments have been grouped into three heritage zones, and are as follows:

(a) Hussainabad Complex,

(b) Kaiserbagh Complex, and

(c) La Martiniere Complex.

Of these, the Hussainabad Complex has been looked into for the purposes of this investigation since it is in a better architectural condition and is the most important tourist [Figure 34, 35].

The Hussainadad Complex comprises of the Asfi Imambara, Asfi Masjid, Roomi Darwaja, Jama Masjid, Clock Tower and Hussainadad Imambara, Tomb of Janab Aliya and Mohammad Ali Shah.

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PLAN OF HUSAINABAD HERITAGE AREA

Map labels: GOMATI RIVER, GIRDHARLAL MATHUR ROAD, AATA MIRZA ALI, WALL, CHHOTA IMMAMBARA, RAIS MANZ, JAMA MASJID, NAPIER STREET, MONUMENTS, DRAIN, DRAIN, WALL, WALL, WALL, WALL, HUSAINABAD TRUST ROAD, WALL, WALL, BARA IMMAMBARA, WALL, WALL, WALL
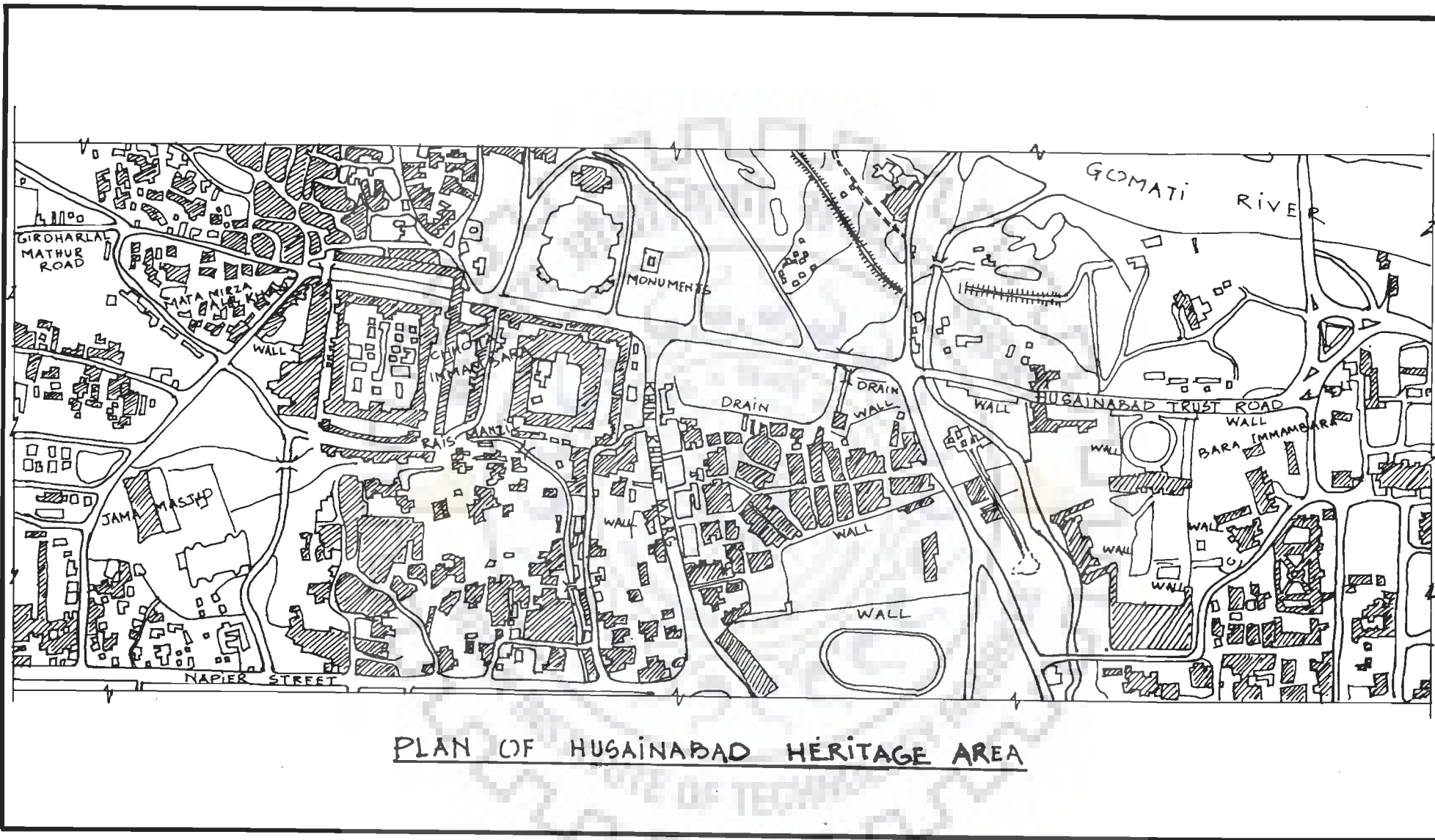
FIG. NO:- 33	TITLE :-
PAGE NO:- 203	HUSAINABAD HERITAGE AREA (PLAN)
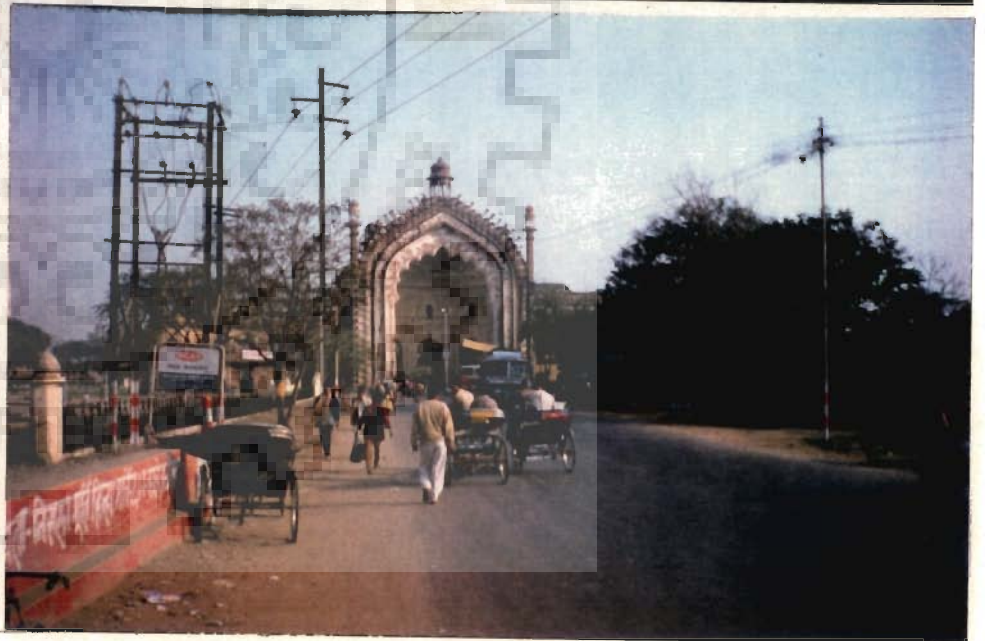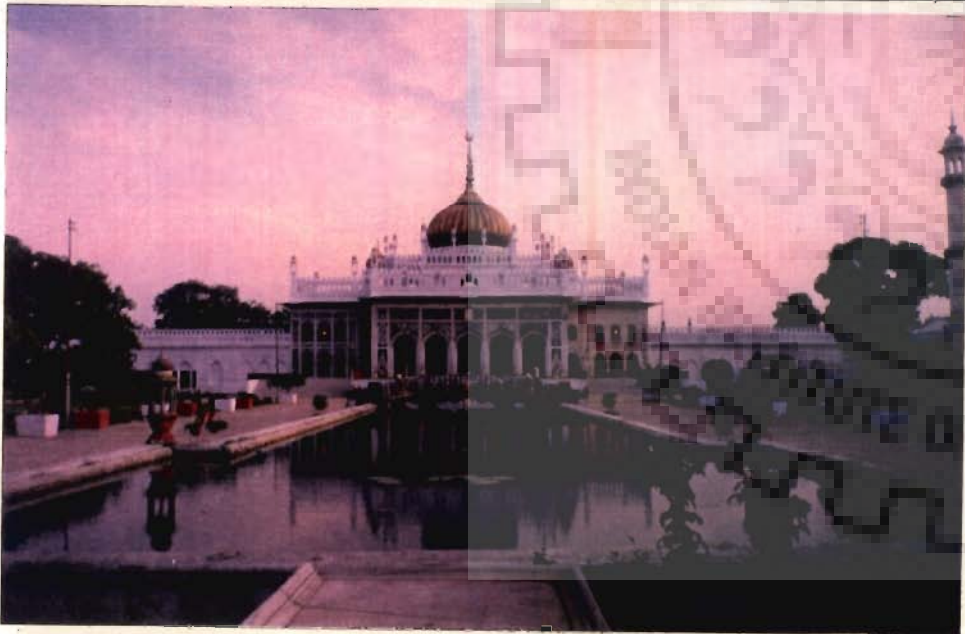
Figure 34 Photographs of Hussainabad Heritage Area .

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In the case of the Imambaras, while parts have been converted into shops, residences, workshops etc an over-whelming unauthorised commercial and industrial activity in the immediate vicinity has created serious transportation and hygiene problems. The adjacent Jama Masjid is ill kept and the Masjid does not have a proper approach to its entrance. Through heavy vehicles between Faizabad, Sitapur and Hardoi roads pass through the historic Roomi Darwaja causing damages. The residential areas in the surrounding of these monuments have degenerated into slums. This complex needs to be conserved and redeveloped as an important historic and tourist centre.

Declaring the area as Cultural Heritage District, will ensured that the monuments will be preserved in a landscaped setting that recaptures the ambience of the past, keeps the encroaching city at bay, and allows the ever increasing number of visitors to get a glimpse of history.

7.2.5 Parks And Leisure Area Development

The city has only 3.78 percent of its total land area as open spaces such as parks and playgrounds. This is considered to be very low as per norms. The distribution of these areas is also highly uneven [74].

The various water bodies, such as, River Gomti, Chinhat Lake, Chand Jhil and Ahal Jhil have all potential to function as recreational areas but these have not been developed as such even today. There are about a dozen drains that release their untreated waste directly into the River Gomti. The problem of encroachment by slum dwellers is rampant, particularly on the dry riverbed [83]. The Lucknow Development Authority in its effort to improve some of the open spaces has developed the Hatti Park, the Bhudda Park and the Roomi Park on

the banks of the Gomti, near the Bara Immambara [Figure 35] [Figure 36].

The landform of the area is generally sloped towards the river with occasional elevations and depressions. The slope would be about 1:3. There is a soil erosion problem due to the lack of vegetation on the banks. There are some open sewerage and drainage that is pumped into the river directly without proper treatment. The circulation on the banks is haphazard. There is no clear arrangement for segregation of vehicles and pedestrian traffic, no defined access to the river, lack of interesting view.

The Hatti Park is fairly small in size and is highly cluttered with play items like swings, slides, sculptural pieces, benches and such things; the landscape is also scrappy. It is basically a children's park and entry is allowed on payment of two rupees. It remains empty during the day but draws a few visitors in the evening. Parking space has been provided in front of the park but it seems to be poorly maintained. The high river embankment, road visually separates this park from the waters of the river Gomti. A lot of investment has been made in this park but the outcome is poor.

The Buddha Park is larger than the Hatti park and is separated from it by a railway line. Here too the landscape is scrappy but it has special water-play facilities. An artificial cemented water channel is provided which spreads all over the park. Small bridges have been built over the water channel and the whole park has been provided with a whole lot of objects, which have little relevance to the need or good design. This park is very popular with the middle and lower middle level families, particularly the children. The river Gomiti that passes along this park is both physically and visually separated by the embankment road. The parking provided in front of this park is adequate.

GOMATI RIVER

SAND

SAND

SAND

HATI PARK

SAND

SAND

KURIYA GHAT

RUMI PARK

MASJID PARK

BUDDHA PARK

SAND

HUSAINABAD TRUCT ROAD

NABIULLAH ROAD
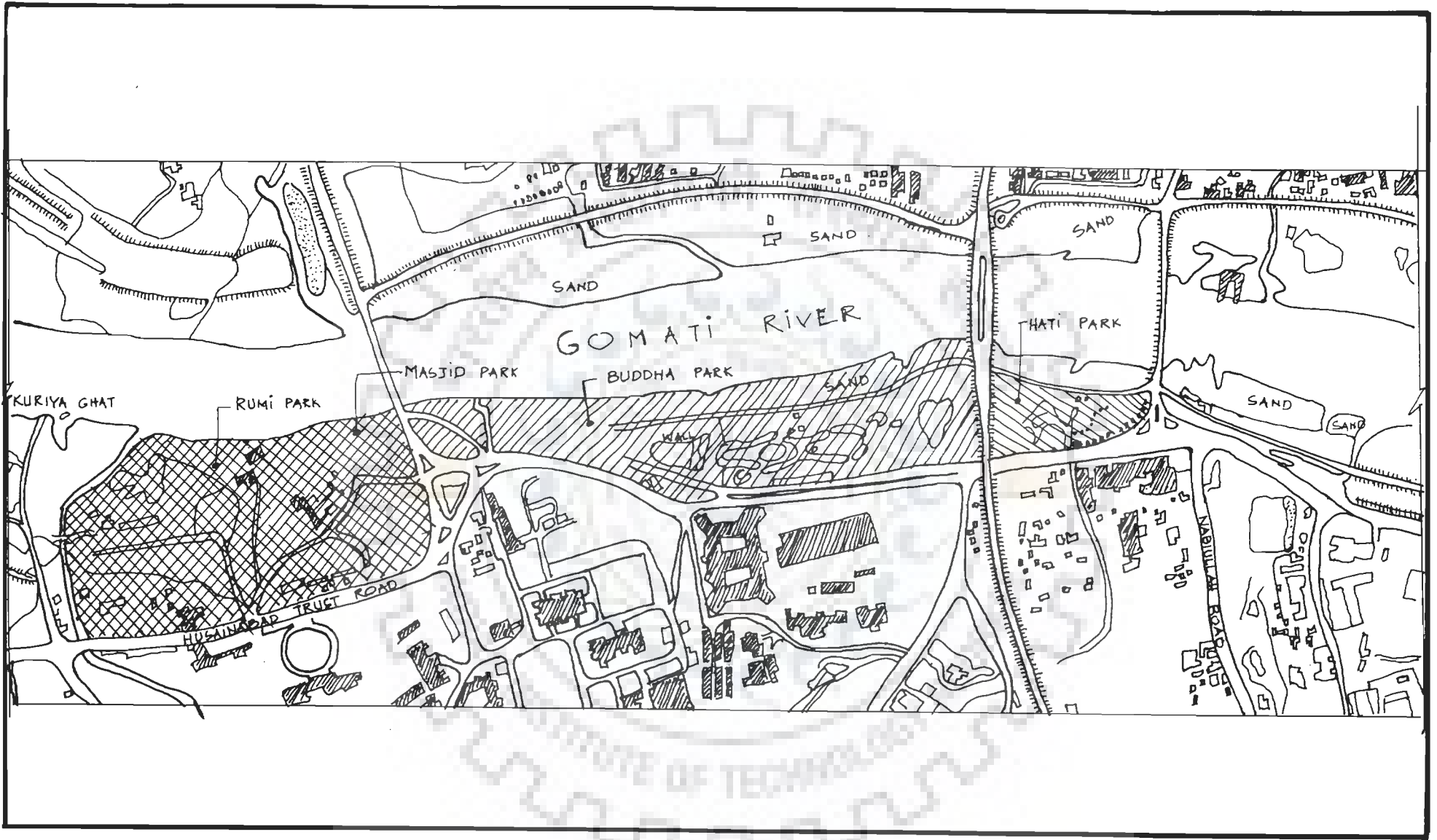
FIG. NO:- 35	TITLE:-
PAGE NO:- 207	LEISURE AREA ON THE BANK OF RIVER GOMATI

Figure 36 Photographs of Leisure Areas On The Banks Of River Gomiti .

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The Roomi Park (also known as Golap Batika) is near to the above two parks but is separated by a large mosque and its adjoining space. The Roomi park is adjacent to the Roomi Darwaza and there fore is basically a heritage park. This park is quite reasonably laid out as a rose garden and it attracts mostly tourists and young couples. It does not have any specific area delineated for purposes of parking. Other facilities for drinking water or toilets are lacking. The area needs some attention of the authorities for its improved maintenance.

7.2.6 Evaluation of the Selected Areas in Lucknow

Performance Evaluation of the areas described above namely Hazratganj Market Area, Chowk Market, Chowk Residential Area, Hussainabad Heritage Area and the River Side Parks have been carried out and presented in [Table 15] below.

Table 15   Name of the study area : Lucknow City

Name of the pedestrian space	Hazratg unj	Chowk	Chowk reside ntial	Hussai nabad	Parks
Functional Parameters					
Land					
a) Open space available for expansion or landscape.	3	2	2	9	8
b) No objectionable uses that produce noise, dust, smoke, or traffic conflict.	8	4	2	6	7
c) Compactness of the core area of the particular land use.	8	8	8	3	8
Topography					
a) Slope appropriate for proper drainage.	6	6	5	7	8
b) Slope appropriate for easy construction.	8	8	8	8	8
c) Gradient right for easy walking.	8	8	8	8	8

Geology

a) Soil appropriate for construction.	6	6	4	5	5
b) Soil appropriate for plantation.	8	8	7	6	8

Foliage

a) Adequate for good micro climate.	6	2	2	3	7
b) Adequate for survival of wild life.	5	2	2	2	5
c) Adequate for shade or social life.	2	2	2	1	5

Micro Climate

a) Good for human comfort.	3	7	8	3	4

Density

a) Appropriate for qualitative living.	7	6	4	8	7
b) No hawkers in the area.	3	3	7	5	4

Age

a) Major age groups have necessary facilities.	7	5	5	3	4
b) Children have play areas and schools.	7	7	7	6	8
c) Children have segregated pedestrian access to play areas and school.	4	7	7	5	4
d) Sports facilities for young boys and girls.	7	2	3	7	3
e) The young have places for interaction like clubs etc.	7	4	7	6	3
f) The old have walk ways, resting places and places for interaction.	6	6	7	6	7

Religion.

a) The major religious groups have places for worship.	8	8	8	8	5
b) The major religious groups have appropriate community facilities.	7	8	8	8	5
c) There is good communal harmony between the religious groups	8	4	3	2	5

Sex

a) Good male to female ratio	7	6	5	8	7
b) Appropriate facilities according to the male/ female ratio.	4	4	5	4	7

Marital Status.

a) Most of the population in the marriageable age is married.	7	6	7	7	7

Size of the Household

a) Housing area available for facilities proportionate to size of household.	7	3	3	3	5

Annual Income.

a) Good annual income and good standard of living.	8	3	3	4	5

Built-up Area

a) Size and the type of accommodation appropriate to the uses.	8	7	4	3	8

Occupancy

a) Occupancy of the uses is appropriate.	8	8	8	2	8

Condition of the Buildings

a) Well maintained buildings / parks.	7	2	2	5	7
b) Interesting man-made or natural facades.	8	7	7	8	5
c) Functionally up to date.	7	3	3	7	4
d) Harmonious.	7	6	8	9	3

Sanitary Conditions.

a) Adequate toilets.	3	1	2	2	3
b) Toilets clean and well maintained.	2	1	2	2	2

Use Supportive Buildings.

a) Adequate use supportive buildings like banks, post offices and medical centres.	8	7	8	6	2

Internal Access.

a) No congestion.	6	3	2	8	7
b) Good circulation.	7	3	2	8	7
c) Adequate parking.	4	2	2	8	5
d) No conflict at traffic intersections.	4	2	2	9	5
e) No loading conflict.	7	2	2	8	5
f) Adequate footpaths.	7	8	8	2	7

External Access

a) Convenient access to over all town.	8	7	7	7	7
b) Adequate public transport routes to town.	8	8	8	7	7
c) Proper access for trucks.	3	5	7	7	7
d) Adequate parking.	3	2	2	8	7

Water Supply.

a) Water supply system good and adequate.	7	2	2	5	5
b) Adequate water for fire fighting.	5	2	2	5	5

Sewerage.

a) Sanitary sewer adequate and good.	7	2	1	5	7
b) Good storm water drainage.	5	2	1	6	7
c) Storm water drains covered.	7	2	1	4	3

Garbage Disposal

a) Adequate garbage removal.	7	2	1	5	6
b) All the areas clean of thrown garbage.	7	3	2	3	7

Telephone

a) Adequate supply.	8	5	3	5	5
b) Overhead wires well organised and looks clean.	7	4	2	7	5
c)Telephone posts well designed and properly located.	5	3	2	5	5

Electricity.

a) Adequate supply.	3	3	1	6	7
b) Overhead wires well organised and looks clean.	6	3	1	6	8
c) Posts well designed and properly located.	5	3	1	5	8

Lighting

a) Street lighting adequate.	8	6	2	7	8
b) Attractively designed street lighting furniture.	3	2	2	3	8

Cable T.V.

a) Overhead wires clearly laid out.	5	2	2	3	5

Fire Fighting

a) Good access facilities for fire fighting.	7	2	2	3	5
b) Fire hydrants properly located in required numbers.	5	2	2	3	5

Post and Telegraph.

a) Letterboxes properly located in required numbers.	7	7	7	5	5
b) Post office located in the area within easily accessible distance.	4	7	8	6	5

Police

a) Adequate protection available.	8	8	9	6	3

Emergency Medical Assistance

a) Available easily.	7	8	8	7	3

Public Awareness

a) Public very conscious about their surrounding.	7	8	3	4	3
b) Good general community awareness.	7	8	7	8	8

Promotional Efforts of the Government.

a) Government is making good effort to improve the condition of the people	9	4	5	8	7
Total	9	4	5	8	7

Aesthetic Parameters

Shape

a) The skyline is interesting.	5	6	7	8	3
b) The settlement shape has a definite order.	7	8	8	8	7

Colour

a) The settlement has a nice colour scheme.	7	8	8	8	6

Texture

a) There is a special textural quality to the settlement.	7	8	8	8	6

Position

a) The area enjoys a special position with respect to the rest of the settlement.	10	8	8	8	6

Orientation

a) The area has a good orientation from the climatic point of consideration.	4	8	8	8	8
b) The area has a pleasing visual orientation.	5	8	2	8	8

Visual Inertia

a) There is a visual tension in the design and layout of the area.	6	5	8	5	8
b) The area maintains a good visual balance between buildings and spaces.	6	8	8	8	8

Unity of Opposites.

a) There is a good contrast between either the high and the low or between the solids and voids.	6	6	8	5	2

Form Defining Space.

a) The buildings define spaces in a special way such as enclosures, vistas, etc.	7	8	6	8	2

Defining Space by Horizontal and Vertical Planes

a) Interesting configuration of vertical and horizontal planes in the settlement	7	6	7	8	2

Quality of Architectural Space

a) Good variety of enclosures of space.	7	8	8	8	8
b) Good views available from and in the settlement.	6	6	8	8	4

Openings in Space Defining Planes.

a) There are beautifully designed / special door and window openings.	7	7	7	8	5
b) Interesting colonnade arrangements.	8	6	7	8	5

Proportions.

a) The structure or architecture has a special pleasing proportion.	7	8	8	7	6

Scale

a) The building and open spaces are in appropriate human scale.	7	8	8	6	8

Axis

a) There are some buildings and spaces which establish an desirable axis	8	9	8	9	2

Symmetry

a) The settlement has situations that show symmetry.	7	9	8	9	2

Hierarchy

a) There is an interesting hierarchy of open spaces.	2	9	8	9	2
b) There is an interesting hierarchy of building sizes.	4	9	8	8	2

Datum

a) There is a line, plane or volume that holds together and organises a pattern of forms and spaces.	6	7	8	7	5

Rhythm

a) There is a regular and harmonious reoccurrence of lines, shapes or colours.	6	8	8	7	2

Repetitions.

a) There is a repetition of elements in size, shape or detailed characteristics.	7	8	8	8	2

Transformation

a) There is a recognisable pattern of transformation of the settlement.	7	7	7	6	2

Total	7	7	7	6	2

Human Cost Parameters

Social Aspects

Social Contact in Pedestrian Routes.

a) Footpaths are very much used by pedestrians.	8	8	7	8	8
b) Pedestrian footpaths and pedestrian areas are used for standing and watching.	9	8	8	7	5
c) Benches, Culverts etc. are used for sitting in pedestrian areas and footpaths.	4	8	8	7	9
d) Pedestrian routes are used for walking with company.	8	7	8	8	6
e) Footpaths are used to stand with	10	8	8	8	5

company and eat, watch or talk.

f) Benches on footpaths are used for sitting with company.	4	8	8	8	8
g) Friendship is developed while standing, sitting or walking on the footpath / pedestrian areas.	7	7	8	8	6

Socialisation and Circulation.

a) While walking to work, market, etc. footpaths are used for socialisation.	8	5	8	7	5
b) Points of modal change like bus stops, etc. are used to socialise.	3	5	8	7	5

Children and Their Activities on Pedestrian Paths.

a) Children are comfortable using the footpaths.	5	3	8	3	9
b) Children play regularly on the footpaths	0	3	8	2	9
c) Children make friends on the footpath.	2	3	8	2	9
d) Children are safe on the footpaths and pedestrian routes.	6	6	8	2	9

Social Environment for Elders on Footpaths.

a) Elders are comfortable while using the footpaths or pedestrian routes.	4	4	7	2	8
b) Elders spend time on the footpaths and pedestrian areas sitting, reading, or talking with company.	2	2	8	2	8

Family Behaviour on the Pedestrian Areas.

a) The family as a whole uses the footpaths or pedestrian areas.	8	2	4	7	8
b) Your family meets and socialises with other families on the footpaths, pedestrian areas.	8	2	4	2	8

Psychological Aspects.

Comfort or Irritation on the Pedestrian Areas.

a) You are comfortable with the excessive crowds on the footpaths.	4	3	5	7	5
b) The surface unevenness of the footpaths does not bother you.	3	7	8	6	8
c) The filthy and unpleasant surroundings do not bother you.	6	2	3	4	8
d) You are comfortable on the footpaths during inclement weather.	6	7	7	5	2
e) Discontinuity of flow while walking weather more or less does not trouble you.	3	7	8	5	7

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f) Hawkers on the pavement do not bother you.	4	8	8	5	8
g) Beggars do not trouble you while walking on the pedestrian routes.	3	8	8	5	8

Tranquillity or Tension in Pedestrian Areas.

a) You are at ease even with the disorganised traffic moving about near the footpaths or inside a generally pedestrian area.	3	3	3	5	5
b) You are at ease even with antisocial elements hanging around in the pedestrian paths and areas.	5	5	3	5	3
c) You have no problem because of the noise created in the footpaths or pedestrian areas.	3	3	8	5	8
d) You are happy and feel secure while walking on lonely footpaths or pedestrian areas.	7	5	8	4	5

Conveniences and Inconveniences in the Pedestrian Areas.

a) There are adequate public conveniences like toilets, drinking water, dustbin etc. in the existing footpaths and pedestrian areas.	2	2	3	3	6
b) There is adequate security on the footpath and pedestrian areas in your locality.	7	8	5	3	7
c) Walking late at night is convenient, as there is adequate lighting in the area.	9	2	5	2	3

Likes and Dislikes of People Walking on the Footpaths or Pedestrian Areas.

a) You enjoy the entertainment provided by footpath performers.	7	5	5	5	5
b) You like to watch people moving about on the footpaths and pedestrian areas.	8	7	5	5	7
c) You enjoy interacting with the opposite sex on the pedestrian areas.	8	6	5	1	5
d) You enjoy the surroundings of the pedestrian areas in your locality.	8	5	5	8	7
e) You enjoy shopping from the hawkers in the pedestrian areas of your locality.	8	7	8	8	6
f) You enjoy eating from the stalls in the footpaths.	8	7	8	8	7
g) You enjoy the quite environments in the pedestrian areas of your locality.	3	5	8	5	8
h) You like locations that are purely pedestrian in your locality.	8	8	5	8	8

Health and Fitness.

a) You feel walking is beneficial to your heath and fitness.	6	5	5	8	8
b) You use the pedestrian routes in your area for walking for fitness.	6	5	5	8	9
c) The pedestrian areas are good for health because of the lack of vehicular pollution.	6	5	8	8	9

Safety

a) The pedestrians use the pedestrian areas and routes with courtesy and good manners.	3	6	5	5	7
b) The pedestrians are well informed about the traffic rules.	2	2	5	3	4
c) The drivers of vehicles use the road and other facilities with courteously and with good manners.	1	3	2	4	5
d) The drivers are mostly in a good state of mind while driving on the roads.	5	4	4	4	5
e) The physical facilities that have been provided for circulation of vehicular traffic and pedestrian movement are being used properly.	8	4	5	7	8
f) The physical facilities provided for movement of vehicles and pedestrians is adequate.	2	2	6	3	8

Pollution

a) The air pollution in the neighbourhood is very low.	7	8	8	5	6
b) The noise pollution in the locality is within reasonable levels.	7	8	6	5	6
c) There is no visual pollution. (Visuals which are offensive to the eye).	7	8	5	6	8
d) Water bodies in the area are not polluted.	5	8	3	3	4

Energy

a) You walk to save cost and consequently energy.	5	5	5	8	5
b) You worry about unnecessary use of energy for travel purposes.	5	5	5	8	5
c) You walk because of non-availability of motor transport.	8	8	3	8	5
d) In the future you will walk more and use vehicular mode to a lesser extent.	7	5	5	5	5
Total	25	23	18	29	20

Functional Aspects.	446	329	310	397	416
Percentage	61.94	45.69	43.06	55.14	57.78
Aesthetic Aspects.	166	196	195	198	121
Percentage	63.85	75.35	75.00	76.15	46.54
Human Cost Aspects.	309	300	342	300	368
Percentage	55.18	53.57	61.07	53.57	65.71

7.2.7 Conclusions

The Hazratgunj has been evaluated as an area having qualities of function, aesthetics and human cost aspects in a near balance. The area can be considered to be an above average area when compared to the general conditions of Indian cities. It gets a score of 61.94 % in functionality, 63.85% in its aesthetics and 55.18 percent in the human cost aspects.

Chowk Market are is considered to be functionally below average scoring only 45.69 %, however in the aesthetic parameter it gets a high score of 75.35% and an average score of 53.57 in the human cost parameter.

Chowk Residential Area is again having a low score of 43.06 in the functional aspects, while in the aesthetic aspect it scores a high of 75.00% and an slightly higher average score of 61.07 in the human cost factor.

The Heritage area of Hussainabad gets the highest score of 76.15% while in terms of the functionality and human cost aspect it gets an average score of 55.14 % and 53.57 % respectively.

The park areas of Lucknow gets average scores in functionality and aesthetics, and a above average score in the human cost aspect. It gets 57.78%, 46.54%, and 65.71 % respectively.
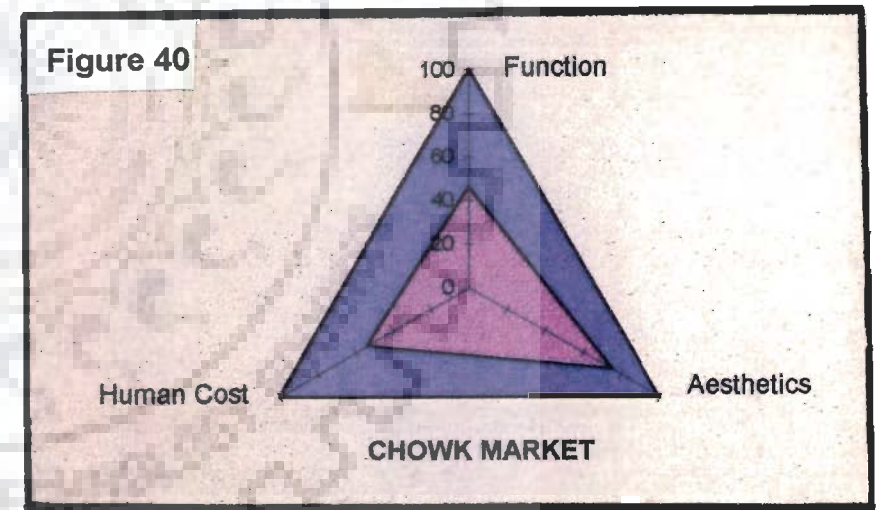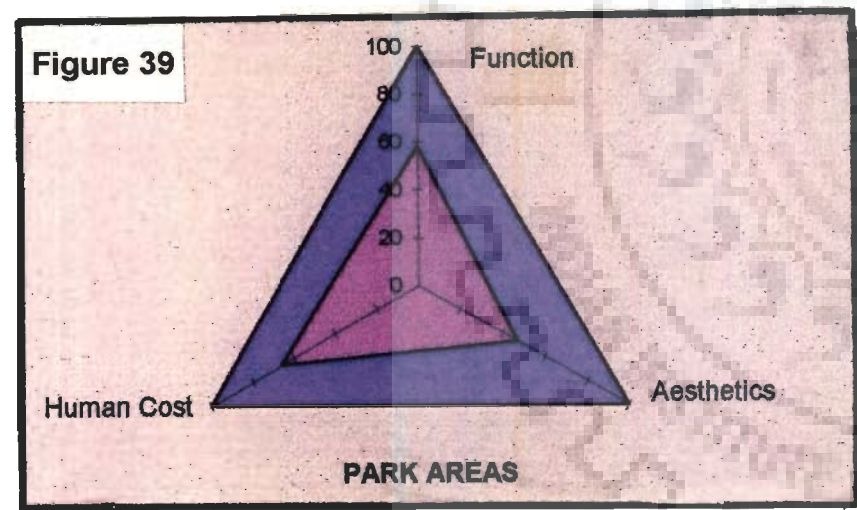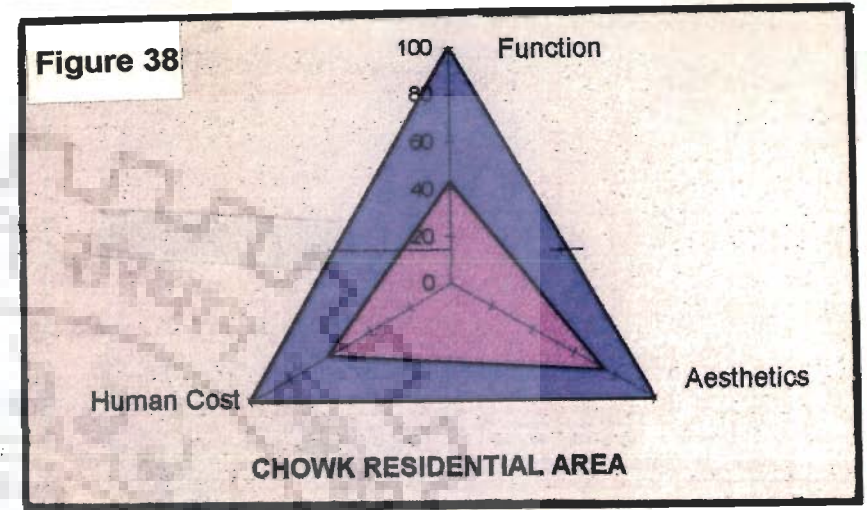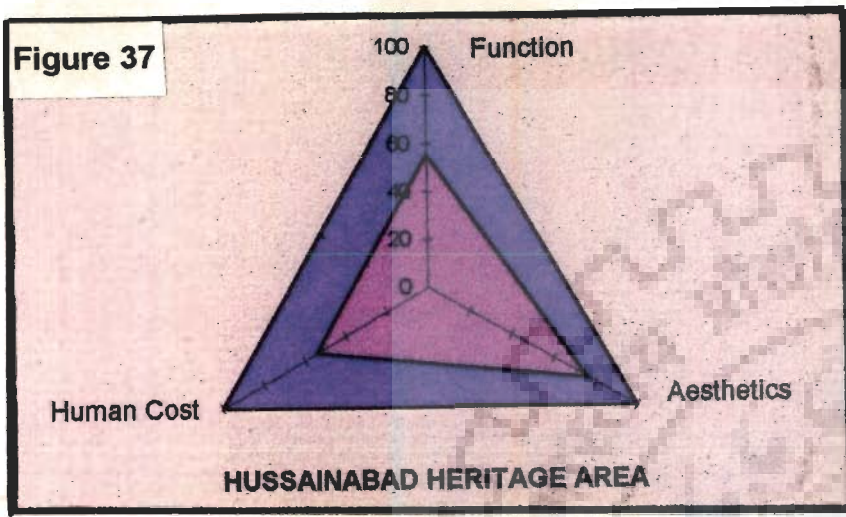
Figure 37 — HUSSAINABAD HERITAGE AREA

Figure 38 — CHOWK RESIDENTIAL AREA

Figure 39 — PARK AREAS

Figure 40 — CHOWK MARKET

| FIG. NO :- 37 – 40 | PAGE NO:- 219 | TITLE :- PERFORMANCE EVALUATION OF DIFFERENT AREAS IN LUCKNOW ON THE TRIAD SCALE. |

Figure 41 — Performance Of Hazratganj

Function · Aesthetics · Human Cost

Figure 42 — Combined Effect Of Different Areas Of Lucknow

Function · Aesthetics · Human Cost

Legend:
- highest
- Chowk R
- Hussain
- H-Gunj
- Chowk M
- Parks
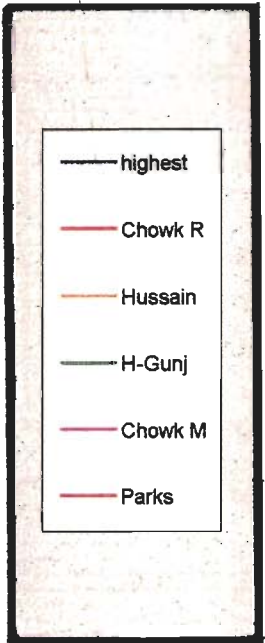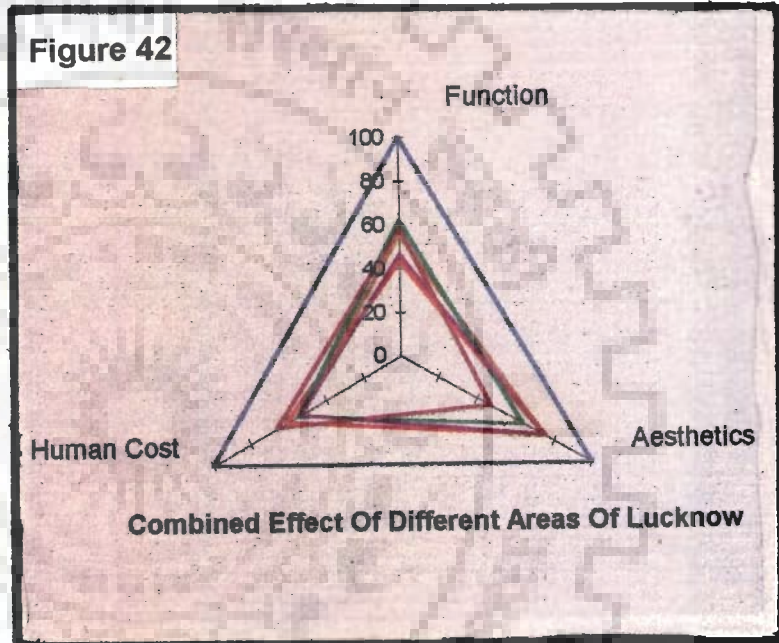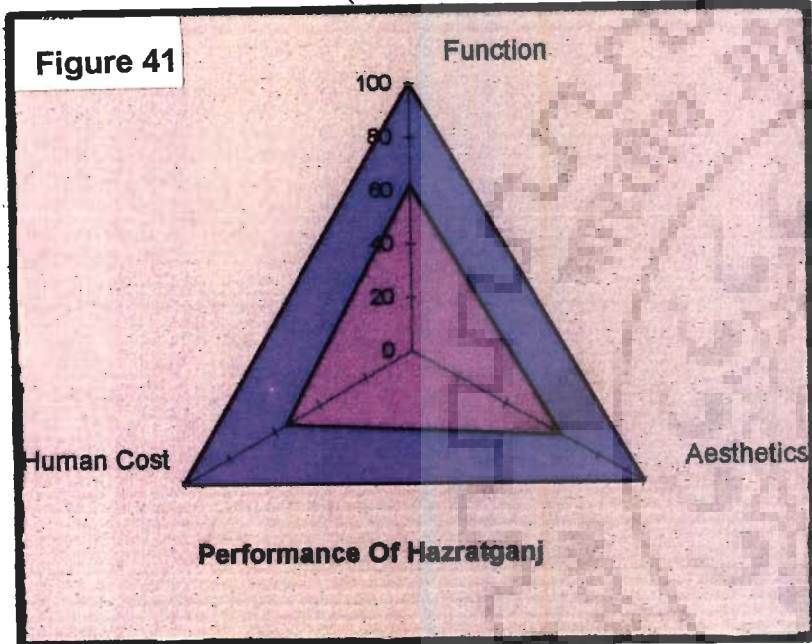
FIG NO:	PAGE NO:	TITLE: PERFORMANCE EVALUATION OF HAZRATGANG AND COMBINED
41-42	220	EFFECT OF DIFFERENT AREAS ON THE TRIAD SCALE.

In the city of Lucknow the general level of scoring on the factors of Functionality and Human Cost Aesthetics aspects have been average while it has a very high aesthetic standard. The performance of the areas on the Triad scale have been shown in [

Figure 37 Figure 38 Figure 39 Figure 40 Figure 41 Figure 42]

7.3 THE CITY OF PATNA

Patna is the capital of Bihar, which is one of the states of India. It lies on the main line of the Eastern Railways connecting Calcutta, Delhi, Bombay and Madras. It is located on the southern bank of the river Ganga. The river Punpun flows on the southern side of the city and meets the river Ganga about 8 km down stream. On the west flows the river Sone and the rivers Koilvar and Gandak meets the Ganga from the northern side in front of the Central Zone of the city. Thus rivers surround the city of Patna on all the sides.

Patna which was historically known as Pataliputra, rose to prominence about 2500 years ago, as a seat of imperial government of Magadh and acted as a catalyst for the spread of Buddhism in Asia, Europe and Africa. At that time a small settlement called "Pataligram" existed at the site and this was the home of several Rishis.

Historians consider the history of Magadh to be representative of the history of the Indian Sub-continent as a whole. The most notable king of the Magadh dynasty was Bimbisara who is said to have built a new city at the foot of the four hills lying to the north of "Giriraja", he named the city Rajagriha (modern

Rajgir) or the king's house. Later king Udayan, grand son of Ajatsatru, built a town, the fortress and shifted his capital there from Rajgriaha. This historic city had a population of about 4,00,000 was 80 stadia (9.2 miles) long and 15 stadia (1.7 miles) broad and was surrounded by a moat 600 feet broad and 45 feet deep. It had 570 towers and 64 gates.

The urban management was the responsibility of a 30-member committee. Due to the contact with the Greeks a new Indo-Greek culture developed which is well reflected in the archaeological finds.

Ashoka, the grand son of Chandragupta Maurya, accended the thrown after the death of his father Bindusara in the 272 BC. The capital he built was so magnificent in form and structural beauty that it was believed that no human hands could have ever built Pataliputra.

After the death of Ashoka, Pataliputra decayed and for a while its history went into oblivion. But during the reign of the Guptas in the fourth century AD the town once again came into prominence as a capital city.

After the Guptas the glory of Pataliputra declined again for sometime. In the 5th cent. AD it was ransacked and destroyed by the Huns and king Shashanka of Bengal an archenemy of Buddhism, which was prevalent in the city.

Afghan chief Shershah established his capital at Pataliputra in 1541 and once again the city became a bustling centre of trade and commerce in northern India. Shershah also built a magnificent fortress here, of which the "Paschim and Purab Darwaza" are two magnificent remains even today.

The city is said to have reached the zenith of its splendour during the rein of Azim - Us - Shah the grand son of Aurangzeb. In 1704 AD. He named the city as Azimabad after himself.

The French, Dutch, Portuguese and English came to Patna for business and established themselves in the trade of saltpetre a basic material for gun powder and thus Patna developed as a trading city.

There was a great turmoil between 1720 to 1748 and there was a turning point in the history of India in 1765 when Lord Clive succeeded to get the Diwani Rights of Bengal, Bihar and Orissa from the last mogul ruler Shah Alam.

Patna, thus is an ancient city with a chequered history, it has witnessed the rise and fall of many empires. It had its phases of glory and prosperity and also its periods of oblivion and decline.

Present day Patna has a population of 10,99,647, and there are almost no remains of the past in the form of architectural edifices. During the post independence period Government activities have increased by many folds and so has its administrative machinery. The implementation of the Government's welfare programme and the five-year plans have resulted in large scale building activities in the city both in the public and the private sectors.

Land use wise Patna can be divided into four broad zones which have one or the other type of specialised functions [Figure 43].

The Eastern Zone which caters to the wholesale marketing of rice, wheat, pulses, spices, and vegetable. The major wholesale markets of this area are Maroofganj, Masoorganj, Maharajganj and Khazekalan. Household and small-scale industries like those of plastics, ferrous and non-ferrous metals, synthetic rubber and others are also located here.

The Central Zone which consists of the Patna University, Patna Medical College, the centres of recreation, retail shopping, district courts and other important government offices. Retail trade in various consumer goods and

agro-industrial materials and hardware are also located in this zone. Therefore this zone contributes considerably to the economic activity of the city. The land value in this zone is much higher than in the others.

Western Zone which constitutes of the planned segment of the city. Here all the state level offices such as the Legislative assembly, the High Court, Parks and clubs are mostly located. This zone is functionally not compact and depends on the other zones for the essential requirements and activities. The land use pattern of this zone is less mixed as compared to the other zones.

The Southern Zone. This zone is located to the north of the main railway line. The dominant function of this zone is residential. There is inadequate public transport connecting this zone with the rest of the city[79].

7.3.1 Patna Market and Ashok Raj Path

This area is located in the central parts of the Patna city. The Ashok Raj Path is a very important through-fare of the town, connecting the old town in the northeast to the newer development in the west. It has Retail Street shopping on one side and on the other side all the important Institutional and educational buildings of Patna are located. On both sides of the road there are footpaths (sidewalks) which vary in its width at different location on the street [Figure 44]. The Patna market is an upper class shopping area abutting onto the Ashok Raj Path. It was built in the year 1947 and has since grown through a process of accretion. It covers an approximate length of about 110-ft. and has an average width of about 50-ft. It is tightly packed with small and medium size shops, which sell mostly clothing items along with other ladies and children needs [Figure 45].
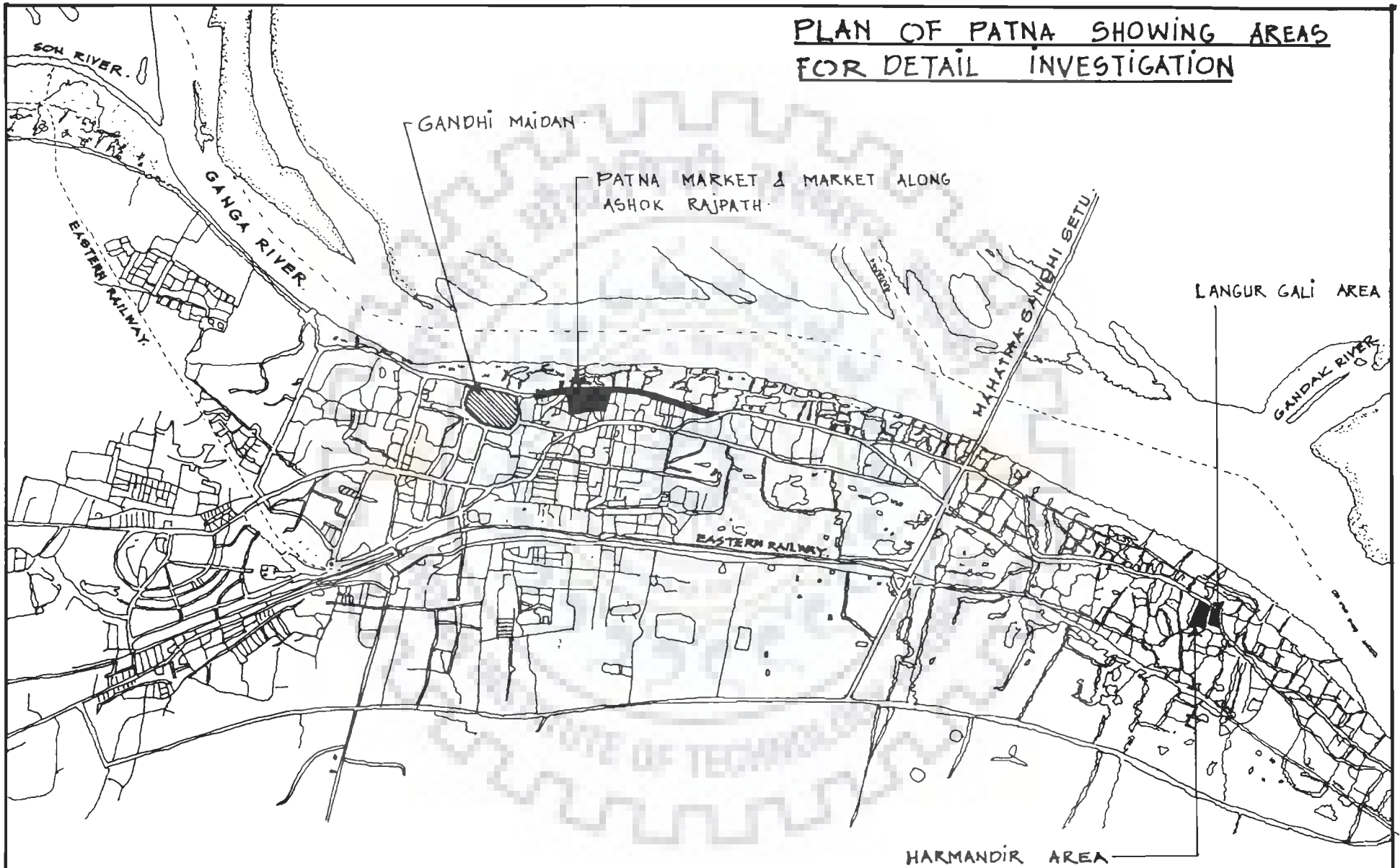
Figure 43 Plan of Patna Showing Areas for Detailed Investigation .
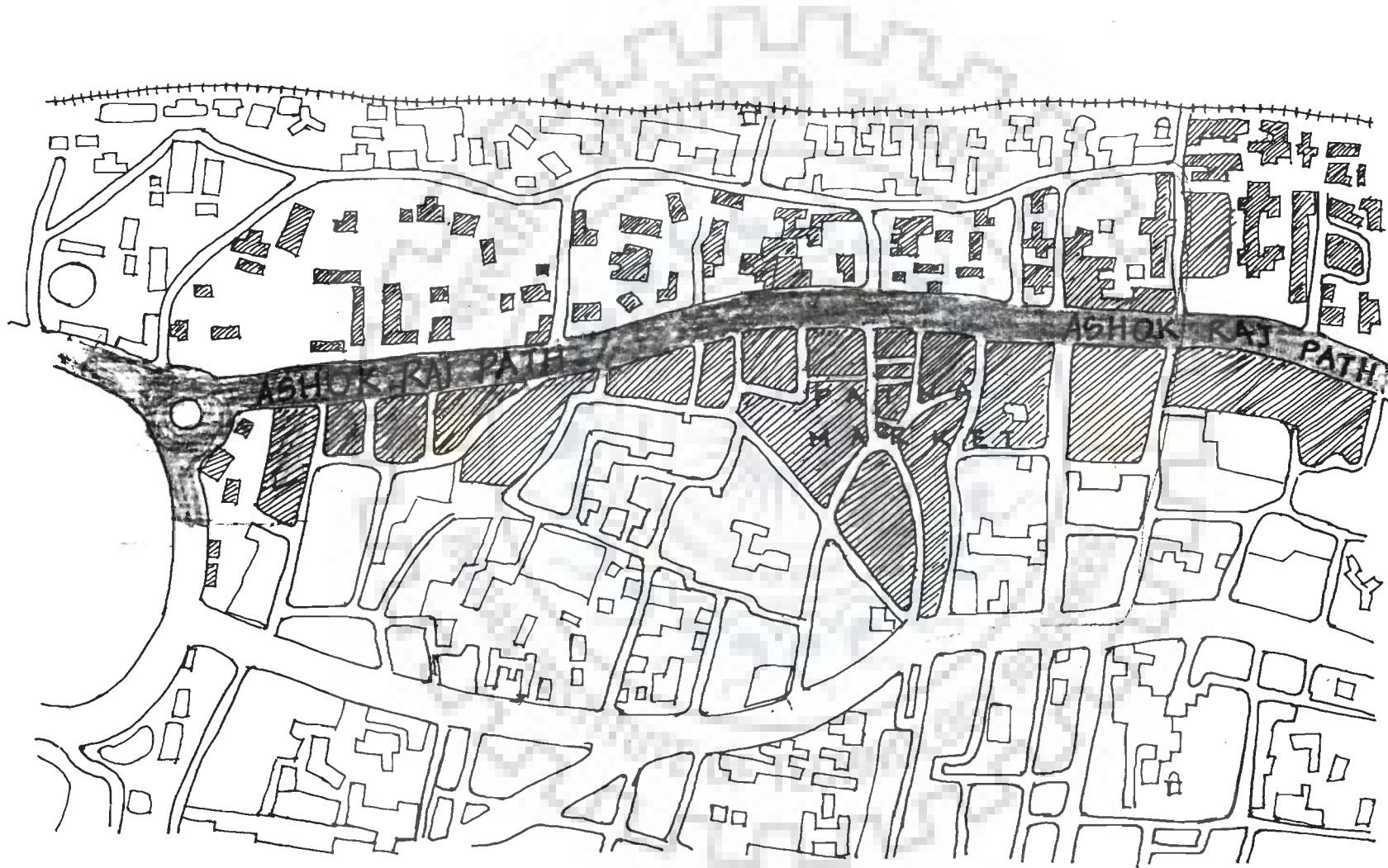
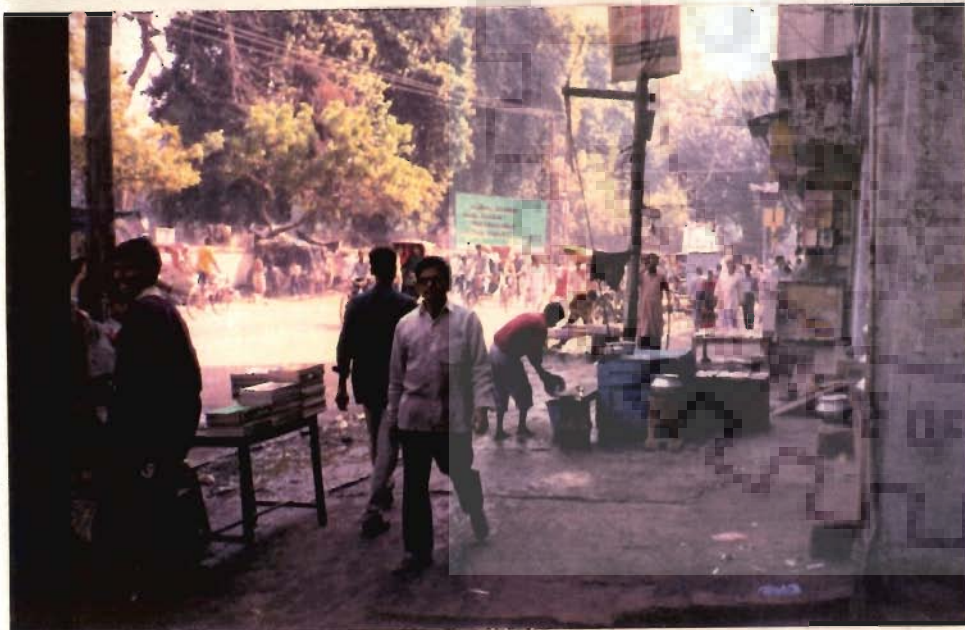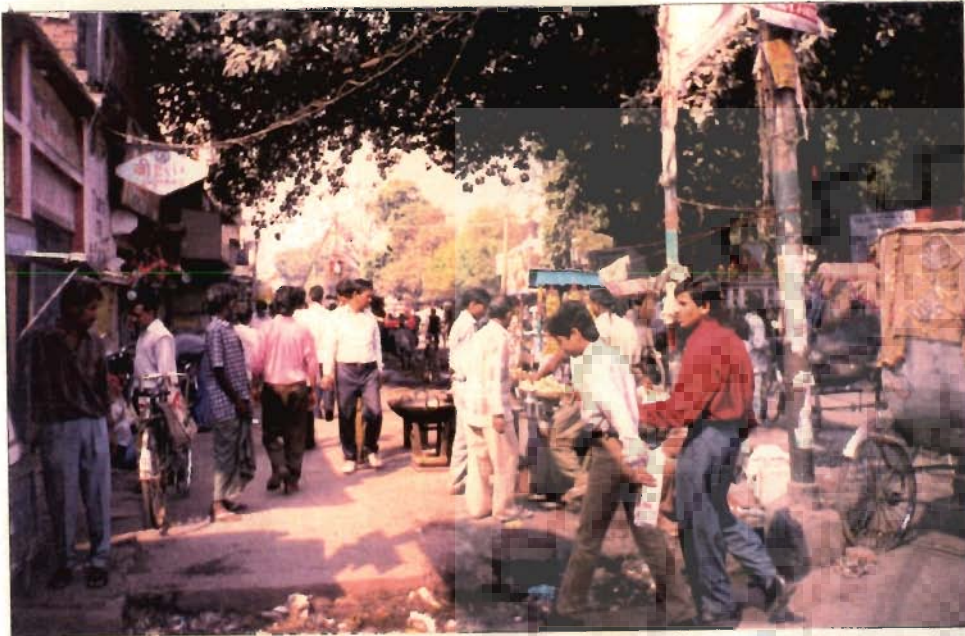**Figure 44 Plan of Patna Market and Ashok Raj Path.**

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Figure 45 Photographs of Patna Market and Ashok Raj Path .

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7.3.2 Langur Gali Area

Langur Gali is a middle class residential area located in the older eastern parts of Patna City. The area is adjacent to the historic Har Mandir area and is bounded by the Ashoka Raj Path on the Northern side, Har Mandir gully on the western side, Langur Gali on the South side and the same continues along the eastern boundary also. Inside the body of this area the buildings are provided access through Pau Gali. All the access routes can be described as fit only for pedestrian movement due to the narrow width. Most of the houses in this area are built of brick and are ground plus one or ground plus two storeys in height. The services in the area are in a deplorable condition. The municipal workers come rarely to the locality to do their cleaning and maintenance work. There are a number of khatals in the areas, which add to the misery of the residents by way of pollution, blockage of the drains with cow dung and the breading of mosquitoes. About ninety percent of the houses have septic tanks and the balance ten- percent pass the untreated night soil directly to the storm water drains. Some of the people own cars and they keep them in community garages close to the roads, which permit vehicular access. These community garages are privately owned and managed. The pedestrian routes are so filthy that they discourage any type of social use and are used only for purposes of access to the houses [Figure 46] [Figure 47].

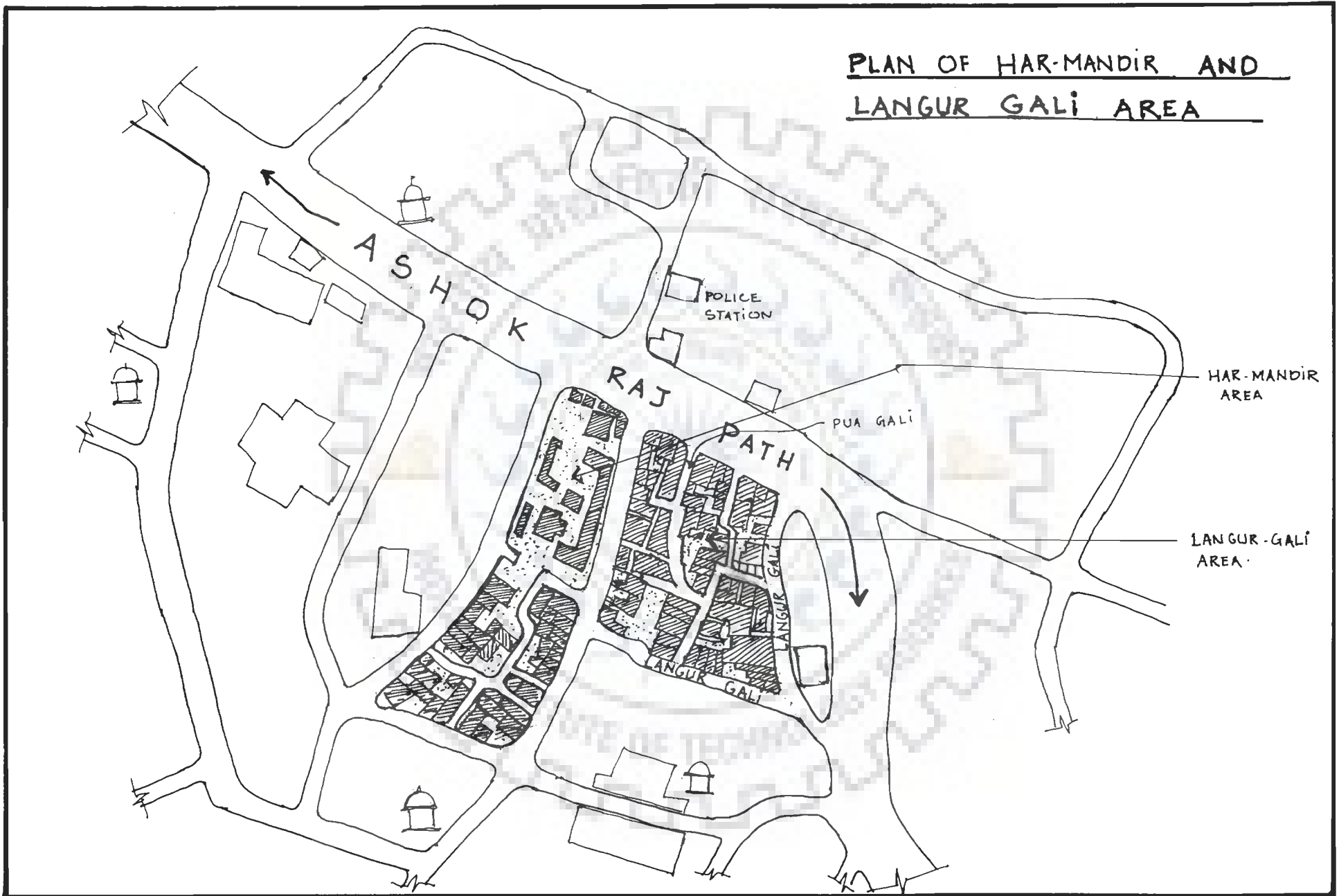PLAN OF HAR-MANDIR AND LANGUR GALI AREA

ASHOK RAJ PATH

POLICE STATION

HAR-MANDIR AREA

PUA GALI

LANGUR-GALI AREA

LANGUR GALI

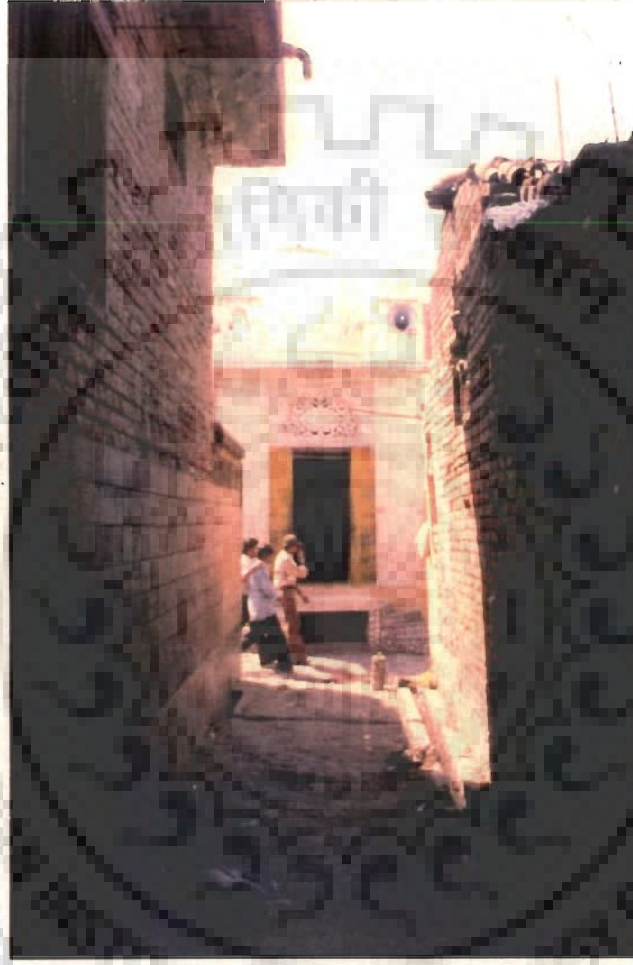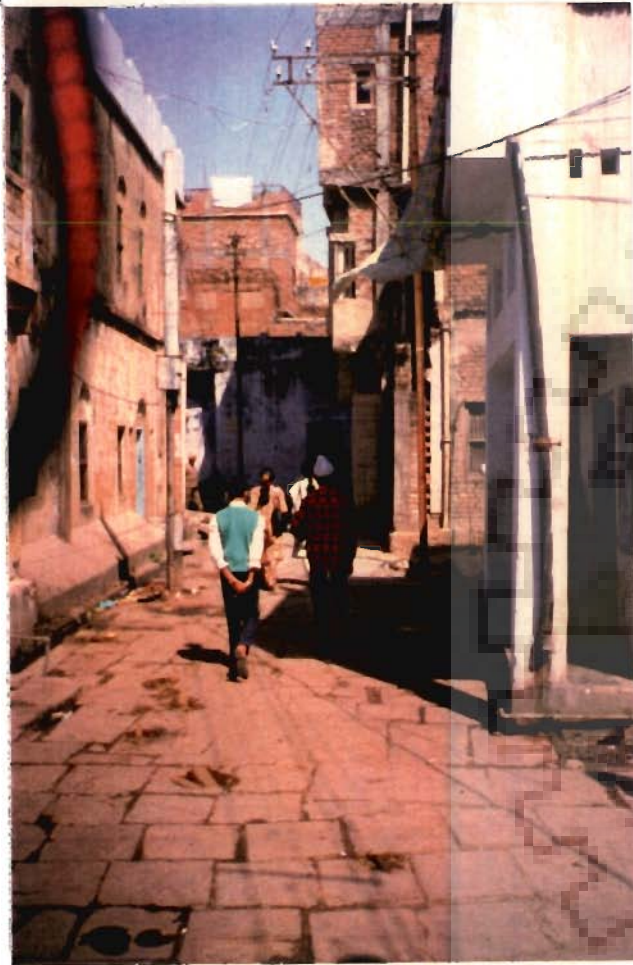Figure 46 Plan of Har Mandir and Langur Gali Areas.

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Figure 47 Photographs of Langur Gali Area .   (PAGE :- 230)

7.3.3 Har Mandir Area

Patna is steeped in history but very little of its relics remain today. Takht Patna Saheb also known as Har Mandir area is located in the older parts of eastern Patna. It is the second most sacred place for the Sikhs, it is one of the few historic sites which remain deeply rooted in the minds of the people for it was here that Shri Guru Govind Singh, the tenth Guru of the Sikh religion was born in 1666 AD. The buildings in this site have under gone change over the years and even to day there is a lot of physical change taking place as new constructions are being made and ownership of the land is being taken over by the Gurdwara authorities. The area also accommodates a masjid, which is 350 years old, known as " Khaja Amber Ki Masjid". Khaja Amber was working under the then governor of Patna, Shaistha Khan. A Jain temple that is about 500 years old is located in this area near the main gurdwara. I t is known as Jain Suretamber Mandir . The Jain temple has its access from the Bareki Gali. A minor Hindu temple is also located in this area [Figure 48].

The study area is physically bounded by the Ashok Raj Path on the North, the Har Mandir gali on the east, the Bara Gali on the west and a non-descriptive, narrow gali on the south side. The area also contains a large number of residential houses and some shops on the peripheral access routes. Due to the particular interest of the

Sikhs, because of the sites religious value, the gurdwara authorities have been buying of the property belonging to several individuals. Most of the land has now come under the possession of the gurdwara authorities. The gurdwara authorities are also constructing many new structures, which have been

designed by one Delhi based architect. The area is now quite open and spacious but the architecture of the

monuments are rather incohesive. The condition of the services is much better that the adjoining residential areas. The area remains particularly well maintained and clean due to the personal efforts of the Sikh community.

7.3.4 Gandhi Maidan

Patna has three major public open spaces. The biggest is the Gandhi Maidan located in the central zone situated to the highly congested residential area of Bakarganj. This open space is oval in shape and surrounded on all its sides by the Mahatma Gandhi Road which is almost 150 feet wide. A large number of institutional buildings and corporate offices have come up all around this maidan but on the other side of the surrounding road. This is the only public open space in the city where organised games and large public meetings can be held. The maintenance of this open space is very poor. Infrastructure for this area in terms of lighting, water, and public conveniences is inadequate. However it is very popular amongst the youth who play active games and the politicians who use this space for their public meetings [Figure 49] [Figure 50].

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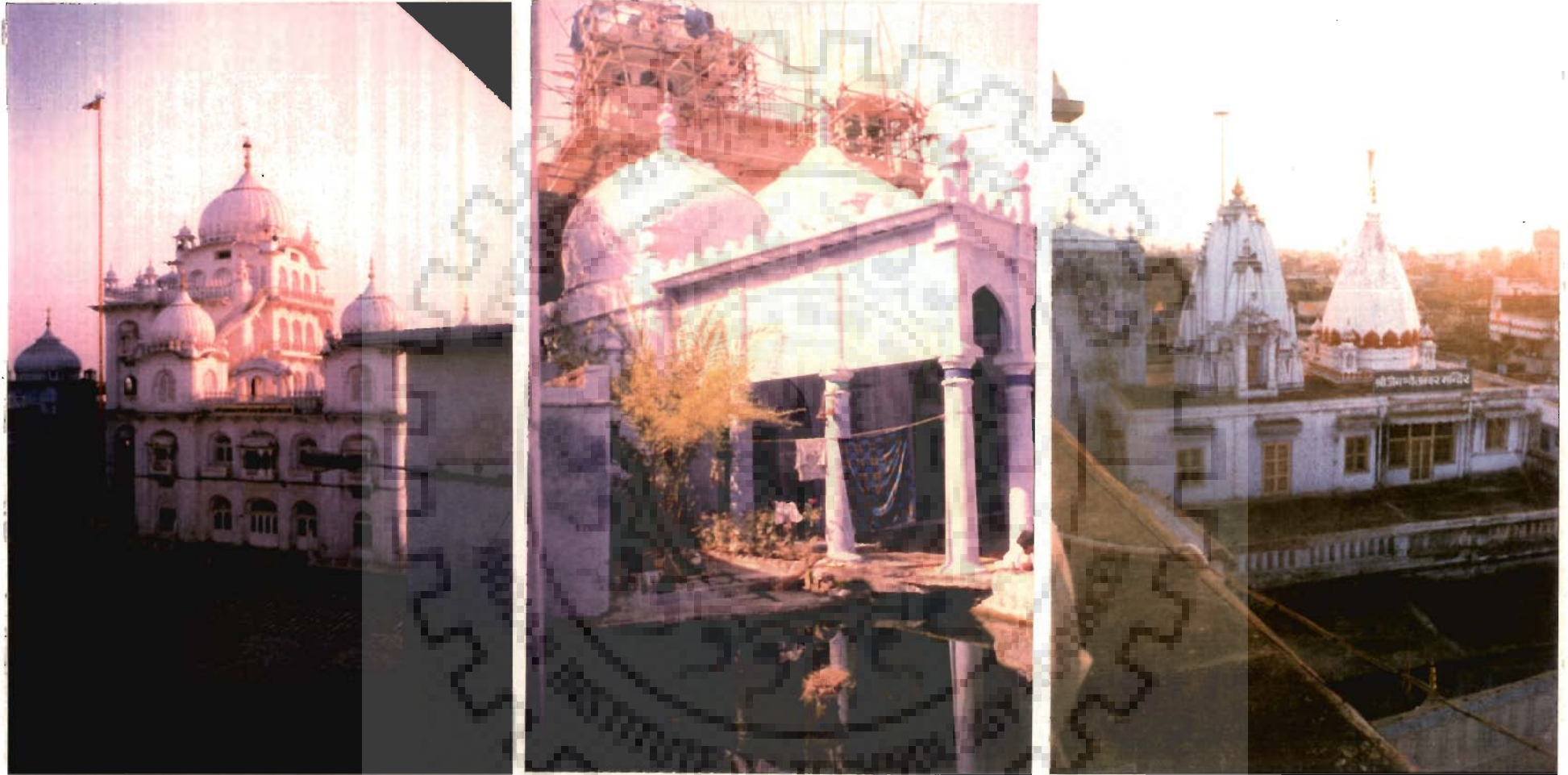
Figure 48 Photographs of Har Mandir Area.. (PAGE :- 233)

ASHOK RAJ PATH

Podium Gandhi Maidan

Flag Post

Gandhi Statue

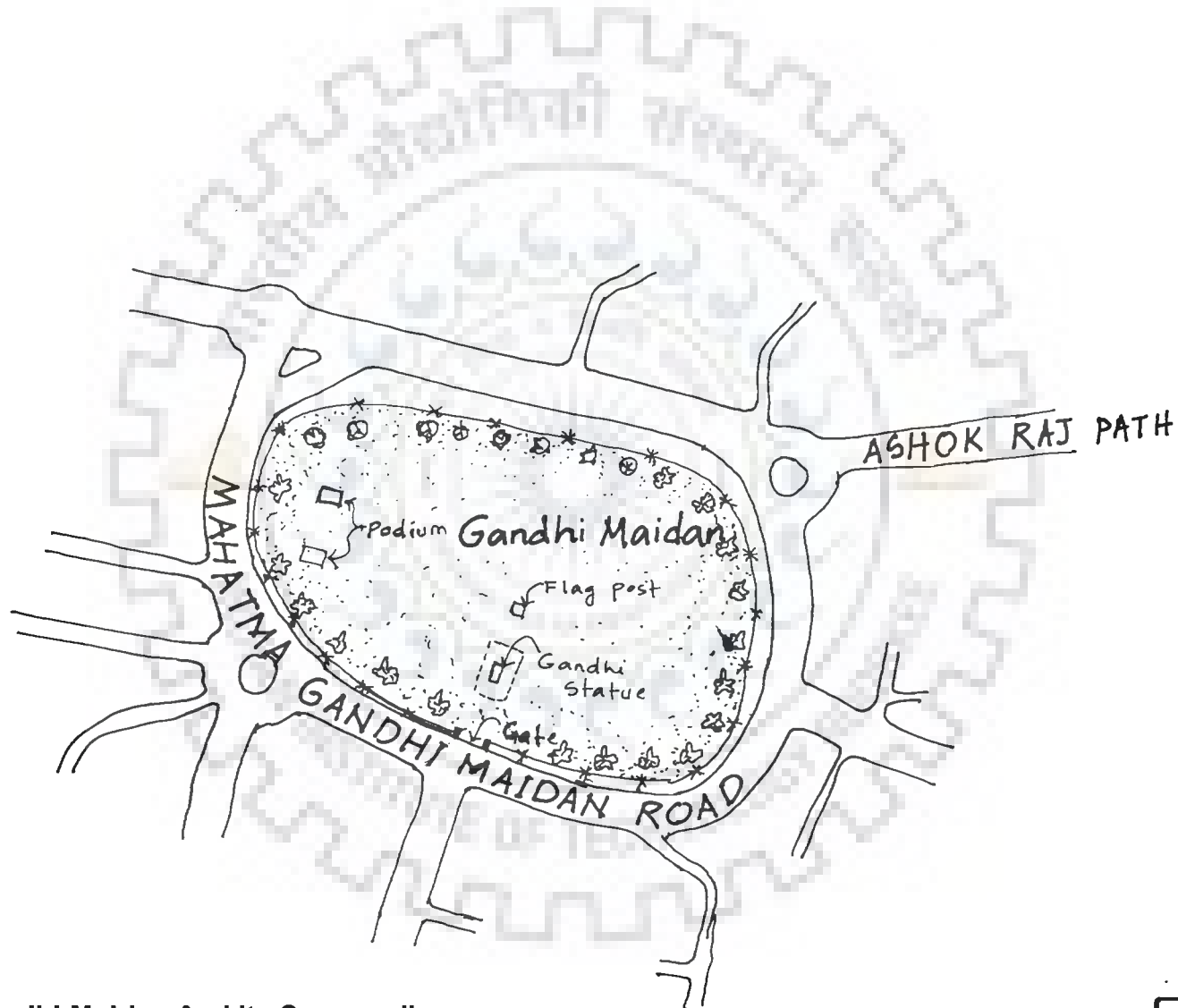Gate

MAHATMA GANDHI MAIDAN ROAD

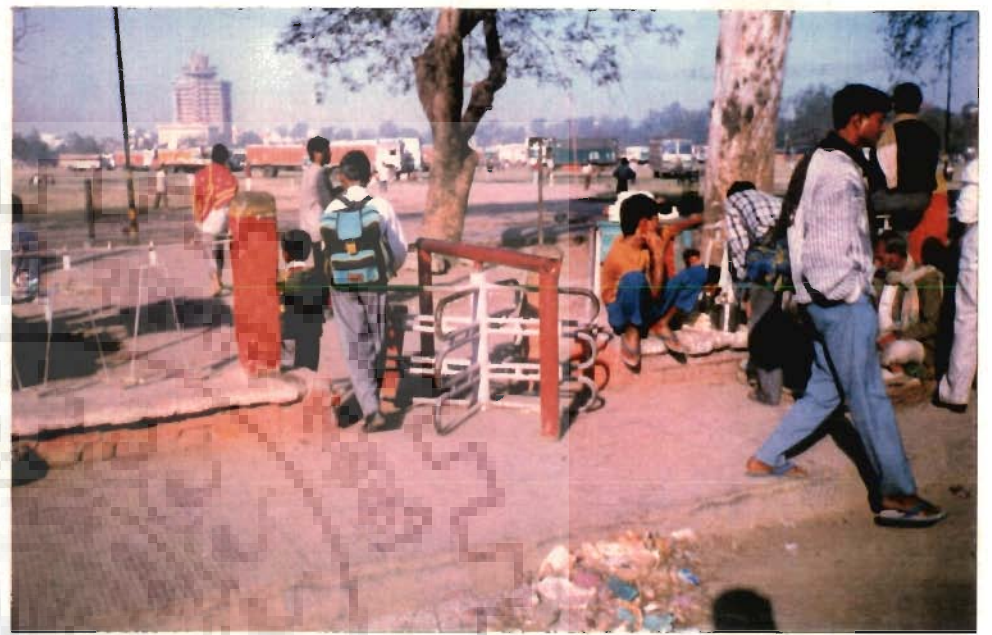**Figure 49 Plan of Gandhi Maidan And Its Surroundings.**

Figure 50 Photographs of Gandhi Maidan And Surooundings .

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7.3.5 Evaluation of the Selected Areas in Patna

Performance Evaluation of the areas described above namely Patna Market and Ashok Raj Path, Langur Gali area, Har Mandir area and Gandhi Maidan area have been carried out and presented in [Table 16] below:

Table 16   Name of the study area : Patna City

Name of the Pedestrian Spaces	Patna Market	Langur Gali	Har Mandir	Gandhi Maidan
Functional Parameters				
Land				
a) Open space available for expansion or landscape.	2	2	7	9
b) No objectionable uses that produce noise, dust, smoke, or traffic conflict.	6	2	4	5
c) Compactness of the core area of the particular land use.	8	7	6	8
Topography				
a) Slopes appropriate for proper drainage.	7	2	4	3
b) Slopes appropriate for easy construction.	8	7	6	8
c) Gradient right for easy walking.	10	7	8	9
Geology				
a) Soils appropriate for construction.	3	3	3	3
b) Soils appropriate for plantation.	7	7	8	8
Foliage				
a) Adequate for good microclimate.	4	3	3	5
b) Adequate for survival of wild life.	3	2	3	2
c) Adequate for shade or social life.	3	3	3	3
Micro Climate				
a) (Good human comfort)	6	7	7	7
Density				
a) Appropriate for qualitative living.	3	3	8	7
b) No hawkers in the area.	3	7	8	3
Age				
a) Major age groups have necessary facilities.	3	3	6	7
b) Children have play areas and schools.	2	2	5	7
c) Children have segregated pedestrian access to play areas and school.	1	3	6	4
d) Sports facilities for young boys and girls.	2	2	3	4

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e) The young have places for interaction like clubs etc.	4	2	5	3
f) The old have walk ways, resting places and places for interaction.	2	2	8	7

Religion.

a) The major religious groups have places for worship.	8	8	9	3
b) The major religious groups have appropriate community facilities.	5	5	7	3
c) There is good communal harmony between the religious groups	3	6	8	7

Sex

a) Good male to female ratio.	4	7	7	3
b) Appropriate facilities according to the male/ female ratio.	3	5	5	3

Marital Status.

a) Most of the population in the marriageable age are married.	8	7	5	5

Size of the Household

a) Housing area available for facilities proportionate to size of household.	4	3	6	5

Annual Income.

a) Good annual income and good standard of living.	4	3	6	7

Built-up Area

a) Size and the type of accommodation appropriate to the uses.	4	3	8	9

Occupancy

a) Occupancy of the uses is appropriate.	5	6	8	9

Condition of the Buildings

a) Well maintained buildings / parks.	3	3	8	4
b) Interesting man-made or natural facades.	3	3	8	4
c) Functionally up to de	3	3	8	3
d) Harmonious.	3	3	5	3

Sanitary Conditions.

a) Adequate toilets.	3	3	6	1
b) Toilets clean and well maintained.	1	3	6	1

Use supportive buildings.

a) Adequate use supportive buildings like banks, post offices and medical centres.	8	3	7	2

Internal Access.

a) No congestion.	3	5	8	8
b) Good circulation.	3	3	8	4
c) Adequate parking.	5	3	6	4

d) No conflict at traffic intersections.	4	6	7	5
e) No loading conflict.	6	6	5	5
f) Adequate footpaths.	4	7	8	8

External Access

a) Convenient access to over all town.	6	3	3	8
b) Adequate public transport routes to town.	3	3	3	9
c) Proper access for trucks.	2	3	3	9
d) Adequate parking.	3	3	2	6

Water Supply.

a) Water supply system good and adequate.	3	4	5	5
b) Adequate water for fire fighting.	4	3	5	5

Sewerage.

a) Sanitary sewer adequate and good.	3	2	5	2
b) Good storm water drainage.	5	2	5	2
c) Storm water drains covered.	5	1	5	2

Garbage Disposal

a) Adequate garbage removal.	5	2	7	2
b) All the areas clean of thrown garbage.	5	1	8	2

Telephone

a) Adequate supply.	6	4	7	6
b) Overhead wires well organised and looks clean.	2	3	6	5
c) Telephone posts well designed and properly located.	2	3	6	5

Electricity.

a) Adequate supply.	6	4	5	3
b) Overhead wires well organised and looks clean.	3	3	4	5
c) Posts well designed and properly located properly.	3	3	4	3

Lighting

a) Street lighting adequate.	4	2	6	3
b) Attractively designed street lighting furniture.	3	2	4	3

Cable T.V.

a) Overhead wires clearly Laid out.	3	2	3	5

Fire Fighting

a) Good access facilities for fire fighting.	3	3	5	8
b) Fire hydrants properly located in required numbers.	3	1	3	3

Post and Telegraph.

a) Letterboxes properly located in required numbers.	6	3	6	5
b) Post office located in the area within easily accessible distance.	7	4	6	5

Police

a) Adequate protection available. 7 3 8 6

Emergency Medical Assistance

a) Available easily. 8 3 6 5

Public Awareness

a) Public very conscious about their surrounding. 4 2 9 3

b) Good general community awareness. 3 2 9 3

Promotional Efforts of the Government.

a) Government is making good effort to improve the condition of the people. 3 1 2 3

303	255	420	349
42.08	35.42	58.33	48.47

Aesthetic Parameters

Shape

a) The skyline is interesting. 3 2 8 5

b) The settlement shape has a definite order. 3 2 3 6

Colour

a) The settlement has a nice colour scheme. 3 2 4 7

Texture

a) There is a special textural quality to the settlement. 3 3 5 7

Position

a) The area enjoys a special position with respect to the rest of the settlement. 5 2 9 9

Orientation

a) The area has a good orientation from the climatic point of consideration. 7 4 8 8

b) The area has a pleasing visual orientation. 4 2 8 8

Visual Inertia

a) There is a visual tension in the design and layout of the area. 6 4 6 5

b) The area maintains a good visual balance between buildings and spaces. 3 3 4 7

Unity of Opposites.

a) There is a good contrast between both the high and the low or between the solids and voids. 3 3 7 8

Form Defining Space.

a) The buildings define spaces in a special way such as enclosures, vistas, etc. 3 3 6 7

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Defining Space by Horizontal and vertical Planes

a) Interesting configuration of vertical and horizontal planes in the settlement.   3   2   5   8

Quality of Architectural Space

a) Good verity of enclosures of space.   3   3   7   8

b) Good views available from and in the settlement.   3   3   5   8

Openings in Space Defining Planes.

a) There are beautifully designed / special door and window openings.   3   3   6   5

b) Interesting colonnade arrangements.   3   3   6   4

Proportions.

a) The structure or architecture has a special pleasing proportion.   2   4   6   5

Scale

a) The building and open spaces are in appropriate human scale.   6   7   4   3

Axis

a) There are some buildings and spaces, which establish a desirable axis.   3   4   8   7

Symmetry

a) The settlement has situations that show symmetry.   3   3   8   6

Hierarchy

a) There is an interesting hierarchy of open spaces.   2   5   4   6

b) There is an interesting hierarchy of building sizes.   3   4   4   7

Datum

a) There is a line, plane or volume that holds together and organises a pattern of forms and spaces.   3   3   3   7

Rhythm

a) There is a regular and harmonious reoccurrence of lines, shapes or colours.   3   3   5   6

Repetitions.

a) There is a repetition of elements in size, shape or detailed characteristics.   3   4   5   5

Transformation

a) There is a recognisable pattern of transformation of the settlement.   3   6   4   6

88	87	148	168
33.85	33.46	56.92	64.62

Human Cost Aspects

Social Aspects

Social Contact in Pedestrian Routes.

a) Footpaths are very much used by pedestrians.	3	8	8	7
b) Pedestrian footpaths and pedestrian areas are used for standing and watching.	3	3	4	7
c) Benches, Culverts etc. are used for sitting in pedestrian areas and footpaths.	2	3	6	8
d) Pedestrian routes are used for walking with company.	5	3	8	2
e) Footpaths are used to stand with company and eat, watch or talk.	5	3	2	3
f) Benches on footpaths are used for sitting with company.	2	3	4	3
g) Friendship is developed while standing, sitting or walking on the footpath / pedestrian areas.	2	3	5	3

Socialisation and Circulation.

a) While walking to work, market, etc. footpaths are used for socialisation.	2	3	3	3
b) Points of modal change like bus stops, etc. are used to socialise.	2	2	2	2

Children and Their Activities on Pedestrian Paths.

a) Children are comfortable using the footpaths.	3	6	6	5
b) Children play regularly on the footpaths.	3	4	3	5
c) Children make friends on the footpath.	2	5	5	7
d) Children are safe on the footpaths and pedestrian routes.	3	7	6	7

Social Environment for Elders on Footpaths.

a) Elders are comfortable while using the footpaths or pedestrian routes.	3	6	7	8
b)Elders spend time on the footpaths and pedestrian areas sitting, reading, or talking with company.	3	5	5	8

Family Behaviour on the Pedestrian Areas.

a) The family as a whole uses the footpaths or pedestrian areas.	3	3	4	3
b) Your family meets and socialises with other families on the footpaths, pedestrian areas.	2	2	4	2

Psychological Aspects.

Comfort or Irritation on the pedestrian Areas.

a) You are comfortable with the excessive crowds on the footpaths.	3	3	3	4

b) The surface unevenness of the footpaths does not bother you.	2	3	3	5
c) The filthy and unpleasant surroundings do not bother you.	2	2	3	2
d) You are comfortable on the footpaths during inclement weather.	2	2	2	2
e) Discontinuity of flow while walking weather more or less does not trouble you.	2	4	5	2
f) Hawkers on the pavement do not bother you.	2	4	3	2
g) Beggars do not trouble you while walking on the pedestrian routes.	3	4	8	7

Tranquillity or Tension in Pedestrian Areas.

a) You are at ease even with the disorganised traffic moving about near the footpaths or inside a generally pedestrian area.	2	3	3	6
b) You are at ease even with antisocial elements hanging around in the pedestrian paths and areas.	2	3	1	2
c) You have no problem because of the noise created in the footpaths or pedestrian areas.	5	4	4	4
d) You are happy and feel secure while walking on lonely footpaths or pedestrian areas.	4	4	4	5

Conveniences and Inconveniences in the Pedestrian Areas.

a) There are adequate public conveniences like toilets, drinking water, dustbin etc. in the existing footpaths and pedestrian areas.	3	2	7	0
b) There is adequate security on the footpath and pedestrian areas in your locality.	5	4	7	6
c) Walking late at night is convenient, as there is adequate lighting in the area.	3	3	6	3

Likes and Dislikes of People Walking on the Footpaths or Pedestrian Areas.

a) You enjoy the entertainment provided by footpath performers.	5	4	4	2
b) You like to watch people moving about on the footpaths and pedestrian areas.	6	7	7	7
c) You enjoy interacting with the opposite sex on the pedestrian areas.	8	7	7	7
d) You enjoy the surroundings of the pedestrian areas in your locality.	3	4	7	8
e) You enjoy shopping from the hawkers in the pedestrian areas of your locality.	6	4	7	4
f) You enjoy eating from the stalls in the footpaths.	3	3	5	7
g) You enjoy the quite environments in the	5	6	8	8

pedestrian areas of your locality.

h) You like locations, which are purely pedestrian in your locality.	7	7	8	8

Health and Fitness.

a) You feel walking is beneficial to your heath and fitness.	8	8	8	9
b) You use the pedestrian routes in your area for walking for fitness.	4	6	5	9
c) The pedestrian areas are good for health because of the lack of vehicular pollution.	6	6	7	7

Safety

a) The pedestrians use the pedestrian areas and routes with courtesy and good manners.	3	5	8	6
b) The pedestrians are well informed about the traffic rules.	3	4	5	3
c) The drivers of vehicles use the road and other facilities with courteously and with good manners.	3	3	3	5
d) The drivers are mostly in a good state of mind while driving on the roads.	5	3	3	5
e) The physical facilities, which have been provided for circulation of vehicular traffic and pedestrian movement, are being used properly.	3	4	5	3
f) The physical facilities provided for movement of vehicles and pedestrians is adequate.	3	1	2	2

Pollution

a) The air pollution in the neighbourhood is very low.	4	7	4	4
b) The noise pollution in the locality is within reasonable levels.	5	8	4	5
c) There is no visual pollution. (Visuals which are offensive to the eye).	4	3	4	5
d) Water bodies in the area are not polluted.	3	5	4	3

Energy

a) You walk to save cost and consequently energy.	8	7	8	8
b) You worry about unnecessary use of energy for travel purposes.	8	7	8	8
c) You walk because of non-availability of motor transport.	4	5	5	3
d) In the future you will walk more and use vehicular mode to a lesser extent.	6	7	7	6
Total	213	243	285	277
Percentage Score.	38.04	43.39	50.89	49.46

Overall scores in percentages for pedestrian spaces in Patna is shown in [Table 17].

Table 17   Overall scores in percentages for pedestrian spaces in Patna city

	Patna Market	Langur Galli	Har Mandir	Gandhi Maidan
Functional Aspects.	42.08	35.42	58.33	48.47
Aesthetic Aspects.	33.85	33.46	56.92	64.62
Human Cost Aspects.	38.04	43.39	50.89	49.46

7.3.6. Conclusion

The Patna Market / Ashok Raj path area have been evaluated as a very poor design consequence. The area is functionally, aesthetically and humanly below standard, having scored 42.08 %, 33.85% and 38.04% respectively.

The Langur Gali area has also scored less than average on the Triad scale. The area is functionally, aesthetically and humanly below standard having score 35.42 %, 33.46 % and 43.39 % respectively. This area is a poor performer in terms of a design exercise undertaken in the area over the last few hundred years.

The Har Mandir area is better positioned in context to its functionality and aesthetic where it scores 58.33 % and 56.92 %. However, from the human cost point of view it makes the grade with a score of 50.89 %.

The Gandhi Maidan is aesthetically considered to be the most valuable of all the case studies taken up in the Patna City area, it has received the highest score of 64.62 %. Functionally and in the human cost aspect it is just less than the minimum grade.

Figure 51 — ASHOK RAJ PATH AREA (Funtional, Human Cost, Aesthetic)

Figure 52 — HAR MANDIR AREA (Funtion, Human Cost, Aesthetics)

Figure 53 — LANGUR GALLI AREA (Functional, Human Cost, Aesthetic)

Figure 54 — GANDHI MAIDAN AREA (Function, Human Cost, Aesthetics)
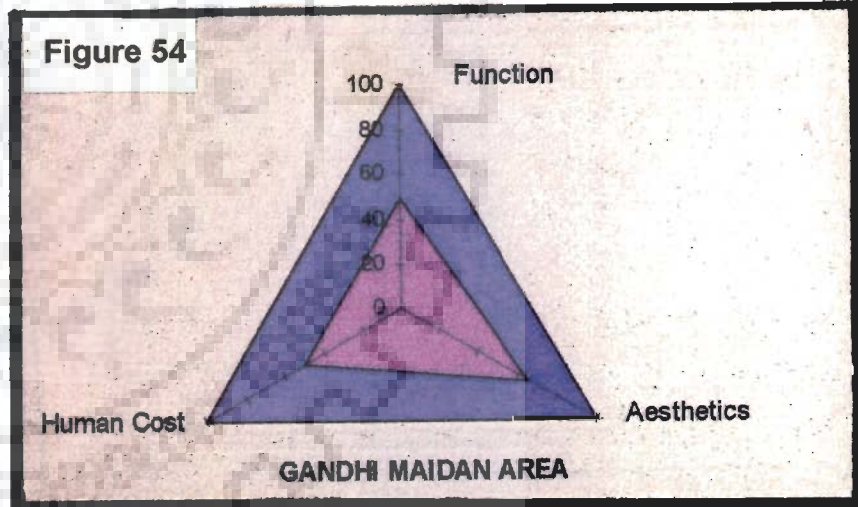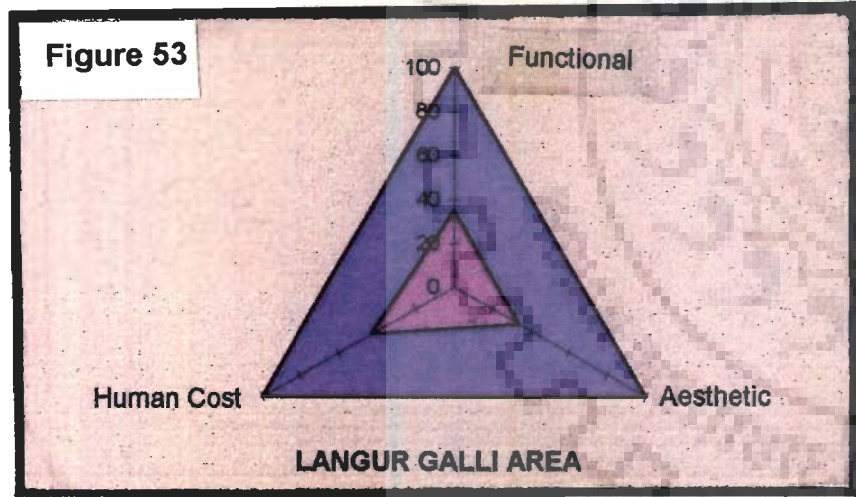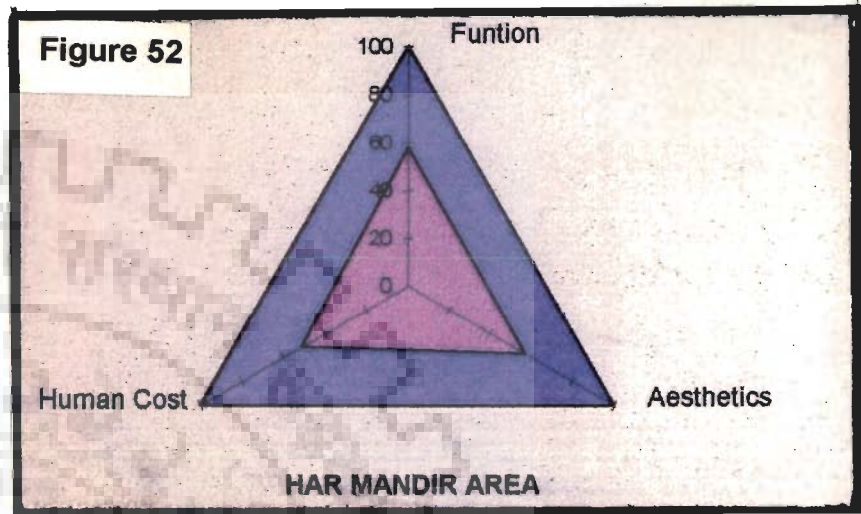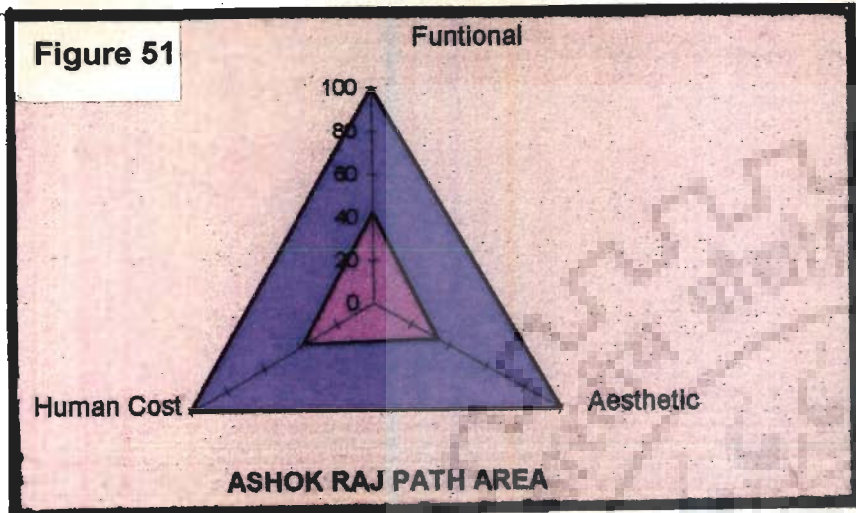
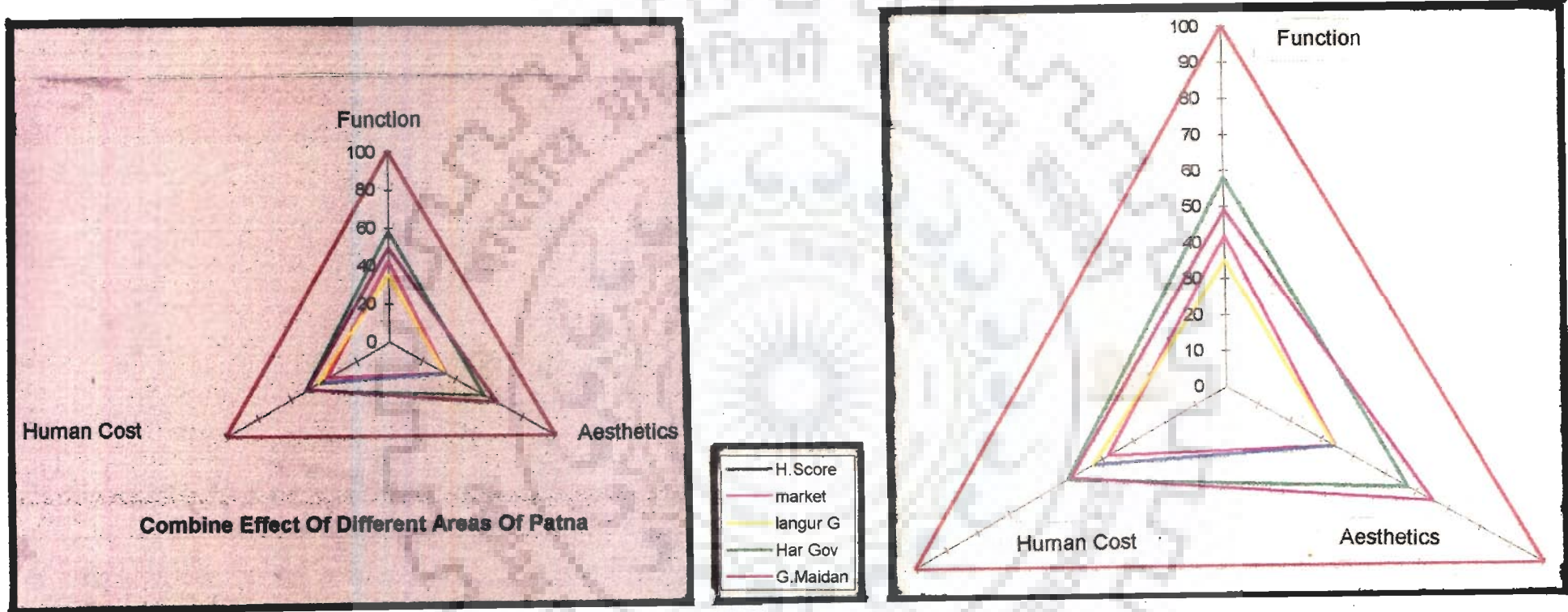| FiGURE: 51 TO FiGURE - 54 | PAGE NO: 245 | TITLE:- PERFORMANCE EVALUATION OF DiFFERENT AREA iN PATNA ON THE TRiAD SCALE. |

Left chart labels: Function, Human Cost, Aesthetics
Combine Effect Of Different Areas Of Patna

Legend:
- H.Score
- market
- langur G
- Har Gov
- G.Maidan

Right chart labels: Function, Human Cost, Aesthetics

Figure 55 Combined Effect of Different Areas on the City of Patna.

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The general level of scoring on the factors of Functionality, Aesthetics and Human Cost aspects have been low in the city of Patna. This shows that the general standards of urban environment in the city are in bad shape, further it can be deduced that the status of most settlements in the whole state is in very bad condition. The performance of the areas on the Triad scale have been shown in [Figure 51 Figure 52 Figure 53 Figure 54 Figure 55]

7.4 COMBINED EVALUATION OF LUCKNOW AND PATNA

The combined effect of the selected areas in the city of Lucknow and Patna have been put together and generalised conclusions have been made regarding markets, residential , historic and leisure areas in the National Pedestrian Zone under the present investigation and shown in [Table 18].

Table 18   Evaluation of Patna and Lucknow together

Name of the Pedestrian Spaces	Patna Market, Hasratganj and chowk	Langur Gali and Chowk Residential	Har Mandir and Hussainabad	Gandhi Maidan and Parks of Lucknow.

Functional Parameters

Land

a) Open space available for expansion or landscape. 2 3 2 2.3 2 2 2 7 9 8 9 8 8.5

b) No objectionable uses that produce noise, dust, smoke, or traffic conflict. 6 8 4 3 2 2 2 4 6 5 5 7 6

c) Compactness of the core area of the particular land use. 8 8 8 8 7 8 7.5 6 3 4.5 8 8 8

Topography

a) Slopes appropriate for proper drainage. 7 6 6 6.3 2 5 3.5 4 7 5.5 3 8 5.5

b) Slopes appropriate for easy construction. 8 8 8 8 7 8 7.5 6 8 7 8 8 8

| c) Gradient right for easy walking. | 10 | 8 | 8 | 8.7 | 7 | 8 | 7.5 | 8 | 8 | 8 | 9 | 8 | 8.5 |

Geology

| a) Soils appropriate for construction. | 3 | 6 | 6 | 5 | 3 | 4 | 3.5 | 3 | 5 | 4 | 3 | 5 | 4 |
| b) Soils appropriate for plantation. | 7 | 8 | 8 | 7.7 | 7 | 7 | 7 | 8 | 6 | 7 | 8 | 8 | 8 |

Foliage

a) Adequate for good micro climate.	4	6	2	4	3	2	2.5	3	3	3	5	7	6
b) Adequate for survival of wild life.	3	5	2	3.3	2	2	2	3	2	2.5	2	5	3.5
c) Adequate for shade or social life.	3	2	2	2.3	3	2	2.5	3	1	2	3	5	4

Micro Climate

| a) Good for human comfort. | 6 | 3 | 7 | 5.3 | 7 | 8 | 7.5 | 7 | 3 | 5 | 7 | 4 | 5.5 |

Density

| a) Appropriate for qualitative living. | 3 | 7 | 6 | 5.3 | 3 | 4 | 3.5 | 8 | 8 | 8 | 7 | 7 | 7 |
| b) No hawkers in the area. | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 8 | 5 | 6.5 | 3 | 4 | 3.5 |

Age

a) Major age groups have necessary facilities.	3	7	5	5	3	5	4	6	3	4.5	7	4	5.5
b) Children have play areas and schools.	2	7	7	5.3	2	7	4.5	5	6	5.5	7	8	7.5
c) Children have segregated pedestrian access to play areas and school.	1	4	7	4	3	7	5	6	5	5.5	4	4	4
d) Sports facilities for young boys and girls.	2	7	2	3.7	2	3	2.5	3	7	5	4	3	3.5
e) The young have places for interaction like clubs etc.	4	7	4	5	2	7	4.5	5	6	5.5	3	3	3
f) The old have walk ways, resting places and places for interaction.	2	6	6	4.7	2	7	4.5	8	6	7	7	7	7

Religion.

a) The major religious groups have places for worship.	8	8	8	8	8	8	8	9	8	7.5	3	5	4
b) The major religious groups have appropriate community facilities.	5	7	8	6.7	5	8	6.5	7	8	7.5	3	5	4
c) There is good communal harmony between the religious groups	3	8	4	5	6	3	4.5	8	2	5	7	5	6

Sex

| a) Good male to female ratio. | 4 | 7 | 6 | 5.7 | 7 | 5 | 6 | 7 | 6 | 7.5 | 3 | 7 | 5 |
| b) Appropriate facilities according to the male/female ratio. | 3 | 4 | 4 | 3.7 | 5 | 5 | 5 | 5 | 4 | 4.5 | 3 | 7 | 5 |

Marital Status.

| a) Most of the population in the marriageable age is married. | 8 | 7 | 6 | 7 | 7 | 7 | 7 | 5 | 7 | 6 | 5 | 7 | 6 |

Size of the Household

a) Housing area available for facilities proportionate to size of household. 4 7 3 4.7 3 3 3 6 3 4.5 5 5 5

Annual Income.

a) Good annual income and good standard of living. 4 8 3 5 3 3 3 6 4 5 7 5 6

Built-up Area

a) Size and the type of accommodation appropriate to the uses. 4 8 7 6.3 3 4 3.5 8 3 5.5 9 8 8.5

Occupancy

a) Occupancy of the uses is appropriate. 5 8 8 7 6 8 7 8 2 5 9 8 8.5

Condition of the buildings

a) Well maintained buildings / parks. 3 7 2 4 3 2 2.5 8 5 6.5 4 7 5.5

b) Interesting man-made or natural facades. 3 8 7 6 3 7 5 8 8 8 4 5 4.5

c) Functionally up to date 3 7 3 4.3 3 3 3 8 7 6.5 3 4 3.5

d) Harmonious. 3 7 6 5.3 3 8 5.5 5 9 7 3 3 3

Sanitary Conditions.

a) Adequate toilets. 3 3 1 2.3 3 2 5 6 2 4 1 3 2

b) Toilets clean and well maintained. 1 2 1 1.3 3 2 5 6 2 4 1 2 1.5

Use Supportive Buildings.

a) Adequate use supportive buildings like banks, post offices and medical centres. 8 8 7 7.7 3 8 5.5 7 6 6.5 2 2 2

Inter Access.

a) No congestion. 3 6 3 4 5 2 3.5 8 8 8 8 7 7.5

b) Good circulation. 3 7 3 4.3 3 2 4.5 8 8 8 4 7 5.5

c) Adequate parking. 5 4 2 3.7 3 2 2.5 6 8 7 4 5 4.5

d) No conflict at traffic intersections. 4 4 2 3.3 6 2 4 7 9 8 5 5 5

e) No loading conflict. 6 7 2 5 6 2 4 5 8 6.5 5 5 5

f) Adequate footpaths. 4 7 8 6.3 7 8 7.5 8 2 5 8 7 7.5

External Access

a) Convenient access to over all town. 6 8 7 7 3 7 6.5 3 7 5 3 7 7.5

b) Adequate public transport routes to town. 3 8 8 6.3 3 8 5.5 3 7 5 9 7 8

c) Proper access for trucks. 2 3 5 3.3 3 7 5 3 7 5 9 7 8

d) Adequate parking. 3 3 2 2.7 3 2 2.5 2 8 5 6 7 6.5

Water Supply.

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a) Water supply system good and adequate. 3 7 2 4 4 2 3 5 5 5 5 5 5

b) Adequate water for fire fighting. 4 5 2 3.7 3 2 2.5 5 5 5 5 5 5

Sewerage.

a) Sanitary sewer adequate and good. 3 7 2 4 2 1 1.5 5 5 5 2 7 4.5

b) Good storm water drainage. 5 5 2 4 2 1 1.5 5 6 5.5 2 7 4.5

c) Storm water drains covered. 5 7 2 4.7 1 1 1 5 4 4.5 2 3 2.5

Garbage Disposal

a) Adequate garbage removal. 5 7 2 4.7 2 1 1.5 7 5 6 2 6 4

b) All the areas clean of thrown garbage. 5 7 3 5 1 2 1.5 8 3 5.5 2 7 4.5

Telephone

a) Adequate supply. 6 8 5 6.3 4 3 3.5 7 5 6 6 5 5.5

b) Overhead wires well organised and looks 2 7 4 4.3 8 3 2.5 6 7 6.6 5 5 5 clean.

c) Telephone posts well designed and properly 2 5 3 3.3 3 2 2.5 6 5 5.5 5 5 5 located.

Electricity.

a) Adequate supply. 6 3 3 4 4 1 2.5 5 6 5.5 3 7 5

b) Overhead wires well organised and looks 3 6 3 4 3 1 2 4 6 5 5 8 6.5 clean.

c) Posts well designed and proper5ly located 3 5 3 3.7 3 1 2 4 5 4.5 3 8 5.5 properly.

Lighting

a) Street lighting adequate. 4 8 6 6 2 2 2 6 7 6.5 3 8 5.5

b) Attractively designed street lighting furniture. 3 3 2 2.7 2 2 2 4 3 3.5 3 8 5.5

Cable T.V.

a) Overhead wires clearly Laid out. 3 5 2 3.3 2 2 2 3 3 3 5 5 5

Fire Fighting

a) Good access facilities for fire fighting. 3 7 2 4 3 2 2.5 5 3 4 8 5 6.5

b) Fire hydrants properly located in required 3 5 2 3.3 1 2 1.5 3 3 3 3 5 4 numbers.

Post and Telegraph.

a) Letterboxes properly located in required 6 7 7 6.7 3 7 5 6 5 5.5 5 5 5 numbers.

b) Post office located in the area within easily 7 4 7 6 4 8 6 6 6 6 5 5 5 accessible distance.

Police

a) Adequate protection available. 7 8 8 7.7 3 9 6 8 6 7 6 3 4.5

Emergency Medical Assistance

a) Available easily.   8   7   8   7.7 3   8   5.5 6   7   6.5 5   3   4

Public Awareness

a) Public very conscious about their surrounding. 4   7   8   6.3 2   3   2.5 9   4   6.5 3   3   3

b) Good general community awareness.   3   7   8   6   2   7   4.5 9   8   8.5 3   8   5.5

Promotional Efforts of the Government.

a) Government is making good effort to improve   3   9   4   5.3 1   5   3   2   8   5   3   7   5
the condition of the people.

Aesthetic Parameters

Shape

a) The skyline is interesting.   3   5   6   4.7 2   7   4.5 8   8   8   5   3   4

b) The settlement shape has a definite order.   3   7   8   6   2   8   5   3   8   6.5 6   7   6.5

Colour

a) The settlement has a nice colour scheme.   3   7   8   6   2   8   5   4   8   6   7   6   6.5

Texture

a) There is a special textural quality to the   3   7   8   6   3   8   5.5 5   8   6.5 7   6   6.5
settlement.

Position

a) The area enjoys a special position with
respect
to the rest of the settlement.   5   10 8   7.7 2   8   5   9   8   8.5 9   6   7.5

Orientation

a) The area has a good orientation from the   7   4   8   6.3 4   8   6   8   8   8   8   8   8
climatic point of consideration.

b) The area has a pleasing visual orientation. 4   5   8   5.7 2   2   2   8   8   8   8   8   8

Visual Inertia

a) There is a visual tension in the design and 6   6   5   5.7 4   8   6   6   5   5.5 5   8   6.5
layout of the area.

b) The area maintains a good visual balance   3   6   8   5.7 3   8   5.5 4   8   6   7   8   7.5
between buildings and spaces.

Unity of Opposites.

a) There is a good contrast between either the 3   6   6   5   3   8   5.5 7   5   6   8   2   5
high and the low or between the solids and
voids.

Form Defining Space.

The buildings define spaces in a special way such as enclosures, vistas, etc. 3 7 8 6 3 6 4.5 6 8 7 7 2 4.5

Defining Space by Horizontal and Vertical Planes

a) Interesting configuration of vertical and horizontal planes in the settlement. 3 7 6 5.3 2 7 4.5 5 8 6.5 8 2 5

Quality of Architectural Space

a) Good variety of enclosures of space. 3 7 8 6 3 8 5.5 7 8 7.5 8 8 8

b) Good views available from and in the settlement. 3 6 6 5 3 8 5.5 5 8 6.5 8 4 6

Openings in Space Defining Planes.

a) There are beautifully designed / special door and window openings. 3 7 7 5.7 3 7 5 6 8 7 5 5 5

b) Interesting colonnade arrangements. 3 8 6 5.7 3 7 5 6 8 7 4 5 4.5

Proportions.

a) The structure or architecture has a special pleasing proportion. 2 7 8 5.7 4 8 6 6 7 6.5 5 6 5.5

Scale

a) The building and open spaces are in appropriate human scale. 6 7 8 7 7 8 7.5 4 6 5 3 8 5.5

Axis

a) There are some buildings and spaces, which establish a desirable axis. 3 8 9 6.7 4 8 6 8 9 8.5 7 2 4.5

Symmetry

a) The settlement has situations, which show symmetry. 3 7 9 6.3 3 8 5.5 8 9 8.5 6 2 4

Hierarchy

a) There is an interesting hierarchy of open spaces. 2 2 9 4.3 5 8 6.5 4 9 6.5 6 2 4

b) There is an interesting hierarchy of building sizes. 3 4 9 5.3 4 8 6 4 8 6 7 2 4.5

Datum

a) There is a line, plane or volume that holds together and organises a pattern of forms and spaces. 3 6 7 5.3 3 8 5.5 3 7 5 7 5 6

Rhythm

a) There is a regular and harmonious 3 6 8 5.7 3 8 5.5 5 7 6 6 2 4

reoccurrence of lines, shapes or colours.

Repetitions.

a) There is a repetition of elements in size, 3 7 8 6 4 8 6 5 8 6.5 5 2 3.5
shape or detailed characteristics.

Transformation

a) There is a recognisable pattern of 3 7 7 5.7 6 7 6.5 4 6 5 6 2 4
transformation of the settlement.

Human Cost Aspects

Social Aspects

Social Contact in Pedestrian Routes.

a) Footpaths are very much used by 3 8 8 5.3 8 7 7.5 8 8 8 7 8 7.5
pedestrians.

b) Pedestrian footpaths and pedestrian areas 3 9 8 6.7 3 8 5.5 4 7 5.5 7 5 6
are used for standing and watching.

c) Benches, Culverts etc. are used for sitting in 2 4 8 4.7 3 8 5.5 6 7 6.5 8 9 8.5
pedestrian areas and footpaths.

d) Pedestrian routes are used for walking with 5 8 7 6.7 3 8 5.5 8 8 8 2 6 4
company.

e) Footpaths are used to stand with company 5 10 8 7.7 3 8 5.5 2 8 5 3 5 4
and eat, watch or talk.

f) Benches on footpaths are used for sitting with 2 4 8 4.7 3 8 5.5 4 8 6 3 8 5.5
company.

g) Friendship is developed while standing, sitting 2 7 7 5.3 3 8 5.5 5 8 6.5 3 6 4.5
or walking on the footpath / pedestrian areas.

Socialisation and Circulation.

a) While walking to work, market, etc. footpaths 2 8 5 5 3 8 5.5 3 7 5 3 5 4
are used for socialisation.

b) Points of modal change like bus stops, etc. 2 3 5 3.3 2 8 5 2 7 4.5 2 5 3.5
are used to socialise.

Children and their Activities on Pedestrian
Paths.

a) Children are comfortable using the footpaths. 3 5 3 3.7 6 8 7 6 3 4.5 5 9 7

b) Children play regularly on the footpaths.   3 0 3 2 4 8 6 3 2 2.5 5 9 7

c) Children make friends on the footpath.   2 2 3 2.3 5 8 6.5 5 2 3.5 7 9 8

d) Children are safe on the footpaths and 3 6 6 5 7 8 7.5 6 2 4 7 9 8
pedestrian routes.

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Social Environment for Elders on Footpaths.

a) Elders are comfortable while using the 3 4 4 3.7 6 7 6.5 7 2 4.5 8 8 8
footpaths or pedestrian routes.

b)Elders spend time on the footpaths and
pedestrian

areas sitting, reading, or talking with company. 3 2 2 2.3 5 8 6.5 5 2 3.5 8 8 8

Family Behaviour on the Pedestrian Areas.

a) The family as a whole uses the footpaths or 3 8 2 4.3 3 4 3.5 4 7 5.5 3 8 5.5
pedestrian areas.

b) Your family meets and socialises with other 2 8 2 4 2 4 3 4 2 3 2 8 5
families on the footpaths, pedestrian areas.

Psychological Aspects.

Comfort or Irritation on the Pedestrian Areas.

a) You are comfortable with the excessive 3 4 3 3.3 3 5 4 3 7 5 4 5 4.5
crowds on the footpaths.

b) The surface unevenness of the footpaths 2 3 7 4 3 8 5.5 3 6 4.5 5 8 6.5
does not bother you.

c) The filthy and unpleasant surroundings do not 2 6 2 3.3 2 3 2.5 3 4 3.5 2 8 5
bother you.

d) You are comfortable on the footpaths during 2 6 7 5 2 7 4.5 2 5 3.5 2 2 2
inclement weather.

e) Discontinuity of flow while walking weather 2 3 7 4 4 8 6 5 5 5 2 7 4.5
more or less does not trouble you.

f) Hawkers on the pavement do not bother you. 2 4 8 4.7 4 8 6 3 5 4 2 8 5

g) Beggars do not trouble you while walking on 3 3 8 4.7 4 8 6 8 5 6.5 7 8 7.5
the pedestrian routes.

Tranquillity or Tension in Pedestrian Areas.

a) You are at ease even with the disorganised 2 3 3 2.7 3 3 3 3 5 4 6 5 5.5
traffic moving about near the footpaths or inside
a generally pedestrian area.

b) You are at ease even with antisocial 2 5 5 4 3 3 3 1 5 3 2 3 2.5
elements hanging around in the pedestrian
paths and areas.

c) You have no problem because of the noise 5 3 3 3.7 4 8 6 4 5 4.5 4 8 6
created in the footpaths or pedestrian areas.

d) You are happy and feel secure while walking 4 7 5 5.3 4 8 6 4 4 4 5 5 5
on lonely footpaths or pedestrian areas.

Conveniences and Inconveniences in the

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Pedestrian Areas.

a) There are adequate public conveniences like toilets, drinking water, dustbin etc. in the existing footpaths and pedestrian areas. 3 2 2 2.3 2 3 2.5 7 3 5 0 6 3

b) There is adequate security on the footpath and pedestrian areas in your locality. 5 7 8 6.7 4 5 4.5 7 3 5 6 7 6.5

c) Walking late at night is convenient, as there is adequate lighting In the area. 3 9 2 4.7 3 5 4 6 2 4 3 3 3

Likes and Dislikes of People Walking on the Footpaths or Pedestrian Areas.

a) You enjoy the entertainment provided by footpath performers. 5 7 5 5.7 4 5 4.5 4 5 4.5 2 5 3.5

b) You like to watch people moving about on the footpaths and pedestrian areas. 6 8 7 7 7 5 6 7 5 6 7 7 7

c) You enjoy interacting with the opposite sex on the pedestrian areas. 8 8 6 7.3 7 5 6 7 1 4 7 5 6

d) You enjoy the surroundings of the pedestrian areas in your locality. 3 8 5 5.3 4 5 4.5 7 8 7.5 8 7 7.5

e) You enjoy shopping from the hawkers in the pedestrian areas of your locality. 6 8 7 7 4 8 6 7 8 7.5 4 6 5

f) You enjoy eating from the stalls in the footpaths. 3 8 7 6 3 8 5.5 5 8 6.5 7 7 7

g) You enjoy the quiet environments in the pedestrian areas of your locality. 5 3 5 4.3 6 8 7 8 5 6.5 8 8 8

h) You like locations that are purely pedestrian in your locality. 7 8 8 7.7 7 5 6 8 8 8 8 8 8

Health and Fitness.

a) You feel walking is beneficial to your heath and fitness. 8 6 5 6.3 8 5 6.5 8 8 8 9 8 8.5

b) You use the pedestrian routes in your area for walking for fitness. 4 6 5 5 6 5 5.5 5 8 6.5 9 9 9

c) The pedestrian areas are good for health because of the lack of vehicular pollution. 6 6 5 5.7 6 8 7 7 8 7.5 7 9 8

Safety

a) The pedestrians use the pedestrian areas and routes with courtesy and good manners. 3 3 6 4 5 5 5 8 5 6.5 6 7 6.5

b) The pedestrians are well informed about the traffic rules. 3 2 2 2.3 4 5 4.5 5 3 4 3 4 3.5

c) The drivers of vehicles use the road and other facilities with courteously and with good manners. 3 1 3 2.3 3 2 2.5 3 4 3.5 5 5 3

d) The drivers are mostly in a good state of mind while driving on the roads. 5 5 4 4.7 3 4 3.5 3 4 3.5 5 5 5

e) The physical facilities that have been provided for circulation of vehicular traffic and pedestrian movement are being used properly. 3 8 4 5 4 5 4.5 5 7 6 3 8 5.5

f) The physical facilities provided for movement of vehicles and pedestrians is adequate. 3 2 2 2.3 1 6 3.5 2 3 2.5 2 8 5

Pollution

a) The air pollution in the neighbourhood is very low. 4 7 8 6.3 7 8 7.5 4 5 4.5 4 6 5

b) The noise pollution in the locality is within reasonable levels. 5 7 8 6.7 8 6 7 4 5 4.5 5 6 5.5

c) There is no visual pollution. (Visuals which are offensive to the eye). 4 7 8 6.3 3 5 4 4 6 5 5 8 6.5

d) Water bodies in the area are not polluted. 3 5 8 5.3 5 3 4 4 3 3.5 3 4 3.5

Energy

a) You walk to save cost and consequently energy. 8 5 5 6 7 5 6 8 8 8 8 5 6.5

b) You worry about unnecessary use of energy for travel purposes. 8 5 5 6 7 5 6 8 8 8 8 5 6.5

c) You walk because of non-availability of motor transport. 4 8 8 6.7 5 3 4 5 8 6.5 3 5 4

d) In the future you will walk more and use vehicular mode to a lesser extent. 6 7 5 6 7 5 6 7 5 6 6 5 5.5

7.4.1 Scaling Used for Identification of Potentials and Constraints:

Based on the evaluation done above the potentials and constraints for the area may be enumerated for direct and easy translation into physical design or appropriate management decision. The factors, which have received in the range of 1 to 3 in a 10-point scale, have been taken as a constraint. Factors

receiving 4 to 6 have been considered as normal or inconsequential and will not be reviewed. The factors, which have got in the range 7 to 10 in the above scale, are considered as potentials.

7.4.2 Potentials and Constraints in Market Area

7.4.2.1 Potentials

1) Most market areas in the region are compact in their formation and therefore suitable for pedestrianisation.

2) The slope is appropriate for easy construction in this region.

3) The gradient is ideal for easy walking in the market areas studied for the region.

4) The soil condition in the region seems quite appropriate for plantation.

5) Most market areas in the region have adequate facilities for religions worship and related activities.

6) The major religious groups have appropriate community facilities.

7) Most people in the marriageable age group are married and hence form a healthy society.

8) Most of these areas have been designed as markets and are being used for the same purpose.

9) Adequate use-supportive buildings like banks, and post offices are available in the market areas.

10) Location-wise, most of the markets are easily accessible from the other parts of the town.

11) Police help is available within easy reach for most of the markets.

12) The market area studies have emergency medical facilities close at hand.

13) Aesthetically the areas enjoy a special position vis-à-vis the rest of the settlement.

14) The buildings and the open spaces around the markets are in appropriate human scale.

15) In many cases, desirable axis is maintained by the arrangement of buildings and open spaces.

16) Pedestrian routes in these market areas are used for socialising-in the form of walking with company, eating and talking in company, or simply standing and watching life go by.

17) Psychologically the people like social interaction with the opposite sex, shopping form the hawkers, feel themselves as a part of the bustling crowd.

18) Preference is shown for areas that are totally pedestrianised within the market places.

19) The pollution leaves with respect to air, vision and sound seem to be higher than the tolerable limit in most of the market areas.

7.4.2.2 Constraints

1) Most market areas do not have any extra open area available for expansion and landscaping.

2) Objectionable uses like automobile workshops and other light industries producing, noise, dust, smoke are located in many of the markets.

3) Dearth of foliage and greenery in most of the market areas result in lack of shade and hence social interaction, as well as threaten the survival of associated wildlife.

4) Over crowding by hawkers create obstruction to shopping activities in these market places.

5) Public toilets in market areas are very inadequate and in deplorable condition.

6) Parking facilities for vehicles and accessibility for service vehicles are extremely insufficient in all the market areas of the region.

7) Telephone posts, electric posts, lighting fixtures are all poorly designed and improperly located.

8) Children are very uncomfortable in the market areas due to the presence modes of traffic and high density of population.

9) Market areas do not provide any convenient social arrangement for the elders.

10) The filth and unpleasant surroundings together with the excessive crowd cause in convenience to shoppers in the market areas.

11) Psychologically the people are highly tensed because of the disorganised traffic moving about hear the footpaths or inside the generally pedestrianised areas.

12) Market areas lack in public conveniences like drinking water, dust bins, etc. to a great extent.

13) The pedestrians are very poorly informed about the general traffic rules.

14) Undisciplined and discourteous driving in market areas cause further inconvenience to shoppers.

15) Physical facilities provided for movement of vehicles and pedestrians are inadequate in market areas.

7.4.3 Potentials and Constraints in Residential Areas

7.4.3.1 Potentials

1) The residential areas are developed in a compact manner; the population densities are high and therefore suitable for pedestrianisation.

2) The ground slope is wild and suitable for conduction and easy walking.

3) The social condition is congenial for growth of plants.

4) Most cities are located along large water bodies and therefore they provide improved conditions of human comfort.

5) The problem of hawkers is not much felt in the residential areas.

6) All the major religions groups in the residential areas have adequate places of worship and community activities.

7) A healthy male female relationship exists in the residential areas of the cities.

8) There is a sign of change in the use of buildings designed as residential units.

9) Most of the residential areas have accesses that are narrow and therefore suitable only to be used as pedestrian routes.

10) The buildings and open spaces in the residential areas are in good human scale.

11) There is an interesting hierarchy of open spaces in the residential settlements.

12) A recognisable pattern of morphological changes is observed in most of the residential areas.

13) In residential areas the footpaths are used to a great extent and therefore

indicate that pedestrian routs are very important.

14) Children are quite comfortable and safe while using the pedestrian routes in the residential areas of the cities.

15) Children find the pedestrian routes convenient for socialising, making friends and playing within the residential areas.

16) The pedestrian areas in these areas are also congenial for elders of the society and are used to a great extent by them for sitting, reading and talking with company.

17) People find the quieter parts of pedestrian routes enjoyable.

18) People in the residential areas find walking good for their general health and fitness. This indicates that pedestrianisation should be encouraged.

19) Air and noise pollution levels in residential areas of existing towers are still within tolerable limits. Care should be taken to safeguard this.

7.4.3.2 Constraints

1) Most of the old residential areas of existing cities have very little open space for expansion or for landscaping.

2) Objectionable uses are gradually finding their way into residential areas.

3) The ground slope in these areas is so level that it does not provide good drainage.

4) These areas do not have adequate foliage for good micro climate, survival of wild life, providing shade, or inducing social activity.

5) There are no special facilities available in most of these areas for outdoor games for the youth.

6) Since the residential accommodation is insufficient compared to the size of the household, there is slipover on to the outside pedestrian areas.

7) Most of the inhabitants have a low in come and therefore a low standard of living.

8) Buildings in these residential areas are and generally poorly maintained. The planning of the buildings is also not functionally up to date.

9) The availability of toilets, their cleanliness and maintenance fall much below the acceptable standards.

10) The means of access within these residential areas are just about sufficient for pedestrian use presently the onslaught of different conflicting modes of traffic easy movement, create congestion at traffic intersections and generally reduce the accessibility and circulation within the area.

11) For movement between zones, there is no facility for parking and proper arrangement for model change.

12) Water supply for general requirement as well as for fire fighting is absolutely inadequate.

13) Sewerage system and storm water drainage in the areas are very poor.

14) Garbage removal and general cleanliness in the areas are very bad.

15) Overhead telephone wires and telephone posts are all in chaos

16) Electric supply is inadequate and the overhead wires, post is totally disorganised street lighting in inadequate and the fixtures are poorly designed.

17) Access for fire fighting inadequate and fire hydrants are not available in these areas.

18) Public awareness in these areas is very low, and Government is not taking any step to improve these areas.

19) Aesthetically these areas are not at all visually pleasing.

20) Families rarely socialise in the pedestrian routes within these areas.

21) Psychologically, people are very irritated by the filth in the surroundings.

22) There is considerable tension among the pedestrians because of the disorganised traffic and the anti-socials in the area.

23) There are inadequate public conveniences in these areas.

24) Drivers do not use the road and other facilities with courtesy and good manners and thereby create problems for the pedestrians.

7.4.4 Potentials and Constraints in Heritage Areas

7.4.4.1 Potentials

1) Most heritage areas have a lot of open space around therefore, expansion and for landscape.

2) Slope available is appropriate for easy construction and gradient right for easy walking.

3) Soils appropriate and conducive to plantation.

4) Population densities in these areas are usually low and therefore, provide qualitative living.

5) Number of hawkers found in these areas are few.

6) The elderly of these areas have good facilities for their in these areas - like walkways, resting places, etc.

7) Major religious groups have places for worship and for community activities.

8) There is a balanced male to female ratio in these areas.

9) Buildings in these heritage areas are fairly well maintained, and they have in

arresting, man-made facades, which are harmonious in their nature.

10) There are adequate use-supportive buildings like banks, post-offices, and police stations in these areas.

11) Internal access in these areas is easy since there is not much congestion, good circulation, adequate parking, us traffic conflict, etc.

12) Overload wires in these areas are organised and the street lighting is adequate.

13) Police protection and medical assistance are easily available.

14) Public consciousness about the surroundings is high and there is general community awareness.

15) The skyline created by the moments in the heritage zone is positively interesting.

16) The shapes of the settlement have a definite order.

17) There is a special textural quality to the settlements.

18) The areas enjoy a special position with respect to the other parts of the city.

19) The areas have a good orientation from the climatic point of consideration.

20) Visually, the buildings in these areas are oriented in a pleasing manner.

21) The buildings define space in a special way in the form of enclosures, vistas, etc.

22) There is an interesting configuration of vertical and horizontal planes in these areas.

23) Good views are available from in and around the settlement.

24) There are beautifully designed door/window openings along with interesting colonnade arrangements.

25) The structures in these areas have planning proportions.

26) There are many buildings and spaces that establish a desirable axis.

27) The settlements show situations that have symmetry.

28) There is an interesting hierarchy of open spaces perceptible in these areas.

29) There is a repetition of elements in size, shape or detail characteristics.

30) The pedestrians intensively use footpaths available in the heritage areas.

31) Beaches, culverts and other street furniture, when available are popularly used by pedestrians.

32) Beggars are not a bother in historic places.

33) People enjoy, the peaceful environment of these places, and they like to shop from the hawkers and eat from the stalls.

34) People find walking beneficial to their health and fitness in these historic areas.

35) In these areas, people particularly find walking also cost saving.

7.4.4.2 Constraints

1) Foliage in these areas is inadequate for moderating microclimate, or wild life or social life.

2) Fire hydrants have not been provided in any of these areas.

3) People do not socialise as facilities in these areas.

4) Antisocials bother the pedestrians and create tension for them.

7.4.5 Potentials and Constraints in Leisure Areas

7.4.5.1 Potentials

1) Open space available for expansion and landscaping.

2) Most leisure areas are compact and in one large chunk.

3) The topography is convenient for construction and easy walking.

4) The soil condition is congenial for plantation.

5) Densities in these leisure areas normally attain reasonable levels.

6) Children are the main users of these areas

7) The elderly are the second most popular areas.

8) Size and type of accommodation in these areas are appropriate to its functions.

9) Occupancy of the use is appropriate.

10) There is no congestion in the internal access routes and there are adequate footpaths.

11) External access is convenient with respect to the overall town - by way of adequate public transport and sufficient parking for modal change.

12) The areas have definite shape, colour and textural quality.

13) These areas enjoy a special position with respect to the seat of the town.

14) Most of these leisure areas have good orientation from the climatic point of consideration and are visually pleasing.

15) These areas maintain a good visual balance between buildings and open spaces.

16) They have a good variety of enclosures of spaces.

17) Pathways are popular and are extensively used by pedestrians in these areas.

18) Furniture like benches are used to the maximum

19) Children are comfortable and safe in these areas. They make friends and play in the open spaces.

20) The elders of the society find these very closure places and spend time

sitting, reading and talking in company.

21) Beggars do most trouble the pedestrians under in such leisure areas.

22) People like to watch other moving around in the area. They enjoy the natural surroundings.

23) People coming to these areas enjoy eating from the stalls.

24) They like these areas because these are entirely pedestrian and hence provide a quiet environment.

25) These areas are used excessively for health fitness though walking.

7.4.5.2 Constraints

1) Young people for interaction is not using parks.

2) These green spaces are not harmonious

3) They lack adequate toilets and those that are provided are not well maintained.

4) There are not enough use-supportive structures like tents for sports facilities.

5) Storm water drainage facilities in these areas are not adequate.

6) The public is not very conscious about their surroundings.

7) People coming to these areas are apprehensive about anti-social.

8) There is inadequacy in public conveniences.

9) Walking very late in the night is not risk-free.

CHAPTER 8: INTEGRATIVE ANALYSIS

8.1 INTRODUCTION

The inferences, conclusions, potentials and constraints from the earlier chapters and data from the theoretical backup developed in chapter 4 is analysed and synthesised to arrive at recommendations for pedestrian Planning in the Indian cities.

The recommendations have been noted down under appropriate heads for ready use by the potential users of this work, which include policy makers, city planners, urban designers and pedestrian planners. Based on the detailed design findings a set of drawings have been developed which may be used as a set of design guides. This set of drawings titled " Design Guide" is placed in the report in appendix A.

8.2 INTEGRATIVE ANALYSIS

8.2.1 Policy Level

The two most important aspects that affect pedestrianisation in India are its population and its economy. These two are, then, worked out together, through good administration to make a healthy society and subsequently to achieve convenient pedestrian systems.

8.2.1.1 People

The large population of India means a large walking public. And the population of India according to the 1991 census stands at 84.63 crores which is about 16

percent of the worlds population and is growing at the rate of 2.1 percent per year. Today India has 267 person living per square kilometre of land. This is a very high concentration of people and the concentration of people in the urban areas is even more. India is likely to enter the 21st century with an urban population of 34 to 35 crores. It is also estimated that the number of cities with a population of more than one million will go up from 12 in 1981 to 40 in 2001. The high concentration of population calls for a rationalised pedestrian network for the cities of this country.

The countries like Australia, Canada, America and even Europe do not need wide spread pedestrian networks because of the sparse population densities. They need to pedestrianise only their, inner cities and may be some spot pedestrianisation in shopping areas or elsewhere. But in Indian cities, the population being very dense, almost every where, the pedestrianisation of the full city becomes an immediate need and an absolute necessity.

The problem of implementation a pedestrianisation programme in the Indian cities is manifold. The literacy of the Indian people stands at 73.1 percent in the urban areas, 44.7 in the rural areas and the all India rate is 52.5 percent, this is very low and this will affect any urban reorganisation programme due to the inherent lack of understanding and communication amongst the people. Therefore, public awareness programmes have to be worked out keeping this aspect in mind.

The health conditions are still bad, though this aspect has improved considerably over the years. The condition of the environment is deteriorating and this is bound to add on to the problems of health in the future.

Safety in India has deteriorated considerably over the years. There are now

23.8 percent deaths due to road-related accidents, 11.6 percent due to fire accidents, 11.4 percent by drowning, 6.8 percent by poisoning and 2.5 percent duet to snake bites. The deaths by road accidents in India are one of the highest in the world.

Equity is a concept that expounds the idea of things, which are just and fair. This aspect applies to several things but in this investigation it concerns accessibility in the environment with, particular reference to the towns and cities and emphasises on the movement of the poor and the handicapped. This issue of movement of the poor has been attended to on many occasions, but the case of the handicapped has not been addressed till now.

A sense of discipline is totally lacking with the Indian people. The most glaring feature, of course, is the disorderly traffic. Drivers, routinely jump queues at crossings, skip red lights, and overtake injudiciously, coming out of side streets onto main roads without stopping. Parking dangerously or inconsiderately, honking aggressively or excessively. Vehicle whiz over zebra crossings, people hang onto the sides of city buses or hop off from moving ones right in the middle of traffic.

Sights such as stray cattle on busy streets, uneven and broken pavements heavily encroached upon, litter, and wires strung over transmission lines to tap electricity are common. Disorder in trade through endemic use of adulterated or spurious goods, everyday reports of lawlessness by police, instances of disorderly public behaviour are legion.

8.2.1.2 Economy

On the economic front India is considered to be a rich country with poor people.

It is today a developing country with limited resources and its finances need to be managed very carefully.

In recent times the country has developed a large and strong "middle class" in its society, which is nearly 52 million strong. This section of the people is expected to contribute much and make the country develop steadily.

In the last few years India has, more or less, managed to provide its citizens the basic necessities of food, clothing and shelter but now people aspire for more.

Orderly conditions are a must for the country for disorder is not a mere nuisance, it extracts its price in time and energy, let alone loss in terms of money and materials.

The present manufacturing policies of vehicles should be reviewed. The manufacture of public transport equipment should be encouraged while the manufacture of the private car should be discouraged.

Investment in Infrastructure should be reviewed and special emphasis should be placed on mass transport.

Effort should be made to reduce the use of fossil fuel.

8.2.1.3 Administration

Besides the poverty and the large population the main reason for this situation is due to the inability of the democratic governments of this country to curb and punish errant public behaviour. Actually it is a failure of good governance.

The executive agencies seem to have abdicated their functions to control disorder. For anything controversial or unpleasant the politico-administrative leadership tends to shift the onus of decision making to the courts. The top

echelons of government, it appears, are only afraid of being hauled up for contempt of court.

8.2.2 National Pedestrian Zone Level (PZ -2) (Regional Level)

So far, Urban India had been dealt with as a residual issue, an adjunct to rural India. Today, this country can no longer afford to allow cities and towns to take care of them selves; they need the full and undivided attention of our planners and administrators.

8.2.2.1 People

The people of his National Pedestrian Zone have qualities that are in variance to the All India Characterisations. The people are mostly Hindus and Muslims in this Zone. The Hindus and the Muslims have different traditions and these are reflected on their built form.

The Arabic - Islamic civilisation, moulds the Muslims tradition. The development of urban design principles was formed in parallel to the development of the Islamic law. The uniform legislative guidelines and the almost identical socio-cultural framework created by Islam helped to produce remarkable similarities in the city and neighbourhood building process. Deviations from this basically uniform urban pattern did occur owing to the modifying influences of microclimates, economic conditions, available building materials and localised stylistic approaches and influences.

The Hindu traditions of city building and urban design were based on the ancient treatises, such as, Viswakarma Vastusasthra, Manasara, Mayamatam, all dating from before 3000 BC., which contain clear directions regarding the

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location and planning of villages, towns and cities.

Over the years the traditions of these two major groups have amalgamated and today a unique Indo- Islamic variation can be seen in the cities of this region. This style is visible in the arrangement of neighbourhoods, Houses, and in the feature designs.

Racially the North Indians who belong to the Indo -Aryan group occupy this region. They speak the north Indian language of Hindi and its variations. The literacy in this belt is lower than the all India average. Communication in the region will have to be done in Hindi and also special attention has to be paid to the high illiterate population while formulating awareness programmes.

This Pedestrian Zone has the highest population and the highest population densities in the towns and rural areas. Pedestrianisation should be started in this zone first.

8.2.2.2 Physiology

This zone is located in the Indo-Gangetic Plains. It is more precisely known as the Central Plain; it is formed due to the silt deposits by the river Ganga, Yamuna and their tributaries. It occupies the states of Uttar Pradesh and of Bihar. This area is very fertile, level in its topography and has fairly good drainage. This area has all the desirable attributes for Pedestrianisation, that is, opportunity for beautiful landscape and appropriate topography for walking.

8.2.2.3 Climate

The climate is the changing Hot-Dry, Warm-Humid, and cold seasons during the year with in between periods of temperate climate. The conditions are hot-dry during late April, May and June, warm humid during July, August and early

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September, cold during December, January and February and temperate for the rest of the year.

Climates with changing seasons set a difficult task for the pedestrian Planner. Solutions suitable for one season may be unsatisfactory for another.

However, many of the design criteria recommended for the Hot-dry climate and the Cold climates are the same except for minor details.

The other conflicting or incompatible requirements can be sorted out based on the length of different seasons, relative severity of the conditions and their correlation with the living pattern.

8.2.3 Town Level

8.2.3.1 City Planning.

Towns have always responded to the type of transport mode available during a particular period. Particularly, in regard to their sizes, and to the arrangement, surfacing and width of the access ways.

Since towns remain in existence for many hundreds of years, they are moulded by several, socio-economic and political factors and these are reflected in their architecture and Urban designs that one may see today.

Therefore, many of the towns have sections, which were build during the Vedic period, other sections built by the Moguls or by the British. Each section displays it own architecture and features all co-ordinated together by the access routes, which themselves depend on the access modes available at the time, to form the fabric of the town.

The two most important aspects of the town are the built areas or the land use and the other is the transportation.

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In the year 1895, with the invention of the motor vehicle, and its introduction into the cities as a mode of movement, there was a tremendous transformation to the existing cities and also to the planning of the new ones.

The architecture and the urban design along with the road arrangements were altered to facilitate the easy movement of the automobile into every nook and corner of the existing towns. Green open spaces became parking lots, dismantling the facades of buildings increased road widths, Street corners were rounded for the convenient movement of fast moving wheeled vehicles.

New areas were added to the existing cities or totally new cities were planned with the automobile in mind. The automobiles bust the city open at the seams, and till to day we are trying to hold it together.

While all this was happening the pedestrian was the most affected and the least cared.

Today, there is a transformation in thinking the whole world has realised and appreciated the ill effects of the automobile and it is today trying to set right the earlier mistakes made by mankind. There is a realisation that the welfare of man is the true object of planning; his health, happiness and convenience the primary aim.

An efficient, dynamic and proactive planning system and a time bound plan formulation, approval, monitoring and review process are the important aspects of designing and construction of a city. This allows a dynamic, participatory and self sustaining urban planning and development process and contribute to making urban centres generators of economic momentum where the quality of life would be conducive to efficient working and pleasant living.

The other aspect of a city is its management. The day to day running and

maintenance of the city. The urban managers of today face challenging tasks, they need to adopt a verity of policy tools and implement a wide range of projects and programmes and be aware of the urban trends, approaches to development problems, project formulation and monitoring, urban financial management, policies related to shelter programmes especially for the urban poor, estate management, urban community development, traffic and transportation, water supply projects and management, urban information systems, corporate management techniques, urban conservation and environment, public accountability of public utilities and training for urban development. All these aspects call for a lot of special expertise and these should be readily available to the urban managers.

The whole of urban management is an integrated entity but in this investigation, there is an accent on transportation, so the matters relating to transportation have been looked into in detail while other related matters have only a cursory reference.

8.2.3.2 Transportation Planning.

Transport systems are the key to the movement of goods and people to markets, employment, schools and other facilities and land uses. Hence the use of transport modes such as the mass transit systems, the railways, the motor vehicles are all important for the proper functioning of any dynamic settlement. But, today, the motor vehicle has become a burden on the urban system. There has been a spectacular growth in the numbers of motorised vehicles bringing in its wake frustrating problems of parking, accidents, delay, congestion and environmental degradation. It is no longer sufficient to build

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roads of adequate strength and length and to only cater to the needs of the vehicle. It is now necessary to look at the safe, efficient and comfortable movement of the vehicle and the Pedestrian (the human being) who is the most important user of the road.

One of the greatest challenges facing the next millennium is to effect an well-integrated and environmentally acceptable solution for urban transportation.

Managing transport in human settlements should be done in a way that promotes good access for all to place of work, social interaction, leisure, facilities and important economic activities. This should be done while reducing the negative effects of transport on the environment. Transport system priorities should be given to reducing unnecessary travel, developing transport policies that emphasise mobility alternatives other than the automobile, developing alternative fuels and alternative fuel vehicles, improving the environmental performance of existing modes of transport, and adopting appropriate pricing and other policies and regulations.

The need for 'green' modes like bicycle and walking is needed in our larger and medium size cities, provision of pedestrian paths and cycle tracks have been recommended in the report of the working committee on urban transport. However, since the thesis is intended to integrate 'green' modes in to the fabric of existing cities, pedestrianisation is the appropriate mode when the areas of congestion and high density are considered. However cycle tracks may be considered for new areas having low densities.

Improving cycle and pedestrian facilities.

- Encouraging high-occupancy vehicles.

- Preferential treatment to buses.

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- Using modes to their optimal carrying capacity.

- Putting a price on the use of personalised modes.

- Restraining the use of personalised modes.

- Introducing parking meters.

- Declaring certain sections as traffic free zones.

- The National commission on urbanisation (Correa 1988) has recommended that long term and capital intensive plans for transportation should give way, to the extent possible, to low-cost transportation plans. Indigenous planning models that take into account socio-economic conditions should be devised. In the medium and short range, Transport Systems Management (TSM) techniques offer low cost solutions through optimal utilisation of urban transportation plant capacity. The techniques recommended include :

- A national policy should be formulated for the pedestrianisation of the Indian cities.

8.2.4 Area Level

8.2.4.1 Urban Design

Biologically the human being is structured to use his five senses to perceive and live in the environment. However, over the years, science has helped the human being to alter and modify the environment to suit mans perceived necessities. This manipulation and alteration has affected the natural balances because the alterations made by man have not been ecologically harmonious nor sustainable in approach.

To examine mans environment one must go into the genesis of the problem.

The best place to start would be to look at the way the human beings perceive their environment.

Man uses his five senses to its optimum while he sits, stands or walks through the manmade or natural environment. So if settlements are to for the human beings, for their happiness, for their enjoyment, then the settlement should be designed with a pedestrian- centric approach.

Of the five senses the sense of vision contributes to the greatest extent to wards the human beings perception of the physical environment, the other senses of smell, hearing, touch and taste contribute marginally to man ability to perceive the environment.

It is estimated that the visual area that a man can feel to be his own territory lies within a circle of 500 metres in diameter. This also happens to be the distance that he can walk comfortably at one go.

The way a site or group of buildings is perceived is largely a function of the position of the viewer as they move along a circulation system. The scale of pedestrian spaces is much smaller than that of the vehicular circulation system and, because movement through them is much slower, detail becomes increasingly important. More attention is required in the definition of the movement corridors, views, transition spaces, and access points. Mechanical considerations are no less important with respect of slopes, transition grades with ramps and steps, intersections, and the materials used in construction.

To re-establishes the primacy of the scale of values of man on foot and at the same time adjust to the changing social conditions and environment to suit the new needs of the motor age - to utilise the advantages of greater mobility without surrendering the mastery to the machine.

8.2.4.2 Functional Aspects.

A certain amount of land can support a certain number of lives. This is known as the "Life Supporting Land". However, if the same amount of land has to support a much larger numbers of lives, than this land would need investment in Infrastructure, since the land not be in a position to provide the food and neutralise the waste created by this larger numbers of lives. Hence in cities where very large numbers of people are living together, a carefully designed infrastructural system is an absolute necessity. Infrastructure normally includes water supply, sewerage, power, road, pedestrian ways, garbage disposal, and telephone and general maintenance.

However, the quality of infrastructure in the cities of this country is abysmal when compared with that in the developed countries.

Since quality refers to those attributes that uniquely contribute to a person's sense of personal and collective well being and to their sense of satisfaction in being the residents of that particular area, the people do not expect comparable standards with the developed countries. Nevertheless, the investigation shows that the existing conditions are not acceptable.

The conditions of Patna City are deplorable. The evaluation of the various areas show that from the functional point of view the residential areas are the worst affected. The areas that are provided with the most favourable conditions are the historic- Religious areas. The disparity between the various areas is large (from about 30% to 60%).

In Lucknow, the conditions are better. Here the disparity between the various areas is less (from 40% to 60%). The worst provided area is the residential and the old market area in Chowk. The best provided is the historic-religious areas

and the market areas of fashionable Hazratgunj.

8,2,4,3 Aesthetic Aspects.

The human being is so constituted, that, confronted with the multitude of visual phenomena forming his environment, he instinctively proceeds to mentally create some kind of order out of the chaos of impressions. The act of seeing is simultaneously an act of organisation. The instinct for order is so strong that, when the environment itself is orderly, the mind seeks to understand the logic of that orderliness. The eye, which is the organ through which impressions are conveyed, is in its functioning determined by this instinct for orderliness. Each visual impression evokes in the observer a corresponding emotional reaction. It is this emotional state which can be described as the aesthetic experience ().

The enquiry into the aesthetics of the areas under investigation was carried out systematically as per the predefined parameters and accordingly results were obtained.

The inherent aesthetics in the study areas is of a high order in Lucknow while Patna is deficient. The Historic -Religious areas are the most beautiful areas. The old areas of the city are also having good aesthetic qualities, but the new addition and alterations in most old areas is inharmonious and discontinuous.

8.2.4.4 Human Cost Aspects.

From the social, psychological and economic aspects the Indian cities have been very congenial for good living. But in the recent times the excessive increase in population has had a detrimental effect. The poor functional conditions of the areas contribute to social and psychological tension.

The people have developed immunity to many of the bad effect of the existing

environment and therefore they are not in a position to judge the bad or good effect of some of the environmental phenomena. For example, they have become used to a high level of noise pollution, they do not look for a high level of hygiene in their living areas nor do they realise the pleasure of enjoying a quite moment.

The human costs resulting from the poor conditions of health, fitness, safety and pollution are neglected in the urban spaces of the Indian cities.

To overcome this large number of problems a series of curative steps have to be taken.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS AND RECOMMENDATIONS

The Integrative analysis shows that pedestrianisation in the cities and towns of India require proactive action on several issues. These have been suggested in the form of conclusions and recommendation in this section. They are grouped under the heads of Policy Level, National Pedestrian Zone Level, Town and City Level, and Urban Space Level.

9.1.1 Policy Level (National Level)

1. It is recommended that proactive action should be taken at the national level to provide the people with a liveable built environment. Liveability refers to those spatial, social and environmental characteristics and qualities that uniquely contribute to people's sense of personal and collective well being and to their sense of satisfaction in being the resident of that particular settlement.

2. The quality of life in the built environment has to be improved in the Indian settlements. Quality of life implies those attributes catering for the diversified and growing aspiration of citizens that go beyond the satisfaction of basic needs. The planning our cities calls for action that fulfils the broad goals that the people set for themselves for the future.

3. The human settlements must be developed with the concept of sustainability as a prime factor. There should be minimum disparity between the living conditions of the various social groups in the settlements.

4. The cities and towns must have a competitive edge. Well being of the citizens and the cities is dependent   on the competitive advantage, which

in turn would hinge on the efficiency of a society as a whole. And hence, being efficient at different types of economic activity is a necessary condition in order to achieve widespread prosperity.

5. Governing must be improved in the urban institutions of the country. Governing has two major components: self-discipline towards good public behaviour on the part of the citizenry - mostly learnt in homes and schools, and the ability of the authorities to control disorderly behaviour. In fact many are of the view that a leadership determined to enforce common-sense rules of good citizen behaviour can eventually promote self-discipline, especially in matters such as orderly driving or keeping a city clean. For this the people should be made aware of self-discipline and the administrative authorities like the police and others should be reorganised and re-vamped.

6. The message of the environment and its importance should be passed on to the common people. This will encourage participation in the efforts to protect and keep the environment clean.

7. Public awareness in towns and cities must be increased. Awareness has to be carefully managed through alternative means of communication. In view of the large illiterate population.

8. It is recommended that in the Indian context, creation of new towns is not necessary. Containment and decentralisation of existing metropolitan and large city agglomerations is essential.

9. Crash programmes of accelerated infrastructural development in fast growing medium sized cities should be carried out for strengthening employment generation.

10.Employment generation and priority development in medium sized cities is

required since they can reduce the problems, which are aggravated in the major cities.

11. Enlargement of the medium size city network through accelerated development of next-lower-order urban centre.

12. It has been advocated to develop and strengthen the existing small towns by locating public sector industrial development in relationship to existing small towns and to develop a system of mutual dependence.

13. Establishment of multi industry townships rather than single-industry townships is also recommended.

14. It is suggested that the economic base of existing towns is diversified and the urban management systems reorganised to enable them to emerge as viable regional centres so as to take fuller advantage of the large public investments that have been made in them.

15. The whole emphasis is to work on the existing towns and cities and make them more viable.

16. The decay and degradation of services and the increasing pauperisation of the existing urban centres should be immediately reversed.

17. The large and increasing population of the country and the high densities of its concentration calls for, immediate, integrated pedestrianisation of all settlements, particularly in the towns and cities.

18. The Unprecedented increase in the number of motor vehicles and the phenomenal growth of urbanisation in this country complemented by the very poor administration has resulted in traffic congestion, traffic breakdowns, pollution, accidents, delay, serious parking problems. This must be set-right immediately before the problem snowball into a totally unmanageable issue.

19. During the preparation of development plans for cities, traffic, transportation and pedestrianisation must be given appropriate weightage. In many of the cities there is a need for distribution of traffic instead of the unidirectional traffic that exists today.

20. Polly-nodal and Polly-centric cities and towns should be developed which will facilitate traffic in all directions without generating large volume of traffic in any particular corridor.

21. Barrier free physical environment has to be provided for the handicapped. The persons with disabilities (Equal Opportunities, protection of rights and full participation) act were passed in the Indian Parliament in the year 1995. The act besides, covering many aspects of providing relief to the disabled also directs the concerned authorities to provide and create a barrier free environment.

22. The towns of India have a wide mix of traffic modes, which renders it inefficient. It creates congestion, accidents and wastage. If the traffic is managed well it is possible to reduce the disadvantages while optimising the advantages of these various modes.

23. The concepts of pedestrianisation can go along way in solving the may sided problems of our cities. They have a very useful role in mitigating traffic problems as a supporting mode and to improve mobility, accessibility and the general state of the urban environment.

24. Pedestrianisation is the most sustainable mode of movement avail to mankind and should therefore be used to the maximum in the towns and cities of India.

25. Pedestrianisation must be done to reduce the rate of road accidents. The

rate of road accidents in the country has been increasing in multiples and has been bringing to the family's economic loss and the trauma that accompanies such accidents.

26. Pedestrianisation will reduce pollution. Vehicular pollution is responsible for about 60 to 75 percent of the total urban pollution; this can be reduced through pedestrianisation.

27. Individual vehicle ownership should be discouraged. Since their transportation problem can never be solved by individual vehicle ownership for neither the economy of the country nor the width of the existing roads permits the same.

28. Vehicles using fossil fuel must be discouraged. The economic burden on the country because of the large utilisation of fossil fuel is unbearable. Time and fuel are running out. India's appetite for energy will lead it to buy more energy and thereby affect the national economy; the only solution is to tap renewable and non-conventional energy sources. Hence, energy saving by well-worked out pedestrian system in its cities will be an adequately justified objective.

29. Government must set aside funds for introducing mass transport system wherever possible-either by metro rail or surface rail, or even by way of fast bus system on outer ring roads of cities. This will not only lessen the cost of communication for the citizens, but also free the city roads of unnecessary private vehicles.

30. Low cost transportation schemes such as the pedestrianisation schemes must be given precedence over capital intensive transport projects.

31. Transport plans showing the detailed pedestrian networks should be prepared for all towns with population of 3 lakhs and above. It is felt that the

know-how for the preparation of such a plan is easily available so a committee should be formed to look into the mechanism of plan preparation.

32. There is a need for the establishment of a special administrative cell at the national level, to look into and popularise the concept of pedestrianisation in the Indian cities. This cell should have the necessary profession expertise to undertake traffic survey, prepare and monitor traffic and pedestrian planning. Further, there should be similar cells at the state levels to monitor, collect data, supervise planned schemes and look after administrative and legal policies.

33. Protection of pedestrian paths and spaces against encroachment by all and sundry, particularly the squatters and the hawkers has become a national problem. It is therefore recommended that a special pedestrian police force be established in the lines of the mounted police or the traffic police to protect pedestrian paths and open spaces in the cities and towns.

9.1.2 National Pedestrian Zone Level

In this pedestrian zone, the Hindus and the Muslim are the largest two religious groups. Both these groups have different cultural identities leading to conflicts in Indian cities. These are due to the division created by caste, religion, sectarian afflictions, or regional origin but having lived together for several hundred years many of these conflicts have been smoothened. These factor are reflected in the physical urban structures and transformations of the Indian cities and the same should be dealt with appropriately in the pedestrian planning of the areas.

It is recommended that since the literacy in the zone is low, communication in the region should be done in Hindi and special methods must be conceived in

formulating awareness programmes for successful implementation of urban development and pedestrian planning projects.

This National Pedestrian Zone has the maximum population densities in the whole country. It is therefore recommended that pedestrianisation must be taken up immediately in this zone.

The physiology of the land has a lot of impact on the type and arrangement of the pedestrian networks. For example in the mountainous and snowing regions the following aspects has to be looked into.

1. Salting should be done to the pedestrian areas where there is snowing.

2. Handrails should be provided along pedestrian areas for the protection of people from sliding in the snow.

3. The pedestrian areas should have buildings closely spaced on both sides for protection against the cold winds.

4. The towns in mountain region have areas which are sun-shaded (sun does not fall in certain areas because of the hills and hill slopes), these areas should not be used for pedestrian facilities since sun light and the heat from the sun is desirable in this region.

5. The towns in mountain region have windward areas. In these areas strong winds blow, this is also because of the configuration of the hills. These areas should be avoided while designing and providing pedestrian facilities.

6. Landslides are common in mountain regions. Precaution for this should be taken while designing pedestrian routes and facilities.

7. Most pedestrian routes in mountain areas will be having steep slopes, at least on one side; therefore care must be taken to provide continuos handrails or other protections in such cases.

8. Certain sections of the mountains are known as areas of shooting stones (falling stones). These areas should be avoided while organising pedestrian routes. If this is not possible then appropriate steps for protection must be taken.

9. In the mountain areas where there is snowfall the pedestrian pathways

should not have a slope of more than 6% in order to avoid slipping on the surface.

However, in this National Pedestrian Zone, the terrain is flat and featureless so there will be few opportunities to use the aspects mentioned above except in cases where there is a micro level variation. The land in this zone is most favourable for pedestrianisation because of the convenient land form.

This National Pedestrian Zone lies in the Composite Climatic Zone and therefore the following measures are recommended.

Large projecting eaves and wide verandahs are needed in the warm-humid season as out-door living areas, to reduce sky glare, keep out the rain and provide shade. They can also be an asset in the dry seasons. Louvers and other sun breaks used to protect openings during the hot period, are also advantageous in the rainy season, serving as protection against rain and wind driven spray. Shading devices should preferably be of low thermal capacity.

During the cold season, when solar gain is welcome, all shading is undesirable. For the dry seasons controlled landscape and enclosure walls, are necessary to provide protection against dust and thermal winds. They are no great disadvantages in the wet season.

The high rainfall makes it easier to maintain vegetation around the open spaces thereby reducing dust. A courtyard is the most pleasant out-door space for most of the year, because it excludes the winds and traps the sun. It should be designed in such a way as to allow sun penetration during the winter months, but provide shading in the hot seasons. Deciduous plants can serve a useful purpose. A pergola, carrying deciduous creepers may cover courtyards. These would provide shade in the hot season and admit the sun in the 'winter'.

In the composite climatic region there should be a variety of open spaces for the changing climatic pattern.

There should be small arcade type of facilities on the pedestrian pathways, located at intervals, to provide protection against rain and inclement weather.

9.1.3 Town and City Level

The basic issue today, which confronts the city planners and administrators, is to plan and design the settlements so that the people who live in them lead a healthy and satisfying life.

Urban transportation is the most important single component instrumental in shaping urban development and urban living.

Towns have always responded to the type of transport mode available during a particular period. Specially, with regard to their sizes, arrangement, surfacing and width of access ways.

The future of transport systems planning and design offer good scope for decentralisation and de-congestion of population and activities through the emergence of a dispersed yet functionally knit pattern of settlements. This could be articulated at the regional level in the form of clusters of mono and multi-functional centres around a core city linked by fast-movement corridors. At the metropolitan and large city level, the articulation could come through a 'town within town' concept wherein self-contained and manageable functional communities are identified within the metropolitan fabric.

Non of the literature have suggested total pedestrianisation of the city and complete removal of vehicular traffic from it in view of the circumstances that most of the cities have grown beyond the size of a persons walking capacity.

Most of the Indian towns have mixed traffic consisting of motorised and animal drawn vehicles. This makes the movement of traffic quite inefficient. It creates

congestion, accidents and precipitates wastage of energy while at the same time degrading the environment.

Most of the literature expresses the fact that motorised traffic is the biggest polluter of the environment. Some of them are of the opinion that it should be cut off, particularly from the central business district and from the residential areas.

Integration of the traffic network of the city, both upward from the regional, district and local level and downward to the neighbourhood and right up to the building is stressed in many of the literature on transport planning. The modal changes become important in these circumstances.

Pedestrianisation and bicycles seem to be the favourite modes, for movement within cities.

Journey to work and back accounts for more than 50 percent of trips. The demand for transport can be reduced substantially by locating work place in the proximity of residential areas.

Minimum walking to centre of activity, taking into consideration that pedestrians tend to use the shortest possible route.

Cycles did not become a popular mode of transport in urban India, as it was expected in the early 1950's and 1960's. However this mode of travel remains quite popular in the rural areas of the country.

9.1.3.1 Application of Model

At the town and city level it is recommended that the model titled " Integrated Multi-Modal Accessibility Model" and developed in chapter 5 of this investigation, should be used for the integrated pedestrianisation of the concerned town or city.

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The recommended strategy to be used for the purpose is as noted below in detail.

The primary action to be taken in this regard is to incorporate the pedestrian mesh onto the inherited city by using, and supported by, professional knowledge in town planning.

(a) Take the inherited road network plan of the city under consideration.

(b) Mark the roads as per their access hierarchy, namely, arterial and sub-arterial roads at the town level, collector roads and feeder roads for neighbourhoods, etc.

(c) Overlay the land-use resources and the cultural resources on the city plan.

(d) Overlay the "Pedestrian Mesh" on the city plan.

(e) The "Pedestrian Mesh" should then be "bent-on" to the inherited road network of the city as per convenience. Care should be taken to ensure that the arterial roads and other important roads are integrated with the mesh lines and proposed as the vehicular access roads of the town. As far as possible, the neighbourhood and local roads should not be used for movement of vehicles within the town.

(f) Land-use resources and cultural resources should not be disturbed by the cutting across by vehicular roads.

(g) Action must then be to improve the road networks to cope with the reorganised vehicular traffic. This should be done without affecting the aesthetic qualities of the buildings on both sides of the roads.

Study Of the Settlement Identified for pedestrian planning

It is recommended that previous knowledge on the Land Use, cultural and other resources of the town should be clearly understood and established before

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using the above model.

Some of the aspects to be identified prior to preparation of the pedestrian plan for the city are noted below for guidance.

- Location and regional setting of the town.

- Importance of the town

- Existing generalised land use.

- Heritage sites, buildings and areas.

- Education. health care, recreation, religious. cremation and graveyards.

- Traffic and Transportation system of the city.

- Transportation in the city is an important issue since pedestrian planning concerns itself with movement and accessibility with in the city and also with the out side.

- Traffic and transport survey of the existing city has to be done to identify the strengths and weakness of the present system.

Assessment Of Present And Future Demand

- After knowing the existing situation it is necessary to find out the traffic and transportation demands on the road net work and the pedestrian linkages in the future. This may be established by using the traditional four-stage transportation planning process and using the Identified Pedestrian Environment Areas as the traffic zones.

The transportation model commonly known as the gravity model may be used for the purpose. This has to be done in the four stages of 1) trip generation, 2) Trip distribution 3) Modal split and 4) Trip Assignment.

Survey Of Existing Traffic Conditions

Detailed traffic and transportation surveys have to be carried out while going in

for the actual improvement of the roads.

The surveys required for the proposals to be prepared are 1) street surveys 2) Street parking survey 3) off street parking surveys.

Street surveys should include pavement crossings, loading bays, bus stops, taxi stands, pedestrian crossings, visibility splays at junctions, private streets, service and rear alleys, vacant or unused land suitable for temporary or permanent parking space, carriageway widths and any other factor, which may be relevant locally.

Street parking survey shall include controlled parking, areas prohibited for parking, controlled loading and unloading.

Off street parking shall include type of parking, ownership and use, parking for commercial vehicles only, parking on payment, time limited parking, number of parking spaces available, size of parking areas and number of entrances and exists.

Improvement of the Road Network

Since the existing road conditions are known from the survey and the anticipated traffic has been calculated by the gravity model mentioned above, appropriate proposals might then be made to accommodate the traffic and transportation needs of the present and the future.

9.1.3.2 Other Policies and Priorities

Since the planning model is for segregated pedestrian and vehicle access routes the following three provisions should be adopted.

Complete separation of pedestrians and vehicles is desirable in the high-density areas or in the centre of a town where the traffic is intense. In less

Table 19   Classification of Area and Type of Mode of Travel Permissible

Class of city	Type of densities	pedestrian environment area level	general environment area level	intra city level	inter city level
Class 1	congested areas	pedestrian only	auto-rickshaw scooters	auto-rickshaw scooter car bus	car bus truck
	Medium areas	pedestrian only	auto-rickshaw scooter car	auto-rickshaw Scooter car bus	car bus truck
	Open areas	pedestrian only	auto-rickshaw scooter car bus	auto-rickshaw scooter car bus	car bus truck
Class 2 to Class 4	congested areas	pedestrian only	auto-rickshaw scooter car bus rickshaw	auto-rickshaw scooter car bus	car bus truck
	Medium areas	pedestrian only	auto-rickshaw scooter car bus rickshaw	auto-rickshaw scooter car bus rickshaw	car bus truck
	Open areas	pedestrian cycle rickshaw	auto-rickshaw scooter car bus rickshaw	auto-rickshaw scooter car bus rickshaw	car bus truck
Rural Area	congested areas	pedestrian only cycle rickshaw	auto-rickshaw scooter car bus rickshaw animal-vehicles	auto-rickshaw scooter car bus rickshaw animal-vehicles	car bus truck
	Medium areas	pedestrian cycle rickshaw	auto-rickshaw scooter car bus rickshaw animal-vehicles	auto-rickshaw scooter car bus rickshaw animal-vehicles	car bus truck
	Open areas	Pedestrian. Cycle. Rickshaw.	auto-rickshaw scooter car bus rickshaw animal-vehicles	auto-rickshaw scooter car bus rickshaw animal-vehicles	car bus truck

populated areas a small, central pedestrian pathway can lead to each residential unit or pass through it. Thus the combination of both settings establish a continuous pedestrian network radiating from the central parts of the town to the peripheral parts and beyond. Based on the principles of these patterns, pedestrian pathways can link separate blocks to culs-de-sac and focus of social activity.

Maximum separation of all vehicles and minimum mixing of powered vehicles and non-motorised vehicles.

Encroachment of the right of way and pedestrian paths should be removed and protected against such acts.

The type of cities, type of congestion / densities and the type of traffic mode permitted is shown in the[Table 19] above.

Safe movement for children and parents from homes to green areas and open spaces, play grounds, elementary schools, kindergartens and other neighbourhood cultural and economic centres.

Footpaths must never take the form of pavements running along side of the major roads. [27].

Cyclists and pedestrians should not be allowed into the primary net work of roads for reason of safety and the free flow of vehicular traffic.

The basic facilities of footpaths and open spaces for pedestrians which have been provided in a small way in the metropolitan and big cities have been taken over by hawkers and squatters largely due to the lax administration of the local authorities and the political bosses, thereby pushing the pedestrian onto the vehicular road and bringing danger to himself while at the same time

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disrupting the smooth flow of motor traffic. The Calcutta Metropolitan Development Authority has tackled this problem in 1996 and the strategy for this type of action is recommended below: (Refer paper on Calcutta, and Clearance of Hawkers)

Most of the Indian cities have lost all their public spaces to the onslaught of the hawkers and the squatters due to the negligence of the local authorities over the years. The problem has already become enormous and it is not possible for these local authorities to set-right the situation on their own.

The local administration cannot seek the help of the political parties because these parties would not like to infuriate the hawkers and squatters who form a part of their vote banks. There will be total reluctance to help particularly when the elections are near.

In recent times the judiciary has come to the help of the city administration and the common citizen by intervening on their behalf. Therefore, the help of the judiciary should be sort on these matters whenever possible.

The city administrators should not seek a lead from the citizens on this matter since they support this type of clearance of the public spaces but they cannot come out publicly with their support in fear of retribution from the hawkers and squatters.

Any strong action taken by the city administration should be followed by efforts to rehabilitate so that the sympathy of the people remains with the administrative institutions and does not move away to the hawkers or squatters

Once the city administration succeeds in clearing the hawkers and squatters from the footpaths and parks of the cities they should be vigilant and be firm in maintaining the public spaces from repeat encroachment of hawkers and

squatters and this should be done on a regular and continuous basis.

While checking the aesthetics of an area one should look for unity rather than uniformity.

The town should be divided into sound zones based on the land use map of the city and the delineated Pedestrian Environment Areas in the city. There is to be four sound zone: industrial, commercial, residential and silence zones.

Sound levels in industrial zones must not exceed 75 decibels in the day and 70 decibels in the night. Decibel limits stipulated for the other zones during daytime and at night, respectively, are: commercial, 65 and 60, residential 55 and 45, silence 50 and 40.

The damage done to the old parts of the city due to the adjustments made therein to allow the smooth movement of automobiles should "set right" as far as possible.

9.1.3.3 Some Other Issues of the Towns in This Region

There are a number of related issues that have been identified as applicable to the Indian urban scenario, the issues need immediate attention and redress, and these have been stated below:

Master Plans have been prepared for most of the large and medium towns in India. However, the work has not been completed for the small towns. But in case of zonal Development plans, almost no work has been done except in case of a few in the metropolitan cities. Updated Plans at the area levels are not available for most towns in the country. Since pedestrian planning is mostly done at this level, taking up pedestrian planning work in the Indian towns and cities is difficult.

It will be fair to conclude from the Chandigarh experience that when the desire is there it is possible to have pedestrian facilities, teach the people to use properly with care and enforce the correct usage in the Indian cities.

Another aspect is that know-how is lacking, there are no experts in the area of working out the pedestrian arrangements amongst the town planners or the architects. The area of pedestrian arrangements are considered as too negligible for the town planners who feel that there work involves the upper scale of town planning while the architects are limiting there work to only individual buildings and cannot contribute to the access arrangements between buildings.

Pedestrianisation is being adopted in Indian cities, in crisis circumstances, when the number of people to be dealt with is far beyond the normal as in the case of Hardwar town during the Maha Kumbh Mela or the town of Puri during the Rath Yatra.

There are many cases of the very rich finding the urban environment lacking in qualitative open spaces and therefore trying to substantiate this shortage by constructing " farm houses" at the periphery of the towns.

Up to date data regarding pedestrians and pedestrian movement is not available for our cities. This should be generated for the cities and city areas so that detailed designs could be prepared based on this data.

Integration of pedestrian networks into the fabric of existing towns, as per the planning methodology developed in this thesis, is a low cost transport improvement measure and therefor it will get precedence over capital intensive projects, particularly in a developing country like India.

The engineering facilities provided for both the pedestrians and the vehicular

traffic is inadequate and must be improved.

Almost 15 to 20 of the total urban surface is used for roads to move people and goods. If the pedestrian networks were properly provided the total surface for movement of the same traffic would reduce.

Comprehensive provisions for area conservation must be explicitly recognised as an integral part of the town planning process, that is of the land use plan, building regulations and development policies.

The morphology of a town reflects the various socio-economic and political circumstances through which a town has passed. This information allows a sensible and a historically appropriate intervention by the concerned planner.

Therefore, while rearranging the city traffic, it is recommended that the morphology of the city should be recognised and dealt with according to their origin. Many of the cities of India have been built over the years and they reflect the planning style of the various types of rulers and the culture and tradition of the people. The Principles of the Vedic period, the Moguls, the British and the ideas of modern independent India may be found in the different areas of the same settlement.

The portions of the city with Vedic origin will be formal consisting of two central axial roads with its orientation in the east-west direction, the size of the roads being as per their importance and the anticipated volume of pedestrian and animal drawn traffic of those times. However, there may be very few places in North India where such features will found today.

The portion of the city built during the Muslim period that is pre-Mogul period there would be a fortification around the city. The streets would be narrow, paved, with twists and turns and with a number of town squares. This was to

ensure that the intruder was confused during the periods of war.

In the towns built by in the colonial period the residential areas of the white population were clearly separated from those of the native population. The white areas where developed with the horse-carriage as the usual mode of transport and therefore these areas could be reused by the automobile in subsequent period. However the native areas were allowed to grow with out much direction under the supervision of the local bodies. These areas developed mostly as pedestrian areas and within the human scale.

The British developed very interesting pedestrianised urban spaces in their cities and towns. They consisted of the Esplanades and Malls besides the entertainment and commercial centres.

While identifying sections for pedestrianisation it is necessary to remember that the Hindus were the original residents of India, the Muslims came as conquerors and settled down in the country, making this their home. On the other hand the British came to this country to rule and exploit the resources for the benefit of their homeland. So there is a merging of the Hindu and Muslim cultures, which is then manifest in the urban structures of the towns and cities. This did happen, to a certain extent, in the case of the sections built by the British also, but there still remained a major distinction.

The basic house design of the Hindus and the Muslims were identical. The difference lay only on the scale and the details. The courtyards of the Muslims were larger than those of the Hindus. These were sometimes elaborately detailed with interior fountains and pools. This was because the Muslim women spent most of their lives inside these compounds.

Almost every house in this region has a flat walled rooftop, reached by a

narrow stairway, and this open area is an important centre of domestic life. These rooftops are also centres of recreation and the popular pastime of kite flying and pigeon flying were developed because of the spatial parameters offered by the rooftops.

A basic principle of spatial organisation is that open spaces are also interior spaces, invariably surrounded by high walls. One's impression of stifling congestion among the lanes would be altered, if one could view the city from above, and see the thousands of open courtyards that honeycomb the old residential areas.

The colonial areas are antitheses of the spatial organisation of the Hindu and Muslim areas. The urban design of these areas consisted of open networks such as open passages, streets, public open spaces, parks, squares public institutions and houses set in open lots facing the street.

Most cities in this zone have sections that can be divided into the Hindu areas, the Muslim areas and the "civil lines" built by the British. Accessibility into the Hindu and Muslim areas are normally narrow and usually for pedestrian movement, while the European sections are having wide and strait roads laid out for the movement of horse carriages but subsequently used by the motor vehicle.

9.1.4 Urban Space Level

Once the Pedestrian Environment Areas have been delineated at the city level, only pedestrians will use all access facilities within the Pedestrian Environment Area.

The existing access surface should be retained as far as possible to avoid

immediate expenses to the Nagar panchayat, Municipal Corporation or the development authority. With the availability of resources the following prioritised action should be taken.

Garbage disposal from the area should be taken up as the highest priority. The area should be kept totally clean. Unattended Garbage is the biggest offender in the inner areas of the Indian cities.

The proper drainage of the area would be the next priority. The reorganisation and realignment of the water supply and the electric-supply lines should be done.

All these lines should be taken above the pavement level so that maintenance of the lines does not require the regular digging up of the pavement surface which destroys the surface evenness and its aesthetic qualities.

Space for community parking of cars and scooters should be identified near to the outer perimeters of the Pedestrian Environment Area and close to the vehicular corridors.

Animals like cows, buffaloes and sheep are being kept inside human settlements this causes a lot of problems inside these areas with regard to cleanliness, maintenance of storm water drainage, mosquitoes and other related problems.

Pedestrian pathways should have as far as possible level walks inter-spiced by small groups of steps to discourage the movement of wheeled vehicles like rickshaws, scooters, cycles, etc.

9.1.4.1 Surfacing

The materials used on pedestrian surfaces outdoors should be considered carefully, No slick or polished surface finishes should ever be used. This includes materials like ceramic tiles, steel trawled finished concrete, terrazzo, and polished stone. Even small amounts of moisture on these surfaces can make walking treacherous. Always try to select materials and finishes that will provide positive footing in all weather conditions.

Material texture is also another important consideration. Any material used on a walk should be relatively smooth. The aggregate size used in exposed aggregate pavements should be reasonably small. Larger rock makes a very uncomfortable surface. Sharp aggregates should also be avoided.

Some of the materials and designs recommended for this national pedestrian zone are mentioned here.

- There is easy availability of good quality bricks in this zone. Therefore, bricks in the various layouts found commonly in the region may be used.

- Pre-cast cement slabs in different sizes are common in these areas, and can be used conveniently in new pedestrian paving.

- Chequered tiles are an alternative.

- Sand Stone slabs and Cobble stone flooring can be used in the areas were it is available. Particularly in Patna and its surrounding towns. However cobble stone surfacing is not convenient for walking.

- Tar Macadam surfacing is cheap, and easily available. This may be used for pedestrian surfacing.

- Detailed drawing for a verity of surface designs in bricks and other materials have been included in Appendix- A as a design guide.

9.1.4.2 Width

Widths of pedestrian pathways vary depending on the purpose of the pathway and the existing or expected intensity of use. As a general rule of thumb, a 24-inch width for each pedestrian is necessary, which suggests a minimum pathway width of 4 feet for public pathways. When pedestrian flows are significant and greater precision is required to determine the walkway width then the formula and / or table shown below may be used.

It is important to remember that pedestrians, as a group typically do not use the entire width of most walkways. The edge of the walkway adjacent to the curb is avoided by the pedestrian. The edge of a walkway along a building facade is also similarly avoided. These edges are used only under conditions of high pedestrian density.

The presence of pedestrian furniture and features such as fire hydrants, trees, telephone booths, trash receptacles, fountains, sculptures, and kiosks also reduce the effective width of a pathway.

The width of pathways can be decided with the help of the [Table 20] below. (IRC guidelines for pedestrians)

Table 20   Data for Design of Pathways

Capacity of Pathway

Width of pathway	Capacity of persons per hour	
(in metres)	all in one direction	in both directions
1.5	1200	800
2	2400	1600
2.5	3600	2000
3	4800	3200
4	6000	4000

For pathways in shopping areas, the width should be increased by 1m, which is treated as the "dead space ". In other situations where pathways pass adjacent to buildings and fences, the dead width can be taken as 0.5m.

Calculation of walkway width by formula:

Minimum width for a pedestrian pathway can be determined by mathematical calculation as a function of expected pedestrian volume, acceptable density, and desirable rate of movement. The number of pedestrians (volume) passing a stationary point on a pathway is expressed by unit measurements of time, such as "pedestrians per minute" or "pedestrians per hour". Density refers to personal buffer zones, expressed in square feet per pedestrian. Given these criteria, pathway widths can be calculated using the standard flow theory shown below.

In this formula, pedestrian volume (V) refers to the number of pedestrians that are expected to pass any one point on the pathway each minute. Space modules (M) typically range from a minimum of 5 ft^2 per person to 35 ft^2 or greater. Walking speed (S) typically averages 260 ft / min, but can vary significantly depending on the predominant activities in the area, the type of pedestrians, etc. (refer to figures 340-6 and 340-7 for information on pedestrian flow volumes. Refer to figure 340-4 for information on space modules.

Expected loads of pedestrian traffic are determined through observation of similar projects in other areas, formal studies, and professional judgement.

Pathway width = V (M) ÷ S

where V = [s1] volume , pedestrian / minute

M = space module, ft^2/ pedestrian.   S = walking speed, ft / minute.

9.1.4.3 Slope/ Step/Curbs

An important design criterion for the design of pedestrian pathways is the slope of the walking surface.

The most comfortable slopes for walks lie between 1 % to 5 %. Above 5 %, most pedestrians will begin to feel the slope if it is carried over any distance. For short distances slopes of up to 10 % can be used so long as there is no need for handicapped access. And handicapped slopes. Stairs, ramps.

9.1.4.4 Drainage

The drainage of hard and soft surfaces in pedestrian planning is a very important aspect.

When the surfaces become very large the run off requires elaborate arrangements, which is beyond the scope of normal pedestrian planning. However for small and medium areas the following important guidelines is useful.

Table 21 Slope of Surface for Different Materials

MATERIALS	SLOPE	MATERIALS	SLOPE
Slab Paving	1:70	Gravel	1:30
Rolled Asphalt	1:40 To 1:48	Hogging	1:30
Hot Rolled Asphalt	1:48		
Tar macadam	1:40		
In Situ Concrete	1:48	USES	
Engineering Bricks	1:50	Court yards	!:60
Concrete Blocks	1:50	Foot ways (Max)	1:20
Granite Setts	1:40	(Min)	1:40
Cobble	1:40	Cycle tracks	1:40

It may be noted that different surfaces need minimum falls to shed water and leave a dry surface. This usually relies on falls in two directions, where only one is available it should not be less than the figures specified for each material [Table 21].

9.1.4.5 Lighting

In pedestrian areas, sufficient light must be provided to establish confidence and it should be of a pleasing colour. Well-lit surroundings enhance the appearance of the locality and also deter vandals and other undesirables.

Light Sources and Colours

Since running costs are of primary importance in India, the careful selection of the lighting source is essential.

Monochromatic yellow light provided by low pressure sodium lighting is cheap but not good for pedestrian areas, since all plants and surfaces appear to be shades of brown and yellow.

White light produced by high pressure sodium is not as cheap as the yellow light, but it is the cheapest in the 'white light' category. These are suitable for out door pedestrian areas, as they are pleasing to the eyes.

Another attractive light source is the colour corrected mercury vapour lights. However these are quite expensive.

Tungsten and fluorescent tubular lamps have very high running costs and should be used only in limited areas. However, these provide good colour rendering.

Fluorescent tubular lamps should be confined to sub-ways and special applications where for practical reasons a narrow light source is necessary.

Subway Lighting

Subways should be well lit in order to provide a pleasant environment by day and by night, and also to deter snatching and vandalism.

Amenity Lighting

Pedestrian areas and precincts are the most important amenity areas requiring lighting. Here, traditional lighting lanterns should be used in historic areas and in general areas modern lanterns may be used.

The lighting scheme should be such that vertical surfaces are well lit, in order to form bright backgrounds, and covered walkways and canopies should have system of local lighting units.

Area Lighting

This is also known as flood lighting. This type of lighting is very economical but too impersonal. The maintenance required is minimum in this type of facility.

9.1.4.6 Location of Service Lines on Pedestrian Routes

Electrification.

Transmission of electricity is generally by over head lines or underground cables, however in the Pedestrian Environment Areas where the densities of development is usually very high it would be better to take the electricity in cables placed over -ground. This will prevent the danger of having open wires, close to reach, in the narrow lanes. It will be difficult to pilfer power from the lines and there will not be a need to open up the paved surfaces for repair or for giving additional connections. The unpleasant appearance of cluttered overhead wires that is rampant now will be avoided.

However, in areas that are less dense with adequate width of access ways the electricity may be carried through over head wires placed in an aesthetically pleasing manner.

Water Supply

Water supply was earlier under ground, in the recent time they are being taken over the ground along the junction between the pavement surface and the plinth. This practise may be continued with some modifications, since this removes the nuisance of digging up the pavement every time there is a need for repair.

Telephone and Cable T.V

Telephone and cable T.V. lines should be taken on the terraces of the buildings. However they should be neatly arranged so that they do not spoil the appearance of the area.

Fire Protection

For fire fighting purposes a dry riser may be laid out on the routes which are too narrow for the access of fire fighting vehicles. These pipes should be placed underground since they will be large in diameter and the will not need regular maintenance. These dry risers should start from the wider roads and lead up to the narrowest pedestrian passage in the locality. Water from the fire engines could be pumped from the wider roads by the fire engines into the dry risers during times of emergency.

9.1.4.7 Pedestrian Furniture

Pedestrian pathways and spaces are not only transit routes but are spaces

where a lot of social, psychological and economic activities take place. In a properly designed pedestrian space opportunity and facilities for carrying out the activities must be given. Pedestrian furniture provides and facilitates a number of social and other such activities. Some of the pedestrian furniture to be generally provided are as stated below.

- Litter Bins
- Planters
- Seating
- Clock Towers
- Flag poles
- Shelters for inclement weather

9.1.4.8 Pedestrian Signs

Signs should harmonise with the environment, look unique and beautiful.

They should communicate information easily and effectively.

They should be strong to stand against the weather and against vandalism.

They should be located appropriately for good visibility.

Design and placement of signs for use by pedestrians involves considerations of visual field, scale of letters, proportions of letters, and tonal contrast between letters and background.

9.1.4.9 Facilities for the Disabled on the Pedestrian Ways

It is essential to carefully select the critical items, which, with relatively low expenditure, will offer the greatest improvement to accessibility. The critical design elements are ramps, width of doorways, toilet sizes, elevator size, parking facilities etc.

In urban spaces the following could be done to improve accessibility for the handicapped.

- Sloped kerbs to facilitate the transition of ambulatory aids from the different surface levels.

- Reasonable curb heights to enable an average person to negotiate the change without fear of dislocating a joint or hurting an old wound.

- Variations of textures/colours of the pavement material whenever there are change in level to enable tactful recognition by persons with poor vision.

- Telephone booths with sufficiently wide doors and support bar inside.

- Provision of handrails and ramps as an integral part of the main entrance to public buildings.

9.1.4.10 Footpaths Along Vehicular Corridors

Footpaths along vehicular corridors help to collect and channelise the pedestrian traffic created by the buildings abutting these corridors.

Footpaths along the vehicular corridors have to be designed with particular emphasis on safety of the pedestrians and the enabling of the smooth flow of the vehicular traffic.

The design of the pedestrian guardrails is of importance. They should be simple in appearance and vandal proof. Two aspects that need special consideration are the height of handrail and obstruction to visibility. The height should be sufficient so as to deter people from climbing over it. The visibility of the approaching vehicles by the pedestrians as well as the visibility of the pedestrians by the drivers of the approaching vehicles should be adequate (Suggestive Designs have been provided in Appendix-A).

9.1.4.11 Links Between Two Pedestrian Areas

These links in the form of over footbridges, under footbridges or the simple zebra crossings allow for pedestrian continuity between one Pedestrian Environment Area to another. The pedestrian attraction between two Pedestrian Environment Areas, the resources available and other factors govern the type of link to be constructed. These locations will also be convenient points for the establishment of modal changes such as bus stops, taxi stands or car parking lots.

The location of the links between one Pedestrian Environment Area to another should not be preferably located near the intersections of vehicular intersections unless there is provision for over or under footbridges. This will help to avoid chaos due to mixing of the traffic modes.

It will be better to raise or lower the vehicular road level and allow the pedestrian to move between the Pedestrian Environment Areas at the same grade, this may be done since vehicles move with mechanical energy.

9.2 SPECIAL RECOMMENDATIONS FOR IMPORTANT USE ZONES IN THE CITIES

9.2.1 Market Area Specific Recommendation

A) Since most market areas in the region are compact in their formation, they offer suitable scale for pedestrianisation. The soil condition is appropriate for plantation and the gradient in this region is congenial for walking as well as for building construction.

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B) The social milieu in these market areas is very healthy since the market force drives away social inequalities. The incidence of various places of worship also promotes religious and community activities.

C) Most of these markets have been designed as markets and are easily accessible from all parts of the city. Adequate use - Supportive facilities like banks, post offices and facilities such as police and medical help are easily available. These positive aspects need only to be strengthened to instil confidence in people.

D) Science most markets aesthetically enjoy a special position visa vice to the rest of the settlement and in many cases the arrangement of buildings and open space provide a desirable axis and an appropriate human scale, emphasis is to be given in improvement of these qualities.

E) Marketing is an important social activities for the people because here they enjoy talking and eating in company, interacting with opposite sex, shopping from the hawkers or simply standing and watching life go by, feeling themselves as a part of bustling crowd. These should be encouraged. Therefore totally pedestrianised areas with reduced level of pollution with respect to air vision and sound would be the best place for people to come and recreation and relaxation and enjoy the improved quality of life.

F) In order to achieve more spaciousness and more greenery in the existing market areas, sensitive redevelopment is required in the form of removal and relocation of objectionable uses like automobile workshops and other light industries producing pollutants. Over crowding by hawkers is to be discouraged though a limited number of hawkers in a specially allocated space may be permitted without creating obstruction to the main shopping activity.

G)Improvement of parking facilities for vehicles and accessibility for service vehicles are absolutely essential, as is the proper design of telephone posts, electric posts, lighting fixtures and the like.

H)The elderly and the children do not always feel comfortable in the market places and their special needs for quieter and traffic free zones should be created.

I) The lack of poor quality public conveniences like drinking water, dust bins, proper latrines and scavenging activities need immediate attention.

J) Awareness in traffic rules has to be created in pedestrians as well as drivers so that in disciplined and discourteous driving does not create physical in convenience and psychological tension.

9.2.2 Residential Area Specific Recommendations

A)Science most of the residential areas in the region have high pollution densities and are developed in a compact manner, they are ideal for pedestrianisation. The ground slope is mild and suitable for construction and easy walking while the soil condition is congenial for plantation.

B)2-Ahealthy male - female, ratio exists in the residential areas of the cities and in general, religious and community activities are observed to be thriving. The buildings and open spaces in the residential areas are in good human scale and the means of access are narrow and therefore suitable only to be used as pedestrian routes.

C)The pedestrian routes in these residential areas are used and enjoyed by the people to a great extent. Children find these routes comfortable and safe and convenient for socialising and playing. The pedestrian areas are the best

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places for the elderly for sitting, reading, and talking. Since the air and noise pollution levels in these residential areas are still within tolerable limits, care should be taken to safeguard this so that people find walking a good and enjoyable exercise.

D) Most of the residential areas of existing cities have very little open space and hence inadequate foliage for good micro-climate, survival of wild life or provision of shade for inducing social activity.

E) The standard of living being low in most of these residential areas and the accommodation being insufficient compared to the size of the household, there is spill over on to the outside pedestrian areas. This, coupled with objectionable uses gradually find their way into residential areas creates dearth of open space - which should be strongly discouraged.

F) Buildings in these residential areas are not functionally up to date and are generally poorly maintained. The cleanliness and maintenance of toilets also falls much below the acceptable standards.

G) The means of access within these residential areas are barely sufficient for pedestrian use and the onslaught of different modes of traffic creates congestion at traffic intersections and generally reduces the accessibility and circulation within the area. The lack of parking facilities and proper arrangement for modal change is also perceptible. These have to be improved.

H) Water supply for general requirements as well as fire fighting is absolutely inadequate. Sewerage systems, storm water drainage, garbage disposal are very poor. Electric supply is inadequate and the overhead wires and posts are totally disorganised as are the over head telephone wires and telephone posts.

I) Aesthetically these are not at all visually pleasing and there is very little

public awareness and hardly any steps taken by Government to improve these areas.

J) Families rarely socialise in the pedestrian routes within these areas because the surrounding filth is psychologically irritating and there is considerable tension because of the dis-organised traffic and the anti-socials in the area.

K) Discourteous driving and in adequate public conveniences in these areas create problems for the pedestrians which should be redeemed through governmental policy and increased public awareness.

9.2.3 Historic Area Specific Recommendations

A) Most heritage areas have a lot of open space around and therefore suitable for expansion and landscaping. The gradient is right for easy walking and appropriate for construction, and the soil condition conducive to the plantation. These positive aspects need to be exploited.

B) Qualitative living is provided by the factors like low population densities, presence of few hawkers, and a number of places for religious worship and community activities. Care should be taken not to spoil these characteristics.

C) There is a balanced male - female ratio and the elderly have facilities in these areas - like walkways, resting places etc.

D) Buildings in these heritage areas are fairly well maintained and they have interesting man made facades that are harmonious in nature. There are also use supportive buildings like banks, post- offices, and police stations in these areas that add in the qualitative value.

E) Adequate parking, minimum congestion, and less traffic conflict ensure easy accessibility and good circulation in these areas.

F) Public consciousness about the surroundings is very high and there is general community awareness about the heritage value of these areas. The skyline created by the monuments in these zones is positively interesting and fortunately overhead wires in these areas are organised.

G) These areas enjoy a special position with respect to other parts of the city, being favourably oriented from the climatic point of consideration as well as having good scenic view around. The shapes of these settlements have a definite order and there is a special textural quality to these settlements. These plus points are to be conserved by conscious effort.

H) Visually the buildings are oriented in such a manner that they successfully define space in the forms of enclosures, vistas, etc. and there is an interesting configuration of vertical and horizontal planes in these areas.

I) There are beautifully designed doors / windows openings along with interesting colonnade arrangements. There is a repetition of elements in size, shapes and detail characteristics and the buildings are structurally well - proportioned.

J) [s2]The arrangement of buildings and open spaces in many cases establish a desirable axis and show situation of symmetry and an interesting hierarchy of open spaces is perceptible. Care should be taken to preserve these intrinsic features.

K) Footpaths available in the heritage areas are intensively used by pedestrians, and benches, culverts and other street furniture where ever available are highly appreciated.

L) People find walking beneficial to their health and fitness, and also cost - saving, on the whole, people enjoy the peaceful environment of these historic

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places and like to relax by way of shopping from the hawkers and eating from the stalls. General awareness should be fostered so that the users themselves can safeguard these special qualities.

M) Foliage in these areas is not adequate for moderating microclimate or including social interaction. This aspect needs improvement.

N) Though there are not many beggars, anti-socials bother the pedestrians and create tension for them. People will find these areas as better places for socialising if these problems are mitigated.

9.2.4 Leisure Area Specific Recommendations

Most leisure areas are compact and in one large chunk with open space available for further expansion and landscaping. With little effort these qualities can be maintained and improved upon.

A) The topography of these areas is convenient for construction as well as for easy walking, while the soil condition is congenial for plantation.

B) The densities in these leisure areas normally attain reasonable levels with the children being the main users.

C) The size and type of accommodation in these areas are appropriate to its function, as is the occupancy of the use. This is a healthy trend and should be preserved.

D) There is no congestion in the internal access routes and there is no dearth of footpaths. External access is convenient with respect to the over all town by way of adequate public transport and sufficient parking for modal change.

E) Most of these leisure areas have definite shape, colour and textural quality. They generally enjoy a special position with respect to the rest of the town and

have favourable orientation from the climatic point of view and are mostly visually pleasing. Such locational advantages must be used.

F) These leisure areas maintain a good balance between buildings and open spaces and have an interesting variety of enclosures of spaces.

G)Pathways are popular and extensively used by the pedestrians in these areas and benches and other forms of street furniture used to the maximum. These facilities need to be improved for the comfort of pedestrians.

H) Children are comfortable and safe in these areas. They make friends and enjoy playing in the open spaces. The elders of the society find these places very cosy and spend time sitting, reading and talking in company. This is a healthy sign.

I) People enjoy the natural surroundings and like to watch others moving around in these areas. They are not troubled much by beggars in these leisure areas, and there fore enjoy the quiet environment. Eating from stalls and walking for health and fitness are popular activities. Care should be taken to safeguard this entirely pedestrian environment by warding off all objectionable uses.

J) Though green areas are provided, they are not harmonious and are rarely used by young people for social interaction. These could be made more attractive.

K) These areas lack adequate toilets and those, which are provided are not well maintained. There are not many use- supportive structures like tents and pavilions for sports facilities. Storm water drainage facilities are not adequate. In general the problem of inadequacy in public conveniences is to be tacked as a major drawback.

L) People are apprehensive about anti socials and walking very late in the night is not risk-free. This aspect of insecurity is to be eliminated by policing, in an effort to provide a safe environment.

CHAPTER 10: PILOT APPLICATION ON A SELECTED TOWN : ROORKEE

10.1 INTRODUCTION

It may be emphasised that in the test application elaborated in this chapter, it is the way in which the problem is approached that is much more important than any quantitative conclusions reached.

The test application of the recommendations and conclusions on a town would give us a feed back on the applicability of the recommendations, conclusion and the usefulness of the models, which have been developed in the earlier chapters.

For the purpose of application the town of Roorkee was selected because of its small size and its accessibility for the study.

10.2 TOWN PROFILE

10.2.1 History and growth

Though classified as class II town in 'district Census Hand Book', Roorkee enjoys a unique place of distinction not only in its home state U.P. but also in India and outside due to its pioneer educational and research institutions in the field of technical education and research.

Deriving its name from "RURI", the wife of a Rajput chieftain, the history of Roorkee as it stands today can be traced back to 1840, when it existed as a mud built village situated on the elevated ridge on the southern bank of Solani

river, when the town was adopted by the British Indian Govt. with commencement of the construction work on famous Ganga Canal. The town has since been growing with establishment of Government Canal Workshop. Thomason College (now Roorkee University), Roorkee Cantonment, opening of various institutions, Government offices and creation of infrastructural facilities. The growth, development and sustenance of the town is thus closely linked its institutions which stimulated the growth of settlement to accommodate the employee of these establishments / institutions and supporting service population.

Significant growth during the last two decades (1971 - 1991) has been witnessed in open agricultural land on fringes, due to enormous growth of population leaving hardly any scope for development with in the present municipal limits as most of the vacant land within the town has already been brought into use[70] [Figure 57].

10.2.2 Location and regional setting of the town.

Roorkee town is situated in the Indo Gangatic plains. Its bearings are 29 Degrees 51 minutes north and 77degrees 53 minutes east at an altitude of 268m above mean sea level[93].

Roorkee is well connected to the state and national capitals. Its linkages to important towns and cities are mentioned in the [Table 22].

Table 22 Connections to Roorkee Town

Town	type of town	by rail	by road
Delhi	National Capital	217	170
Lucknow	State Capital	491	538
Dehradun	Hill Station	97	68
Saharanpur	District HQ	36	46
Hardwar	Pilgrimage centre	46	31

10.2.3 Importance of the town

Roorkee is famous for the pioneering engineering institute of India, now known as the University Of Roorkee. It is also important for the existence of a large cantonment. Existence of other important technical and research organisations like I.R.I., N.I.H., and C.B.R.I. makes Roorkee an important place in the country. Roorkee is also well known for its drawing and survey instruments industries.

Roorkee falls on the way to some of the most famous pilgrim centres of India, such as, Hardwar, Rishikesh, Badrinath, Kedarnath, Gangotri and Yamonotri. It is also on the way to Dehradun and Mussoorie, which are places of tourist attraction. Piran Kaliyar, the religious shrine of "Shabir Sahaib" is situated six kilometers from Roorkee town. A fair is held here every year, which attracts Muslims from all over the country and also from abroad.

10.2.4 Existing generalised land use.

Roorkee can be said to be constituted of Institutions and the residential areas with commercial strips.

The existing land use as per the field study is as in Figure (). Land use map of Roorkee town (1992). The existence of a large number of educational Institutions, the market area and high residential population which encourages high density in old Roorkee area. Most of the Government and Semi Government establishments are to the north, i.e., in the civil lines area.

Existing land use break up is shown in Table 23] [70]. The land within the municipal area is expected to increase from the present 8.11sq km. to 10sq Km by 2011 A.D. with a projected population of 1,35,000.

Table 23 Break-up of Existing Land-Use: Roorkee

Use	Existing in Hectares	Percentage of Total Area	Projected area in Hectares (2011 AD)	Percentage of total area
Residential	401.08	56.2	576.00	60.00
Roads	99.91	14.00	115.20	12.00
Educational	85.64	12.00	124.80	13.00
Industrial	14.98	02.10	19.20	02.00
Commercial	21.41	03.00	19.20	02.00
Public and Seem Public	17.84	02.50	28.80	03.00
Religious and others	09.27	01.30	09.60	01.00
Open Space, Recreation.	63.51	08.90	67.20	07.00
Total	713.64	100	960.00	100

The residential density varies from 16 persons per acre at the C.B.R.I., to 707 persons per acre at Rajputana area. The details of population, area and density are given in the [Table 24].

10.2.5 Community Facilities

Roorkee town as it stepped towards development after the Independence and large number of people settled in the town, there arose a need for educational, health, recreational and other facilities in the town. These needs were fulfilled to a certain extent but even today there is a short fall.

10.2.5.1 Educational Facilities.

Roorkee has adequate educational facilities for its inhabitants and it also servers the nearby areas. As per district statistical report, it has 30 primary schools, 12 junior secondary schools, 5 senior secondary schools, 5 inter colleges, 3 degree colleges, one university, one polytechnic, seven

Table 24 Ward-wise Population, Area and Density: Roorkee

Name of the ward	area	pop 1981	pop 1991	Gross Density 1991	Gross Density 2011 **
Pubabali	0.53	2950	3826	28	38
Ganeshpur Central	0.38	3208	4160	44	60
Chow Mandi	0.47	3969	4794	41	55
Amber Talab East	0.20	3678	4771	94	128
Purba Din Dayal	0.16	2948	3824	99	135
Maktulpuri	0.41	2784	3621	28	39
Ram Nagar South	0.28	3542	3594	51	70
Ram Nagar North	0.25	2863	3715	58	81
Amber Talab West	0.07	2976	3960	217	281
Ambar Talab East	0.08	2775	3599	192	249
Purana Tehsil	0.24	2884	3754	63	86
Mahigram	0.37	3386	4392	46	63
Sati Mohalla	0.24	3930	5097	86	118
Sot	0.20	3016	3912	76	114
Rajputana	0.02	2990	3787	707	917
Civil Lines North	1.01	3756	4872	19	26
Civil Lines West	0.70	3641	4723	27	36
Roorkee University (western)	1.06	3602	4672	18	24
C.B.R.I.	1.18	3730	4838	16	21

** Probable Density

shorthand and typing schools, one adult literacy centre. Besides these there are a number of nursery schools, music schools, knitting, embroidery and such other training centres.

10.2.5.2 Recreational and Cultural

Roorkee lacks recreational and cultural facilities. The university and C.B.R.I. have their own facilities which is adequate for them and this is not open to the public.

The University has a boat club on the banks of the canal for recreation. The army also uses the canal to train their personnel in temporary bridge building

and other water related activities.

However, the general population of the town does not have much recreational facilities due to lack of resources, both of land and finance.

Playgrounds exist in a few colleges and schools, but no community facilities at the neighbourhood level exist.

In old Roorkee area, it is common to see children playing on the streets, which is a good indicator of the lack in recreational space.

Roorkee has five cinema halls of which four are functioning. It is adequate for the present population. The town has one community hall used for meeting and marriages.

There is a public library and a reading room in the municipality building.

10.2.5.3 Religious Facilities

Due to the mixed population of the town consisting of Hindus, Muslims, Christians, Jains, and Sikhs, the town has religious places for all the sects scattered at different places in the town.

10.2.6 Services

In the course of the growth of the town, its demands for services have increased. The town presently has several services, which are discussed in the subsequent paragraphs.

10.2.6.1 Railway Station

Roorkee has a Railway station where trains from Calcutta, Delhi, Bombay and Lucknow stop. The station is well built with all normal facilities.

10.2.6.2 Bus Stop

The Uttar Pradesh State Roadways provides good bus service to the town and has constructed a bus terminal in the town. The town also has a private bus station on the main road to Delhi; this station does not have any facilities.

10.2.6.3 Taxi Stand

Taxis are available in the taxi stand, which is located near the bus station in the town. The stand connected by telephone and well organised.

10.2.6.4 Truck Stand

There is no regular truck terminal or stand but a make shift stand exists on the canal bank road and on the government workshop road.

10.2.6.5 Other Modes

Tongas, rickshaws, Thelas, bullock carts are abundantly available. The people from the nearby village mostly operate these. Tractors are also used to carry people from the villages into the town.

10.2.7 Utilities

10.2.7.1 Post, Telegraph and Telephone

Roorkee town has its main post office in civil lines area serving the town with its 13 sub-post offices which are located conveniently.

Telegraphic facility exists in 6 post offices. The telephone exchange is near the government workshop. Roorkee has numerous S. T. D. and I.S.D service centres located all over the town. The University, C.B.R.I. and I.R.I have their own exchanges with a good network in the institutions.

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10.2.7.2 Security

Roorkee has two police stations, one in the Civil Lines and the other in Ganeshpur. There are three police choukies in old Roorkee. The number of police personnel in the town is as shown in [Table 25].

Table 25 Police Personnel in Roorkee Town

Inspector		1
Sub - Inspector		13
Head Constable		15
Constable		109
Driver		4
Mali		4
Vehicles	(Jeep)	3
	(Van)	1
	(M/cycle)	3

10.2.7.3 Fire station

Roorkee town has a fire service station in civil lines. It has three fire brigades. In Roorkee, there are 26 fire hydrants.

10.2.7.4 Health

Roorkee M. B area has 3 Government hospitals and dispensaries, and one family health centre. The civil hospital is near Ramnagar chowk which was initially in purana tehsil area.

Besides, there are 5 nursing homes, six ayurvedic clinics, 11 Unani, 15 Homeopathic centres and 56 medical stores.

As per the doctors views the overall health of the people of the area is good.

The nearest medical college is in Meerut which is about 100 km from Roorkee.

The Government medical facilities seems to be inadequate and has led to the mushrooming of private facilities.

10.2.7.5 Electricity

There are two hydel power station near Roorkee town, they are at Pathri and Mohammadpur. Both are approximately 20 km from Roorkee. The hydel sub-station of Uttar Pradesh State Electricity Board which distributes the power from these two stations is located on the fringe of the Roorkee municipal boundary near Ramnagar Industrial Estate.

10.2.7.6 The Municipal Utilities

The municipality is the main body which caters to many of the essential services of the town. Municipal board is an elected body and has a term of 5 years.

Roorkee has been divided into 19 wards as per table() . The members are elected from each ward to the municipal board. The services given by the municipality is mentioned in the subsequent paragraphs.

Street Illumination

Street Illumination is done by the municipality. They illuminate the main roads but inner community lanes are not well illuminated. Considering the 185 km of municipal road net work the lighting is inadequate.

Water Supply

The water supply scheme started in 1951 is at present considered as a class 'C' water supply system. The source of water is from the ground. The total length of the network is 65 km.

The University, C.B.R.I., and I.R.I. are not served by the municipality and they have their own water supply system.

The quality of water supply is generally satisfactory, it is found to have a high iron content and bacterial content and hardness at some places.

Sanitation

Sewer lines are provided in some parts of old Roorkee and the Civil Lines areas. The sewers collect both kitchen and toilet wastes. The University, Cantonment, C.B.R.I. and I.R.I. have their own sewer network, for both storm water and domestic disposal.

The sewerage is pumped to the agricultural field owned by the municipality at Mahigram Point. The sewage from the Civil Lines, University and C.B.R.I. is pumped to the Solani River from the Khanjarpur well.

Total number of sewer connections till 1992 was only 2252.

Garbage Collection

The municipality collects garbage frrom different parts of the town, the University, C.B.R.I. and I.R.I. have their own disposal arrangements. There are all together 13 collection points. The garbage is dumped at the trenching grounds along the solani river bed, to the west of the canal.

The University and the C.B.R.I. does land filling of low lying areas within the campus. The C.B.R.I. burns up the waste in incinerators and dumps in a pit made for the purpose. Compared to other cities and towns of Uttar Pradesh, Roorkee has a better garbage collection system and even then it leaves some areas untouched.

10.2.8 Transport network

The Town of Roorkee is located in the Northern Railway grid of the Indian

Railways. The major railway junctions in the area are in the towns of Luxor, Hardwar, Saharanpur and Deradoon.

The Roorkee town road network is as shown in the figure ().

There are two major traffic corridors in Roorkee town. One is the Delhi-Hardwar road and the other is the shopping street starting from the Century Gate junction of the university of Roorkee and going down to the old Ganga canal bridge and then through old Rookee to Rajputana area. Here, most of the peak hour traffic is for shopping; the bottlenecks are at the petrol pump intersection and the Roorkee talkie intersections.

10.2.9 General Traffic and Transportation Problems in Roorkee Town

The hawkers occupy roadsides with impunity on almost all the busy roads of Roorkee.

Roadsides are encroached by the shops. They use the same as their extended shop spaces.

Signboards are placed all along the shoulders of the access ways.

Street furniture, telephone and electric poles that are haphazardly placed on the roadsides are a common scene in the town.

Violation of traffic rules and the lack of enforcement have created a free for all situations in the town of Roorkee.

10.3 APPLICATION OF WORKING THEORY (Part-1)

The first part of the working theory developed in Chapter 5 titled " Model For Integrated Multi-Modal Accessibility " is applied to the existing plan of Roorkee.

The major type of plans available for the town were the Land Use Map [Figure 56] and the other was the map showing the location of the municipal wards [Figure 59].

- From these maps the following information was available:

- The existing lay out of the road net work [Figure 58] .

- The hierarchy of the road network showing the highways, arterial and sub-arterial roads at the town level collector roads and feeder roads at the neighbourhood level. (Details of the pedestrian routes in side the neighbourhoods were not easily available and had to be prepared by visits to the site)

- Cultural resources of the town in terms of the religious distribution of the population over the town was identified and developed. The cultural building in the town were identified and marked.

All the above maps and the information therein were over laid. The major axial lines of the town are identified. In the case of Roorkee the major axial lines are; the river, the railway line, the highways and the Ganga canal. Of all these the Ganga Canal is the most central and most dominant axis in the town.

10.4 FORMATION OF PEDESTRIAN ENVIRONMENT AREAS

The "Pedestrian Mesh" [Figure 60] is then overlaid on the aggregate formed by the above maps. The Pedestrian Mesh is conveniently bent on to the road network of the town avoiding the neighbourhood roads and minor collector roads.This process achieves a cellular form for the town and each of the cells is a Pedestrian Environment Area [Figure 61] .

RESIDENTIAL

COMMERCIAL

PUBLIC

RECREATIONAL

INDUSTRIAL

AGRICULTURAL

EDUCATIONAL

BARREN (PLOTTED)

CANTONMENT AREA

SCALE :- 3.5 C.M TO 1 K.M.
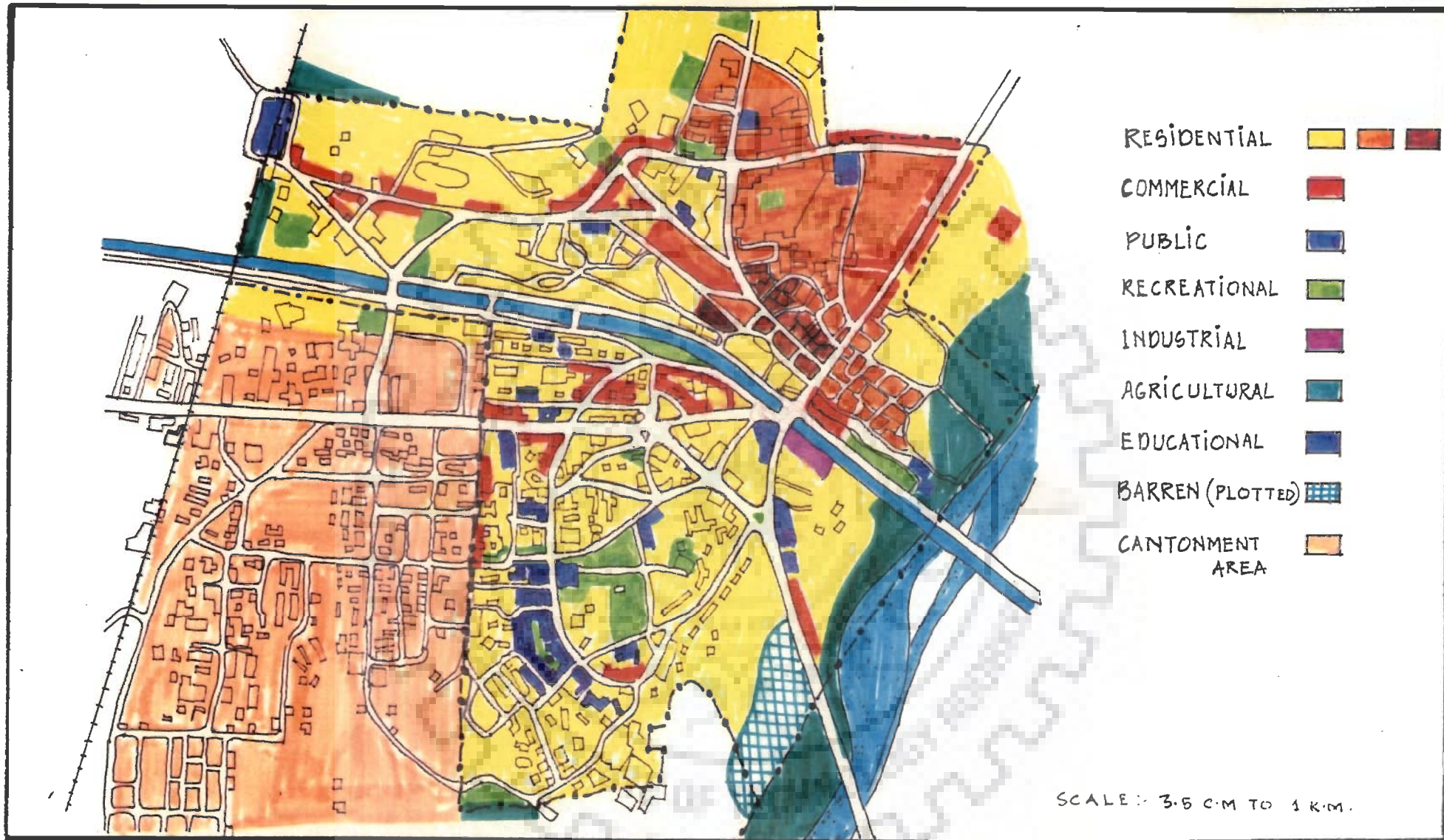
FIG NO:- 56.

PAGE NO:- 335

TITLE :- LANDUSE MAP OF ROORKEE TOWN.

10.5 PEDESTRIAN ENVIRONMENT AREA LEVEL PROFILE

Selected Pedestrian Environment Area for Demonstrative

Pedestrianisation

After the whole town has been made into cells of Pedestrian Environment Areas, the area commonly known as the Civil Lines Market, bounded by the Delhi-Hardwar road on the East, Hardwar to Old Roorkee on the North, the century gate- boat club road on the south and the canal road on the west, has been identified for sample pedestrianisation in this investigation [Figure 62].

10.5.1 Community Facilities

This area is centrally located and is the new commercial hub of the town. It has a large number of shops which sell a variety goods. It also accommodates some offices, banks and the main police station.

There are two cinema halls in the area one is called the Roorkee talkies and the other is known as the Sudarshan Talkies. These are important centres of entertainment in the town. The area also has a number of religious centres for the Hindus and the Muslims.

The Inner parts of the area provides residential accommodation for the higher income group.

10.5.2 Services

The area is having the head post Office of Roorkee on its southern side adjacent to a wide access road known as the 'Post office Road'. Telephone services in the area is very good, there are a number of Public Call Offices located in the locality.

Figure 57 Photographs of Roorkee Town .

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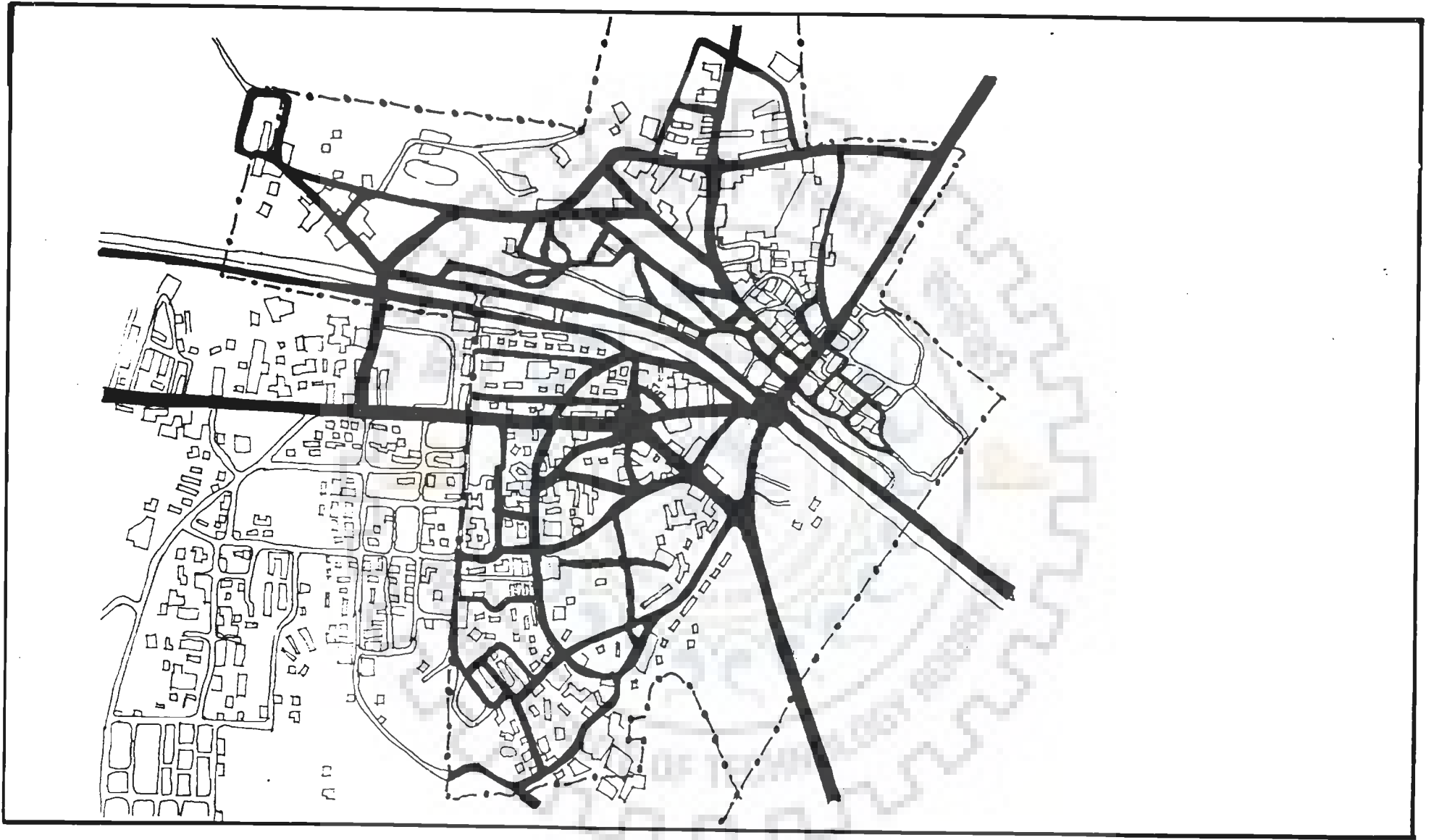
| FIG NO:- 58 | | TITLE :- |
| PAGE NO: · 338 | | ROAD NETWORK MAP OF ROORKEE TOWN · |
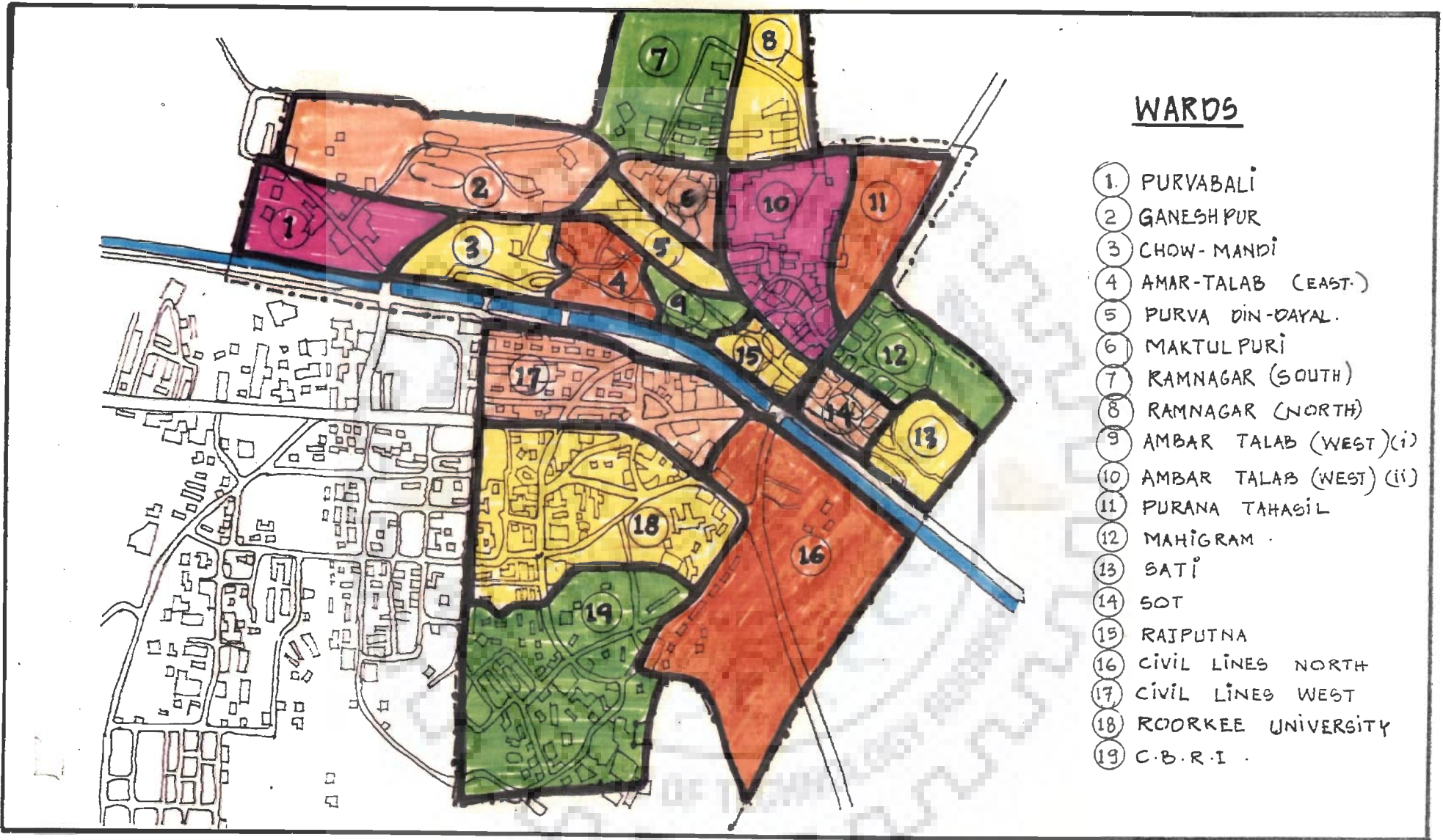
WARDS

1. PURVABALI
2. GANESHPUR
3. CHOW-MANDI
4. AMAR-TALAB (EAST.)
5. PURVA DIN-DAYAL.
6. MAKTUL PURI
7. RAMNAGAR (SOUTH)
8. RAMNAGAR (NORTH)
9. AMBAR TALAB (WEST)(i)
10. AMBAR TALAB (WEST)(ii)
11. PURANA TAHASIL
12. MAHIGRAM.
13. SATI
14. SOT
15. RAJPUTNA
16. CIVIL LINES NORTH
17. CIVIL LINES WEST
18. ROORKEE UNIVERSITY
19. C.B.R.I.

FIG NO:- 59		TITLE :-	
PAGE NO:- 339		WARD MAP OF ROORKEE TOWN.	
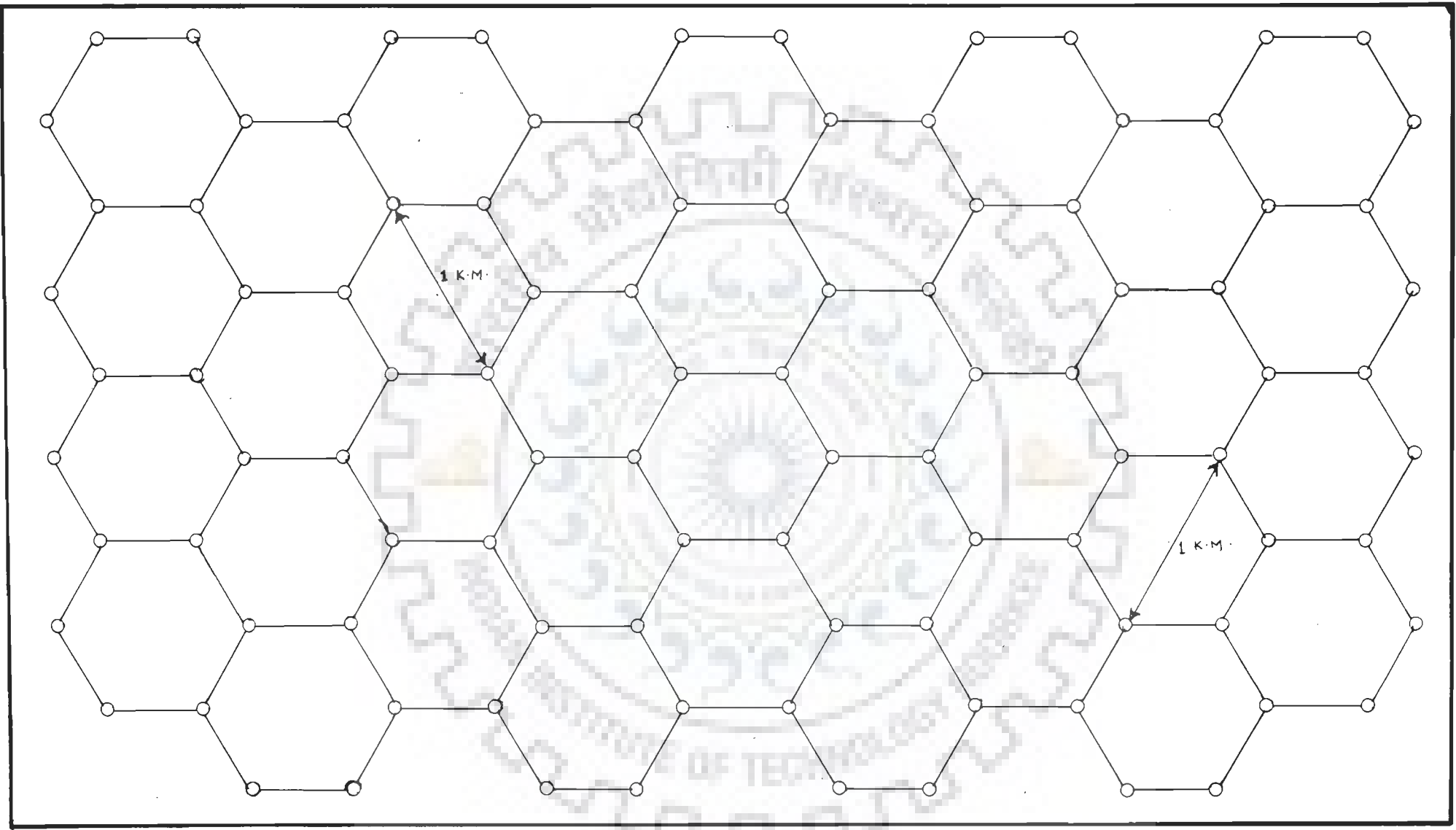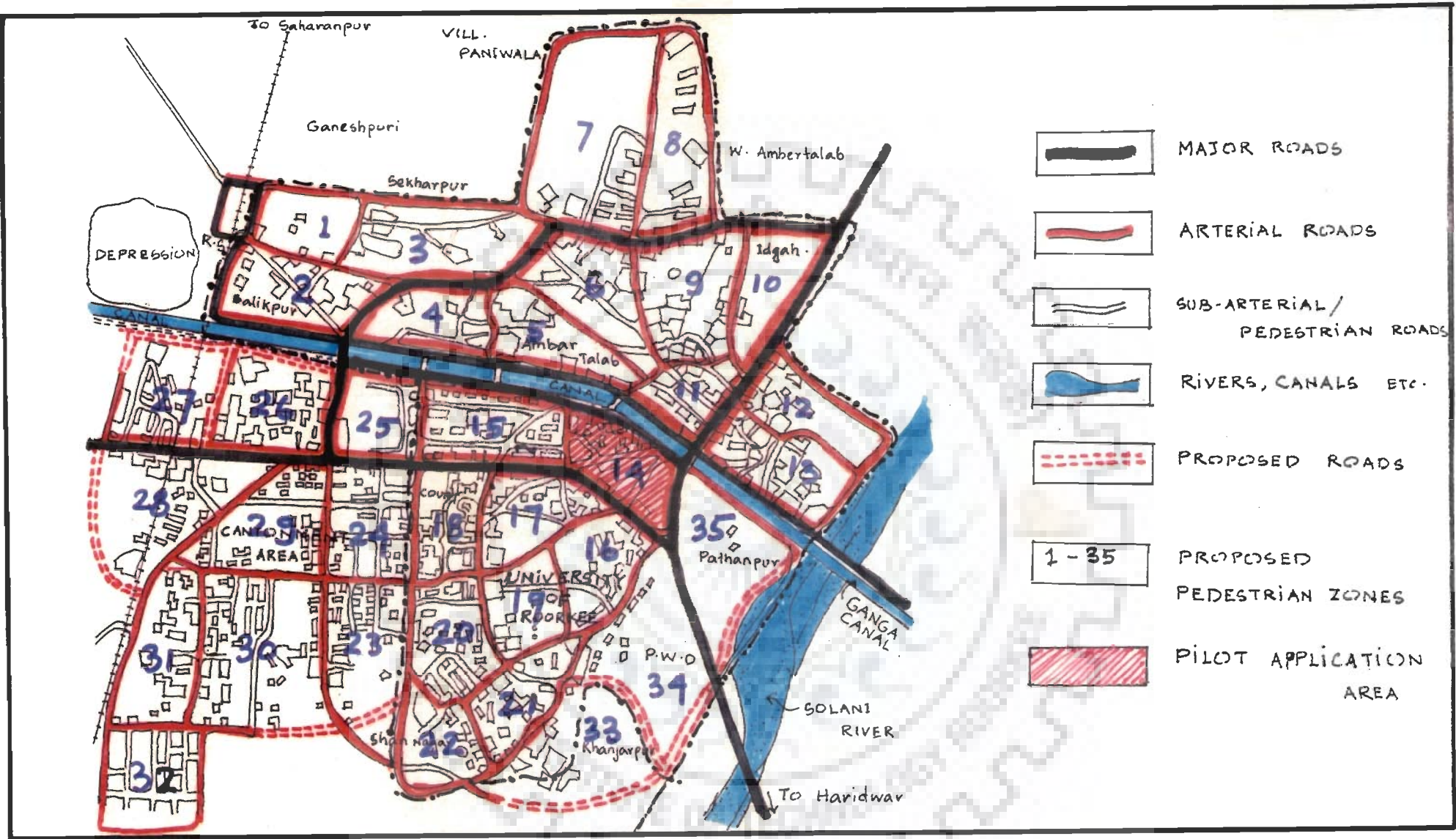
1 K·M·

1 K·M·

| DRG·NO:- 60 | TITLE :- |
| PAGE NO:- 340 | PEDESTRIAN MESH |

Legend:

- ▬▬▬ MAJOR ROADS
- ～～～ ARTERIAL ROADS
- ～～ SUB-ARTERIAL / PEDESTRIAN ROADS
- ▬▬ RIVERS, CANALS ETC.
- ▬▬▬ PROPOSED ROADS
- 1 - 35 PROPOSED PEDESTRIAN ZONES
- ▨▨ PILOT APPLICATION AREA

Map labels: To Saharanpur, VILL. PANIWALA, Ganeshpuri, Sekharpur, W. Ambertalab, Idgah, DEPRESSION, Balikpur, CANAL, Ambar Talab, CANAL, Cantonment Area, University 1906 Roorkee, Pathanpur, GANGA CANAL, P.W.D., Shiv nagar, Khanjarpur, SOLANI RIVER, To Haridwar

Security is the best available in the town. The main police station of Roorkee is located here. However, there is no special provision for fire fighting for the locality. A number of medical stores and small clinics are located here.

10.5.3 Utilities

The area has good drainage due to the appropriate land slope. It has underground sewerage facilities in most of the parts.

The municipal services in this area is the best available in the town. Garbage collection is good. There is enough street lighting in most areas [Figure 63].

10.5.4 Traffic

The Pedestrian Environment Area is adjacent to the State High Way connecting Hardwar with Delhi. All buses moving on this route make a stop at the 'Century Gate Junction' on the South East corner of this Pedestrian Environment Area.

On the West side of the Pedestrian Environment Area is the Ganga Canal and the canal road which runs parallel to it. This road provides traffic free access to the locality [Figure 64].

10.5.4.1 N.D.G.C Junction

At the N.D.G.C junction the following are the problems:

The road towards the University is wider. Thus some parking arrangements can be accommodated on either side of the road.

The road towards Hardwar is narrow and needs widening.

A number of automobile workshops are located on either side of the road towards the civil lines. These workshops carryout the repair of the vehicles on

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LAND USE PLAN OF PILOT STUDY AREA

GANGA CANAL

MAIN ROAD (11M. WIDE)

PUBLIC TOP

PETROL PUMP

TO OLD ROORKEE

TO SOLANI

COOP. STORE

SCHOOL

STORE

P.O.

FIRE STATION

MANDIR

SUDARSHAN TALKIES

NAGAR PALIKA

BOAT CLUB ROAD

P.O.

POST OFFICE ROAD

MAIN ROAD (9M. WIDE)

MAIN ROAD (6M. WIDE)

MAIN ROAD (10M. WIDE)

ROORKEE TALKIES

PREM MANDIR

OLD EXPOSED BRICK BUILDING

BUS STOP

TO MEERUT

BUS STOP

NATIONAL HIGHWAY

TO UOR

TO U.D.R.K

TO U.C.O.R

TO C.B.R.I.

TO HARDWAR

	RESIDENTIAL AREAS
	COMMERCIAL AREAS
	PUBLIC AMENITY AREAS
	GREEN AREAS

FIG NO :- 62

PAGE NO :- 343

N

TITLE :-

LAND USE PLAN OF PILOT STUDY AREA

GANGA CANAL

MAIN ROAD (11 M. WIDE)

PUBLIC TOILET
PETROL PUMP

TO OLD ROORKEE

TO SOLANI

MAIN ROAD (9 M. WIDE)

MAIN ROAD (6 M. WIDE)

MAIN ROAD (6 M. WIDE)

BOAT CLUB ROAD

POST OFFICE ROAD

BUS STOP

BUS STOP

HIGHWAY

HIGHWAY

HIGHWAY

HIGHWAY

TO U.O.R.

TO U.O.R.

TO C.B.R.I.

TO HARDWAR

— · — · — SWEAR LINE
— — — — OPEN DRAIN

➤ SLOPE
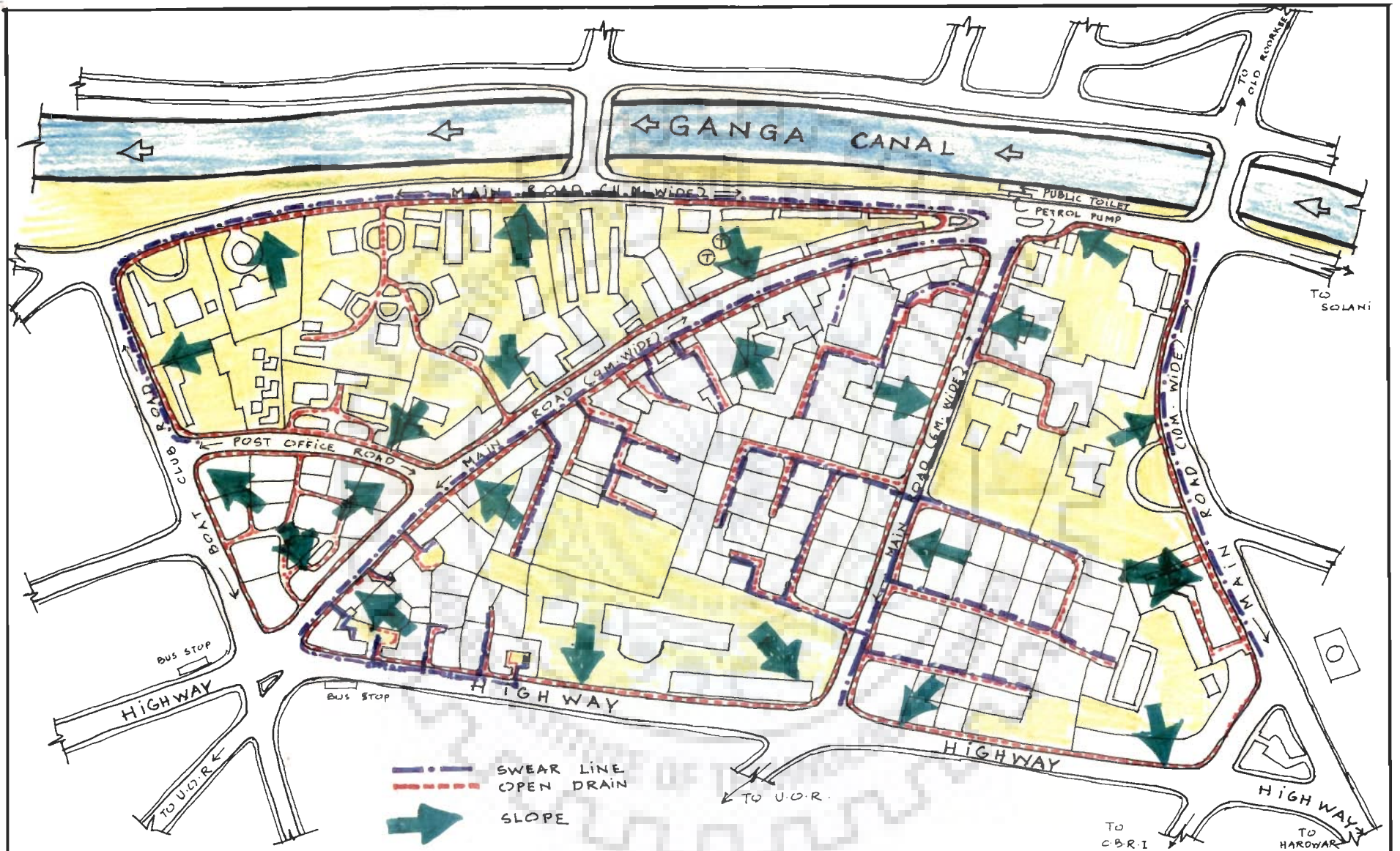
| FIG NO:- 63 | ⊕N | TITLE:- UTILITY PLAN OF PILOT STUDY AREA |
| PAGE NO:- 344 | | |

GANGA CANAL

MAIN ROAD (11M. WIDE)

PUBLIC TOILET
PETROL PUMP

FOOD GRAIN STORE
BARRACKS
STORE
MANDIR
SUDARSHAN TALKIES
MAIN ROAD (9M. WIDE)
GANJ COMPLX
P.S

POST OFFICE
POST OFFICE ROAD

GUEST HOUSE

MAIN ROAD (10M. WIDE)

BOAT CLUB ROAD

ROORKEE TALKIES

PREM MANDIR

MAIN ROAD (6M. WIDE)

BUS STOP

BUS STOP

OLD EXPOSED BRICK BUILDINGS

HIGHWAY

TO U.O.R

TO U.O.R

TO C.B.R.I

TO HARDWAR

▦	PAVEMENT CROSSINGS	
■	PRIVATE PARKINGS	
▨	SPECIAL AMENITIES	
▨	VACANT OR UNUSED LAND SUITABLE FOR PARKING	

FIGURE NO:- 64

PAGE NO:- 345

TITLE:-

TRANSPORTATION STUDIES OF THE PILOT STUDY AREA.

the road sides and thereby cause traffic congestion and environmental pollution. Pedestrians find it difficult to cross the road at this point because of the heavy vehicular traffic on the road.

Traffic detailing should be done to avoid conflict and assure safe movement.

Drainage of the roads and sidewalks are absent. This should be looked into immediately.

Encroachment of the road by the workshops and fruit sellers should be checked.

Proper parking space for cycle rickshaws should be provided.

Adequate parking has to be provided for the long distance heavy vehicles.

10.5.4.2 Junction of University and College Road.

The congestion in this junction is less.

There is some amount of vegetation near the junction that gives a soothing effect to the travellers.

Some newly constructed buildings extend towards the road and this reduces visibility at the junction.

Most of the activity on the road is commercial and so adequate parking need to be provided.

The road towards the university is wider and lined with vegetation, but there is no drainage or sidewalks.

There is a need for pedestrian crossing at the junction since there is a lot of fast moving vehicles on the Delhi-Hardwar Road.

10.5.4.3 Century Gate Crossing.

This is the most accident-prone area in the town. The junction has a number of roads meeting at a point. There are five major roads and two small roads meeting in this place. The sight lines are obstructed, road widths are narrow, there is conflict between different modes and direction of travel.

The shops extend into the roads obstructing movement of pedestrian and vehicles.

There is parking on both sides of the road, which create further obstruction to the movement of pedestrians and vehicles.

There is no segregation between the pedestrians and the vehicular movement. Most of the problems can be solved by the proper planning of the traffic island, direction of movement, cross sections of the roads and controlling the pedestrian movement. Adequate parking at convenient points has also to be provided. The sides of the road towards the boat club can be used for parking of light vehicles.

10.5.4.4 The Boat Club Junction

This junction is not worked out well but at the same time there is less traffic on this point. This junction has capacity to take additional traffic.

10.5.4.5 Petrol Pump Junction

On this junction there is a large pedestrian traffic. However there is no through vehicular traffic, but the petrol pumps attract vehicles for petrol fillings. These vehicles sometimes create problems by forming queues that extend on to the roads. The canal side road on this end is lightly used and has additional load carrying capacity.

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There are two major roads cutting through the area. There is little through traffic on these roads, however local traffic creates a lot of congestion on the roads. A large number of pedestrians move through the main road commonly known as the 'Civil Lines market'. Most of the towns major shopping is located on this street.

The other road that passes through the area is less used by Vehicular traffic or even by the pedestrians.

The other roads in the area are narrow neighbourhood roods which vary in size from 1.25m to 3m. The are mostly used by pedestrians but scooters and four wheelers also enter these narrow access ways creating congestion and inconvenience to all the residents of the area.

Though the Road Sides appear crowded and lacking in green spaces, the inner areas are open having some greenery.

10.6 MANAGEMENT AND DESIGN

The main difference in administering what exists and managing for development, for progress, for an improved living lies in good team work. To this can be added the aspect of having a well designed built environment. Management and design are therefore important aspects in a successful built environment. In this exercise the recommendations available from the earlier chapter are used to guide and control the development. Designs for development have been similarly drawn up based on the earlier recommendation and at the same time a marriage has been made with the local and the existing situation of the area.

10.6.1 Pedestrianisation Proposal For The Selected Pedestrian Environment Area

Once the Pedestrian Environment Areas have been delineated at the city level, only pedestrians should use all access facilities within the Pedestrian Environment Area.

The existing access surface should be retained as far as possible to avoid immediate expenses to the Nagar panchayat, Municipal Corporation or the development authority.

With the availability of resources the following prioritised action should be taken:

Garbage disposal from the area should be taken up as the highest priority. The area should be kept totally clean. Unattended Garbage is the biggest offender in the inner areas of the Indian cities.

The proper drainage of the area would be the next priority.

The reorganisation and realignment of the water supply and the electric-supply lines should be done.

All these lines should be taken above the pavement level so that maintenance of the lines does not require the regular digging up of the pavement surface which destroys the surface evenness and its aesthetic qualities.

Space for community parking of cars and scooters should be identified near to the outer perimeters of the Pedestrian Environment Area and close to the vehicular corridors.

Animals like cows, buffaloes and sheep are being kept inside human settlements this causes a lot of problems inside these areas with regard to

cleanliness, maintenance of storm water drainage, mosquitoes and other related problems.

Pedestrian pathways should have as far as possible level walks inter-spiced by small groups of steps to discourage the movement of wheeled vehicles like rickshaws, scooters, cycles, etc.

The existing access system of the area is conceptually 'Outside In' and in the design of the Pedestrian Environment Area a redesigning of the access system has to be done along the lines of a ' Inside Out' concept.

The first thing that had to be done is to identify open spaces on the outer sides of the Pedestrian Environment Area that could be used for modal change facilities.

These open spaces needed to have convenient access to the outer surrounding road and at the same time to the inner access pedestrian routes.

The area of the open space had to be adequate to provide facilities for parking, toilets, shops, shelters, pedestrian police facilities and other pedestrian needs.

The existing roads passing through the area had to be closed at their entrances and converted to pedestrian routes.

Vehicular access to the police station had to be maintained. Emergency access to all areas had to be permitted.

The pedestrian spaces in and around public buildings like the temples and the cinema halls had to be treated with special emphasis to pedestrian activities.

The management and operation of the modal change areas are very important. It is proposed that these centres are given to private organisations on the basis of 'Build, Operate and Transfer'. Pedestrian links between the Pedestrian Environment Areas have identified and shown in [Figure 65].

10.6.2 Demonstrative Design of Typical Modal Change

The most crucial design situation is present at the point where the pedestrian change to the vehicular mode of movement. It was therefor assumed that this would offer the best opportunities for an demonstrative pedestrian related design.

The design was developed keeping in mind all the facilities required for the well being and conveniences of the pedestrian [Figure 66].

The detailing of the pedestrian elements were done according to the 'Design Guide' developed in this investigation and placed in Appendix-A.

Surfacing done in the area is with the conventional local materials available. The pedestrian areas are paved with brick work placed in the herring bone pattern. The areas subject to heavy pedestrian movement have been paved with concrete blocks. The vehicular road surface is paved with the usual tar macadam.

Width of the pedestrian and vehicular access ways have been designed for the anticipated pedestrian and vehicular traffic.

Slope/ Step/Curbs have been conveniently located at the appropriate places. Slopes and steps have been provided to segregate the vehicular parking zone from the pedestrian areas. Kerbs of concrete have been provided so that they have the strength to with stand the impact caused by the vehicles. Slopes with convenient slopes allow handicapped access.

Drainage channels are located along the edges of the main circulation areas for vehicles and pedestrians. This would allow the areas to remain dry and prevent water logging during rainy seasons.

Adequate lighting, both in white and yellow light, have been provided to make visibility easy.

Most of the service lines have been kept over the ground level so that maintenance becomes easy.

Pedestrian Furniture in the form of a clock tower, concrete benches, litter bins and post boxes have been placed at convenient locations.

Pedestrian Signs showing drinking water facilities, toilets, telephone and other facilities have been provided.

Facilities for the Disabled on the Pedestrian Ways have been provided for easy and uninterrupted access.

Footpaths along Vehicular Corridors have been provided for the collection of pedestrians from the abutting premises. Pedestrian guard rails have been fixed between the pedestrian and vehicular ways.

Links Between Two Pedestrian Areas have been shown and the connections have been made by zebra crossings, since the local municipality is unable to finance footbridges or subways.

10.6.3 Design of Elements In the Modal Change Area from Appendix-A (A)

The designs of the elements used in the modal change areas have been taken from the 'design guide' developed in this investigation and places in appendix-A of this report [Figure 67 Figure 68 Figure 69].

The following is the list of elements used:

1) Pedestrian Paving (Brick)

2) Pedestrian Paving (Concrete Block)

3) Steps (Natural Stone)

4) Tree Surround (Pre-cast Concrete)

5) Pedestrian Guard Rail

6) Low Rail

7) Kerb and Channel

8) Seating

9) Clock Tower

10) Letter Box

11) Litter Bin

12) Advertising and Posters

The Pilot Application on the Town of Roorkee shows that a complex transport problem involving several modes of travel and a fairly degraded environment is susceptible to analysis. The methods described in this chapter are comparatively crude, but given the time and resources a very reliable projection could have been made.

GANGA CANAL

MAIN ROAD (11 MT. WIDE)

PETROL PUMP

TO SOLANI

SUDARSHAN TALKIES

MANDIR

MAIN ROAD (10M. WIDE)

BOAT CLUB ROAD

POST OFFICE

ROORKEE TALKIES

MANDIR

HIGH WAY.

BUS STOP

HIGHWAY.

TO MEERUT

TO U.O.R

TO U.O.R

HIGH WAY.

TO U.O.R

HIGH WAY

TO C.B.R.I

TO HARDWAR

PROPOSED MODAL CHANGES	
PEDESTRIANISED AREAS	
GREEN SPACES	

FIGURE NO:- 65

PAGE NO:- 353

N

TITLE:-

PEDESTRIAN PROPOSAL FOR SELECTED PEDESTRIAN ENVIRONMENT AREA

DRAINAGE
CHANNEL

PARKING FOR
FOUR WHEELERS

CONCRETE PAVING

PARKING FOR
TWO WHEELERS

TWO WHEELER PARKING

LAMP POSTS

CLOCK
TOWER

C

BOLLARDS

CYCLE PARKING

DN

PEDESTRIAN
ACCESS

LITTER BIN

LOW RAIL

ADVERTISING/
POSTERS

SEATINGS

DRINKING
WATER

ADVERTISINGS
1 POSTERS

S
H
O
P
S

SHOPS

BRICK PAVING.

PEDESTRIAN
SIGNS

LADIES
TOILET

PEDESTRIAN
SIGNS

S H O P S

PEDESTRIAN
SIGNS

GENTS
TOILET

PEDESTRIAN
ACCESS

GREEN SPACE

EXISTING BUILDING

RICKSHAW/AUTO RICKSHAW
PARKING

BUS
BAY

BUS BAY

TO HARDWAR

DRAINAGE CHANNEL

SHELTER

LETTER
BOX

SHOPS

EXISTING
BUILDING

PEDESTRIAN
GUARD RAIL

EXISTING
BUILDING

H I G H W A Y

TO MERUT

FIG NO:- 66	TITLE :-
PAGE NO:- 355	DEMONSTRATIVE DESIGN OF TYPICAL MODAL CHANGE

PEDESTRIAN PAVING (BRICK)

- GOOD QUALITY BRICK LAID ON EDGE
- CEMENT MORTAR BED (1:4)
- JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3)
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM THK.
- COMPACTED GROUND.

SECTION-'XX'

PEDESTRIAN PAVING CONCRETE BLOCK.

- RECTANGULAR CONCRET PAVING BLOCKS LAID IN HERRING BONE PATTERN. VIBRATED AFTER LAYING.
- JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3) BRUSHED IN DRY AND WELL WATERED
- COMPACTED SAND 50 MM TK.
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM TH.
- COMPACTED GROUND.

SECTION

UNIT

PLAN

STEPS (NATURAL STONE)

- SMOOTH FINISH GRANITE STONE TREAD 300 MM ON CEMENT MORTAR BED ALL JOINTS POINTED UP CEMENT MORTAR (1:3) AND RECESSED.
- CAST IN SITU CONCRETE (1:3:6)
- HARD CORE OF OVER BURNT JHAMA BRICK COMPACTED.

SECTION

TREE SURROUND (PRE-CAST CONCRETE)

- PRE CAST CONCRETE
- CRUSHED GRAVEL

PLAN

- CRUSHED GRAVEL.
- CONCRETE UNITS
- PAVING AS SPECIFIED
- SAND BED 25 MM
- GRAVEL 50 MM

SECTION

Figure 67 Design of Elements In the Modal Change Area from Appendix-A (A).

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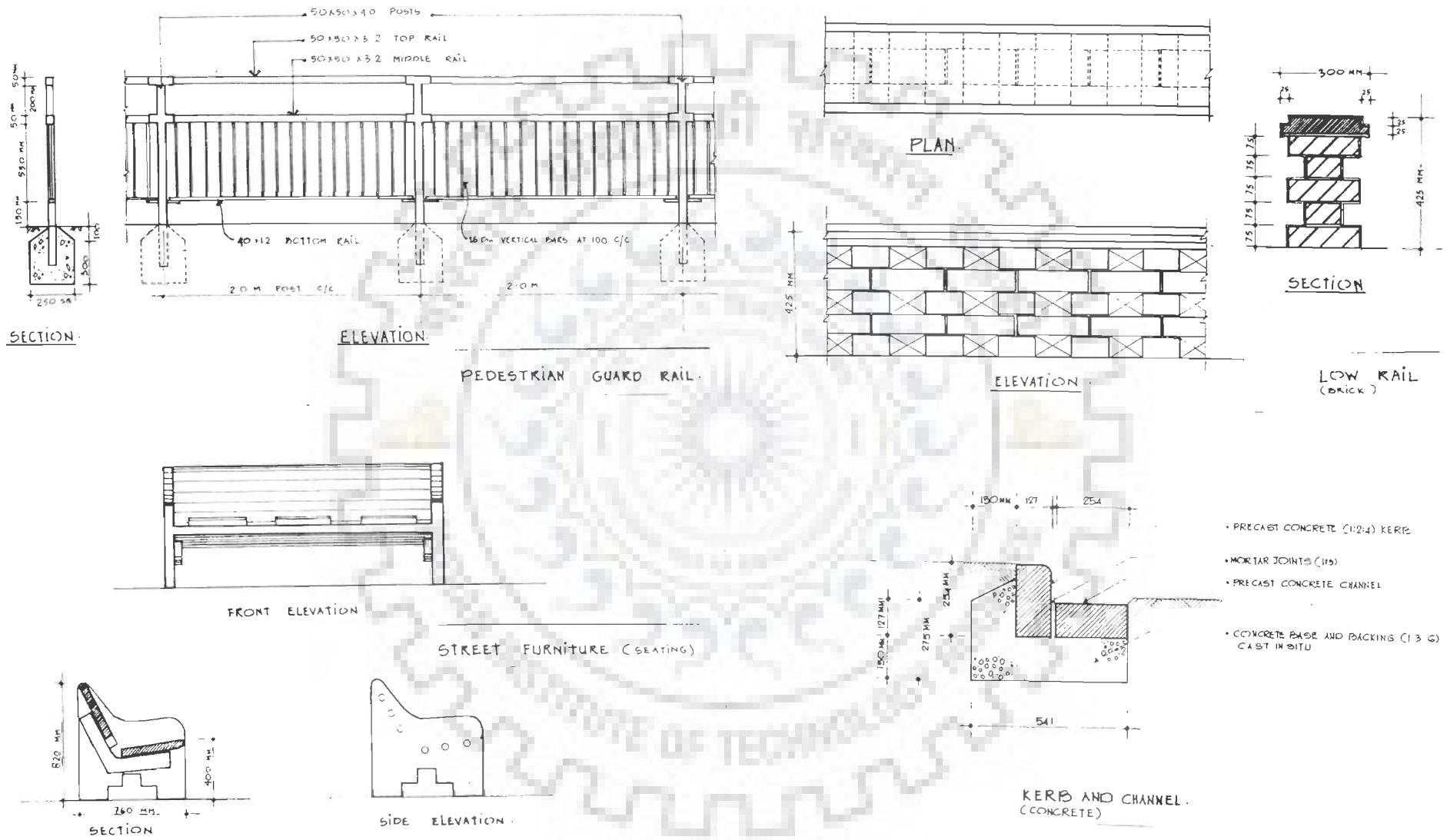
Figure 68 Design of Elements In the Modal Change Area from Appendix-A (B).

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PLAN

STREET FURNITURE (CLOCK TOWER)

FRONT ELEVATION

ADVERTISING / POSTERS

18 SHEET POSTER DIMENSION (WALL MOUNTED)

DIFFERENT TYPES OF ADVERTISING / POSTERS TO BE PASTED IN THE AREAS AS ALLOCATED TO THEM

4 SHEET POSTER DIMENSION (STRUCTURE SUPPORTED)

16 SHEET POSTER DIMENSION (STRUCTURE SUPPORTED)

LETTER BOX (OCTAGONAL SHAPE)

LETTER BOXES

KEY TO UNLOCK

HINGED BOLLARD (LOCKING BOLLARD)

WHEN BOLLARD IS REMOVED, FLAP CLOSES FLUSH

LOCKING PIN AND PADLOCK

REMOVEABLE BOLLARD

ELEVATION

LITTER BIN

VIEW

Figure 69 Design of Elements In the Modal Change Area from Appendix-A (C).

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128. T.O.I. 4.23 lakh litre fuel is wasted daily in Capital. Times of India. 7th March 1997.

129. T.O.I. Impotency among men on the rise: Study. Times of India. 11th May 1998.

130. T.O.I. Delhi roads kill more than other metros put together. Times of India. 6th March 1997.

131. T.O.I. Police claim rate of accidents was brought down in '96. Times of India. 1st January 1997.

132. The Telegraph. Court directs CMC, panel to prepare sound zones in city. High Court bans rallies at Esplanade. The Telegraph. 25th February 1997.

133. The Telegraph. Fine for garbage. Telegraph. 3rd January 1997.

134. The Telegraph. Noise Pollution. Telegraph. 26th November 1996.

135. The Telegraph. Hawkers burn Rs. 50 lakhs in fuel daily: study. Telegraph. 25th November 1996.

136. UNCHS. Rising incomes and increasing motorizat

137. ion. Economic Instruments and Regulatory Measures for the Demand Management of Urban Transport, UNCHS, 1995.

APPENDIX

APPENDIX A: DESIGN GUIDE

The design guide has been developed for the convenience of the users of this research. They will find typical designs of the various details that one may encounter while planning for the pedestrian. The designs have been developed from the observations made during visits to the case study areas and combined with information on the matter available in the existing literature. The recommendations of the investigation have also been reflected in the designs, wherever applicable. The specifications mentioned on the drawings are as per the National Building Code of India.

Special effort has been made to reflect the traditional Indian styles, which are mostly a combination of the Hindu, Muslim and Colonial styles, in the design features of the detail elements.

The drawings have been grouped under the following heads:

- Pedestrian Paving
- Street Furniture
- Tree Surrounds
- Steps and Ramps
- Drainage Channels and Kerbs
- Low Rails
- Margins, Trims and Edges
- Advertising, Posters and Pedestrian Signs
- Pedestrian Guard Rails.
- Foot Bridges.
- Bollards
- Pedestrian Subways and Zebra Crossings.

SECTION

- RECTANGULAR CONCRET PAVING BLOCKS LAID IN HERRING BONE PATTERN. VIBRATED AFTER LAYING.
- JOINTS TO BE FILLED WITH CEMENT MORTAR. (1:3) BRUSHED IN DRY AND WELL WATERED
- COMPACTED SAND 50 MM TH.
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM TH.
- COMPACTED GROUND.

60 MM 50 MM

100 MM

UNIT

200 MM

100 MM

60 MM

PLAN
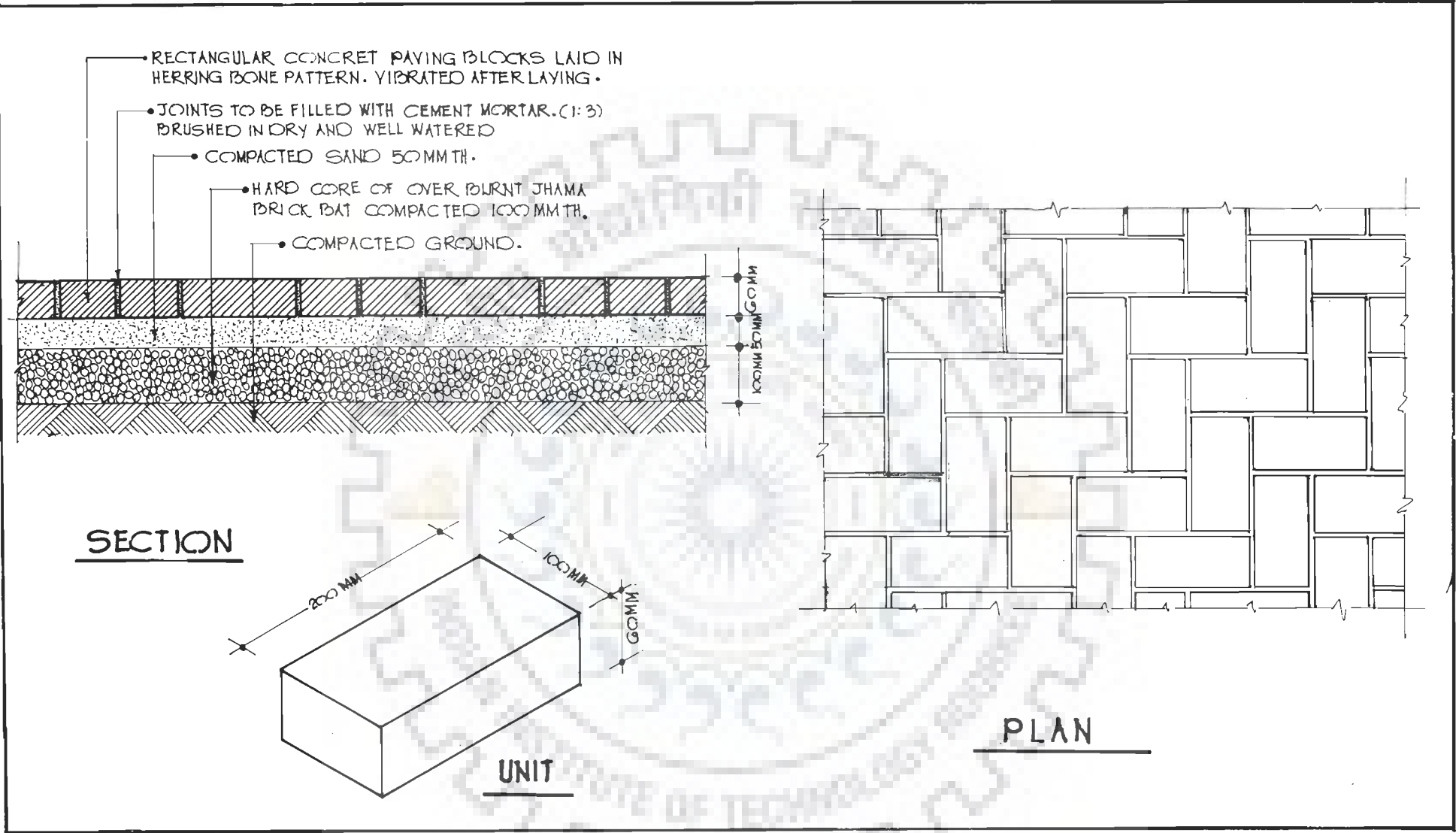
| FIG NO 70 | SCALE - 1:8 | PAGE NO :- 372 | TITLE | PEDESTRIAN PAVING. CONCRETE BLOCK. |

GRANITE SETTS 102 × 204 × 102 SIZE LAID

JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3).
BRUSHED IN DRY AND WELL WATERED.

CORSE OF SAND BED COMPACTED.

HARD CORE OF OVER BURNT BRICK BAT COMPACTED.

COMPACTED GROUND.

100 75 102

204

204

204

204

SECTION

PLAN
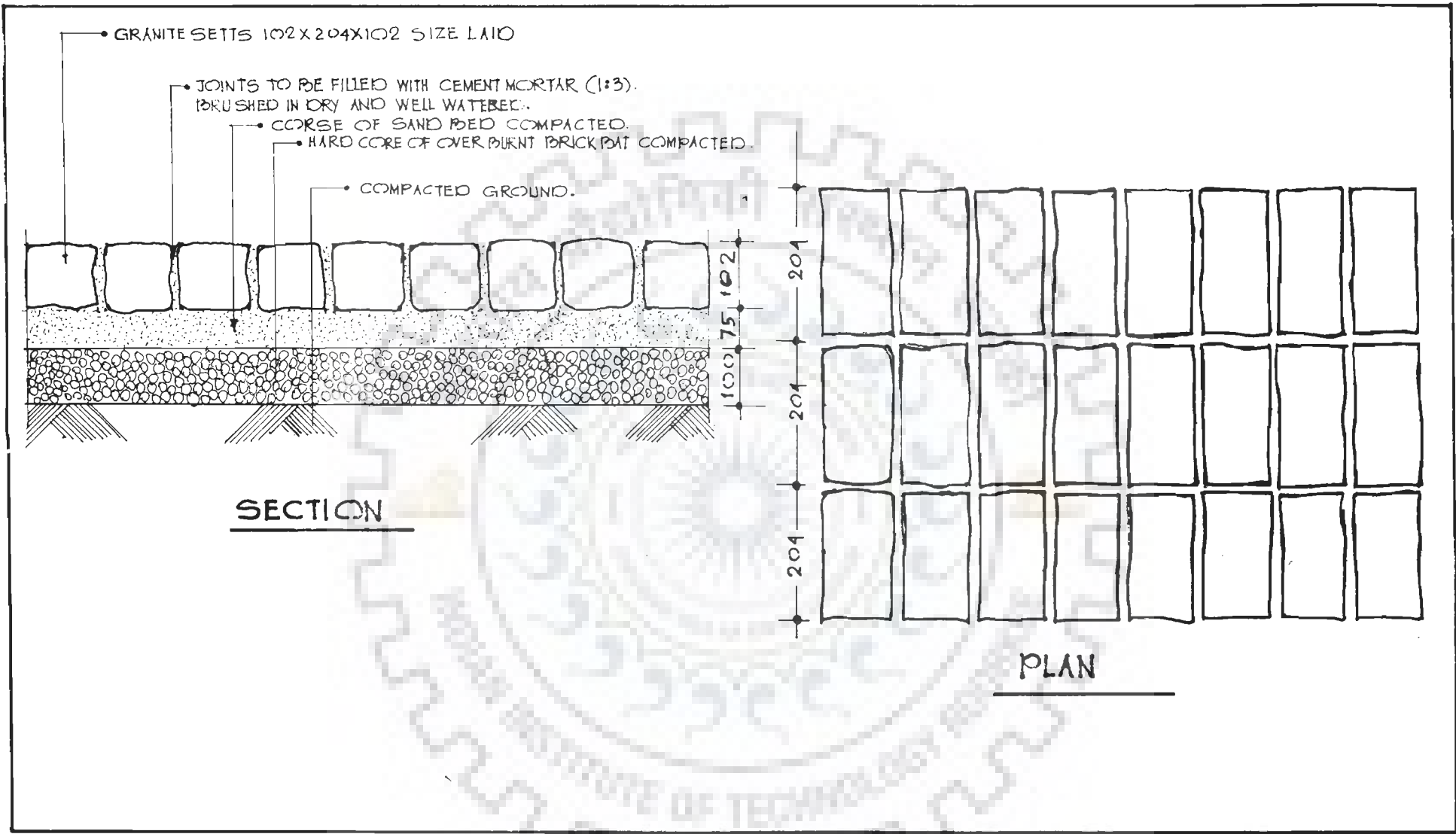
| FIG NO 71 | SCALE 1:8 | PAGE NO:- 373. | TITLE | PEDESTRIAN PAVING. GRANITE SETT (RECTANGULAR) |

- •BRICKS WELL BURNT OR SLIGHTLY OVER BURNT LAID FLAT IN BASKET WEAVE PATTERN.
- •JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3).
- •CEMENT MORTAR BED. (1:4)
- •HARD CORE OF OVER BURNT JHAMA BRICK BATS COMPACTED TO 100 MM TH.
- •COMPACTED GROUND.

75MM.

100MM 25MM

SECTION

PLAN
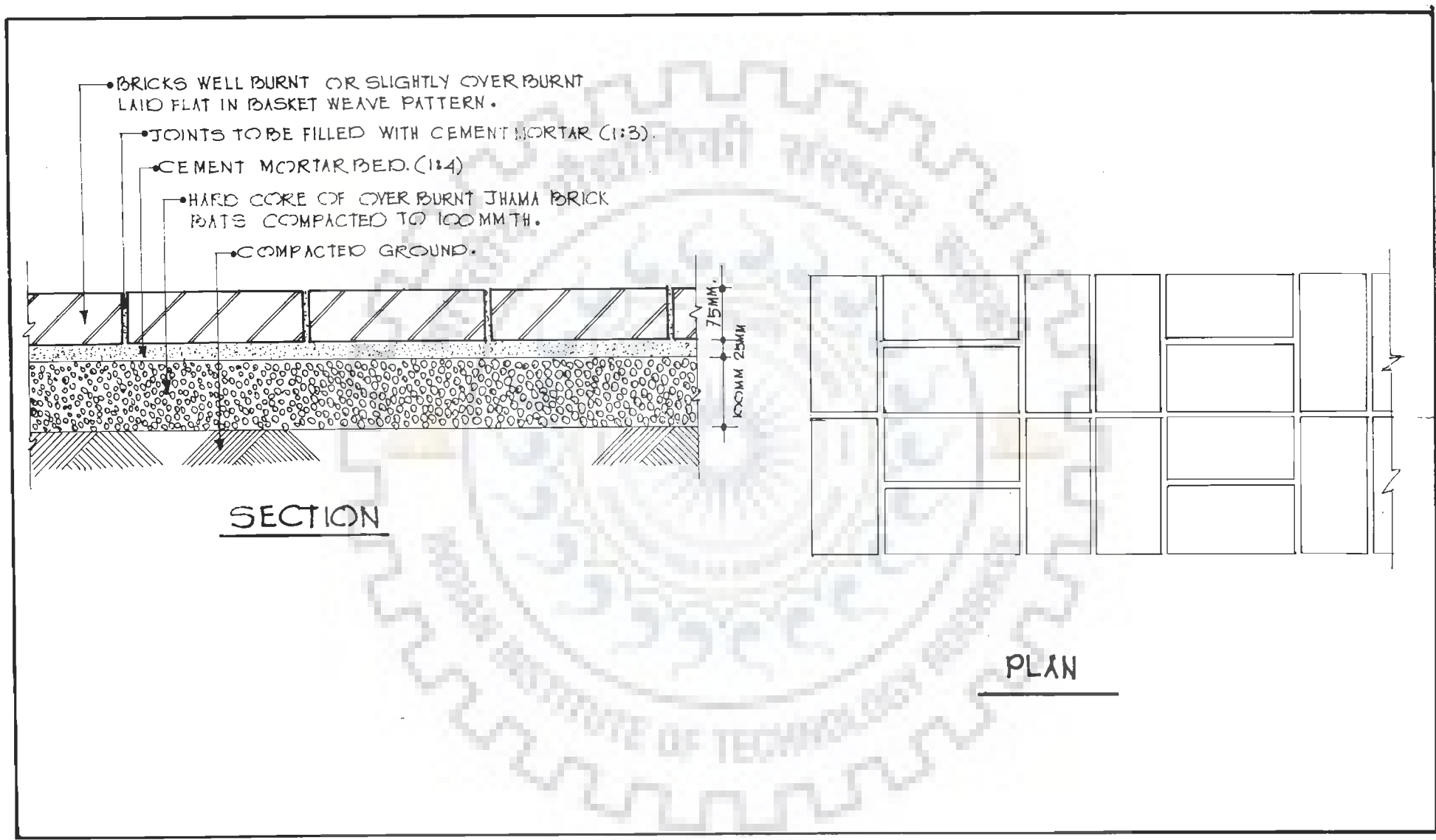
| FIG NO 72 | SCALE 1:8 | PAGE NO:- 374 | TITLE PEDESTRIAN PAVING. BRICK (BASKET WEAVE) |

- ROUGH SURFACED STONE SETT 180×360×50 LAID STACK BOND JOINTS
- JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3) BRUSHED IN DRY AND WELL WATERED
- COMPACTED SAND 50 MM TH.
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM TH.
- COMPACTED GROUND.

50 MM.
150 MM
100 MM

SECTION

PLAN
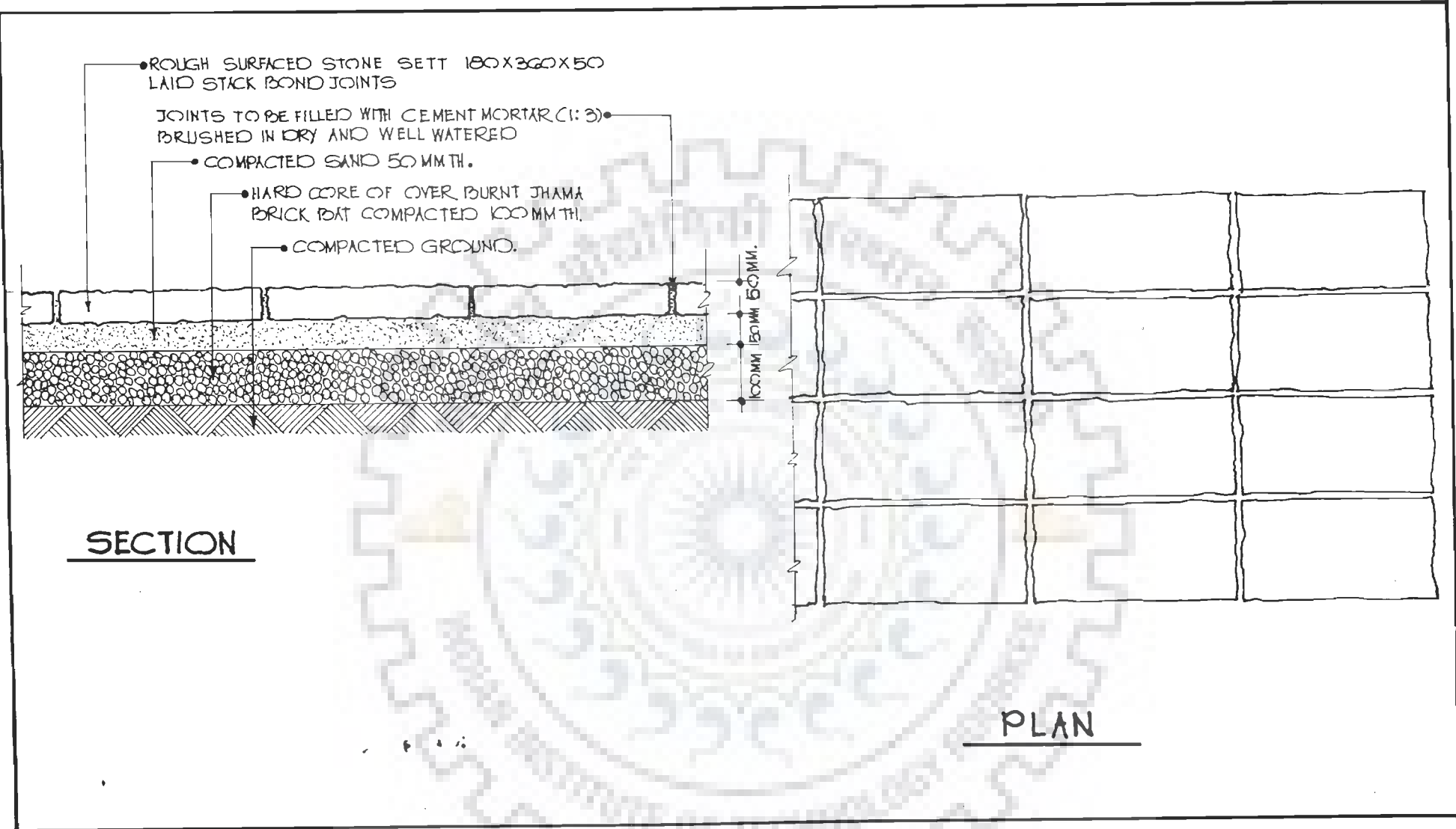
| FIG NO :- 73 | SCALE 1:8 | PAGE NO :- 375 | TITLE | PEDESTRIAN PAVING. RECONSTRUCTED STONE. |
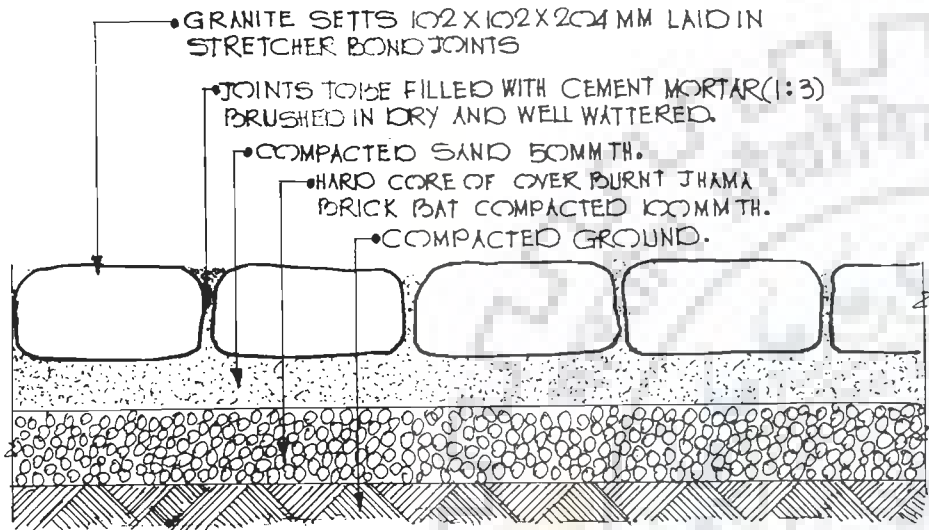
- GRANITE SETTS 102 X 102 X 204 MM LAID IN STRETCHER BOND JOINTS
- JOINTS TO BE FILLED WITH CEMENT MORTAR(1:3) BRUSHED IN DRY AND WELL WATTERED.
- COMPACTED SAND 50MM TH.
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100MM TH.
- COMPACTED GROUND.

102 MM

50MM

100MM
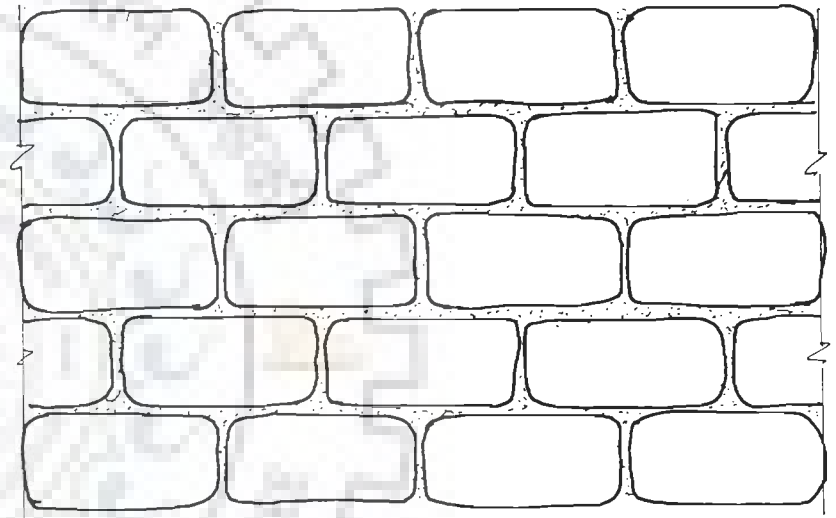
SECTION

PLAN

| FIG NO : 74 | SCALE 1:8 | PAGE NO:- 376 | TITLE | PEDESTRIAN PAVING. GRANITE SET. |

- GOOD QUALITY BRICK LAID ON EDGE
- CEMENT MORTAR BED (1:4)
- JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3)
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM. THK.
- COMPACTED GROUND.

125 MM

25 MM

100 MM
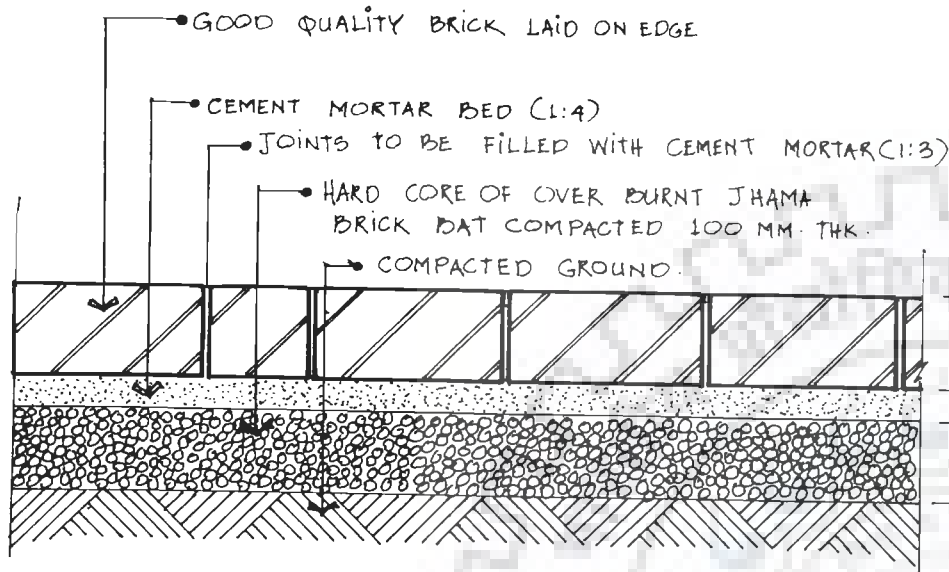
SECTION 'XX'
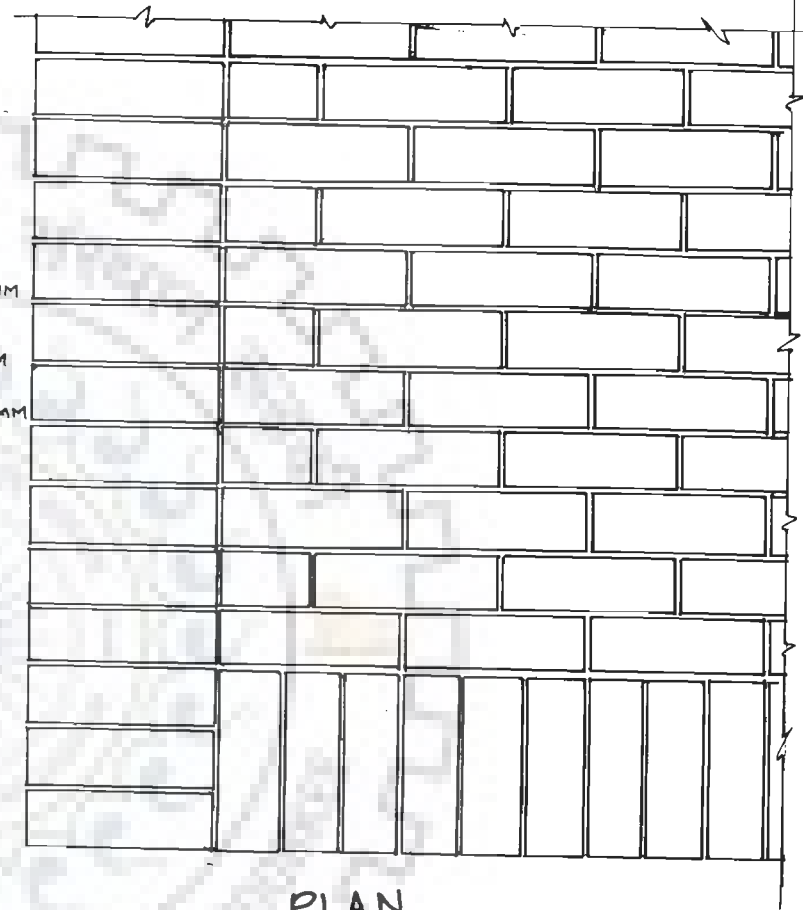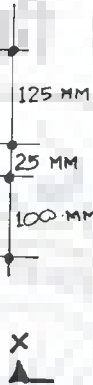
PLAN.

FIG NO- 75	SCALE - 1:10	PAGE NO:- 377	TITLE- PEDESTRIAN PAVING (BRICK)

- GOOD QUALITY BRICK LAID ON EDGE
- CEMENT MORTAR BED (1:4)
- JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3)
- HARD CORE OF OVER BURNT JHAMA BRICK BAT COMPACTED 100 MM THK.
- COMPACTED GROUND

125 MM
75 MM
100 MM

SECTION.

PLAN
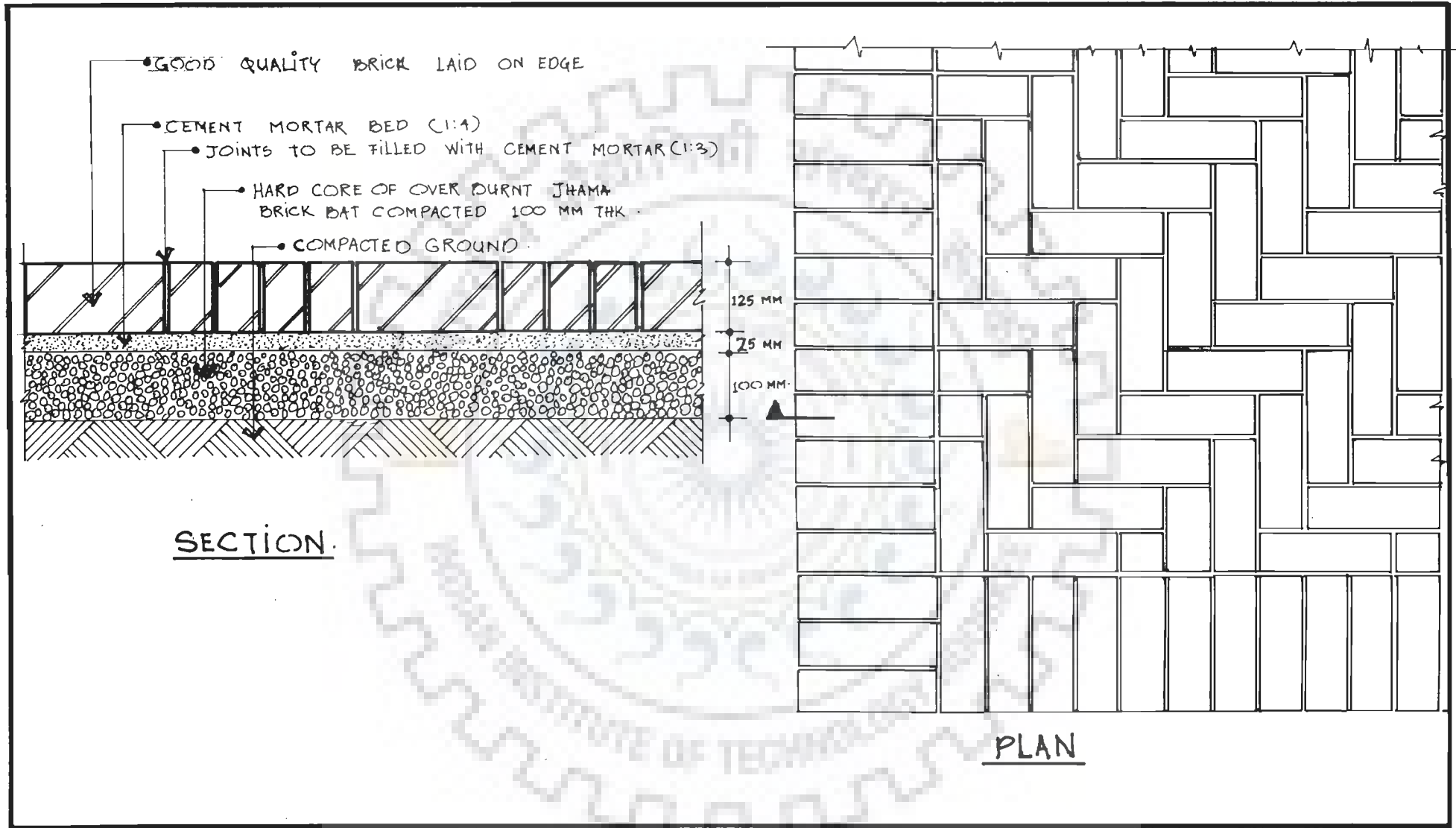
| FIG NO - 76 | SCALE - 1:10 | PAGE NO:- 378 | TITLE PEDESTRIAN PAVING. (BRICK) |

BRICKS WELL BURNT OR SLIGHTLY OVER BURNT
LAID FLAT IN HERRING BONE PATTERN. BRUSHED
IN DRY AND WELL WATERED.

JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3).

CEMENT MORTAR BED (1:4).

HARD CORE OF OVER BURNT JHAMA
BRICK BAT COMPACTED 100MM TH.

COMPACTED GROUND.

75MM.
25MM
100MM
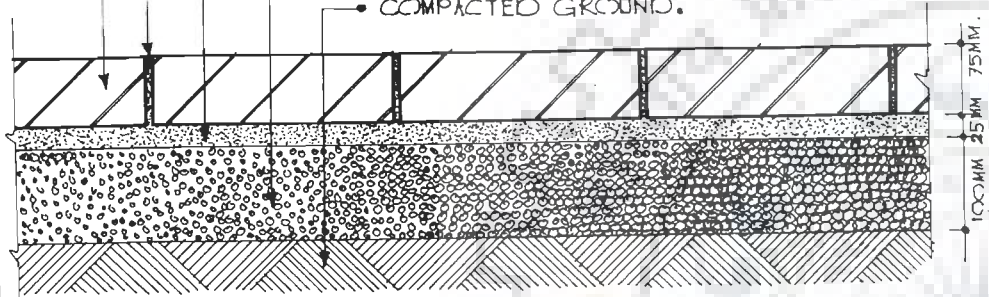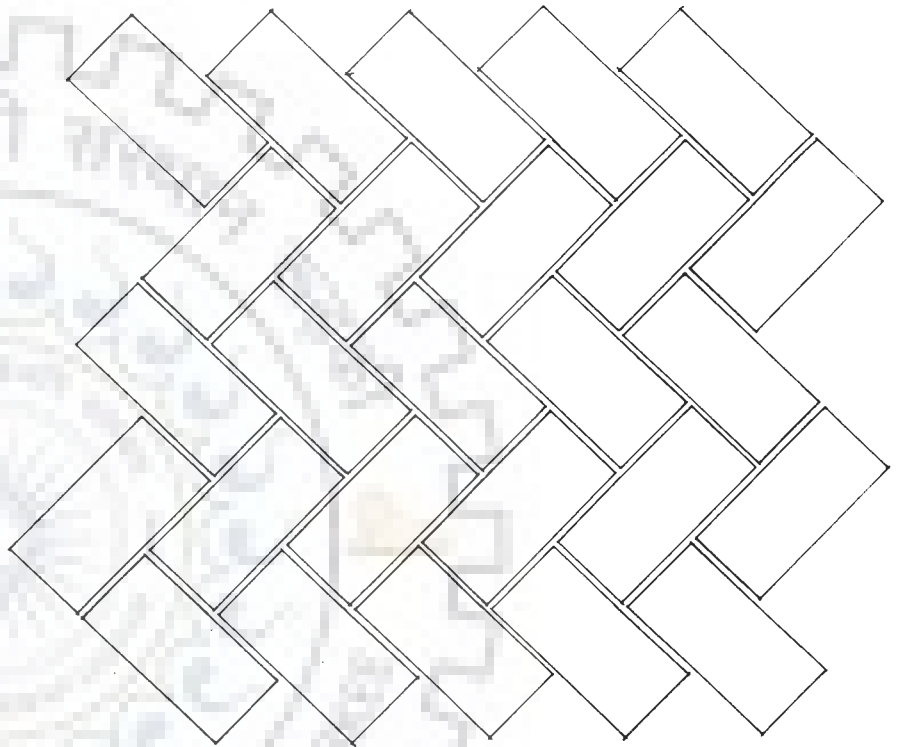
SECTION

PLAN

| FIG NO 77 | SCALE. 1:8 | PAGE NO:- 379 | TITLE | PEDESTRIAN PAVING. BRICK (HERRING BONE) |

JOINTS TO BE FILLED WITH CEMENT MORTAR (1:3)

CEMENT MORTAR BED (1:4)

HARD CORE OF OVER BURNT JHAMA
BRICK BAT COMPACTED 100MM THK.

BRICKS WELL BURNT LAID ON EDGE

125 MM

25 MM

100 MM

COMPACTED GROUND.
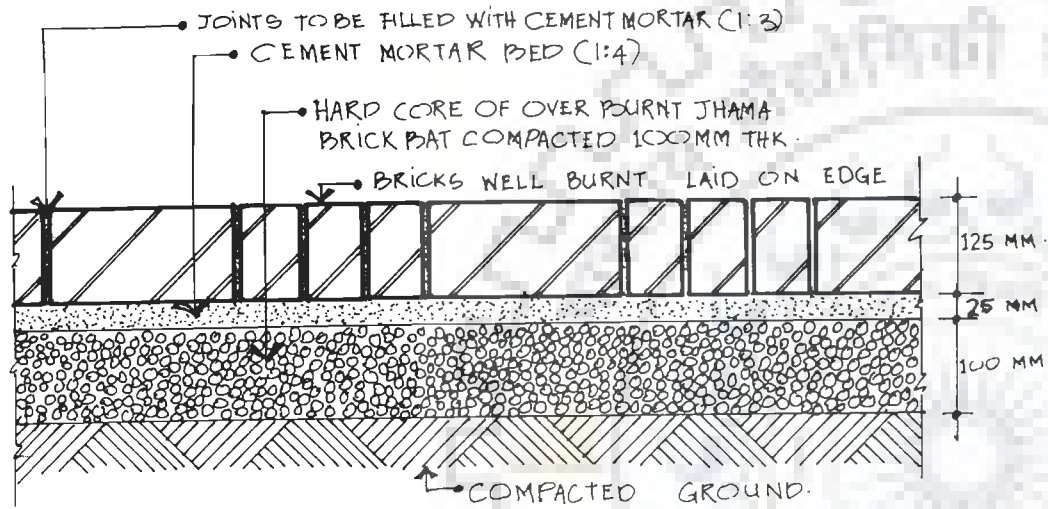
SECTION

PLAN.

| FIG NO. 78 | SCALE - 1:10 | PAGE NO: - 380 | TITLE PEDESTRIAN PAVING. (BRICK) |

NATURAL SLATE STONE, SAWN FACE AND
EDGES 600MM WIDE, 38MM TH IN RANDOM
LENGTH LAID BREAKING JOINT ON MORTAR.
MORTAR BED 25MM TH.
(1:4) JOINTS TO BE CLOSE BUTTED.
HARD CORE OF OVERBURNT
JHAMA BK BAT COMPACTED.
COMPACTED
GROUND.

JOINTS
TO BE FILLED
BY SLURRY.

38 MM
25 MM
100 MM

SECTION

PLAN
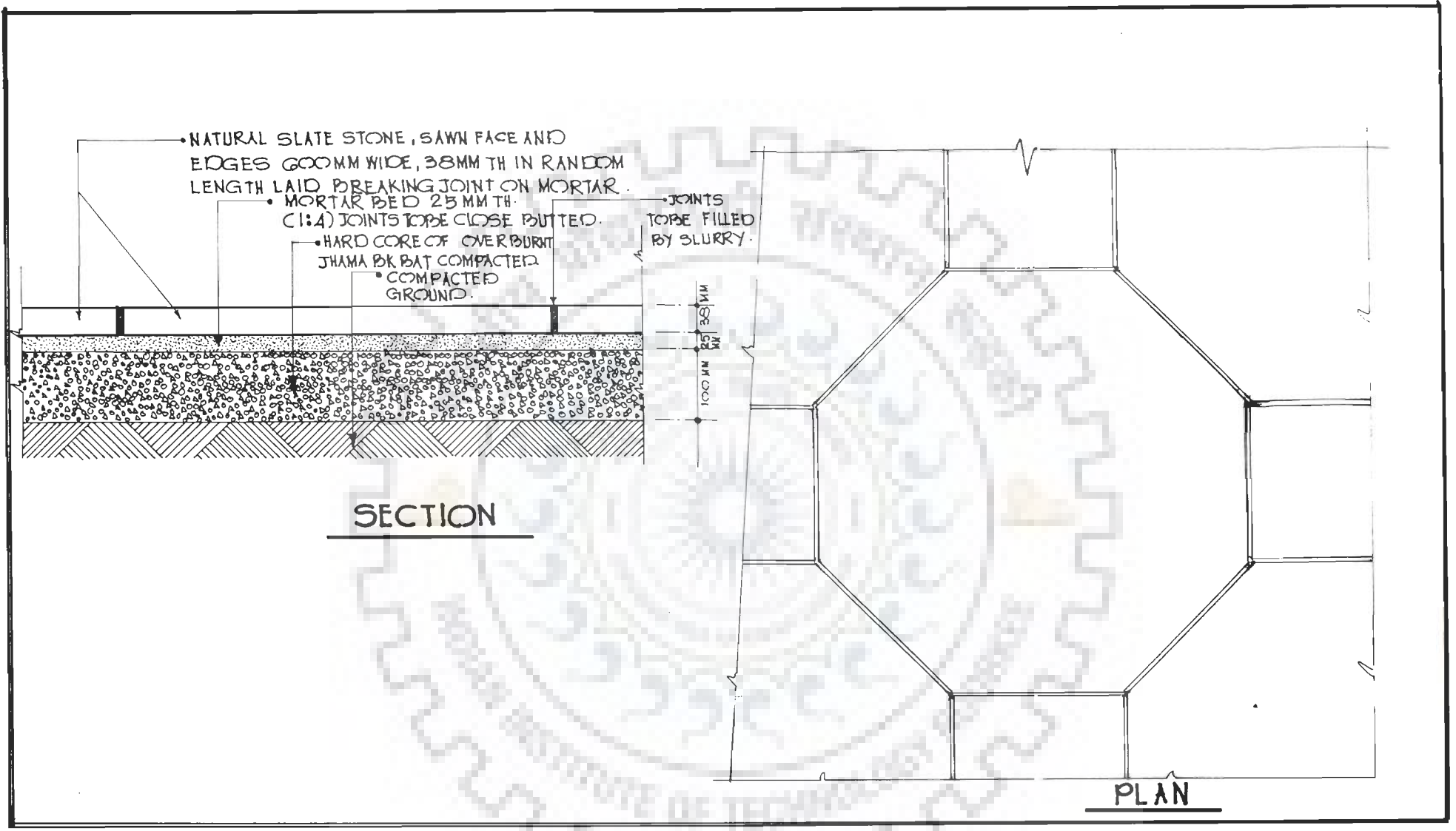
FIG. NO:-79	SCALE. 1:8	PAGE NO:- 381	TITLE:	PEDESTRIAN PAVING
				NATURAL SLATE STONE

550 Φ

1200

LETTER BOX
(OCTAGONAL SHAPE)

1400

1200

1400

800
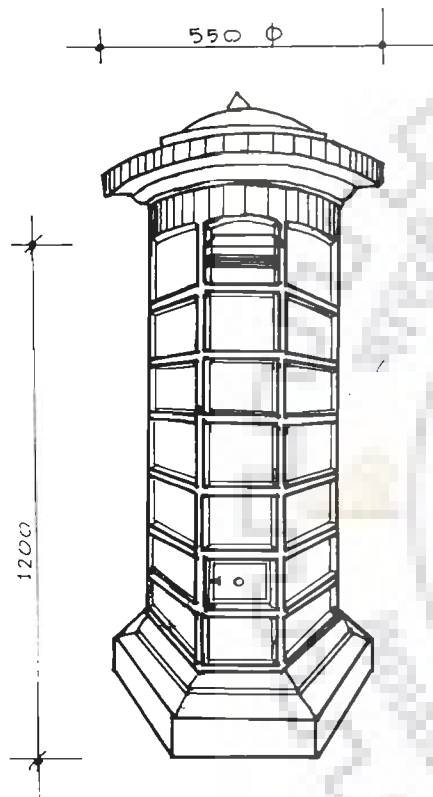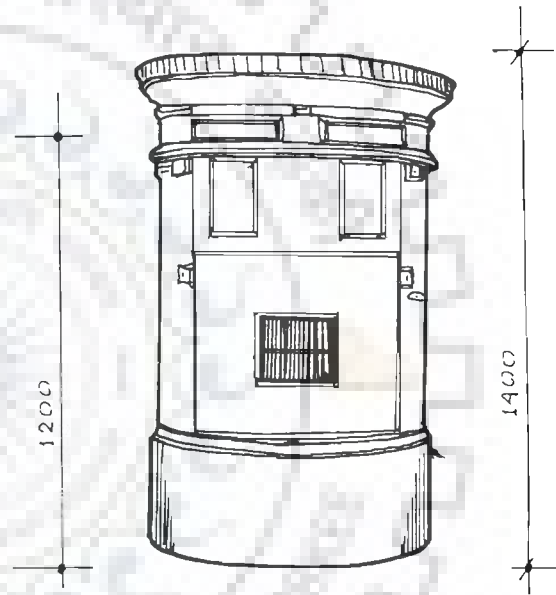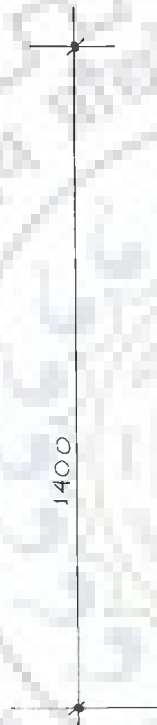
DOUBLE PILLER LETTER BOX
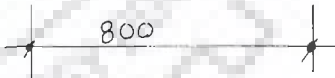
FIG. NO:- 80	SCALE:- NTS.	PAGE NO:- 382	TITLE:- LETTER BOXES

600 MM.

700 MM.

300 MM.

1000 MM. (MAX.)

G.L.
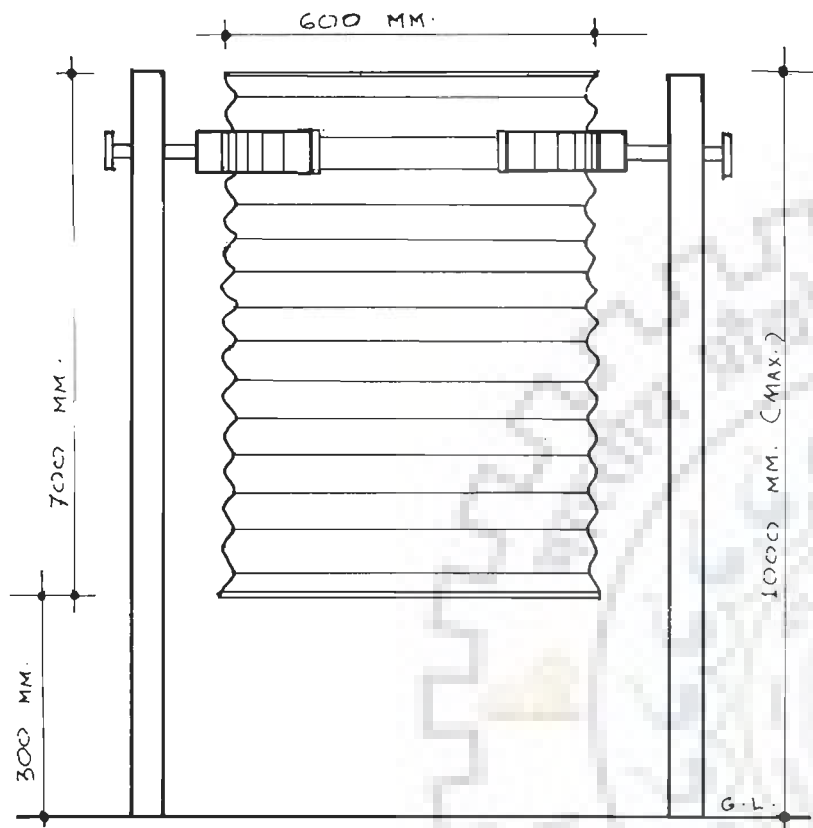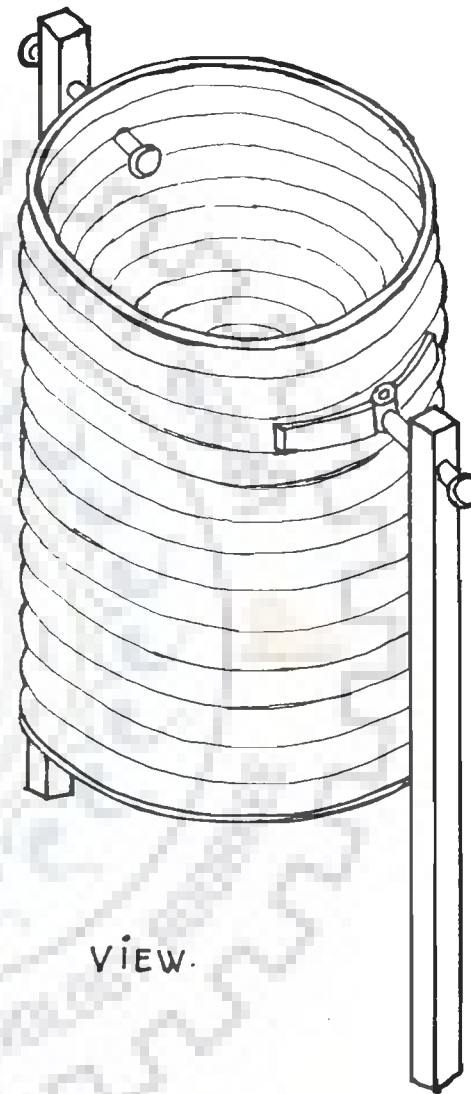
ELEVATION

VIEW.

| FIG. NO:- 81 | SCALE - N.T.S | PAGE NO:- 383 | TITLE:- LITTER BIN. (STREET FURNITURE) |

1000 MM. ⌀

1000 MM.

1000 MM.

500 MM.

500 MM.
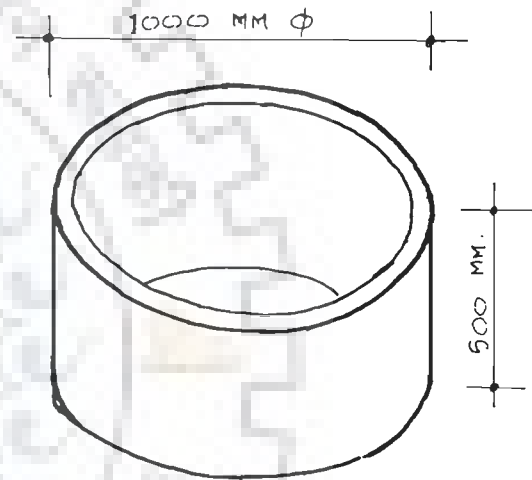
CYLINDRICAL LITTER BIN.

CUBICAL LITTER BIN.

FIG NO:- 82	SCALE:- N·T·S	PAGE NO:- 384	TITLE:- LITTER BIN (STREET FURNITURE) (R.C.C)
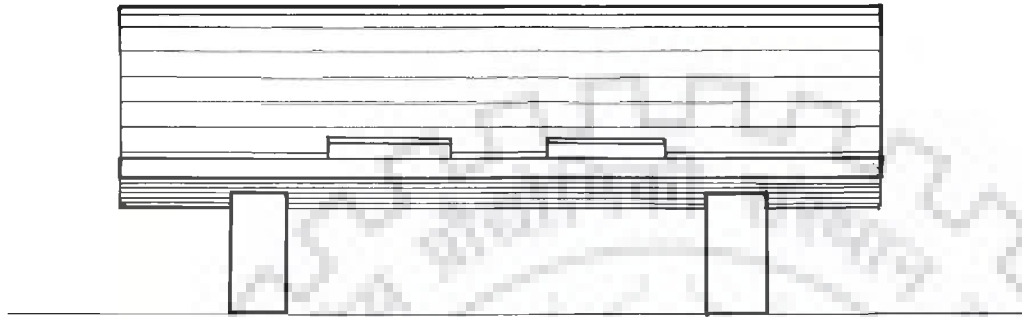
FRONT ELEVATION.
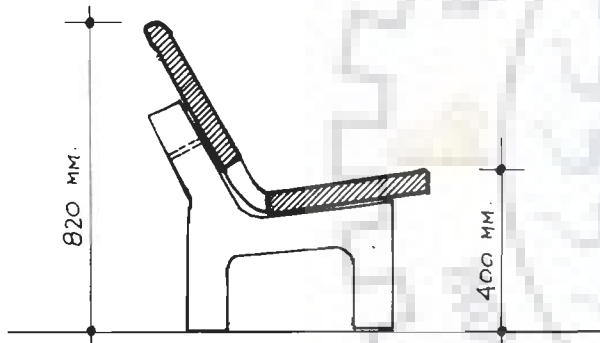
820 MM.

400 MM.

760 MM.
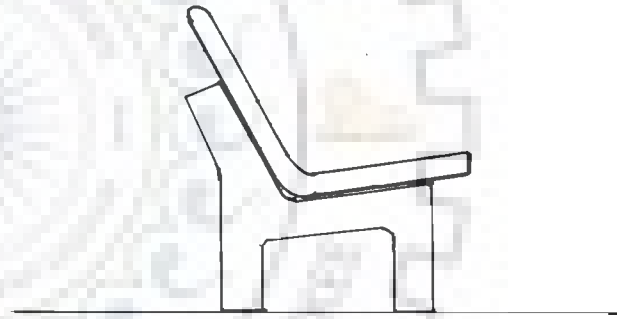
SECTION.

SIDE ELEVATION.

| FIG. NO:- 83 | SCALE:- 1:20. | PAGE NO:- 385 | TITLE :- | STREET FURNITURE (SEATING) |

FRONT ELEVATION

820 MM.

400 MM

760 MM
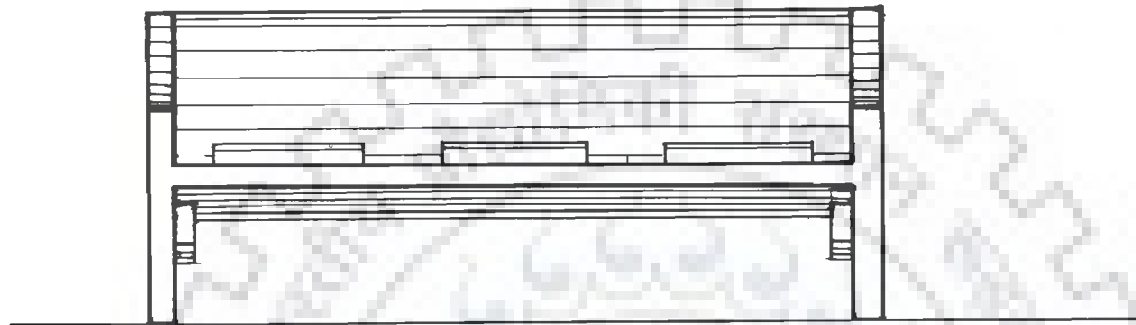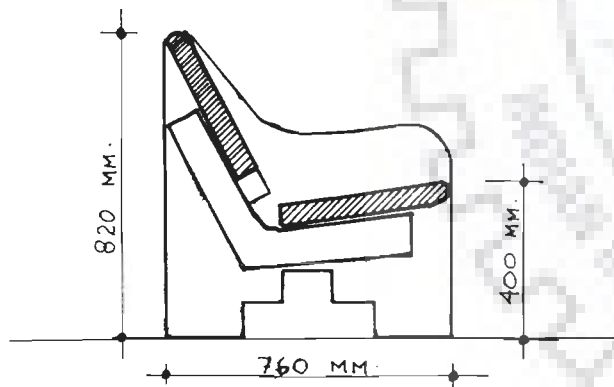
SECTION.
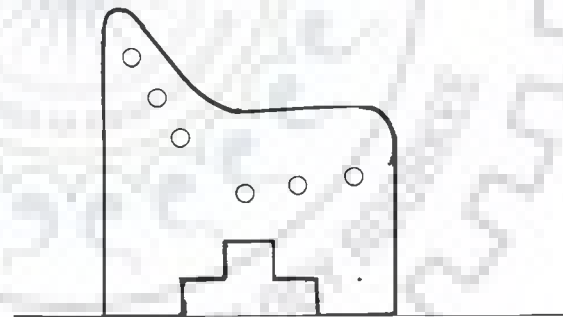
SIDE ELEVATION.

FIG. NO:- 84	SCALE:- 1:20	PAGE NO:- 386	TITLE:-	
			STREET FURNITURE (SEATING)	

PLAN.

4800 MM.

800 MM.   800 MM.

800

4800 MM.

800

UP

FRONT ELEVATION.

3700 MM.

2500 MM.

50 MM.

6000 MM.
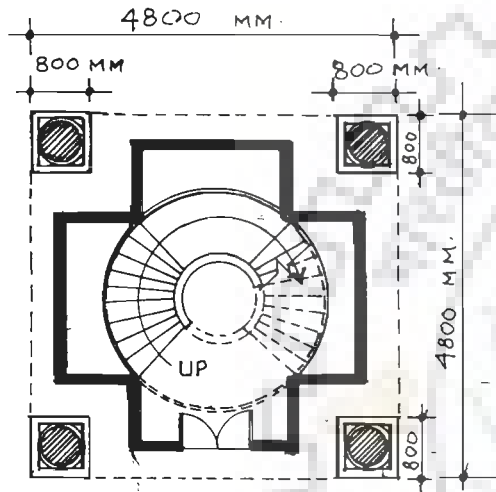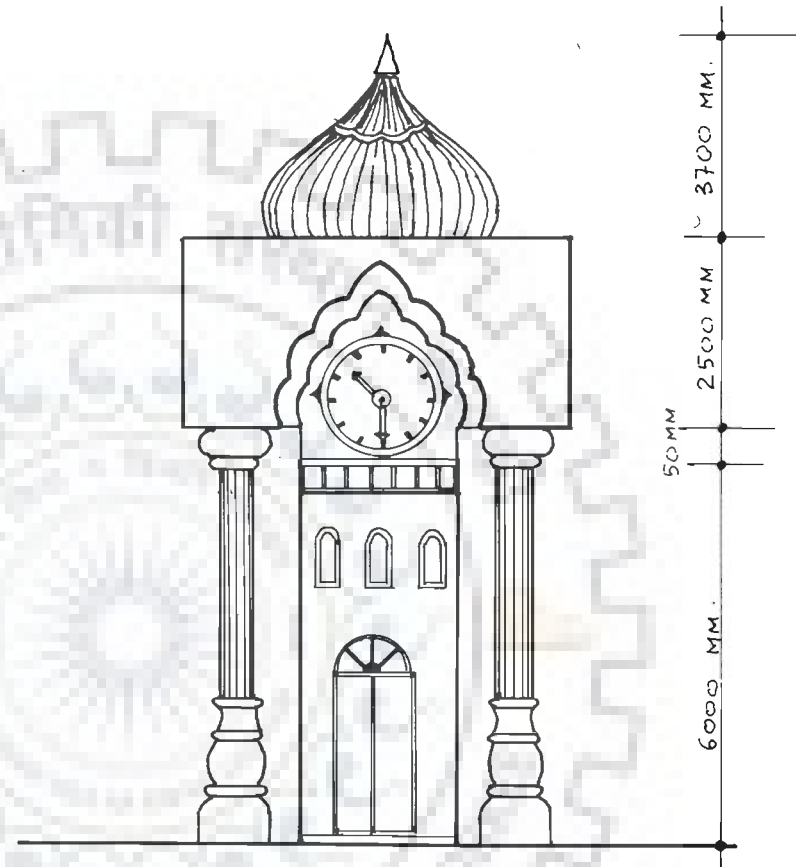
| FIG. NO:-85 | SCALE:- 1:100 | PAGE NO:- 387 | TITLE:- STREET FURNITURE (CLOCK TOWER) |

CRUSHED GRAVEL

SAW-CUT GRAVEL

GRAVEL 50MM

1210

1210

SQUARE GRAVEL

CRUSHED GRAVEL
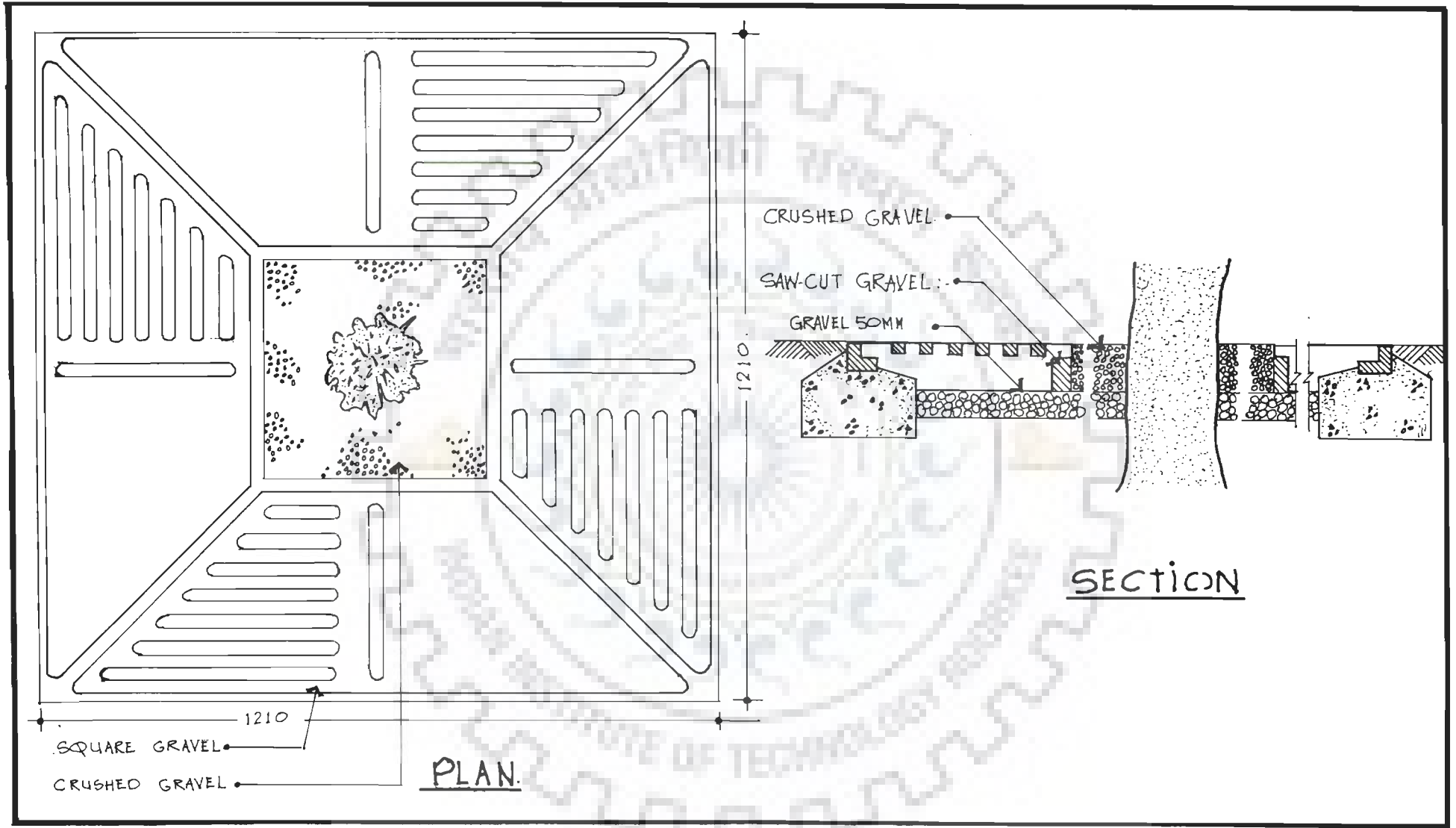
PLAN.

SECTION

| FIG NO :-86 | SCALE :- 1:10 | PAGE NO:- 388 | TITLE:- TREE SURROUND (A) |
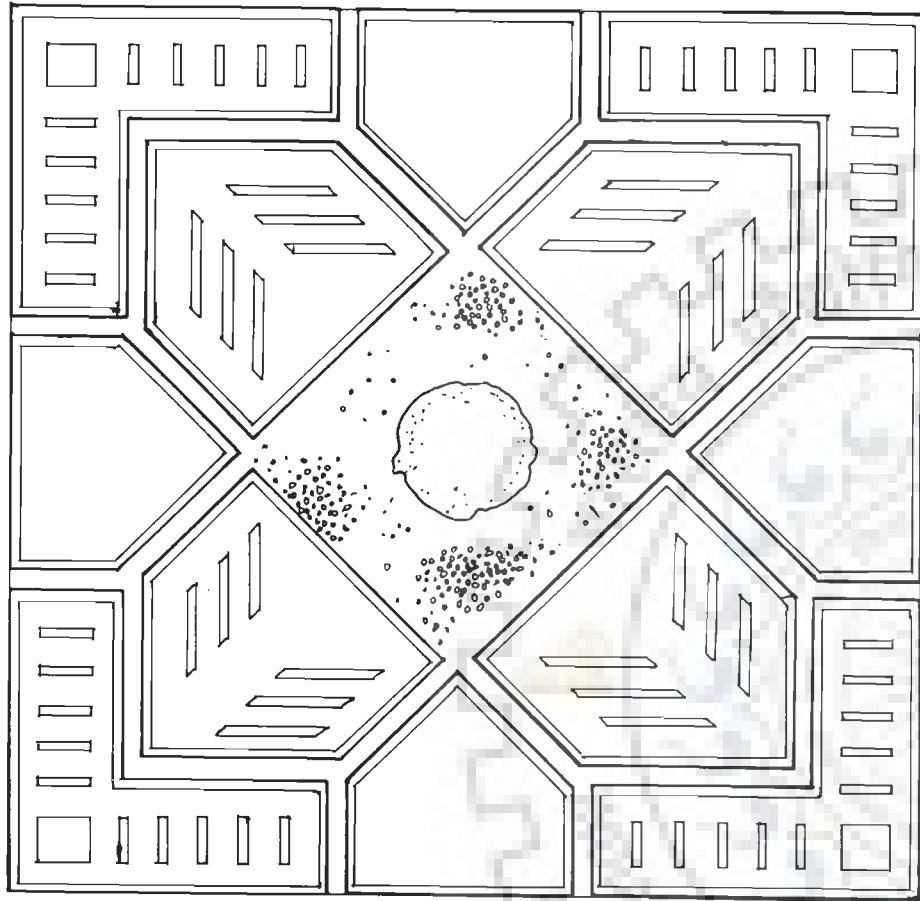
CRUSHED GRAVEL:—

SAW-CUT GRAVEL:—

GRAVEL 50MM—
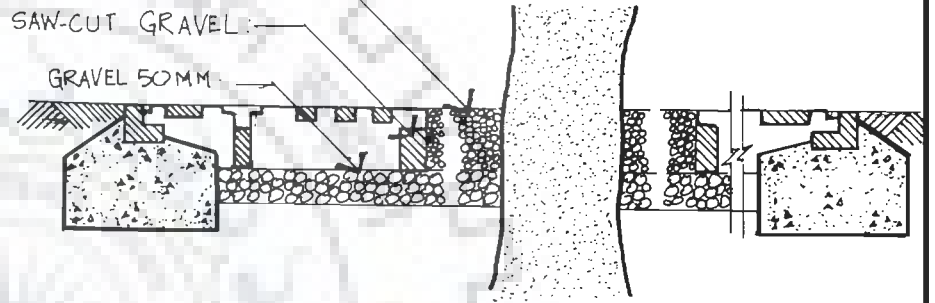
SECTION.

PLAN.

| FIG NO :- 87 | SCALE 1:10 | PAGE NO:- 389 | TITLE:- TREE SURROUND.(B) |

PLAN

SECTION

Labels in drawing:
- 1500 (top horizontal dimension)
- 1500 (left vertical dimension)
- PRE-CAST CONCRETE
- CRUSHED GRAVEL
- CRUSHED GRAVEL
- CONCRETE UNITS.
- PAVING AS SPECIFIED.
- SAND BED 25 MM.
- GRAVEL 50 MM.
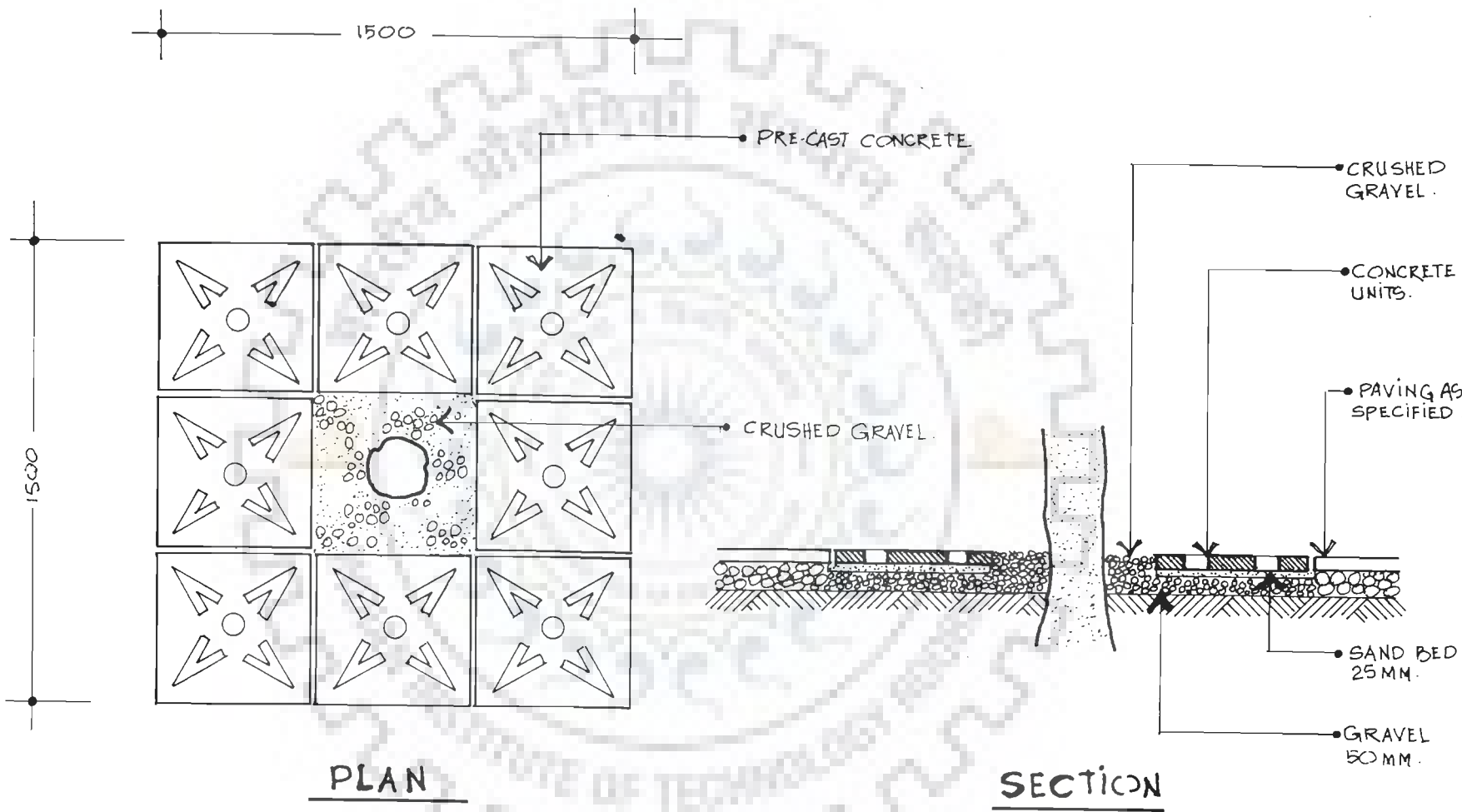
| FIG NO:- 88 | SCALE 1:16 | PAGE NO:- 390 | TITLE:- TREE SURROUND (C) (PRE-CAST CONCRETE) |

PLAN

SECTION

PRE CAST CONCRETE
MENO METRIC 4 SQ
TREE GRILLS.

CRUSHED GRAVEL.

CRUSHED GRAVEL.

CONCRETE UNITS.

PAVING AS SPECIFIED.

SAND BED 25 MM.

GRAVEL 50 MM.

1500

1500
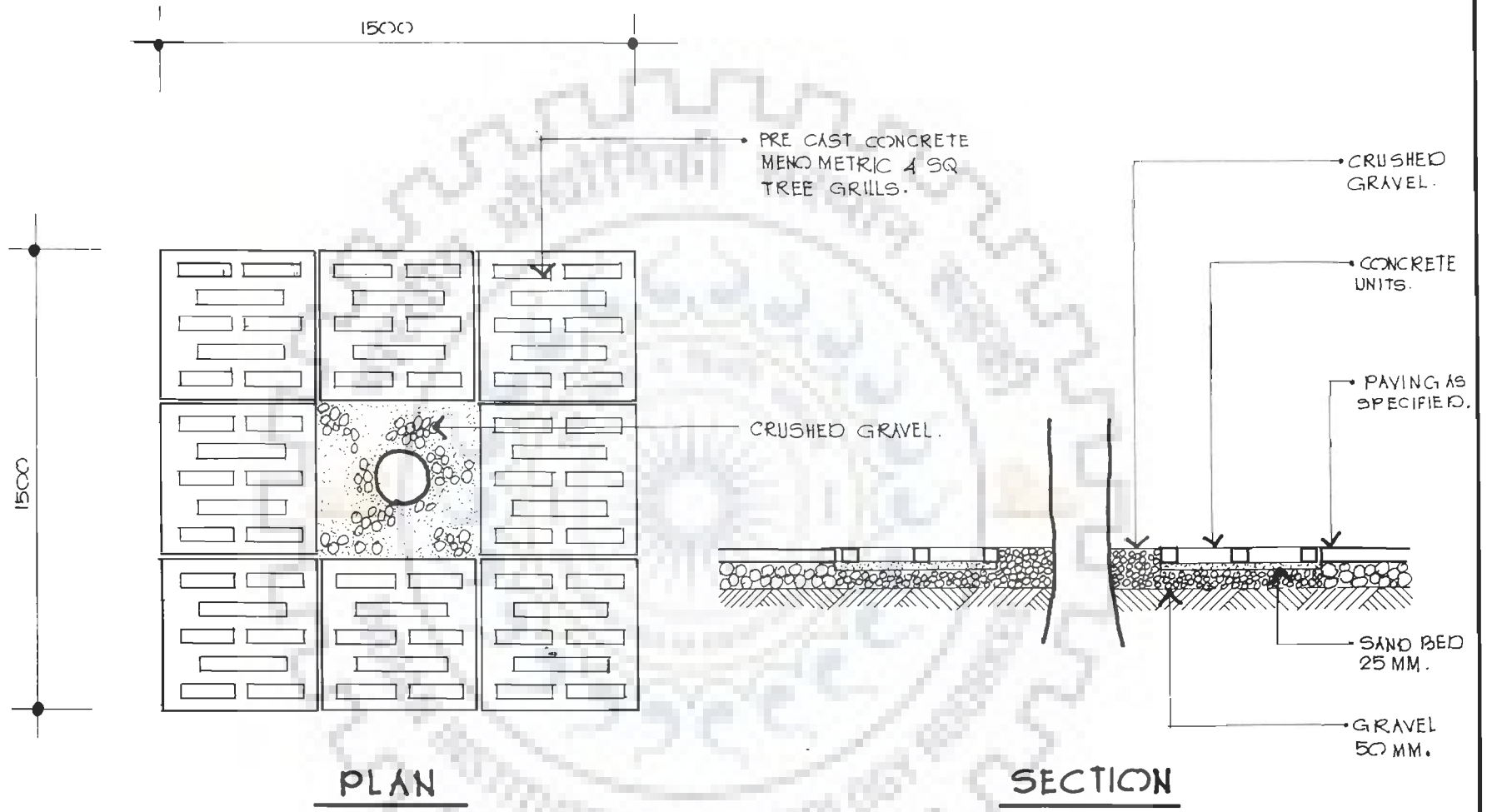
| FIG NO:- 89 | SCALE 1:16 | PAGE NO:- 391 | TITLE | TREE SURROUND (D) (PRECAST CONCRETE) |
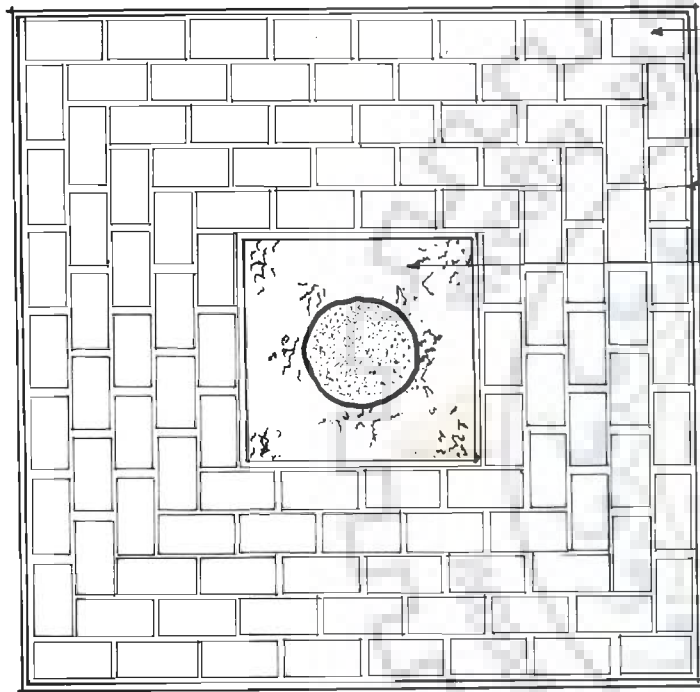
CONCRETE BLOCKS 200x100x70MM

TIMBER EDGE 25x75 MM.

CRUSHED GRAVEL.

CRUSHED GRAVEL.

SAND BED 25MM

CONCRET BLOCK.

TIMBER EDGE.

PAVING AS SPECIFIED

12
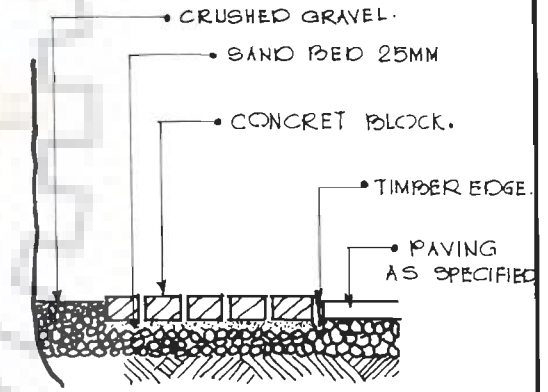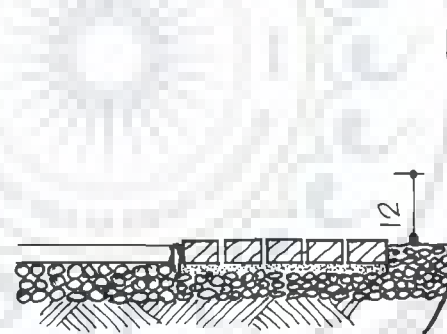
PLAN

SECTION

| FIG NO 90 | SCALE 1:16 | PAGE NO:- 392 | TITLE | TREE GRILLE (CONCRETE BLOCK) |

- PRECAST CONCRETE SLAB TREADS 450 X 900 X 50
  CAST WITH CEMENT CONCRETE (1:1.5:3) NATURAL FINISH
  ON CEMENT MORTAR BED. ALL JOINTS TO BE POINTED AND RECESSED.

- PRECAST CONCRETE EDGING 200 x 900 x 50 MM CAST WITH
  CEMENT CONCRET (1:1.5:3) NATURAL FINISH ON CEMENT
  MORTAR BED 15MM. ALL JOINTS TO BE POINTED.

- CAST IN CITU CONCRETE (1:3:6) 100MM

- HARD CORE OF OVER BURNT JHAMA BRICK BAT
  COMPACTED TO 100MM TH

- COMPACTED GROUND.

450

50MM

900

300 MM

250 MM
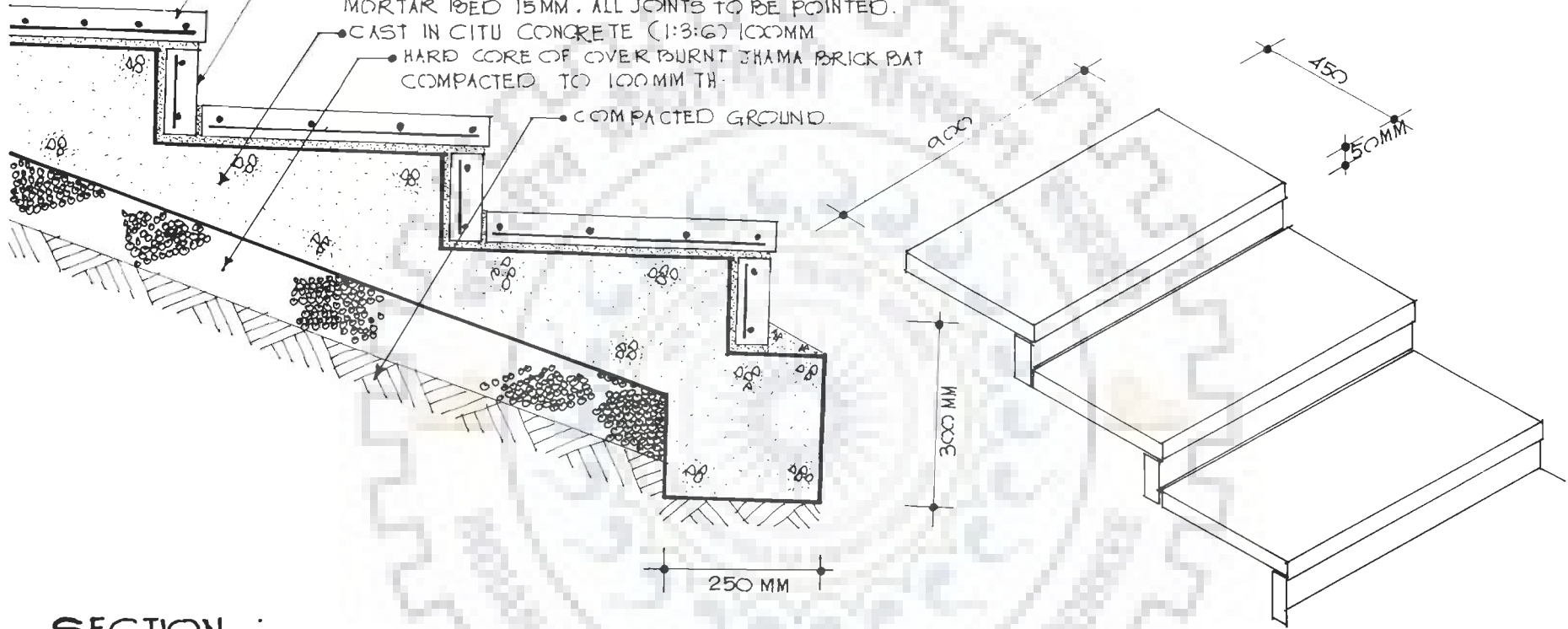
SECTION

| FIG NO:- 91 | SCALE 1:10 | PAGE NO:- 393 | TITLE. STEPS (CONCRET SLAB) |

PRECAST CONCRETE BLOCK PAVIORS.

CEMENT MORTAR BED. (1:4) JOINTS 10MM.

CAST INSITU CONCRETE BASE (1:3:6) 150MM

COMPACTED GROUND.

300 MM.

400 MM

400 MM

300 MM

SECTION

PLAN
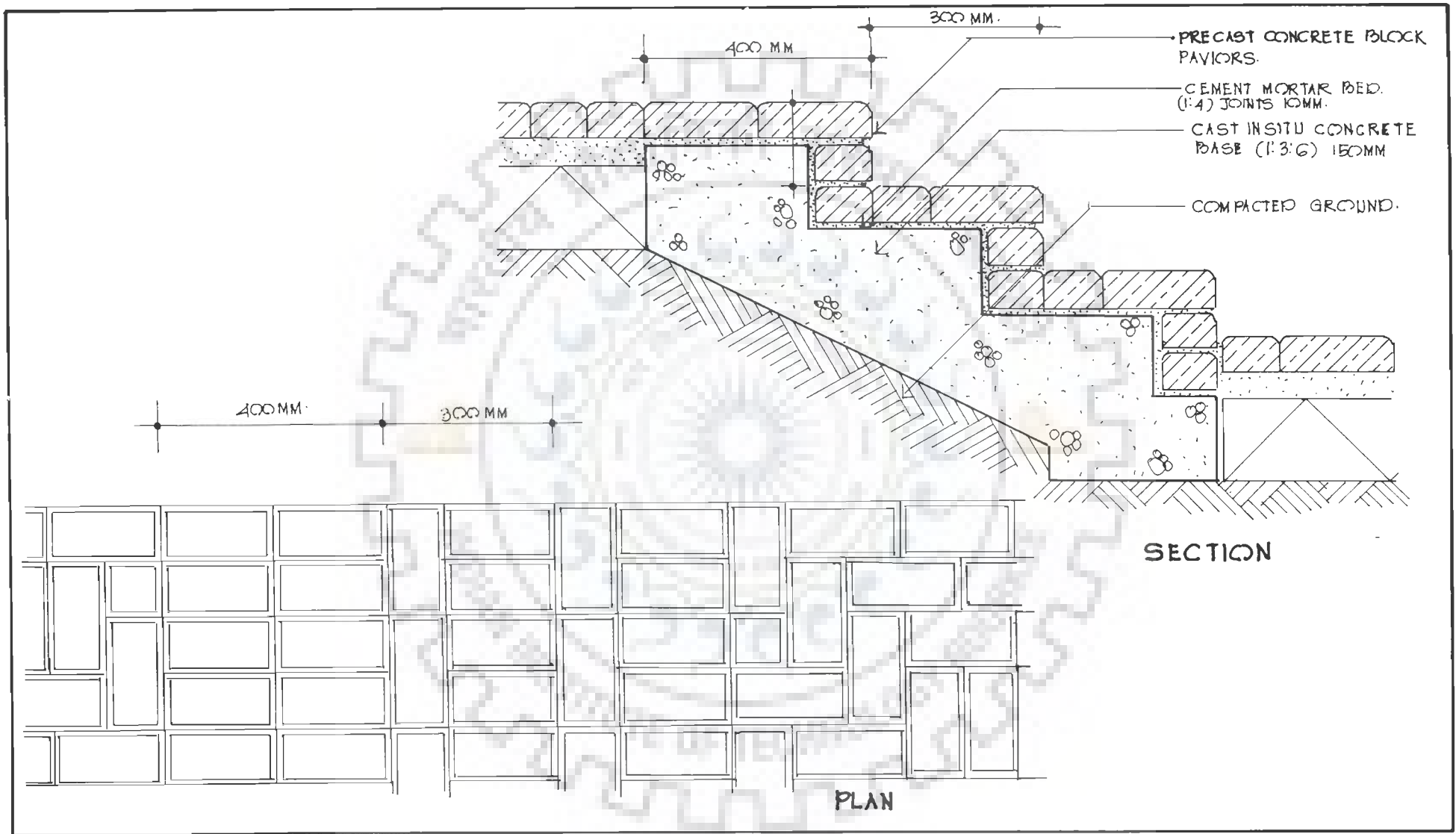
| FIG NO 92 | SCALE 1:10 | PAGE NO:- 394 | TITLE STEPS (CONCRET BLOCK PAVIORS) |

300

GRANITE SETS 200 X 100 X 100 MM BEDDED
ON CEMENT MORTAR (1:4). ALL JOINTS 10MM
POINTED WITH CEMENT MORTAR (1:3)

INSITU CONCRETE (1:3:6) 150MM MIN.

HARD CORE OF OVER BURNT JHAMA BRICKS
COMPACTED TO 100 MM TH.

COMPACTED GROUND.

100 MM

100

250

250

SECTION

VIEW
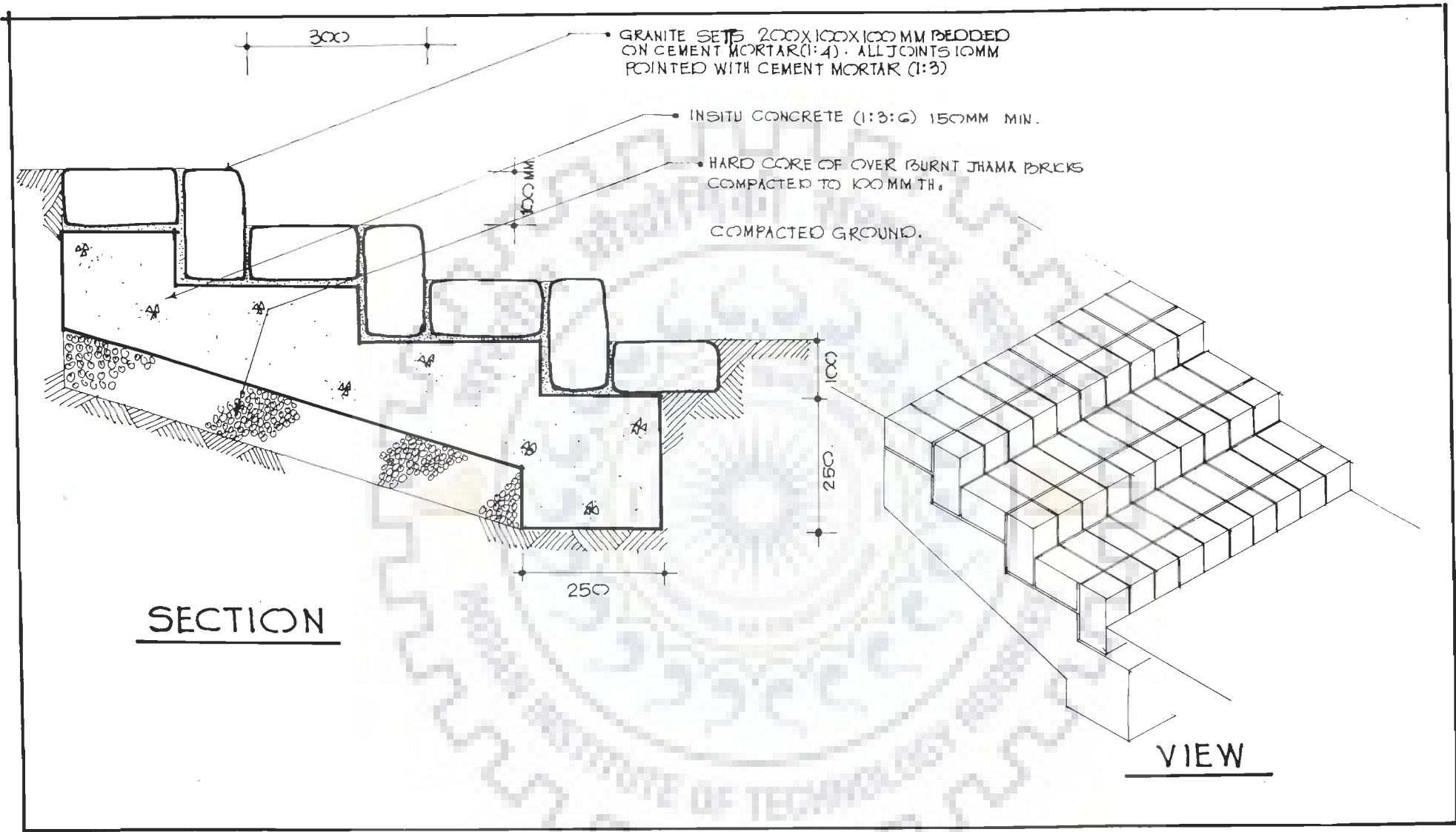
| FIG NO 93 | SCALE 1:10 | PAGE NO:- 395 | TITLE | STEPS (GRANITE SETT) |

SECTION

- SMOOTH FINISH GRANITE STONE TREAD 300X150 MM ON CEMENT MORTAR BED (1:4) ALL JOINTS POINTED UP CEMENT MORTAR (1:3) AND RECESSED.

- CAST IN SITU CONCRET (1:3:6)

- HARD CORE OF OVER BURT JHAMA BRICK COMPACTED.

325 MM

150 MM

300 MM

250
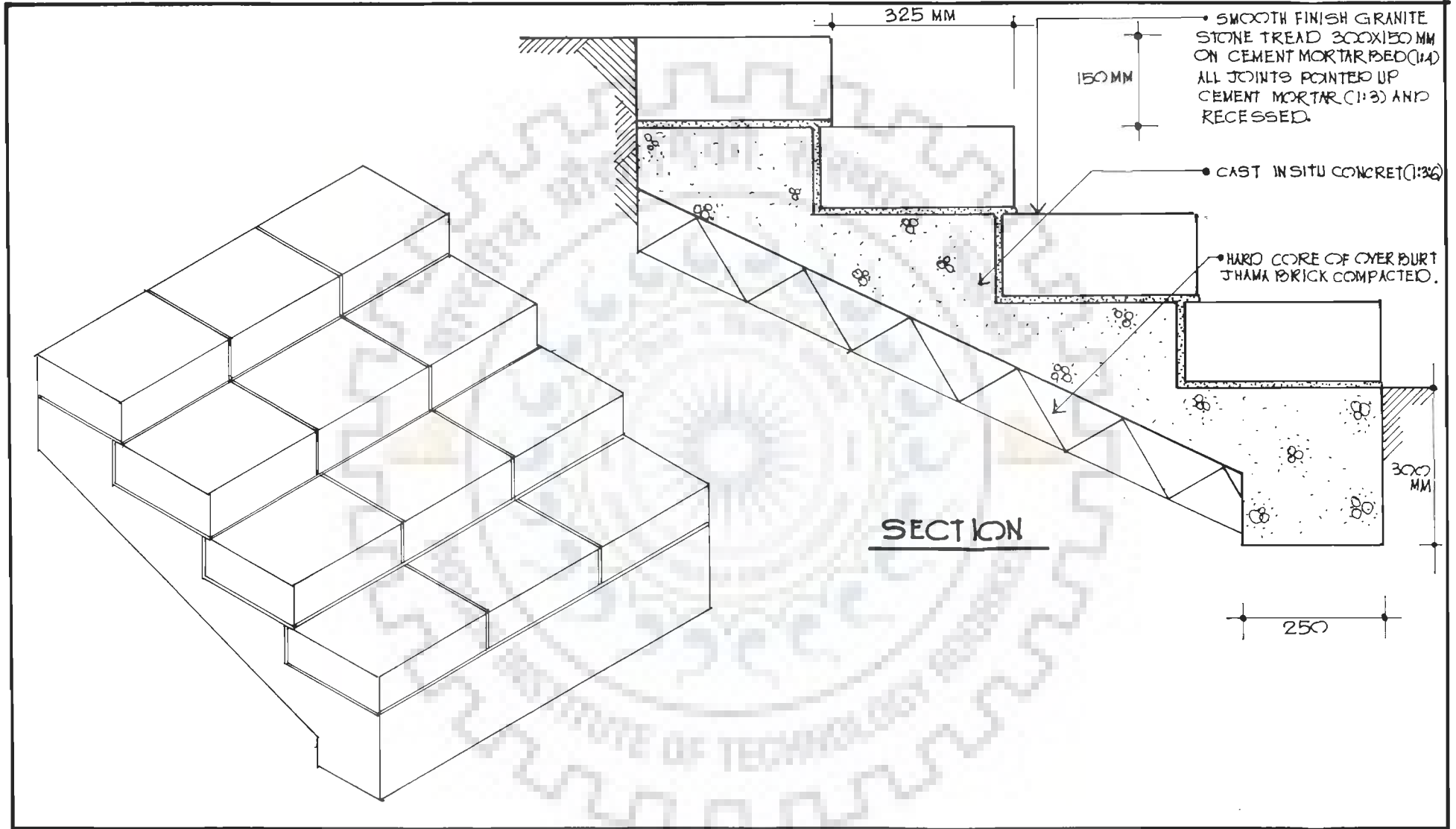
FIG NO:- 94	SCALE 1:10	PAGE NO:- 396	TITLE	STEPS (NATURAL STONE)

CONCRETE SETTS LAID TO FORM DISHED
CHANNEL ON MORTAR (1:4) BED, ALL
JOINTS FLUSH POINTED WITH CEMENT MORTAR (1:3).

CONCRETE (1:3:6) BED AND HAUCHING.

SAND BLINDING.

HARD CORE OF OVER BRUNT JHAMA
BRICK BATS COMPACTED TO 100 MM THICK.

600

75
75
100
50
100

400

900
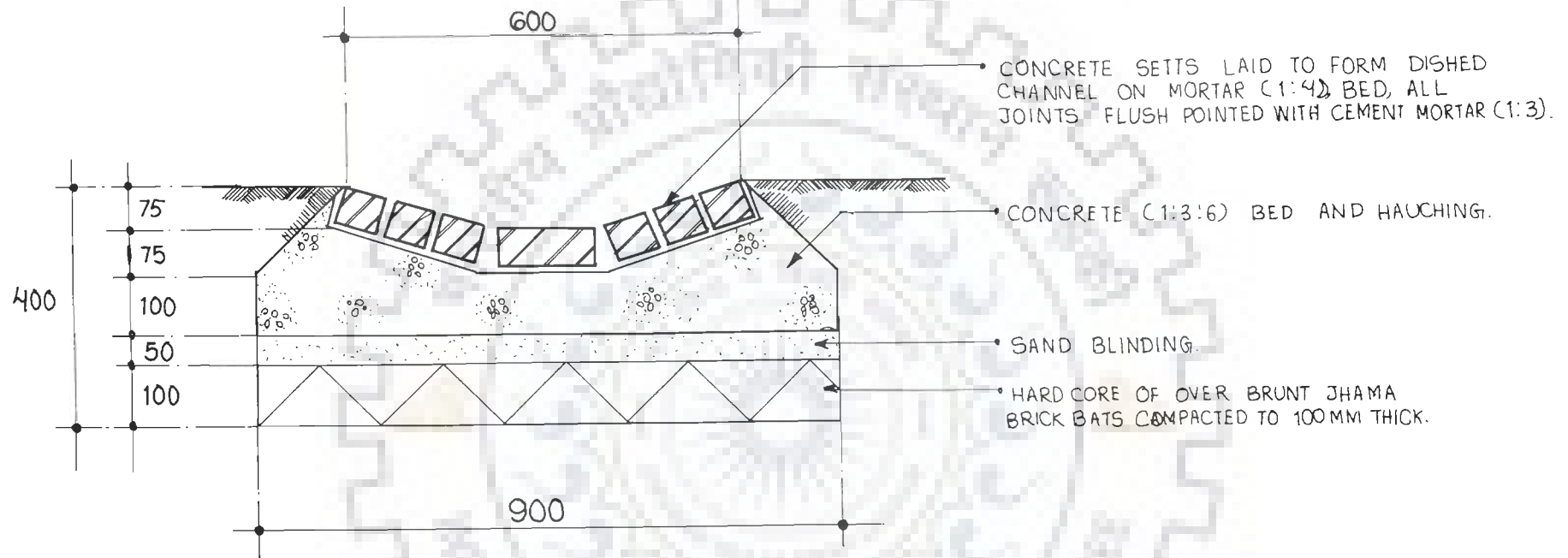
SECTION.

| FIG. NO: 95 | SCALE: 1:10 | PAGE NO:- 397 | DRG. TITLE: DRAINAGE CHANNEL. (CONCRETE SETTS) |

PRECAST CONCRETE DISHED CHANNEL 250 x 250 CAST WITH CEMENT CONCRETE (1:2:4) BEDED ON CEMENT MORTAR ALL JOINTS POINTED WITH CEMENT MORTAR (1:3).

CONCRETE (1:3:6) BED AND HAUCHING 100 MM.

SAND BLINDING 50 MM.

HARD CORE 150 MM OF OVERBRUNT JHAMA BRICK BATS RAMMED TO 150 MM THICK.

375

100

50

100

400
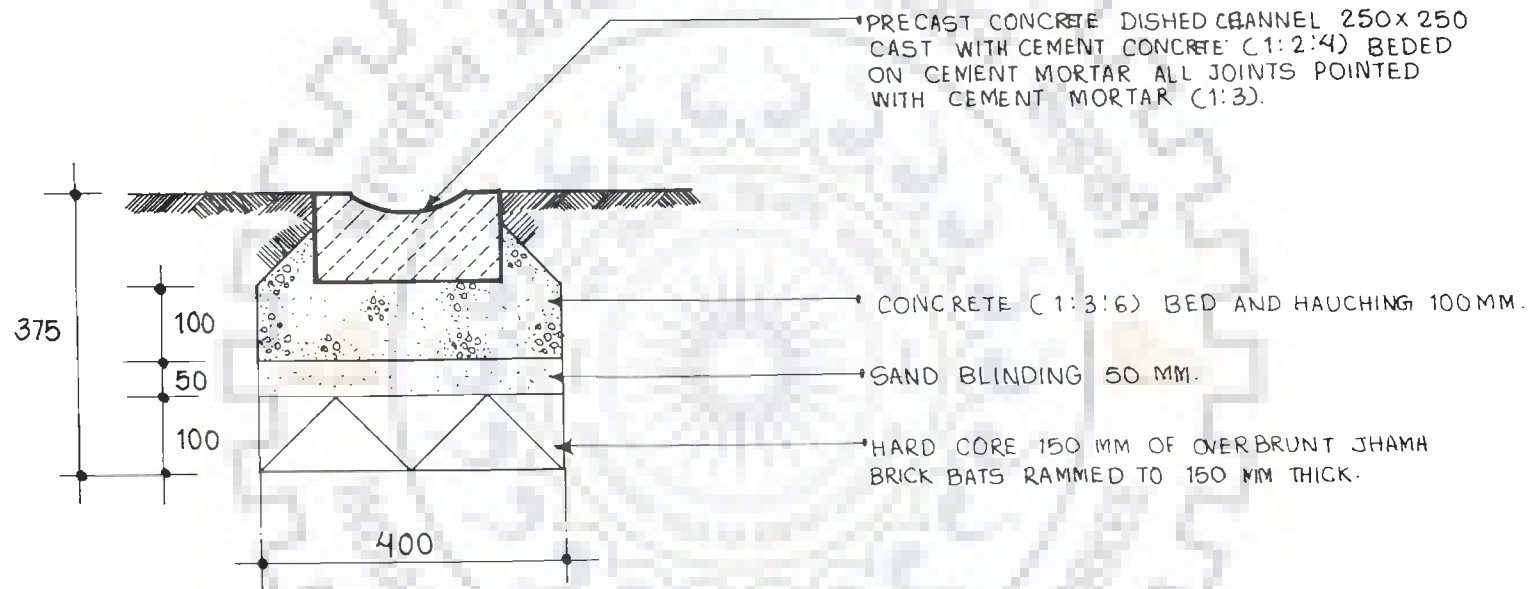
SECTION.

| FIG. NO: 96 | SCALE: 1:10 | PAGE NO:- 398 | DRG. TITLE: DRAINAGE CHANNEL. (PRECAST CONCRETE). |

PRECAST CONCRETE (1:2:4) KERB.

MORTAR JOINTS (1:3).

PRECAST CONCRETE CHANNEL.

CONCRETE BASE AND BACKING (1:3:6)
CAST IN SITU

150 MM · 127 · 254 ·

254 MM

150 MM · 127 MM · 275 MM

541
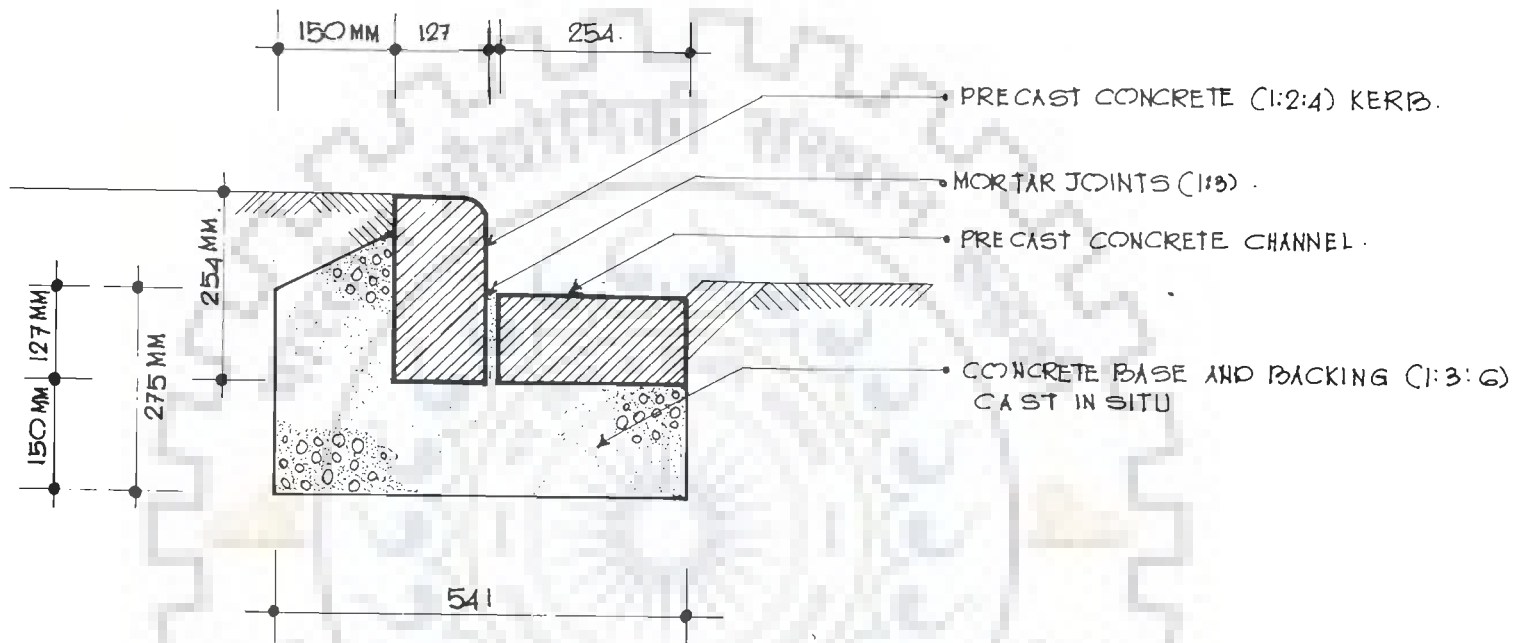
FIG NO 97	SCALE 1:10	PAGE NO:- 399	TITLE. KERB AND CHANNEL. (CONCRETE)

150   300

100

200

GRANITE KERB 300×200.

(1:3:6) CONCRETE FOUNDATION
WITH BACKING.

100

500

SECTION.

100   125   100

100

150

100

175

300

SINGLE CANT 1ST CLASS K·B WELL BURNT.

BRICK ON EDGE, JOINTS POINTED WITH MORTAR (1:3).

(1:3:6) CONCRETE FOUNDATIONS AND HAUNCHING 100 MM.
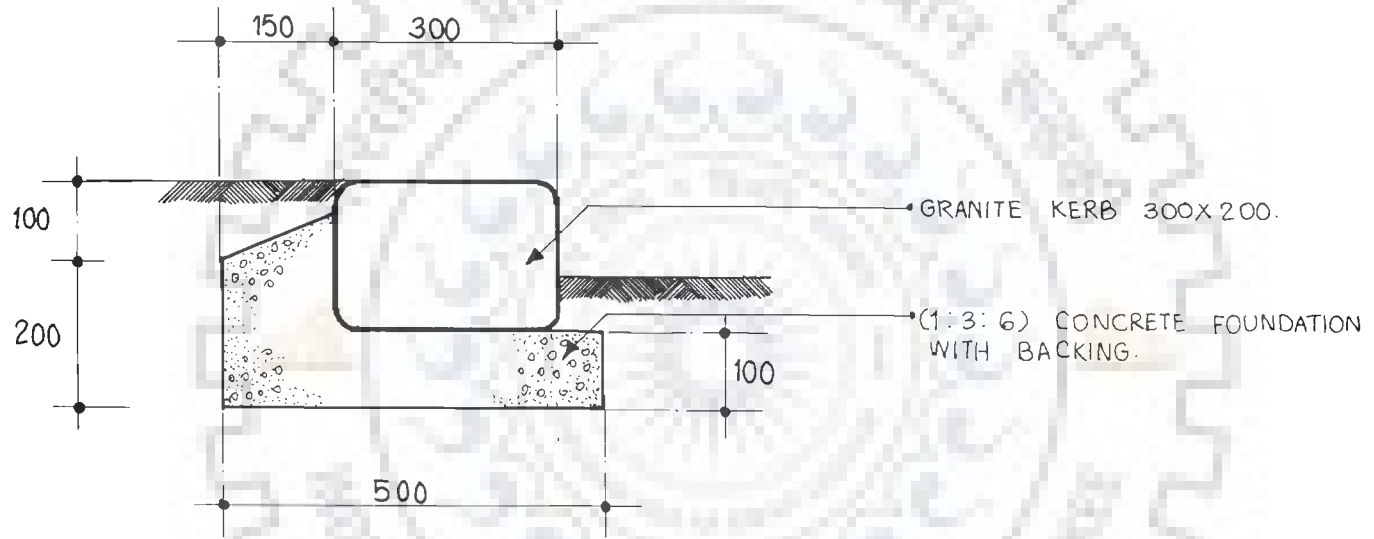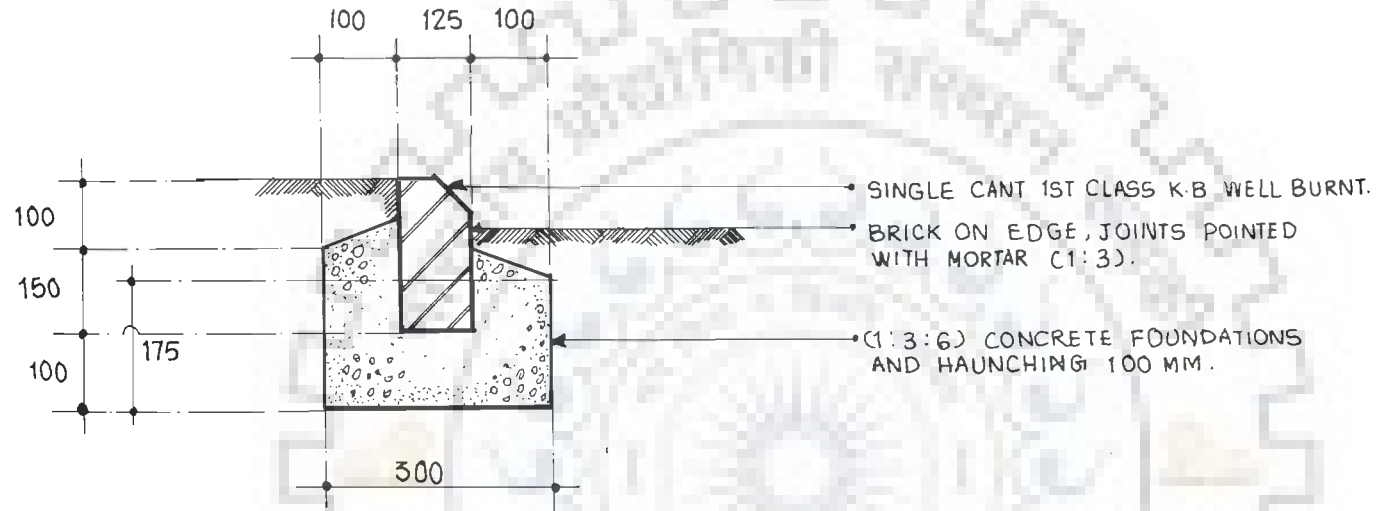
SECTION.

FIG. NO: 99	SCALE: 1:10	PAGE NO:- 401	DRG. TITLE: KERB (BRICK).

PLAN.

ELEVATION.

300 MM

25   25

25
25

425 MM

SECTION

75 75 75 75 75 75 75

425 MM
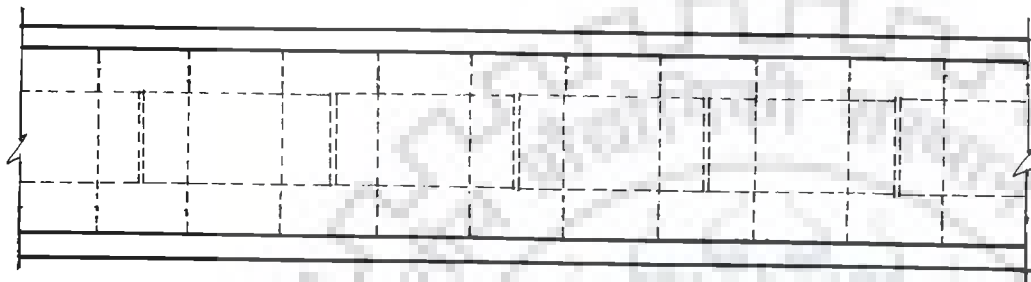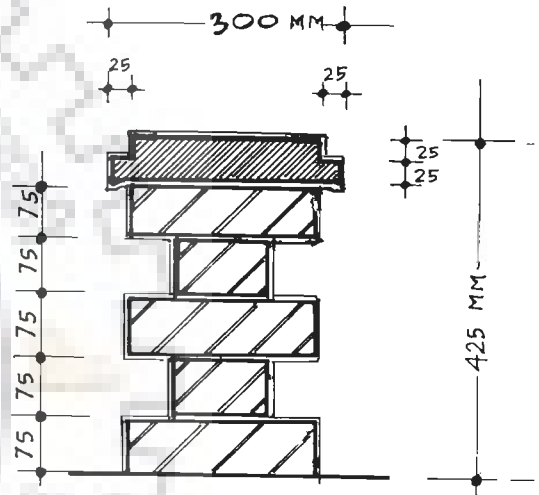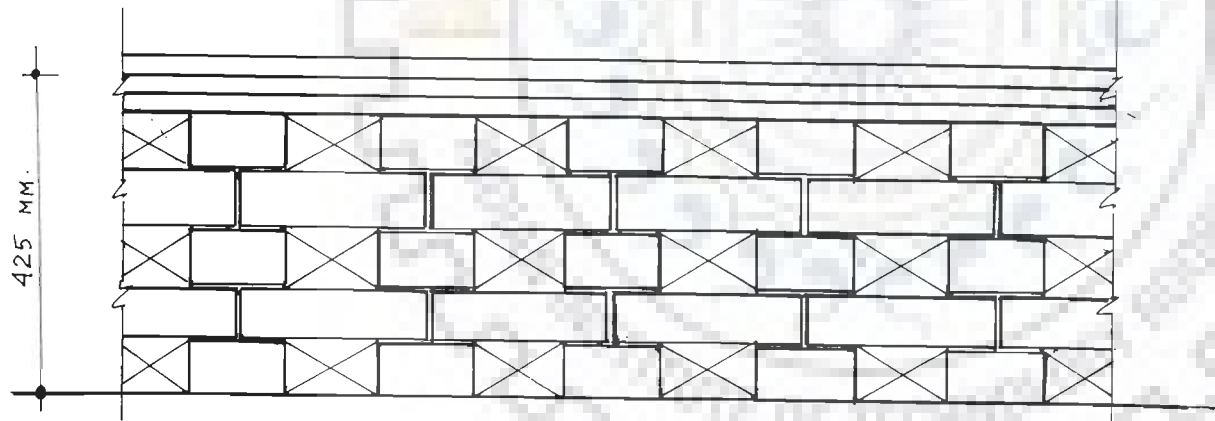
| FIG. NO 100 | SCALE = 1:10 | PAGE NO:- 402 | TITLE LOW RAIL (BRICK) |

1200

HOLLOW STEEL TUBE, GALVANISED 32 MM SQ SECTION
ALL WELDED CONSTRUCTION WITH UPRIGHT AT 1200 MM
CENTRES SECTIONS, CONNECTED BY INTERNAL SPIGOT
POINT FINISH WITH 2 COAT OF SYNTHETIC ENAMEL PAINT
OVER A COAT OF PRIMER.

300 MM

CONCRETE (1:3:6) SURROUND TO UPRIGHTS
300 X 300 X 300 MM

250 MM

75MM
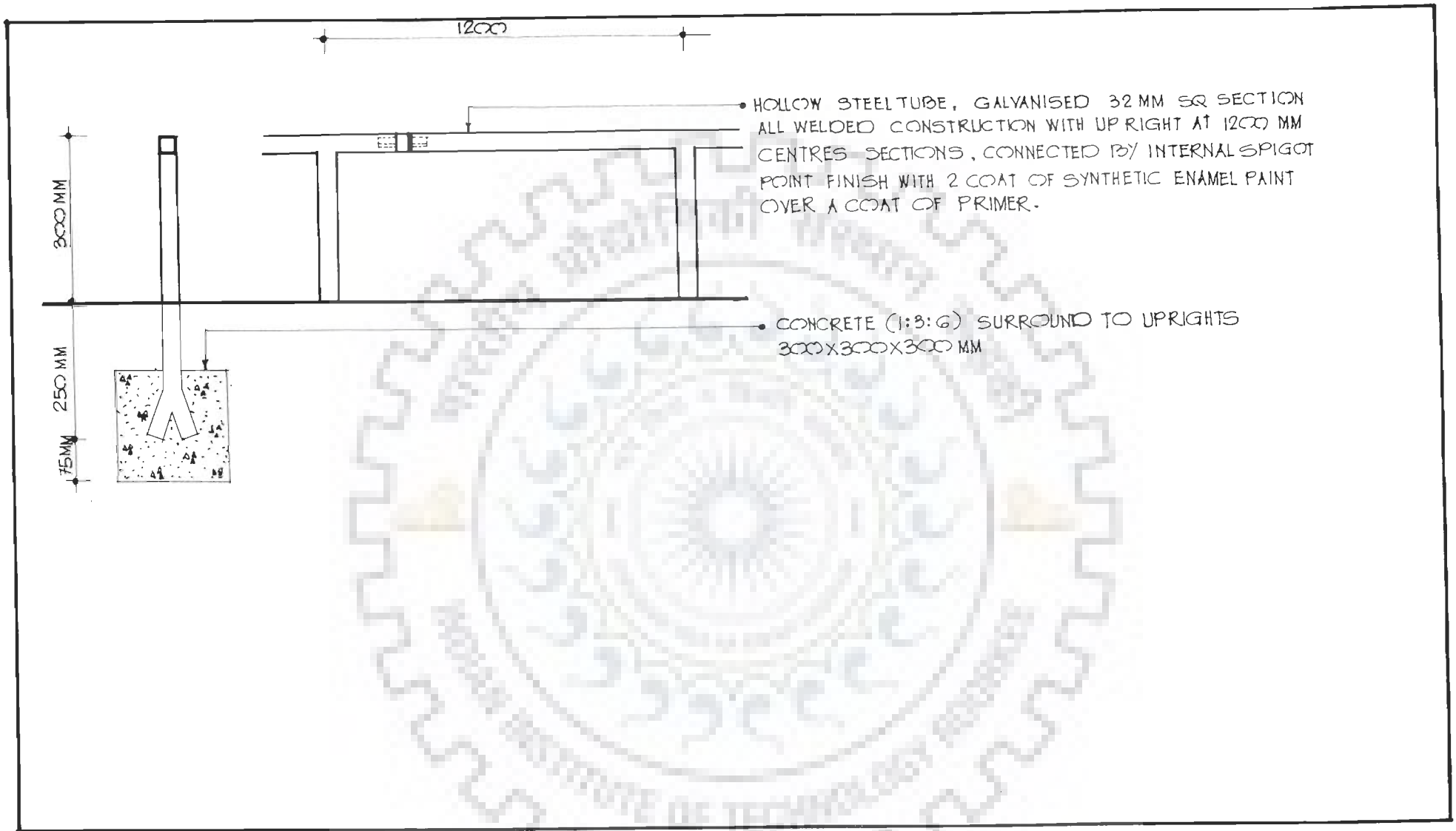
| FIG NO: 101 | SCALE 1:10 | PAGE NO: 403 | TITLE. | LOW RAIL (STEEL TUBE) |

BRICK BANK ON MIN 35 MM MORTAR (1:4)
WITH 10MM RACKED JOINTS WITH CEMENT MORTAR(1:3)

CAST IN SITU CONCRET (1:3:6) 150 MM.

PAVING AS SPECIFIED
ON NATURAL GROUND.

COMPACTED GROUND OF BANK.

NOTE.

MESH REINFORCEMENT IS REQUIRED
WHERE THE SLOPE EXCEEDS 1 IN 3

2000

SECTION
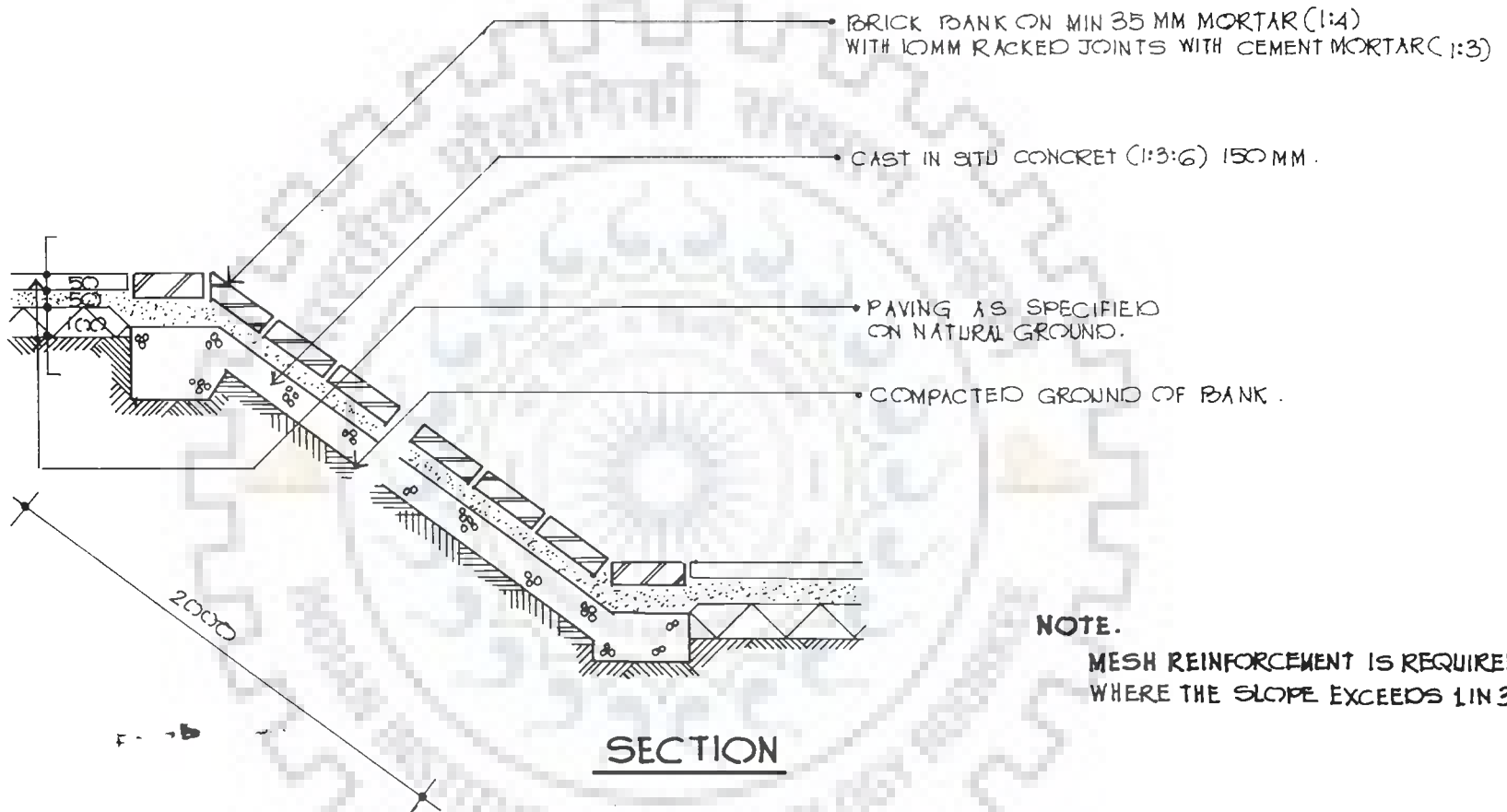
| FIG NO: 102 | SCALE 1:10 | PAGE NO: 404 | TITLE EMBANKMENT (BRICK) |
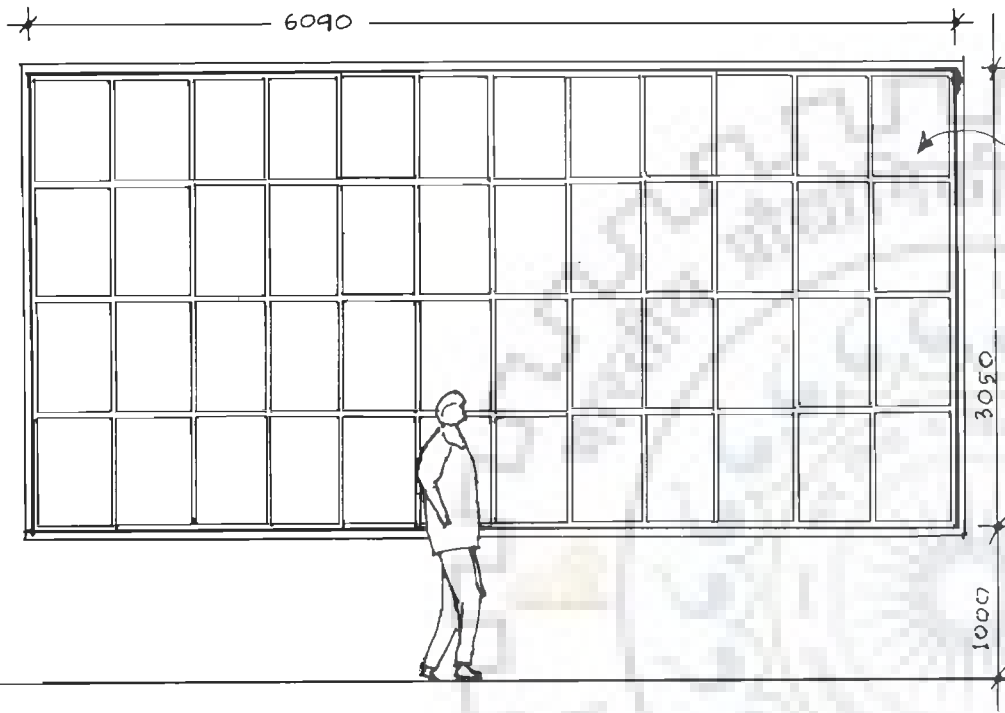
6090

DIFFERENT TYPES OF
ADVERTISING / POSTERS
TO BE PASTED IN
THE AREAS AS
ALLOCATED TO THEM.

2030

3050

3050

1000

1000

48 SHEET POSTER DIMENSION
(WALL MOUNTED)

1016

1524

400
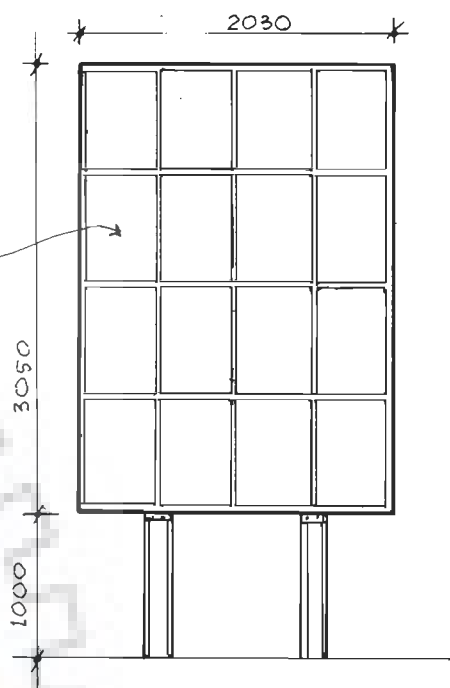
4 SHEET POSTER DIMENSION
(STRUCTURE SUPPORTED)
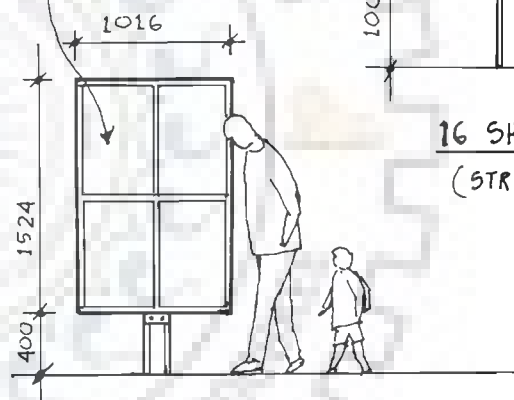
16 SHEET POSTER DIMENSION
(STRUCTURE SUPPORTED)

SHEET NO:- 103	SCALE:- 1:50	PAGE NO: 405	TITLE:- ADVERTISING / POSTERS

75×10 ALUMINIUM
FINGERS RIVETTED
TO POST

SIGN FINGERS
MAY BE ATTACHED
TO EXISTING COLUMNS
BY STRAPS OR RIVETS

75×75 GALVANIZED
STEEL POST

75 φ GALVANIZED
STEEL POST
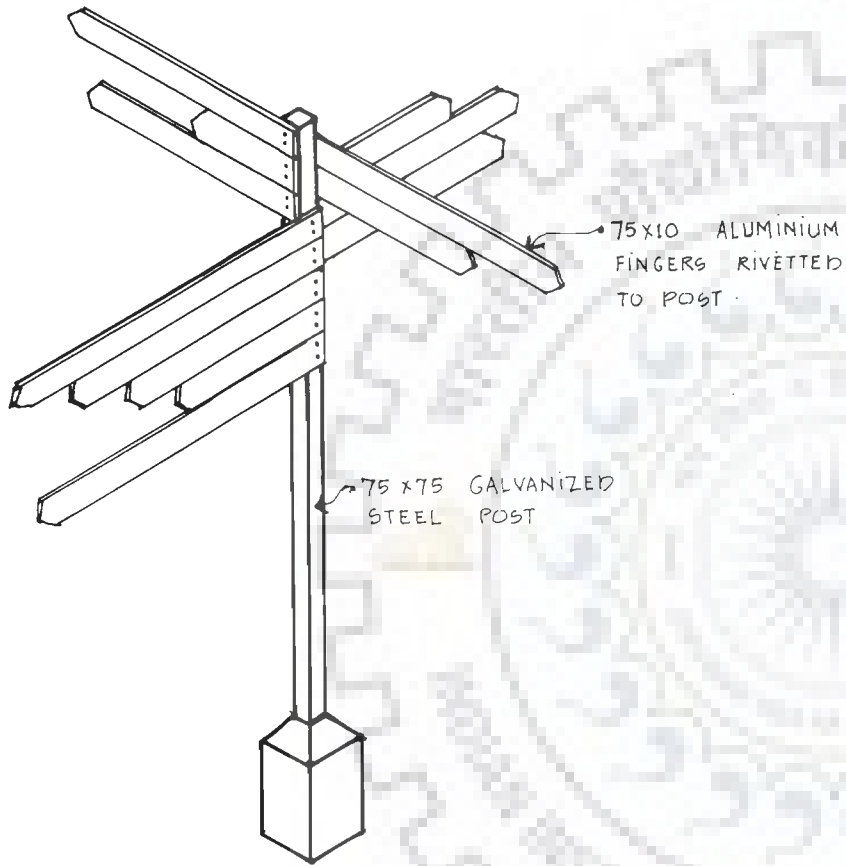
TYPICAL FINGER-POST PEDESTRIAN SIGN.

(SQURE POST)

CIRCULAL FINGER POST
PEDESTRIAN SIGN.

FIG NO:- 104	SCALE:- 1:50	PAGE NO: 406	TITLE :- PEDESTRIAN SIGNS (A)
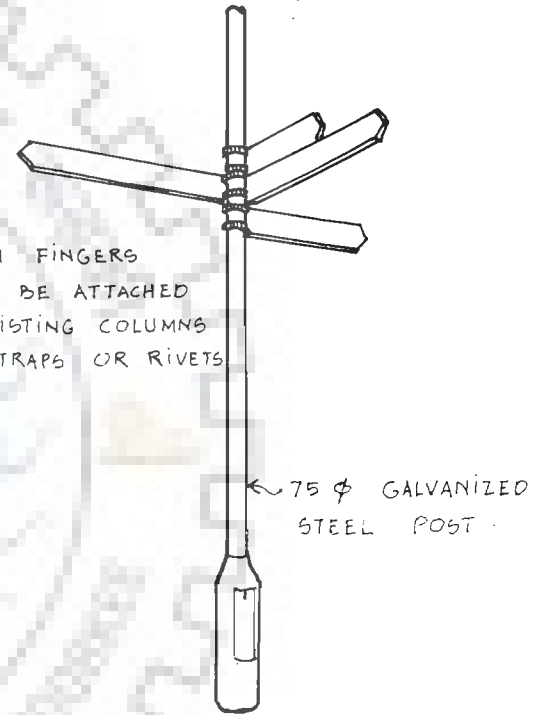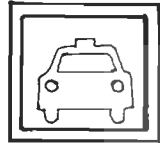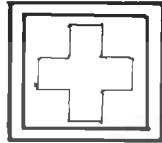
SUB-WAY	TAXI STAND.	HOSPITAL.	POLICE STATION	TEMPLE	CHURCH.	SWIMMING AREA	WATER FOUNTAIN.
RESTURANT.	COFFEE SHOP.	PARKING LOT.	NO-PARKING AREA	BICYCLE PARKING	NO-BICYCLE PARKING	ENTRANCE	EXIT.
EMERGENCY EXIT.	UNDER CONSTRUCTION.	STEPS	WOMEN	MEN	INTERNATIONAL TELEPHONE	TELEPHONE	SHOP
SMOKING CORNER	NO-SMOKING	NO-ENTRANCE ALLOWED	DO NOT TOUCH	LEFT	RIGHT	UP/STRAIGHT	DOWN/BACK.
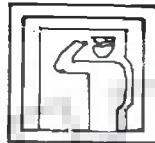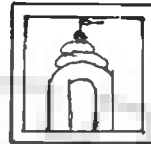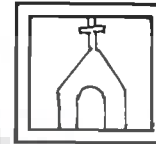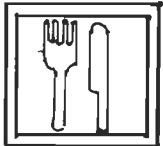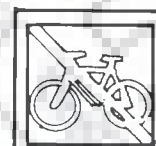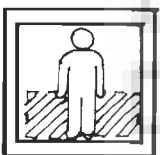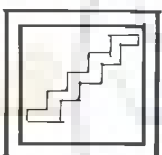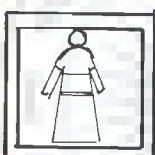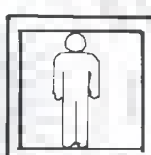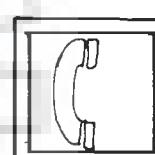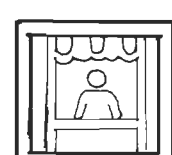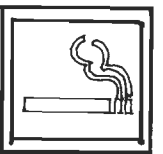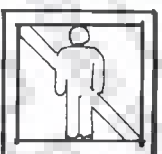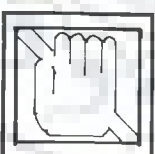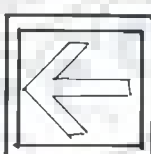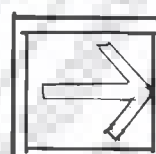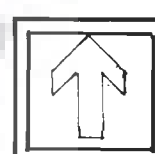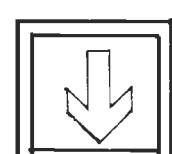
FIG NO:- 105	SCALE:- N.T.S	PAGE NO: 407	TITLE:- PEDESTRIAN SIGNS. (B)

ELEVATION

DETAIL AT 'A'

Labels in elevation:
- 1500
- 1500
- ANGLE IRON (ISA 5050)
- 'A'
- 980
- 1210
- 230
- ANGLE IRON (ISA 5050)
- 20 DIA BAR

Labels in detail:
- M·S BOLT 20 Φ FOR CONNECTING ANGLE POST
- CLEARANCE NUT
- M·S BAR 20×20 WELDED WITH M·S ANGLE
- WELDING
- CLEARANCE
- POST ISA 5050
- ISA 5050 WELDED WITH POST ISA 5050
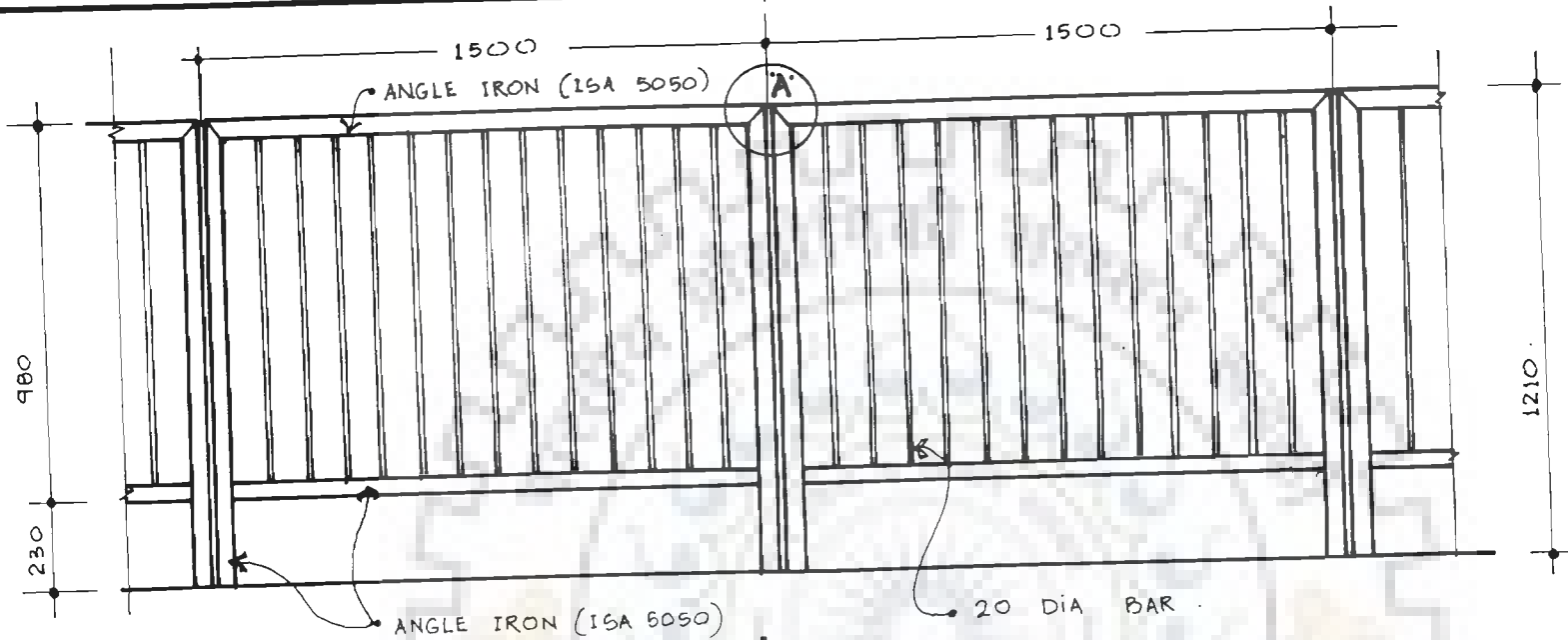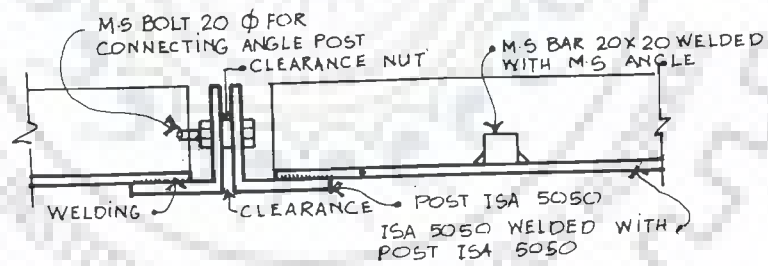
| FIG NO:- 106 | SCALE:- 1:10 | PAGE NO: 408 | TITLE:- PEDESTRIAN GUARD RAIL. (A) |

SECTION.

ELEVATION.

50X50X4.0 POSTS.

50X50X3.2 TOP RAIL.

50X50X3.2 MIDDLE RAIL.

40X12 BOTTOM RAIL.

16 DIA VERTICAL BARS AT 100 C/C.

2.0 M. POST C/C

2.0 M.

50 MM
200 MM
50 MM
550 MM
150 MM
100
300
250 SQ.
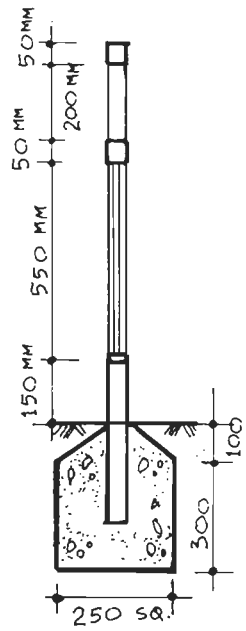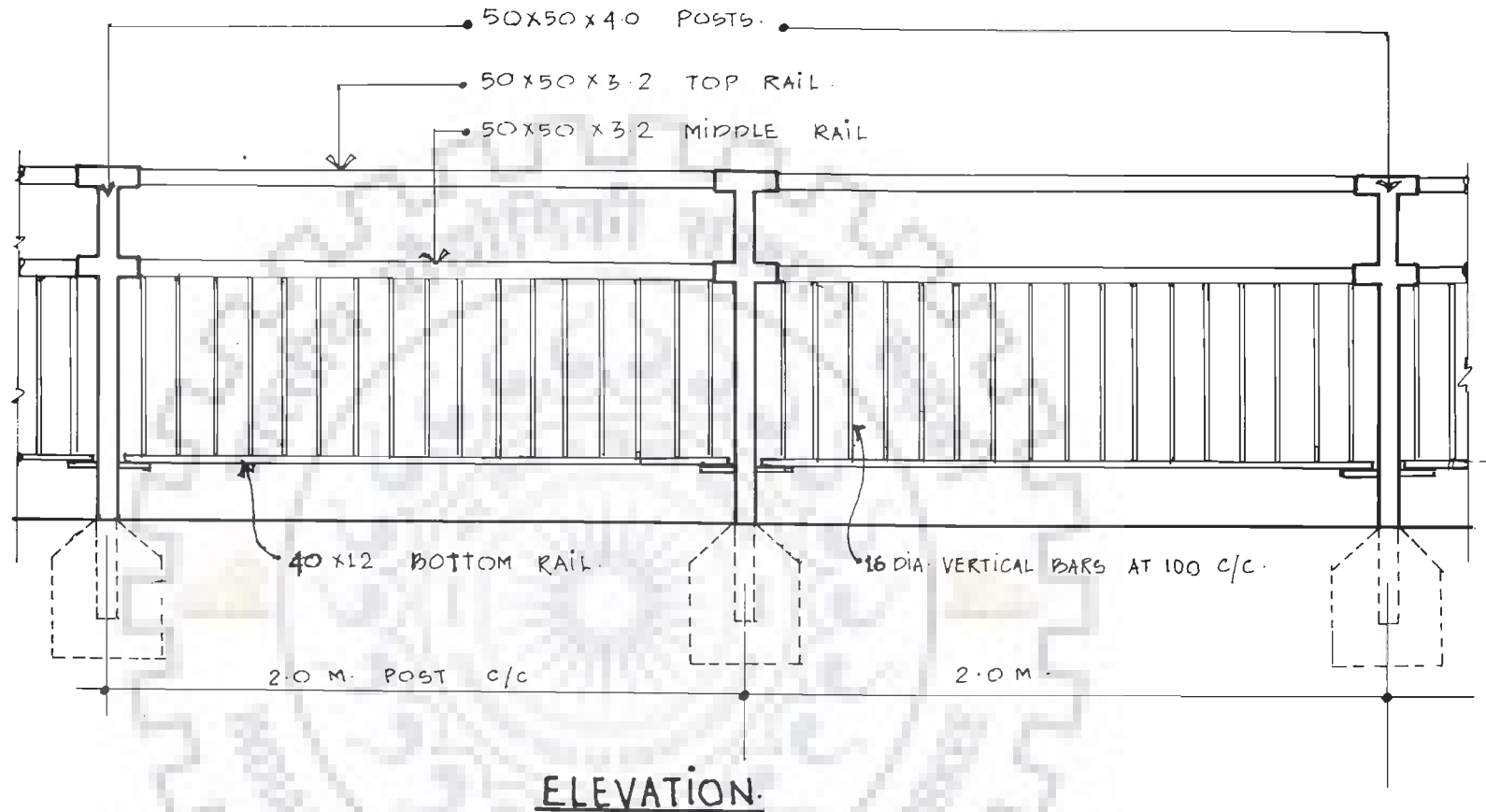
| FIG NO:-107 | SCALE:- N.T.S | PAGE NO: 409 | TITLE:- PEDESTRIAN GUARD RAIL. (B) |

2.0 M. MIN.

5.1 M. MINIUMUM HEAD CLEARANCE

1.0 M — 1.2 M.
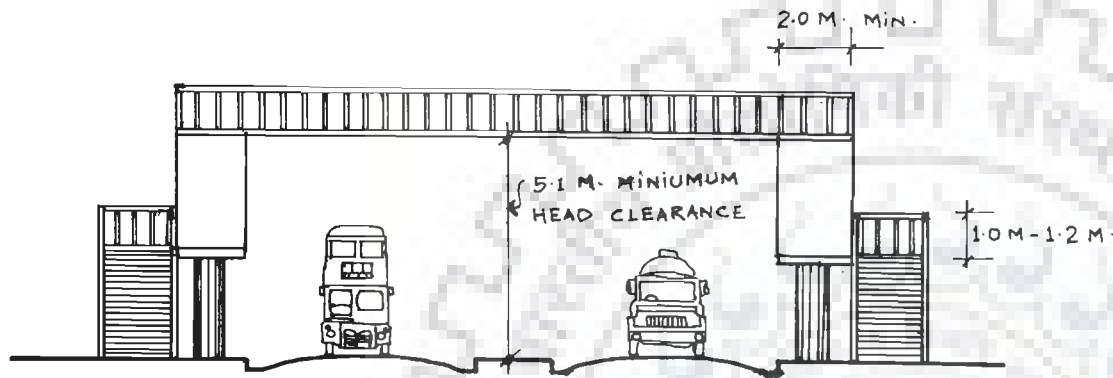
FOOT BRIDGE WITH STEPS (ELEVATION).

RAMP 1 IN 12 (8.3%) IS PREFERED
[1 IN 6 (16.6%) IS MAX.]

MIN. HT. 0.9 M.

HORIZONTAL DISTANCE

MIN — 0.8 M.
MAX — 1.5 M.
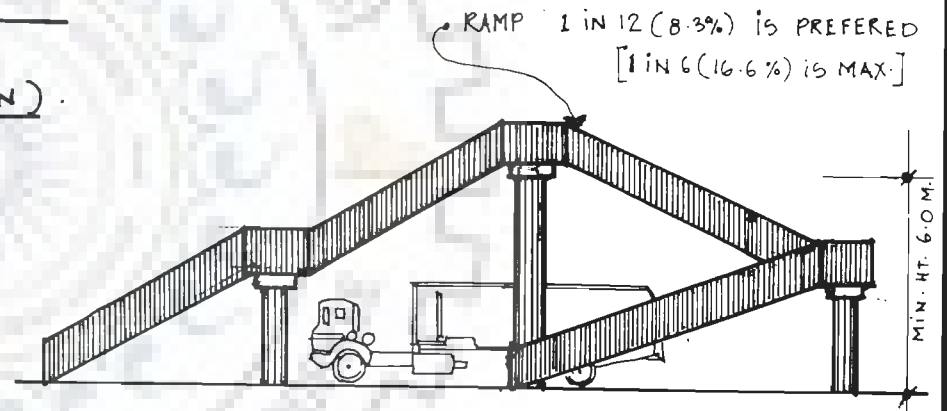
FOOT BRIDGE WITH RAMPS

SPIRAL RAMP FOOT BRIDGE

FIG NO:-108	SCALE :- N.T.S	PAGE NO: 410	TITLE :- FOOTBRIDGES

HINGED BOLLARD. (LOCKING BOLLARD)

50 φ — KEY TO UNLOCK.
750
100
200
100
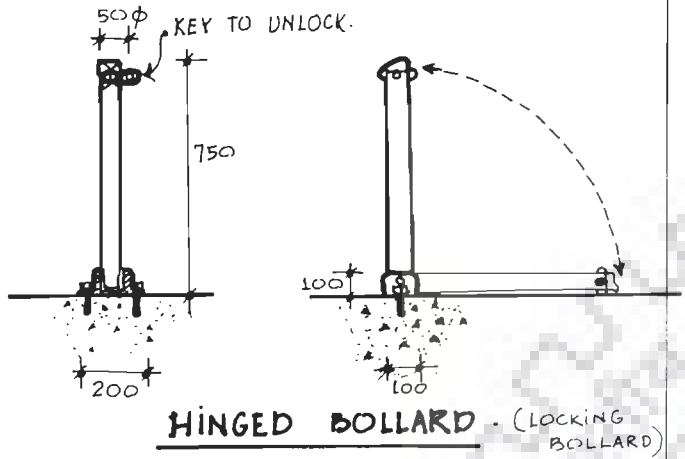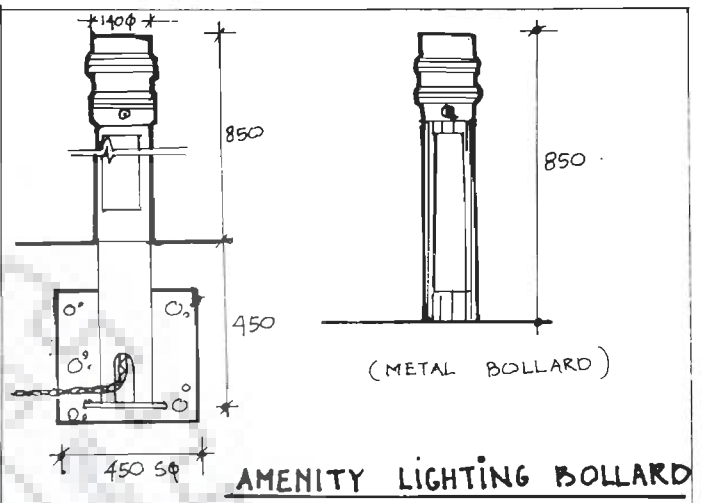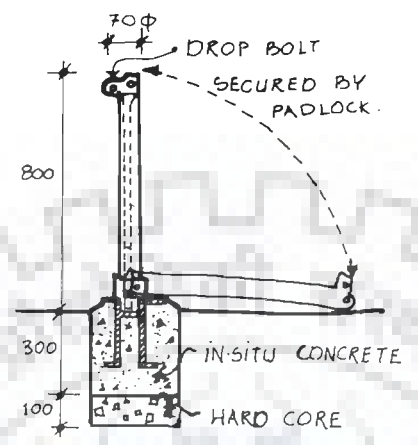
AMENITY LIGHTING BOLLARD

140 φ
850
450
450 SQ
850
(METAL BOLLARD)

DROP BOLT
SECURED BY PADLOCK.
70 φ
800
300
100
IN-SITU CONCRETE
HARD CORE

REMOVEABLE BOLLARD

75 φ
900
LOCKING PIN AND PADLOCK
WHEN BOLLARD IS REMOVED, FLAP CLOSES FLUSH
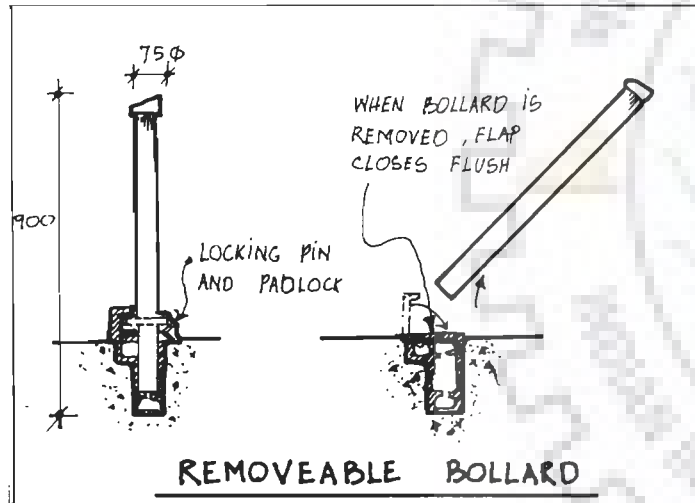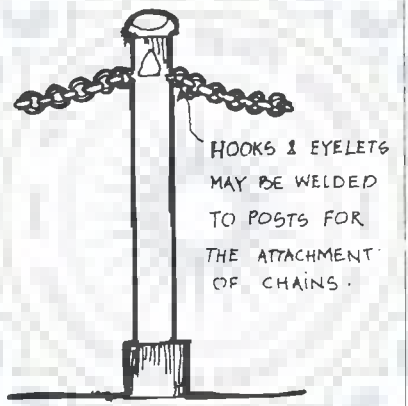
STANDARD HINGED BOLLARD
(GALVANIZED STEEL)

HOOKS & EYELETS MAY BE WELDED TO POSTS FOR THE ATTACHMENT OF CHAINS.
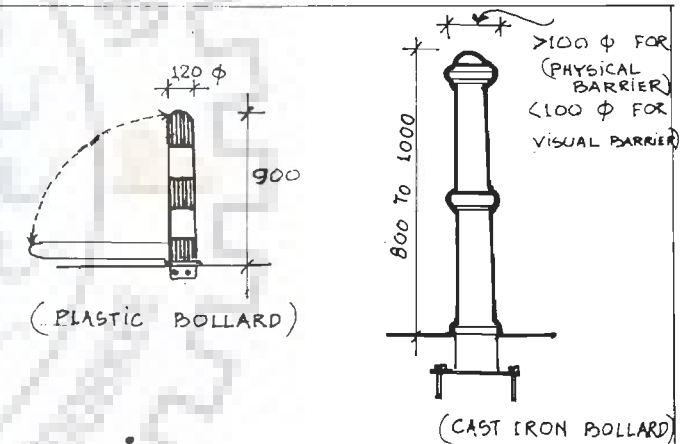
BARRIER BOLLARDS
(PHYSICAL & VISUAL DETERRENTS)

120 φ
900
(PLASTIC BOLLARD)

800 TO 1000
>100 φ FOR (PHYSICAL BARRIER)
<100 φ FOR VISUAL BARRIER
(CAST IRON BOLLARD)

| FIG NO:- 109 | SCALE:- N.T.S | PAGE NO:- 411 | TITLE:- BOLLARDS. |
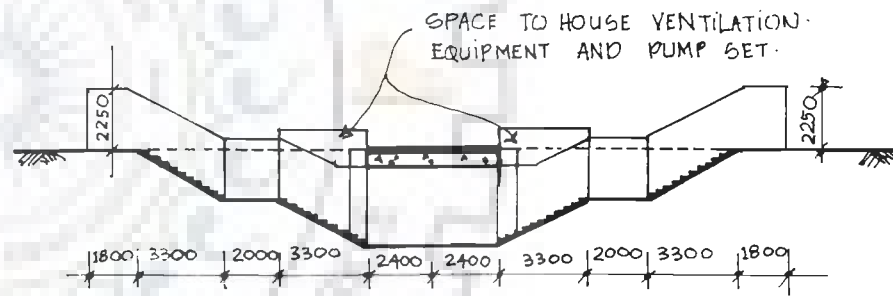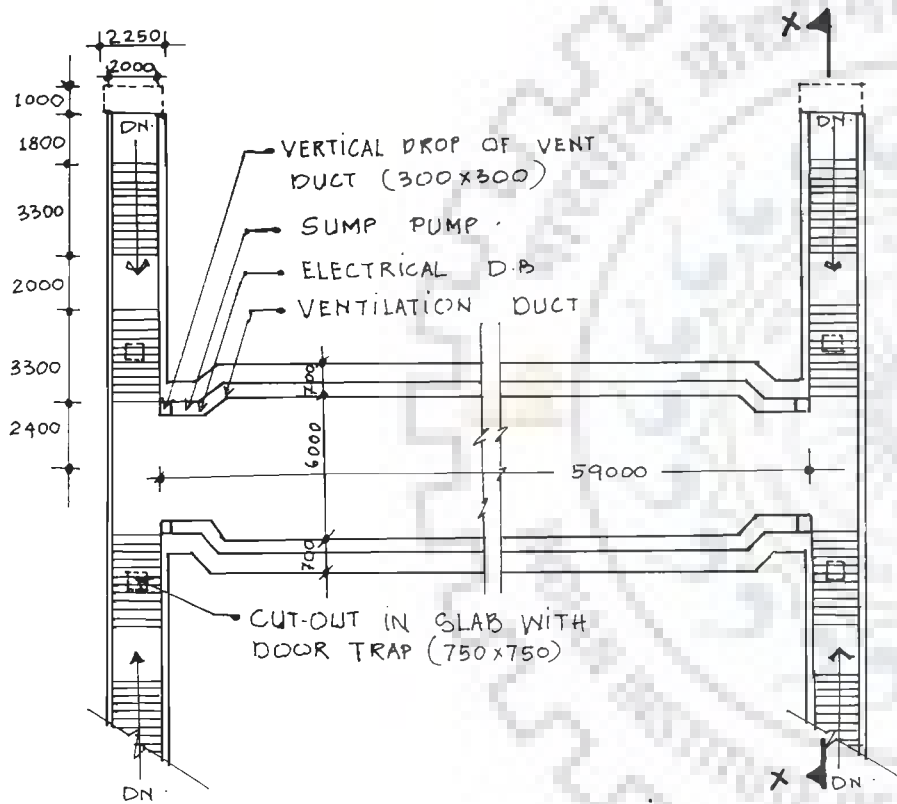
PLAN OF A PEDESTRIAN SUB-WAY.

Labels on plan:
- VERTICAL DROP OF VENT DUCT (300×300)
- SUMP PUMP.
- ELECTRICAL D.B
- VENTILATION DUCT
- CUT-OUT IN SLAB WITH DOOR TRAP (750×750)

Dimensions on plan: 2250, 2000, 1000, 1800, 3300, 2000, 3300, 2400, 700, 6000, 700, 59000

SECTION AT - XX

Labels on section:
- SPACE TO HOUSE VENTILATION EQUIPMENT AND PUMP SET.

Dimensions on section: 2250, 2250, 1800, 3300, 2000, 3300, 2400, 2400, 3300, 2000, 3300, 1800

| FIG NO:- 110 | SCALE :- N.T.S | PAGE NO : 412 | TITLE :- PEDESTRIAN SUB-WAY |

PEDESTRIAN CROSS SIGN

FLASHING SIGNAL

STOP

STOP

ZEBRA CROSSING ACROSS TWO-WAY STREET

FLASHING SIGNAL

PEDESTRIAN CROSS SIGN

RAILING

PEDESTRIAN CROSS SIGN

PEDESTRIAN CROSS SIGN

RAILING

STOP

STOP

STOP

STOP

RAILING

PEDESTRIAN CROSS SIGN

PEDESTRIAN CROSS SIGN

RAILING
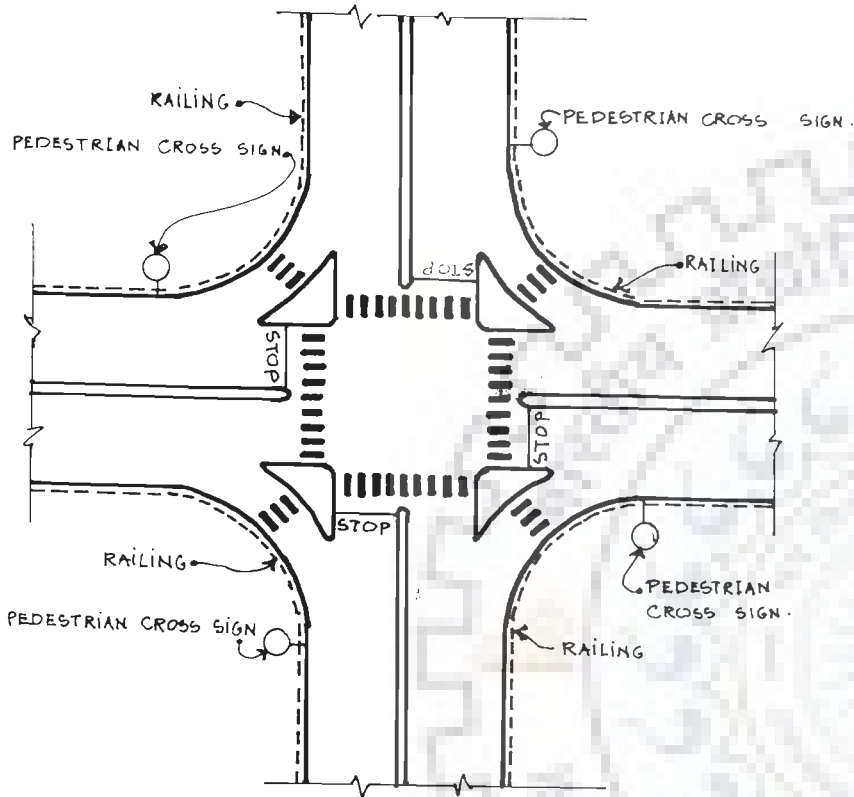
FOUR ARM CHANNELISED ZEBRA CROSSING

PEDESTRIAN CROSS SIGN

FLASHING SIGNAL

STOP
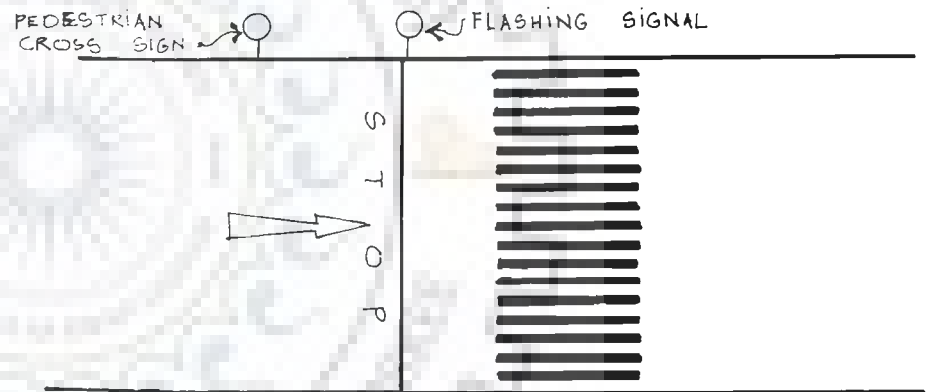
ZEBRA CROSSING ACROSS ONE-WAY ROAD.

FIG NO:-111	SCALE :- N.T.S	PAGE NO: 413	TITLE:- ZEBRA CROSSING

APPENDIX B: QUESTIONNAIRE

Department of Architecture and Planning

University of Roorkee

Roorkee 247 667, India.

PEDESTRIAN PLANNING STUDIES IN INDIAN CITIES

Note:

This is an open questionnaire and, therefore, your personal views on the subject are solicited.

If you find the space for your views inadequate, you may use additional papers for the same.

All this information shall be used for academic purpose only.

Q.1 You are requested to suggest pedestrian / originally pedestrian areas as sub-divided below in your town or any other town, which you feel is worthy of a study. (Please give the name of the area, the town and the state for follow up action at this end. If some material such as a write -up or plans of the area is available then please enclose the same.)

A) An Urban Village :

B) A Market:

C) A residential area:

D) A historical area:

E) Pedestrian link between nodes:

F) Pedestrian in recreational areas:

G) Pedestrian in religious areas:

H) Any other pedestrian area:

Q.2 What are your views on pedestrianisation as an approach to solving our transportation problems? Your views may be expressed considering the following aspects.

A) India has a large walking population and, therefore, pedestrianisation will help the national economy as it saves on costly fossil fuel.

Your Views:

B) Pedestrianisation is pollution free, and therefore, should be encouraged.

Your Views:

C) Organised and grade separated pedestrianisation will help to reduce accidents

and the related expenses / social disasters.

Your Views:

D) The Indian climate is good for pedestrian movement and therefore should be used to our advantage.

Your Views:

E) Pedestrianisation will provide opportunity for physical exercise and consequently improve the health of the general population.

Your Views:

F) Pedestrian traffic, if properly worked out can improve the social/ psychological life of the Indian people as it will give an opportunity for human contacts and interactions at places like 'Gullies', 'Mohallas', 'Chowks', 'Markets' and 'recreational areas' etc.

Your Views:

G) Provision of organised pedestrianisation in the Indian towns will be an expensive proposition and therefore it should not be attempted.

Your Views:

Q.3 Books/Reports/ Research Papers which you would recommend for reading on this and related topic.

Your Views:

Q.4 Could you suggest some statistical or spatial models for measuring social, psychological and transportation aspects of pedestrianisation?

Your Views:

Q.5 Please suggest any town, neighbourhood or any other area where the concept of pedestrianisation could be gainfully used/applied.

Your Views:

Q.6 Cycle tracks should be included along side of pedestrian pavements.

Your Views:

Q.7 Cycle tracks should be independent and have their own separated network.

Your Views:

Q.8 Cycles should be taken along with the buses, cars, scooters and mopeds in the regular street system.

Your View:

Signature of respondent:

Name of respondent:

Address:

Place and Date:

APPENDIX C: SCHEDULE

Department of Architecture and Planning

University of Roorkee

Roorkee 247 667 India

PEDESTRIAN PLANNING STUDIES IN INDIAN CITIES.

National Pedestrian Zone Number:

Name Of the City:

Name of Pedestrian Space under Investigation:

Type of pedestrian Space: A) Market B) Residential Area C) Leisure Areas D)

Historical Areas.

FUNCTIONAL PARAMETERS

Land

a) Open space available for

expansion or Landscape.

b) No objectionable uses that

produce noise, dust, smoke, or

traffic conflict.

c) Compactness of the core area

of the particular land use.

Topography

a) Slopes appropriate for proper

drainage.

b) Slopes appropriate for easy construction.

c) Gradient right for easy walking.

▢▢▢▢▢▢▢▢▢▢▢▢

▢▢▢▢▢▢▢▢▢▢▢▢

Geology

a) Soils appropriate for construction.

b) Soils appropriate for plantation.

▢▢▢▢▢▢▢▢▢▢▢▢

▢▢▢▢▢▢▢▢▢▢▢▢

Foliage

a) Adequate for good micro climate.

b) Adequate for survival of wild life.

▢▢▢▢▢▢▢▢▢▢▢▢

▢▢▢▢▢▢▢▢▢▢▢▢

c) Adequate for shade or social life.

▢▢▢▢▢▢▢▢▢▢▢▢

Micro Climate

a) (Good human comfort)

Density

a) Appropriate for qualitative living.

▢▢▢▢▢▢▢▢▢▢▢▢

b) No hawkers in the area.

▢▢▢▢▢▢▢▢▢▢▢▢

Age

a) Major age groups have necessary facilities.

▢▢▢▢▢▢▢▢▢▢▢▢

419

b) Children have play areas and schools.

c) Children have segregated pedestrian access to play areas and school.

d) Sports facilities for young boys and girls.

e) The young have places for interaction like clubs etc.

f) The old have walk ways, resting places and places for interaction.

Religion.

a) The major religious groups have places for worship.

b) The major religious groups have appropriate community facilities.

c) There is good communal harmony between the religious groups

Sex

a) Good male to female ratio.

420

b) Appropriate facilities according to the

male/ female ratio.

Marital Status.

a) Most of the population in the

marriageable age is married.

Size of the household

a) Housing area available for facilities

proportionate to size of household.

Annual Income.

a) Good annual income and good

standard of living.

Built-up area

a) Size and the type of accommodation

appropriate to the uses.

Occupancy

a) Occupancy of the uses is appropriate.

Condition of the buildings

a) Well maintained buildings / parks.

b) Interesting man-made or natural

facades.

c) Functionally up to de

d) Harmonious.

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Sanitary Conditions.

a) Adequate toilets.

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b) Toilets clean and well maintained.

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Use supportive buildings.

a) Adequate use supportive buildings like

banks, post offices and medical centres.

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Inter access.

a) No congestion.

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b) Good circulation.

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c) Adequate parking.

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d) No conflict at traffic intersections.

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e) No loading conflict.

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f) Adequate footpaths.

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External access

a) Convenient access to over all town.

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b) Adequate public transport routes to

town.

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c) Proper access for trucks.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

d) Adequate parking.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Water Supply.

a) Water supply system good and adequate.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) Adequate water for fire fighting.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Sewerage.

a) Sanitary sewer adequate and good.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) Good storm water drainage.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

c) Storm water drains covered.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Garbage Disposal

a) Adequate garbage removal.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) All the areas clean of thrown garbage.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Telephone

a) Adequate supply.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) Overhead wires well organised and looks clean.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

c) Telephone posts well designed and properly located.

Electricity.

a) Adequate supply.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) Overhead wires well organised and looks clean.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

c) Posts well designed and properly located.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Lighting

a) Street lighting adequate.

b) Attractively designed street lighting furniture.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Cable T.V.

a) Overhead wires clearly Laid out.

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Fire Fighting

a) Good access facilities for fire fighting.

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b) Fire hydrants properly located in required numbers.

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Post and Telegraph.

a) Letter boxes properly located in required numbers.

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b) Post office located in the area within easily accessible distance.

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Police

a) Adequate protection available.

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Emergency Medical Assistance

a) Available easily.

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Public Awareness

a) Public very conscious about their surrounding.

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b) Good general community awareness.

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Promotional Efforts of the Government.

a) Government is making good effort to improve the condition of the people.

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Aesthetic Parameters

Shape

a) The skyline is interesting.

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b) The settlement shape has a definite order.

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Colour

a) The settlement has a nice colour

scheme.

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Texture

a) There is a special textural quality to

the settlement.

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Position

a) The area enjoys a special position

with respect

to the rest of the settlement.

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Orientation

a) The area has a good orientation from

the climatic point of consideration.

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b) The area has a pleasing visual

orientation.

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Visual Inertia

a) There is a visual tension in the design

and layout of the area.

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b) The area maintains a good visual

balance between buildings and spaces.

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Unity of Opposites.

a) There is a good contrast between either the high and the low or between the solids and voids.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Form Defining Space.

a) The buildings define spaces in a special way such as enclosures, vistas, etc.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Defining Space by Horizontal and vertical Planes

a) Interesting configuration of vertical and horizontal planes in the settlement.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Quality of Architectural Space

a) Good variety of enclosures of space.

b) Good views available from and in the settlement.

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Openings in Space Defining Planes.

a) There are beautifully designed / special door and window openings.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

b) Interesting colonnade arrangements.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Proportions.

a) The structure or architecture has a

special pleasing proportion.

Scale

a) The building and open spaces are in

appropriate human scale.

Axis

a) There are some buildings and spaces,

which establish a desirable axis.

Symmetry

a) The settlement has situations, which

show symmetry.

Hierarchy

a) There is an interesting hierarchy of

open spaces.

b) There is an interesting hierarchy of

building sizes.

Datum

a) There is a line, plane or volume that

holds together and organises a pattern of

forms and spaces.

Rhythm

a) There is a regular and harmonious reoccurrence of lines, shapes or colours.

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Repetitions.

a) There is a repetition of elements in size, shape or detailed characteristics.

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Transformation

a) There is a recognisable pattern of transformation of the settlement.

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COST BENEFIT ASPECTS

Social Aspects

Social Contact in Pedestrian Routes.

a) Footpaths are very much used by pedestrians.

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b) Pedestrian footpaths and pedestrian areas are used for standing and watching.

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c) Benches, Culverts etc. are used for sitting in pedestrian areas and footpaths.

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d) Pedestrian routes are used for walking with company.

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e) Footpaths are used to stand with company and eat, watch or talk.

f) Benches on footpaths are used for sitting with company.

g) Friendship is developed while standing, sitting or walking on the footpath / pedestrian areas.

Socialisation and Circulation.

a) While walking to work, market, etc. footpaths are used for socialisation.

b) Points of modal change like bus stops, etc. are used to socialise.

Children and their activities on pedestrian paths.

a) Children are comfortable using the footpaths.

b) Children play regularly on the footpaths

c) Children make friends on the footpath

d) Children are safe on the footpaths and pedestrian routes.

Social Environment for Elders on Footpaths.

a) Elders are comfortable while using the footpaths or pedestrian routes.

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b) Elders spend time on the footpaths and pedestrian areas sitting, reading, or talking with company.

[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Family Behaviour on the Pedestrian Areas.

a) The family as a whole uses the footpaths or pedestrian areas.

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b) Your family meets and socialises with other families on the footpaths, pedestrian areas.

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Psychological Aspects.

Comfort or Irritation on the pedestrian areas.

a) You are comfortable with the excessive crowds on the footpaths.

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b) The surface unevenness of the footpaths does not bother you.

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c) The filthy and unpleasant

surroundings do not bother you.

d) You are comfortable on the footpaths

during inclement weather.

e) Discontinuity of flow while walking

weather more or less does not trouble

you.

f) Hawkers on the pavement do not

bother you.

g) Beggars do not trouble you while

walking on the pedestrian routes.

Tranquillity or Tension in pedestrian

areas.

a) You are at ease even with the

disorganised traffic moving about near

the footpaths inside a generally

pedestrian area.

b) You are at ease even with antisocial

elements hanging around in the

pedestrian paths and areas.

c) You have no problem because of the

noise created in the footpaths or pedestrian areas.

d) You are happy and feel secure while walking on lonely footpaths or pedestrian areas.

Conveniences and Inconveniences in the pedestrian areas.

a) There are adequate public conveniences like toilets, drinking water, dustbin etc. in the existing footpaths and pedestrian areas.

b) There is adequate security on the footpath and pedestrian areas in your locality.

c) Walking late at night is convenient, as there is adequate lighting in the area.

Likes and Dislikes of people walking on the footpaths or pedestrian areas.

a) You enjoy the entertainment provided by footpath performers.

b) You like to watch people moving about

on the footpaths and pedestrian areas.

c) You enjoy interacting with the opposite

sex on the pedestrian areas.

d) You enjoy the surroundings of the

pedestrian areas in your locality.

e) You enjoy shopping from the hawkers

in the pedestrian areas of your locality.

f) You enjoy eating from the stalls in the

footpaths.

g) You enjoy the quite environments in

the pedestrian areas of your locality.

h) You like locations that are purely

pedestrian in your locality.

Health and Fitness.

a) You feel walking is beneficial to your

heath and fitness.

b) You use the pedestrian routes in your

area for walking for fitness.

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c) The pedestrian areas are good for health because of the lack of vehicular pollution.

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Safety

a) The pedestrians use the pedestrian areas and routes with courtesy and good

b) The pedestrians are well informed about the traffic rules.

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c) The drivers of vehicles use the road and other facilities with courteously and with

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d) The drivers are mostly in a good state of mind while driving on the roads

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e) The physical facilities, which have been provided for circulation of vehicular traffic and pedestrian movement, are being used properly.

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f) The physical facilities provided for movement of vehicles and pedestrians is adequate.

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Pollution

a) The air pollution in the neighbourhood

is very low.

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b) The noise pollution in the locality is

within reasonable levels.

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c) There is no visual pollution. (Visuals

which are offensive to the eye).

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d) Water bodies in the area are not

polluted.

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Energy

a) You walk to save cost and

consequently energy.

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b) You worry about unnecessary use of

energy for travel purposes.

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c) You walk because of non-availability

of motor transport.

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d) In the future you will walk more and

use vehicular mode to a lesser extent.

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Signature of Surveyor:
Name of Surveyor:
Address: Place and Date:

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1982	:	Post graduate Diploma in Urban design, Heriot-Watt University, Edinburgh, U. K.
1975	:	Master of Architecture, I.I.T., Kharagpur, India.
1973	:	Bachelor of Architecture, Sir J.J College of Architecture, Bombay university, Mumbai, India
1966	:	Indian School Certificate Examination, La Martiniere School, Calcutta.

AWARDS

1994 - 1995	:	Adjudged to be the best teacher of the College of Engineering & Technology, OUAT, Bhubaneswar.
1981 - 1982	:	Rotary Foundation Educational Award.
1973 - 1975	:	Govt. of India Merit Scholarship For post Graduate study.

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1989 - 1998	:	Professor of Architecture.
1987 - 1989	:	Reader in Architecture.
1975 - 1987	:	Partner in M/s Architectural Design Cell Ekamra marg, Bhubaneswar - 751001

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