STREET DEVELOPMENTS: CASE OF AHMEDABAD, INDIA

by

VINAY SHAH

Diploma in Architecture, School of Architecture
Centre for Environmental Planning and Technology
Ahmedabad, India
1978

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE
DEGREE OF

MASTER OF CITY PLANNING
AND
MASTER OF SCIENCE IN ARCHITECTURE STUDIES

at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
February 1982

© Vinay Shah 1982

The author hereby grants to M.I.T. permission to reproduce and
to distribute copies of this thesis document in whole or in part.

Signature of Author

Department of Architecture, February 5, 1982

Certified by

Professor of Architecture
Thesis Supervisor

Accepted by

Chairman, Departmental Committee for Graduate Students

Accepted by

Chairman, Departmental Committee for Graduate Students
STREET DEVELOPMENTS: CASE OF AHMEDABAD, INDIA

by

VINAY SHAH

Submitted to the Department of Urban Studies and Planning on February, 1982 in partial fulfillment of the requirements for the degrees of

Master of City Planning

and

Master of Science in Architecture Studies

ABSTRACT

This study identifies and analyzes the existing street patterns of the cities in India. It focuses on the city of Ahmedabad through a comparative analysis of traditional streets vs. contemporary streets. The streets are evaluated in their social, physical and economic condition. The major emphasis of the study is on design guidelines, that of the past and present, for physical development. The laws which develop hierarchy of the streets, create streets in three dimensions, decide density and level of services, are examined in the socio-economic context of the city of Ahmedabad.

The study identifies and shows the relationship of social and economic aspects with physical development. It concludes with some observations and comments on the street developments. The study is intended to serve as a reference for those who want to go for indepth study of building regulations and street development in arid/semi-arid climatic conditions.

Thesis Supervisor: Julian Beinart
Professor of Architecture
STREET DEVELOPMENTS:
CASE OF AHMEDABAD, INDIA

VINAY SHAH
ACKNOWLEDGMENT

I am extremely grateful to:

My thesis committee--Professors Julian Beinart, Tunney Lee and William Porter for the valuable advice and assistance.

Aga Khan Program at Harvard and M.I.T. for their partial grant for the field research.

My friends and family.
Marsha and Yanna.

Vinay Shah
ENVIRONMENTAL DESIGN
School of Architecture and Planning, M.I.T
February 5, 1982

CONTENTS

INTRODUCTION ........................................... 1

PLANNING
- Early Examples .....................................9
- Vastu Shastras .....................................10
- Changing Trend .....................................17
- Modern Planning ....................................19

AHMEDABAD
- Introduction ........................................25
- History ..............................................29
- Issues-Changes .....................................33

STREETS: TRADITIONAL vs CONTEMPORARY
- Introduction ........................................40
- Social ...............................................44
- Economic ............................................48
- Physical .............................................50

OBSERVATIONS ...........................................59
SUMMING UP .............................................67

BIBLIOGRAPHY ...........................................69

Copyright © Vinay Shah, 1982
All rights reserved; no part of this work may be reproduced by any means without a written permission from the author.
INTRODUCTION

Urbanization has been occurring at a very rapid pace in India over the last few decades. This process is rapid due to various forces, but rural-urban migration has been one of the major contributing factors. Cities have grown to sizes unperceived by the planners of the past and beyond the scope of traditional planning methods. In fact, planning today does not serve the needs of a large portion of the society—planners are criticized for vast expenditures on development of garden suburbs and projects like "new capitals" that are built according to "high standards" and at a great cost. Especially when a large portion of the population will not be able to afford the services which an urban center has to offer.

Though the necessity of planning for the population in relation to their socio-economic requirements has long been acknowledged, negligible efforts have been made to study the needs, efficiency and deficiency of the present modes of planning. In this era of rapid urbanization the importance of understanding the needs, developing design guidelines, and channeling available resources in the proper direction can hardly be unjustified. Immediate attention is needed to stop the physical decay of the existing urban environment and ensure proper future developments.

On the average, 45 per cent of the nation's population occupy 50 sq. ft. per person. About 72 percent of the houses lack amenities like bathrooms and water closets. It is natural for this population to migrate, not only for economic reasons, but because of the social and other services available in urban areas, too. Thus India needs to focus more on proper urban developments, having entered the era of urbanization and being in the social, physical and economic situation whereby urbanization seems inevitable.

Appropriate urban development needs proper development policies, economic planning, transportation facilities and so on which respond to the needs of the society. The multi-use of streets in India is a good example of what a proper development policy must encompass.

In India, as well as in some other countries where a large portion of the country is in a semi-arid arid climatic zone, streets have served various purposes and functions to its population. Processions occur in India characteristically strolling through the streets of the city. Windows and doors of buildings open up

1 Twenty percent of India's population is concentrated in 142 cities, of which 8 are major metropolitan cities. The rest of the 669 million people live in villages and smaller settlements. The smallest of the smaller settlements have populations of less than 1,000 people. There are 565,000 of these small settlements with some 36,000,000 people.

2 On the average, 45 per cent of the nation's population occupy 50 sq. ft. per person. About 72 percent of the houses lack amenities like bathrooms and water closets.

3 It is natural for this population to migrate, not only for economic reasons, but because of the social and other services available in urban areas, too. Thus India needs to focus more on proper urban developments, having entered the era of urbanization and being in the social, physical and economic situation whereby urbanization seems inevitable.

4 Appropriate urban development needs proper development policies, economic planning, transportation facilities and so on which respond to the needs of the society. The multi-use of streets in India is a good example of what a proper development policy must encompass.

5 In India, as well as in some other countries where a large portion of the country is in a semi-arid arid climatic zone, streets have served various purposes and functions to its population. Processions occur in India characteristically strolling through the streets of the city. Windows and doors of buildings open up

1: Sarin, M. - The Urban Poor: Chandigarh
### GROWTH OF URBANIZATION

<table>
<thead>
<tr>
<th>City</th>
<th>Population 1971 Census (000)</th>
<th>Sex ratio females per 1000 males</th>
<th>Density per km²</th>
<th>Per cent increase 1961-71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td>3,149</td>
<td>638</td>
<td>30,276</td>
<td>7.57</td>
</tr>
<tr>
<td>Greater Bombay</td>
<td>5,971</td>
<td>716</td>
<td>13,640</td>
<td>43.80</td>
</tr>
<tr>
<td>Delhi</td>
<td>3,288</td>
<td>806</td>
<td>N.A.</td>
<td>59.47</td>
</tr>
<tr>
<td>Madras</td>
<td>2,469</td>
<td>904</td>
<td>19,293</td>
<td>42.81</td>
</tr>
<tr>
<td>Hyderabad</td>
<td>1,607</td>
<td>928</td>
<td>9,494</td>
<td>43.70</td>
</tr>
<tr>
<td>Ahmedabad</td>
<td>1,586</td>
<td>833</td>
<td>17,053</td>
<td>37.88</td>
</tr>
<tr>
<td>Bangalore</td>
<td>1,541</td>
<td>877</td>
<td>11,462</td>
<td>35.02</td>
</tr>
<tr>
<td>Kanpur</td>
<td>1,154</td>
<td>769</td>
<td>4,413</td>
<td>31.01</td>
</tr>
</tbody>
</table>

Note: Class I towns are towns (called cities) with a population 100,000 and above; Class II: 50,000 to 99,999; Class III: 20,000 to 49,999; Class IV: 10,000 to 19,999; Class V: 5,000 to 9,999; Class VI: less than 5,000.

Census of India
and residents come out thus interacting with the street activity.

On commercial streets, the shops open up into the street. The commercial environment dominates. The poor use sidewalks to open up petti shops and have thus found a means of living in the urban environment.

The residential streets, located in sectors away from the major circulation arteries, become an extension of the living spaces. Streets substitute for playgrounds, clubs, and for the physical needs of the living spaces to an extent. It is evident that a dynamic environment has to be created to achieve this multi-functional layout.

The factors influencing street layout are three fold:

a. Social
b. Economic
c. Physical

a. Social Factors
The social condition of a particular locale is reflected in the street layout. Social factors affecting the use of open space and streets are:

1. Composition of inhabitants
   - The social structure is reflected in the composition of the inhabitants. Religious standing plays an important role in the social intimacy of India.

2. Organizations
   - Institutes established by the residents not only reflect their needs as they perceive them, but mirror the "intimacy" and "togetherness" between the residents.

3. Services
   - The physical configuration of spaces is influenced by various services available to the residents of a neighborhood.

b. Economic Aspects
Economic aspects are important in the layout of streets. The economy of the users influences the use and maintenance of open spaces, as evidenced by the following:

1. Income distribution
   - Income distribution among groups of residents residing in a neighborhood has a more direct impact on the space organization than other factors. It is a good indicator of the capacity of the users to purchase services.

2. Occupation
   - Housing location is important in relation to distance from the work place. The time and effort one can spend in community activities also depends upon the type of occupation.

3. Mode of transport
   - The modes of transportation have a direct relationship with the economic capacity of the residents. It also influences the type of street spaces required by the users.
Religious procession—Chariot Procession—on the main avenue of the city of Jagannath Puri [Top]
Photograph: Dasa, B.

Commercial activities extending on a street in Ahmedabad [Bottom Left]
Photograph: Shah, V.

A dead-end street being used for sleeping in the old city of Ahmedabad [Bottom Right]
Photograph: Chavda, V.
c. Physical

Physical planning of streets, which reflects the social and economic situation of the society, has an immediate impact on promoting or discouraging a particular type of street function. The planning of streets is easily controlled by laws. Design factors which affect the environment of street layout are:

1. Hierarchy
   - Functional sequence from commercial to residential, the transition from public to private spaces, from accessible to limited access streets, creates a hierarchical sequence.

2. Spatial Shaft
   - The three dimensional space created using the width of the street, facades of the building, overhangs, the interplay of shadow and light, expansion and contraction, stimulates the perception of the users and promotes interaction between the user and his environment. Climate plays an important role in the user's interaction.

3. Density
   - The number of users on a street is dependent on the density. Densely built neighborhoods increase the use of open space which is comparatively less than in a sparsely built neighborhood.

4. Services
   - The level of services and the mode of providing them is not only indicated in the physical environment of the neighborhood, it bears the socio-economic influence.

Recent developments have eliminated these characteristics and functional segregation of the street to a large extent. The problems of contamination and chaotic transportation which surfaced have arrested the attention of planners of the 19th and 20th century that they have failed to understand aspects of street planning, other than circulation and infrastructure.

Under the present situation few intellectuals feel the need to step back into the past and borrow the wisdom of the ancient treatise of planning, the treatise which reveals the art and science of building cities.1 However, any controversy of Ancient vs. Contemporary is not the major one in the present situation. Immediate attention is required to develop the appropriate standards and planning manuals to suit the economic, social-cultural and physical conditions of India.

The objective of this study is to clarify the relationship between the physical, social, and economic environment and insure that the importance of this relationship is clearly known. Since it is impossible to develop a primer for design developments within the limited time and scope of this study, the focus is on street development, with a comparative study of traditional vs. contemporary street layout. The laws chosen are those that develop the hierarchy of the streets, generate a street in three dimension, and decide density and level of services in a

1: Havell, E. - The Ancient and Mediaeval Architecture of India
neighbornood. The appropriateness of the laws is being tested in the present socio-economic situation.

The study is divided into three parts. Part I is a brief account of planning developments in this socio-economic environment. It lists major considerations given in the planning of streets and laws developed therein. It identifies major design development factors showing their influence on the environment of the neighborhood.

The second part begins with the introduction to the city of Ahmedabad and its social, physical and economic condition. Streets, in reference to the socio-economic condition and major physical attributes defined in part I are reviewed in the case of Ahmedabad. The third part summarizes the information presented in Parts I and II. An attempt is made to put forward suggestions for required changes in the laws and make recommendations for further studies.

<table>
<thead>
<tr>
<th>Country</th>
<th>GNP (US $)</th>
<th>Passenger</th>
<th>Radio</th>
<th>Telephone</th>
<th>Physician</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>110</td>
<td>872</td>
<td>48</td>
<td>500</td>
<td>4,795</td>
<td>1,571</td>
</tr>
<tr>
<td>Australia</td>
<td>2,870</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>847</td>
<td>83</td>
</tr>
<tr>
<td>Brazil</td>
<td>460</td>
<td>40</td>
<td>16</td>
<td>42</td>
<td>1,953</td>
<td>274</td>
</tr>
<tr>
<td>Burma</td>
<td>80</td>
<td>926</td>
<td>67</td>
<td>1,000</td>
<td>8,975</td>
<td>1,165</td>
</tr>
<tr>
<td>Canada</td>
<td>4,140</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>684</td>
<td>100</td>
</tr>
<tr>
<td>Egypt</td>
<td>220</td>
<td>241</td>
<td>8</td>
<td>91</td>
<td>2,004</td>
<td>472</td>
</tr>
<tr>
<td>France</td>
<td>3,360</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>747</td>
<td>139</td>
</tr>
<tr>
<td>W. Germany</td>
<td>3,210</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>561</td>
<td>87</td>
</tr>
<tr>
<td>Israel</td>
<td>2,190</td>
<td>17</td>
<td>5</td>
<td>5</td>
<td>390</td>
<td>173</td>
</tr>
<tr>
<td>Italy</td>
<td>1,860</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>553</td>
<td>95</td>
</tr>
<tr>
<td>Japan</td>
<td>2,130</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>898</td>
<td>79</td>
</tr>
<tr>
<td>Kenya</td>
<td>160</td>
<td>112</td>
<td>21</td>
<td>143</td>
<td>7,829</td>
<td>774</td>
</tr>
<tr>
<td>Rep.Korea</td>
<td>290</td>
<td>470</td>
<td>8</td>
<td>43</td>
<td>2,133</td>
<td>1,823</td>
</tr>
<tr>
<td>Mexico</td>
<td>700</td>
<td>38</td>
<td>4</td>
<td>29</td>
<td>1,445</td>
<td>549</td>
</tr>
<tr>
<td>Pakistan</td>
<td>130*</td>
<td>359*</td>
<td>71</td>
<td>500</td>
<td>4,018*</td>
<td>2,570*</td>
</tr>
<tr>
<td>Philippines</td>
<td>240</td>
<td>133</td>
<td>22</td>
<td>111</td>
<td>9,840</td>
<td>822</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>100</td>
<td>145</td>
<td>24</td>
<td>200</td>
<td>3,698</td>
<td>332</td>
</tr>
<tr>
<td>Sweden</td>
<td>4,240</td>
<td>3</td>
<td>26</td>
<td>2</td>
<td>734</td>
<td>67</td>
</tr>
<tr>
<td>U.K.</td>
<td>2,430</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>787</td>
<td>110</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>5,160</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>645</td>
<td>127</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>1,400</td>
<td>n.a.</td>
<td>2</td>
<td>20</td>
<td>421</td>
<td>91</td>
</tr>
</tbody>
</table>

*relates to Pakistan after the creation of Bangladesh

Source: Tata Publications, Statistical outline of India 1975
This section identifies the planning trends, to which India has been exposed. With a brief introduction to traditional design norms and changing planning profession, the section focuses on the laws which control the physical development.

As the purpose of this part is to create a base for analysis of the physical development of streets, detail account of design norms or the laws of town planning like safety codes, zoning regulations, is not given. The section elaborates on the laws developing hierarchy and spatial shaft as well as determining density and level of services.
Source: Mortimer Wheeler, R. Sir - The Indus Civilization
EARLY EXAMPLES

Town planning is an old art in India. Vastu Shastras, the treatises on architecture and planning, presented a collection of thought which reflects the development of the planning profession. Street layout and spatial organization of the street were two of the important aspects of design. The earliest evidence reflecting the existence of organizational principles of planning are the excavations in the Indus Valley, dated around 3,000 B.C. Mohen Jo Daro, situated on the bank of river Indus, presents an outstanding street layout of the Indus Civilization. The layout, though a gridiron, presents a hierarchy of the organization pattern. Public buildings such as an assembly hall, services such as a well constructed public bath surfaced with bituman, and granaries; are at the top of the hierarchy.1

The streets are linear and major streets cross each other at a right angle. The street gradient is used for surface drainage. An extensive drainage system is worked out using the street gradient and channels.

Another example that throws light on the extent to which the formation of ancient cities was "institutionalized" through conscious planning is the discoveries made after the excavation of Taksha Shila, the university town. A series of excavations at Taksha Shila gives us glimpses of the art of city planning existing at the beginning of the Christian era. The location of major buildings on a point higher than other sites and dwellings on gradual downward sloping sites helps solve the problem of drainage and reflects the social hierarchy existing at the time. Creation of "super-blocks" with the formalized pattern of streets, in turn subdivided by side streets lined by dwellings, shows evidence of developed planning principles.2

It is futile to look for the connection between these archaeological monuments and Vastu Shastras. The important observation here is that the Indus Valley developments existing at the advent of nomadic tribes identified as belonging to the Aryan ethnic group, reflect the socio-economic structure and democratic set up of that society.

1: Mortimer Wheeler, R. Sir - The Indus Civilization
SITE DEVELOPMENT STAGES

A. Erecting the outline of the Vastu-purushamandala.
B. Division into plots [Vastu-purushamandala.]
C. Layout of the principal streets.
D. Division into hypothetical rings of Brahma, Manushya and Paisacha.
E. Linear plots marked by means of beach marks. Erection of outer wall, gate and the main
F. Erection of various edifices according to site-planning and folk-planning principles.

VASTU PURUSA MANDALA

Typical division of Vastu-purushamandala into various spheres.
1. Sphere of Brahma.
2. Sphere of Manushya.
3. Sphere of Paisacha.
4. Sphere of Daivika.

The Aryans, generators of Vedic civilization, conquered Dravidian civilization of the Indus Valley about 3,000 B.C. The learnings of the predecessors were gestated and developed for about 1700 years before the first planning manual came into existence.

The amalgamation of the two ethnic group-cultures, followed by the successive invasions from the north-east by the Shuks, Kushans and Turks leading up to the formation of the Mughul empire, had significant influence on the structure of the cities. Planning norms responded to the socio-economic structure that existed during the period.

The intermingling influence of different factors such as spiritual, physical, social reached such a complex stage that any effort to separate religion from planning norms or planning norms from social structure became impossible.

Vastu Shastras established not only the physical but the spatial, as well as socio-economic hierarchy through the Caste System. The Caste System, which has implications even today, was devised by the Aryans to establish a hierarchy by creation of socio-occupational groups. The group designations subsequently became personifications of a ranking system, not only of the inhabitants of the settlements but also of objects, including locations of city components.

Apart from having locational implications in the distribution of city population, the categories of the Caste System were used as a principles for the designation of "high ranking areas" ranging down to "low ranking areas."

This method of division also corresponded to the hierarchy of various gods and finally to the cosmic order; for instance, the central space in a town diagram was attributed to the Brahma, the "ultimate," while the peripheral sections represent the lower gods.

However, the symbolic representation of the hierarchy—the social and religious order—became fixed in the forms laid out earlier. A dark skin Dravidian slave, Shudra, can not rise up to a higher caste as was possible in the Caste System originally. Although the symbolic presentation of the logical principles is one of the reasons for the rigid social form existing today, Aryans can not be accused of generating the system in its present form. Aryans presented the arts and sciences through symbolism and prescriptive methodology to provide an abstraction to the masses who were not expected to intellectualize on the issue.

1: Shah, V. - Ancient Planning Principles - India, Paper
Source: Reddi, S. - Building Regulations
Hierarchy
The traditional art of planning was not only slow but dealt with design and size of cities on a different scale. The establishment of hierarchy was one of the most important tasks. Streets were named according to their function, with a development of pattern according to settlement diagrams prescribed in the treatise. The spatial sequence was prescribed through design codes.

Towns were connected with other towns by highways with trees planted on both sides, resting places and drinking wells located at regular intervals.

10 Towns were to have streets as follows: Raj Marg, Rathya, Maha Marg, Marg, Vithi, and Kshudra Marg.

Raj Marg is the main avenue of the town leading to the temple or king's palace. Rathya is a carriage street, which should run north/south and east/west direction with footpaths on both sides. They should be of width 8', 16', 24', 32' or more and one, three, five, or seven in numbers. There should be Maha Marg (large roads), Marg (roads), and Vithi (streets) running length and breadth wise. The width of Maha Marg should be equal to Vithi of largest width in town. The Vithi in center should be equal to Maha Marg. The width of Marg should be equal to or 3/4 or 1/2 of Vithi and Kshudra Marg (narrow lane) should run straight between Vithi and Maha Marg. The width of the lane should be 3/4, 1/2 or 1/4 of the Marg.

Segregation of different street functions was apparent. Since the environment was a pedestrian dominated one, it was recommended that the residential quarter be located off the streets for conveyance. The rule mentions that the architect should avoid such location of heavy traffic as it ruins the prosperity of the residents. Even the ceremonial route, Mangal Vithy, should not cross streets reserved for conveyance, to attain efficient circulation and uninterrupted ceremonial processions. The ceremonial routes should not pass through places of sacrificial offering so as to avoid the slightest possibility of offending any other person by disturbing his rites and rituals.

Spatial Shaft
The width of streets and the height of the buildings were designed in proportion prescribed in the treatises. One perceived the street in three dimensions. Width and height of the building, as well as its projection on the street are laid out in the codes. The codes considered houses on both sides of streets as a part of the spatial shaft. The breadth of a building on the main street is recommended to be 24', 32', 40' or as required.
The plinth was to be in proportions of 1/5, 1/7 or 1/9 of the height of the building for one story buildings. The projection of plinth should be in proportion to its length. One seventh or 1/9 of the length of a dwelling is a good proportion for the depth of a plinth. The projection over the plinth could be less in the length if desired.

It was recommended that the houses on a street have one to twelve stories but they should correspond with other buildings on the same street. This was to ensure a unique and continuous facade. Moreover, it was recommended that the houses have a step back profile as the height of the structure increased. This was not only to assure structural stability, but to reduce shadow on other adjacent buildings. The width of the street was to be decided on the basis of the population of a village, as well as its function. Roads for chariots, beasts of burden, general pedestrian traffic and access to dwellings were clearly defined and correspondingly designed.

The measurements, starting from an atom to a 6'-0" long yard stick, were used in explaining various street widths, formulating a system of proportion. These measurements were classified under various categories, using human dimensions, and were applied in relation to the object of measurement. The flexibility achieved was immense and so was the possibility of misuse.

Main street in the old city neighborhood
Photograph: Chauda, V.
Density
An unstable political situation and the complexity of the social structures played their part in deciding the density of a settlement. Tightly woven settlement patterns with narrow lands resulted from this situation. Neighborhoods under control of the residents provided enough flexibility in a broad spectrum of city design. Environmental control was achieved by means of Vastu Purusha Mandala, land use pattern, allocating different areas to different professional groups. Factors such as importance of a site in reference to social and economic status are also presented through the symbol of Vastu Purusha Mandala.

A system of proportion is derived to suit individual needs. The length of a building is recommended one and one half, two or three times its breadth. There is hardly any rule directly governing density of a neighborhood. This made the dense neighborhoods, and narrow and crooked streets possible. It also made administration of the growing city a very complex task. As the finite administrative details were left to the residents of a neighborhood, the city administration had little control over the density of any development. However, proper development was assured by the rules of proportion which were followed religiously.

Services
Control over the design of finite rules, regulations and guidelines for the development and maintenance of the neighborhood was in the hands of the residents. The dispersed administrative structure led to a variety of methods for achieving an adequate level of infrastructure and social services through community effort. The symbolic design guidelines represent the need for storm drainage by recommending a site sloping north/northeast. In sparsely populated towns extensive drainage systems are not a requirement. An accessible location to everybody for a drinking well is recommended. A dwelling is designed with an underground tank to store rain water for use in dry seasons.

Even though buildings are attached to other buildings, each one has adequate light and ventilation. The cardinal direction for the orientation of street layout are preferred so as to assure proper sun and shade in the street. Radial street layouts were discourage, for reasons of defense, traffic and climate. An open space at a junction of streets or in the center of a layout was recommended for public meetings. Thus pockets of open spaces were created to suit the needs of the residents.

The building Bye-Laws presented here are inferred from different verses of the ancient treatises translated by various authors. Major reference used in this study is, "Architecture of Mansara" (in Sanskrit) - translated by Acharya, P. 1933.
CHANGING TREND

Tradition continued in the slow moving stature of the society until the introduction of a new mode of living. The exposure given to India by the British initiated a movement, a movement of social change, which in turn created a physically dynamic society. This, in turn, resulted in the adoption of new methods of planning.

The roots of modern town planning in India lie in the social-political movement of the continent of Europe. For example, a town in medieval Europe changed its face so slowly that at any point in time the town was static. The town was given a definitive architectural definition with sufficient margins to absorb future growth in an era of slow moving reality.

The method became less and less appropriate as the tempo of change became more rapid. The changing political situation, dynamic social conditions, and proliferating industrialization associated with the growing economy of the cities required a new system of planning.

Growth of London is one example of the impact of change. New methods of planning became apparent in plans developed in the 18th century for the development of London.

With mechanization of the coal, iron and textile industries, which began there, the production of goods increased manyfold. For example, the cotton industries produced 273,000,000 pounds in 1872 in comparison to 3,800,000 in 1775. This drastic increased production, in turn, increased trade, which was reflected in a higher demand on various services, particularly on communication's network in these countries.

The invention of the locomotive, automobile and other means of transportation had a major influence on future planning. Many roads were replaced by turnpikes. Railroads were laid out connecting many industrial areas. These changes filtered through the British administration in the Indian peninsula. The immediate impact of industrialization and the changing network of communication was felt by the industrial cities.

The first to be affected was the economic structure of these cities. Growing industrialization continued to influence the growth of Indian cities later on.

1: Benevolo, L. - The origins of Modern Town Planning
HAS
DEATH
(IN A RAGE)

Been invited by the Commissioners of Common Sewers to take up his abode in Lambeth? or, from what other villainous cause proceeds the frightful Mortality by which we are surrounded?

In this Pest-House of the Metropolis, and disgrace to the Nation, the main thoroughfares are still without Common Sewers, although the Inhabitants have paid exorbitant Rates from time immemorial!

"O Heaven! that such compassion thou'rt unknown. And put in every honest heart, a whip. To lash the reprobate through the world."

Unless something be speedily done to allay the growing discontent of the people, retributive justice in her salutary vengeance will commence her operations with the Lamp-iron and the Halter.

SALUS POPULL.

Lambeth, August, 1832.

A. W. PEEL, Printer, S. New Cut, Lambeth.

A POSTER

A DRAWING SHOWING OVERCROWDING

Source: Benevolo, L. - The Origins of Modern Town Planning
MODERN PLANNING

In the industrial era - era of rapid change - migrants poured into industrial cities from all directions. Industrialization created a demand for housing development near work places and industries. This helped the city expand beyond its limits. The developers, pressed by the high demand, showed little interest in the environment of the dwellings they erected. Since it was economically advantageous to build quickly, they disregarded any environmental issues.¹

A series of workers quarters were constructed on muddy soil, with damp cellars and inadequate living spaces. Although it is difficult to ascertain the economic capacity of the occupants of those dwellings, it is obvious that they were not well provided for. The houses were unclean and the streets muddy. The untidiness of the dwelling environment took constant attention of the intellectuals.²

A new society, culture and social order was generated as a result of this situation. The industrial workers union evolved as a social organization, organized in search of better working environments and to achieve political strength to back up their demands.

An acute shortage of sanitary facilities was the second most important issue after transportation demanding immediate attention. The never ending growth of the city boundaries, creeping out into the country, resulted in the uncontrolled construction which made the sanitary conditions unbearable.³ Inadequate sanitation was not a problem of the sparsely populated villages in the country but remained a major issue in the overcrowded, vast number of new buildings on the fringes of the city. Open sewers running along the road side, rubbish piling up in the corners intermingling carts, pedestrians, animals and later on automobiles became common sights in the neighborhoods.

This hopeless situation became the starting point for a social and political revolution. A socialist organization began to take shape, complementing the work in the factory with study and leisure. The socialist reformists like Owen, Simon, and Cabet suggested a configuration of political, social and technical issues to formulate new town planning manuals.

However, planning was settling into an economic mould which disregarded the social, and to some extent political, implications. The situation reached a point where all factors became separate elements. For example, within the limits of political discussions, the underlying social problems and their implicit connection with planning could find no place.

1: Engels, F. - Condition of the Working Class in England in 1844
2: Saarinen, E. - The City, Its Growth, Its Decay, Its Future
3: Clapham, J. - An Economic History of Modern Britain
The British implemented new programs of public works to improve the sanitary problems that emerged during the industrial revolution, such as Cholera epidemics. To assure safe and quick military movement they also instigated two legislations as the forerunner of modern town planning legislation. These were sanitary legislation and railways/public work legislation. The British realized the political importance of improving the living environment and sanitary conditions of British colonies in developing countries after the experience of the socialist movements of Europe. Thus India was exposed to the modern movement of planning.

1: Benevolo, L. - The Origins of Modern Town Planning

Source: Reddi, S. - Building Regulations
Hierarchy
Rapid commercial growth had a devastating influence on city development. Commerce became the focus of growth. Transportation and sanitary facilities influenced the street layout to a large extent. Street planning became a technical and practical matter. The social order, village structure, spatial hierarchy and other traditional factors became unimportant in town planning. Technical aspects of infrastructure and transportation influenced the profession to such an extent that the movement of social reform--changes in the social structure based on kinship and the Caste System--hardly caught the attention of the planners. Streets were designed and designated for the capacity and function of handling traffic.

Planning manuals today require that a city be connected to other cities and towns via highways, railroads, etc. Cities are directed to have roads as follows: arterial road, sub arterial road, major road, feeder road, collector road, and residential road. The width of large thoroughfares, arterial, sub arterial, and major roads is decided by the city authority, depending upon the projected need of the neighborhood.

The internal road in a layout must be 20' wide, if less than 250' in length; 25', if less than 500'; 30' if less than 1,500' in length.

Roads with lengths of more than 1500' have a prescribed width of more than 35' when found necessary by the local authorities.

A road, if a continuation of an existing road, has to correspond in width. It also must fulfill the standard of width stated earlier. Roads, their junctions, curves and corners of the junctions should be as directed by local authorities to maintain a smooth turning radius for vehicles and to allow wide angle vision at the turns.

A dead end street should have a 44' diameter circle at the end of the road to facilitate the turning of a vehicle. The requirement can be waived if the road is less that 150' in length or dead end plots have at least 30' frontage over such a road.

Segregation of different functions is implemented by zoning bye-laws.

Spatial Shaft
A building is set back 15' from the front edge of the lot boundary leaving such elements as lamp posts and trees to create the three dimensional street. The width of a street is decided by its length, and the number of vehicles expected to pass through it in a day. The building code details the relationship of length and width of a street.
The building heights are governed by a floor space index. Thus most of the residential buildings can go to the height of 35' without using an elevator. A fire code restricts the maximum height of the building to 100'.

The plinth of a building is recommended to be 1'-6" from the crown of the road to prevent water entering the house in case of heavy rain and flooding in the surroundings of the house. An over head projection of 4', such as a balcony, is permitted in the margin.

The code clearly defines the dimensions, leaving little leeway for the residents to encroach upon the public property or abuse the codes in extreme conditions.

Density

Administrative details and central control became necessary to administer the large areas of metropolitan cities. Zoning laws and a floor space index replaced the symbolic representation, Vastu Purusha Mandala and other such symbols. Laws, easy to administer with central control, were preferred to guidelines which required grass roots control to ensure proper development and adequate services. Town planning schemes were developed with emphasis on administrative efficiency and economic implementation.

Main street in a suburban residential development
Photograph: Patel, N.
The density of a neighborhood is controlled by the floor space index. A minimum lot area requirement of 240 sq. yds. with 50' frontage defines the maximum number of dwellings in a given area. To limit the possibility of over-building and not leaving open spaces, a building is required to have its ground floor area not more than 1/3 of the lot area. The floor space index is usually higher in commercial areas allowing denser development than residential ones.

Zoning is used as a segregating instrument for land. It can be used efficiently to eliminate polluting industries and factories from the residential and commercial areas, thereby reducing health hazards.

Services

The changes that occurred in the last two centuries have eliminated the traditional methods for the provision of amenities, replacing them with a new system. Transportation problems and sanitary issues dominated the profession of planning. New methods of providing infrastructure and services required a central administration. Administrative control and ease of accessibility became the prime theme of the planning codes.

The provision of social services is left to the neighborhood with one exception. A common plot of approximately 15 per cent of the total plot area in a housing society must be left open for public gatherings and social festivities. Schools and provisions for playgrounds are encouraged in large scale developments.

Roads are used for surface drainage and are laid out accordingly. Building codes require that permission to occupy the building be given after laying out and constructing roads, providing services such as water supply, drainage, storm water drainage, street lighting, foot paths. However, the authorities may postpone enforcement of the law if the owner agrees to execute the work at his own expense before a future date which is agreed upon by the authorities.

Kitchen, bath, toilet, as well as a space for a staircase, can be common if a lot is shared by two or more dwellings. But the lot has to be of certain dimension prescribed elsewhere. To attain efficient ventilation and ensure adequate light in a building, a margin of 10' is required around the building. The code specifies that the window area of a room has to be 10 per cent of the floor area. The city authorities encourage vegetation and plantation around a building to create a cooler micro-climatic environment.

The building Bye-Laws are drawn from various building codes, town planning legislation and different reports published by the planning authority for the state of Gujarat and the city of Ahmedabad.
Aerial Photograph
AHMEDABAD - 1940
Source: Ahmedabad Municipal Corporation

AHMEDABAD

INTRODUCTION

The city of Ahmedabad is located on latitude 23°04' North and 72°38' East at an altitude of 175' above sea level. The largest city of the Gujarat State is located 350 miles North of Bombay and 600 miles South of New Delhi.

The climate of the city is hot and dry most of the year. It falls in the semi-arid zone. The city is divided into two parts, east and west, by the River Sabarmati which flows north-south, but is dry most of the year. The summer is harsh with the high temperature around 44°C and winter is mild with 6°C temperature at its lowest. Monsoon, one of the three seasons, brings about 33" of rain. The sun shines for more than 300 days in a year. The monsoon is also a hot season with short, heavy showers making the summer last for almost 8 months.1

This section is an introduction to the city of Ahmedabad. It lists major historical events of the city which affected the growth and development of the city.

The intention is to identify major changes which influenced the development of streets in the city. As the purpose of this section is to prepare a base for the comparative street study, detail account of the history is not given. Within the scope of the study, changes such as political, are not emphasized. The focus of the study remains on social, economic and physical changes.

1: Census of India - Special Report, Ahmedabad
Plan
AHMEDABAD - 1809

Source: India Office Library - Records
DANDAKA (Staff)

KARNAUKA (Bow)

SARVATOBHADRA (Ambience everywhere)

HISTORY

The city of Ahmedabad was established by King Ahmed in the year 1411. The site selected was close to the existing commerical settlement called Asha Palli. Thus, though the city was established for political reasons, the population remained essentially commerce-oriented, with an economy based on a flourishing trade, along with export-import conducted through the port of Cambay. Weavers and jewellers, inlayers of ivory, ebony and sandlewood were a few of the skills which flourished under Muslim rule. The city, situated on the junction of highways connecting northern to southern India and connected to other countries through the sea port of Cambay, enjoyed certain economic advantages.

It is believed that the planning of the city was based on Hindu cannons, drawing inspiration from existing cities such as Patan. (Patan - the former seat of the ruler before establishment of Ahmedabad). Historians debate the different type of settlement diagrams derived from the ancient treatises on which the city was planned. Few conclude that the city is a "sarvatobhadra" (Happiness everywhere) type of settlement. Few brand it a "Dandak" (staff) which gradually developed into a "Karmuka" (Bow) type of town.

The city developed along the river bank in a rectangular form. The sites near the citadel were considered the best in reference to location, defense, and accessibility, hence were allotted to those in favor with the rulers. The administrative structure of the city was largely drawn from the Muslim community which occupied the sites near the citadel. Hindus occupied the rest of the eastern side of the city.

The development of the town was slow in its early stages until the rule of Sultan Mohammad Begada who initiated the policy of allowing his commanders to establish townships and collect revenue in exchange for services to the Sultan when required.

This policy of a dispersed administrative structure for development became so successful that the city expanded rapidly. The fort wall, a later addition to the city, was constructed to check its growth and accounts for the irregular shape of the city.

The city which prospered under the careful maneuvering of the Muslim Sultans, underwent a series of invasions by Marathas in the 18th century. During the Maratha reign of 110 years, from 1708 to 1818, Marathas promoted the physical decline of the city. They showed least interest in its economic prosperity. The fort wall was broken and the streets deserted. Many edifices

1: Gillion, K. - Ahmedabad
2: Bhatt, P. - Ahmedabad in Time and Space
3: Ahmedabad Gazeteer
View of a street with three gates and surroundings in 1896 (Top - Opp. Pg.)
The same street in 1979 (Top)
Photograph: VIKSAT

Dense development - East part of the city with chimneys of textile mills in distant skyline (Bottom - Opp. Pg.)
Low density - West part of the city with trees and vegetation (Bottom)
Photograph: Shah, V.
VARIATION IN DENSITY

<table>
<thead>
<tr>
<th>Year</th>
<th>Density of Population per square kilometer</th>
<th>Variation per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1872</td>
<td>21,977</td>
<td>---</td>
</tr>
<tr>
<td>1881</td>
<td>22,552</td>
<td>+ 2.62</td>
</tr>
<tr>
<td>1891</td>
<td>13,608</td>
<td>- 39.66</td>
</tr>
<tr>
<td>1901</td>
<td>13,094</td>
<td>- 3.78</td>
</tr>
<tr>
<td>1911</td>
<td>9,970</td>
<td>- 23.86</td>
</tr>
<tr>
<td>1921</td>
<td>11,301</td>
<td>+ 13.35</td>
</tr>
<tr>
<td>1931</td>
<td>19,135</td>
<td>+ 33.93</td>
</tr>
<tr>
<td>1941</td>
<td>11,276</td>
<td>- 25.50</td>
</tr>
<tr>
<td>1951</td>
<td>15,029</td>
<td>+ 33.24</td>
</tr>
<tr>
<td>1961</td>
<td>12,363</td>
<td>- 17.72</td>
</tr>
<tr>
<td>1971</td>
<td>17,053</td>
<td>+ 37.95</td>
</tr>
</tbody>
</table>

Census of India - Statistical Outline, Ahmedabad
were in dilapidated condition. Monumental edifices became filled with dirt, weeds and cow dung. Shops and houses were constructed on and around the edifices. The roads became dusty, ill maintained and narrow. In the rainy season they became muddy creating unhygienic situations.

The old principles of town planning were neglected. The security of life and property became the main aim in the building industry of that era. The city authorities neither controlled nor interfered with the gradual erection of buildings and encroachments agreeable to the social habits of the immediate residents.

In 1818 the British took over control of the city and the city started to revive under their stable administration. Industrialization was felt with the introduction of a textile mill in the year 1861. Investment in trade and industries increased. This rapid industrialization, growth of the textile industry, as well as other amenities and the attraction of technological development intensified the growth of the city. The western bank of the River Sabarmati was opened up with the construction of a bridge in 1870.

Traffic problems in the center city had become so serious that in 1934 the municipality decided to build a road from the west to the east of the city to relieve the center city. But two more bridges constructed over the river in 1939 and 1940 encouraged more suburban development. The residents of the walled city moved out to suburbs. The new area opened up by the construction of the bridges became predominantly an upper income residential area. A dwelling in the suburbs, with a new life style, became a symbol of social and economic status. The city administration encouraged the development of a garden suburbia with imposition of the new town planning code.

ISSUES-CHANGES

It was around the turn of the 19th century that the first suggestion for "planning ahead" was made. The unplanned location of mills, huge British bungalows and large reserves for containment were only a partial reason for higher land prices and for the scarcity of urbanizable land near by. The scheme of green belt around the city to ensure proper development was inadequate to control the growth. Instead of controlling, it encouraged more haphazard development beyond the Green Belt. Workers squatted on any piece of open land. Their priority in choosing the place remain the distance of commuting to their respective employment places. The mills were surrounded by huts of straw and mud built by the mill workers.

1: Jhote, R. - Gujarati Patnagar - Amdavad (Ahmedabad - the Capital of Gujarati) in Gujarati
2: Ahmedabad Municipal Corporation - Draft Development Plan 1975
3: Gillion, K. - Ahmedabad
4: Bombay Government - Special Reports on Slums
Social change remained slow and was largely limited to education, particularly women’s education. Organizations of reformers focused on preventing child marriages, liberating caste rules and financing worthy causes in the humanities. Though women's liberation and education opened up a new direction of social change, society retreated its steps to an extent because of events such as communal riots.

Also the economic and political ups and downs enhanced social ties. The population of the city which is estimated at around 25,000 in the 15th century reached a figure between 250,000 and 500,000 by the end of the 17th century.1 With the decline of the city in the 18th century, the population reached its bottom figure of 80,000. After that point, the city has continuously grown. At the turn of the 19th century, the population of the city increased to 200,000. The growth of the city remains rapid and reached figures of 1,149,918 in 1961; 1,591,832 in 1972 and 2,000,000 in 1981.2 Boundaries of the city were extended to include an area of 10 sq. miles in 1911 from less than 3 sq. miles in 1872 recording an increase of 400 per cent in 40 years. With the recent extension, the city covers 40 sq. miles.3 The city authorities hope to achieve a better environment with the second draft development plan prepared for 1975-1985.

1: Ahmedabad Gazeteer
2: Census of India
3: Ahmedabad Municipal Corporation - Administrative Reports

Source: Ahmedabad Municipal Corporation - Special Reports
The prevailing social conditions and traditional social divisions at the time of the city's establishment were reflected in the spatial pattern of the city. Muslims, being the ruling class, stayed closer to the citadel and Hindus having strong affiliation to the caste system, developed residential neighborhoods popularly known as "Pol." This separation by community and caste was furthered by grouping of families. The ways of living, dress, religion all were reflected in the spatial pattern. Within the community, classes enjoyed social and domestic advantages by adhering to their respective groups.

The social structure has changed very little. When the municipality acted in the early 20th century to widen the streets, the displaced residents preferred to move into other already dense parts of the city because of sentiment and for reasons of security.

Guilds - Mahajan - of each caste attained a strong foothold in the closeknit communities and exercised social control over the society. Mahajan was responsible for such tasks ranging from the responsibility to represent the community to the city administration, to maintenance of hygienic conditions and the social environment of the neighborhood. Individuals were not allowed to act in a fashion unacceptable to the society at large.  

The stable political situation of the 19th century and the prosperity brought about by increasing trade and industrialization loosened up the social ties to an extent. The British enhanced the process by establishing a formal administrative structure (like courts and offices) thus weakening the grip of the guild on the society. The establishment of formal educational institutions, press, and other such organizations furthered the process of social awareness. However, the society was not satisfied with the new system of administration (although the growth of the city demanded the formation of a formal administration--hence the formation of the municipality to deal with the issues of the city). Consequently, a council was formed to deal with the immediate problems such as repair and maintenance of fort wall and roads. The council still maintained the responsibility of presenting the citizens' priorities to the British administration.

There were major recreational places such as Hauj-E-Kutub (Kankaria Lake) and various parks in the city. However, in the former social structure of the city where smaller community places were better utilized, the extensive provision of amenities for a large group of the public was never demanded. Daily services were provided by residents with mutual understanding and common effort. The growth of the city

and changing social conditions required an efficient program of education, health and recreation. Planning and provision for libraries, museums, stadiums and play grounds, parks and gardens, auditoriums and art galleries was necessary in this situation. Also, the need for institutions to provide social services was felt.

CHANGES - ECONOMIC

Since the city was the major trade center in the vicinity, as well as the seat of the ruler, it enjoyed a higher economic yield. There is no accurate information available about the income of an individual of that period, but it is speculated that it was much higher than a subsistence income level. With the construction of the first textile mill in 1861, followed by many others, the seeds of an industrial era were planted. Trade and industry flourished. Industrial growth helped increase per capita income of the city. Urban per capita income was twice that of rural per capita. Per capita income of the city increased from 1/4 Rs. (4 Anna and 1 Pai) in 1897 to 350 Rs. in 1971.¹

Five per cent of the city's population earns more than $1900 per annum, 9 percent between $1100 and $1900, 29 percent between $600 and $1100 and the rest (some 53 percent of the total) falls in the low and very low income groups earning less than $600 per annum.² The increasing trade and the advantages generated through it, are more or less shared by the social groups of the individuals involved in trade. Upward mobility came to the group as a whole leaving many people without these advantages.

¹ Textile mills grew from 9, with 7,541 workers in 1891, to 29, with 16,887 workers in 1901. The number of mills increased over the years as well as modernized. Many subsidiary industries started developing. In 1971, 1729 factories were registered employing a work force of 152,986 persons. The number of subsidiary workshops was closer to 9,000 employing 100,000 people.³ A significant change came in the occupational pattern of the city. Three major groups surfaced. Forty percent were involved in the manufacturing industries and 22 percent in services, thus constituting 68 percent of the total working population. Twenty-seven percent of the working population remained in trade and communication.

Transportation and communication became important to the commuting work force. Public transport is one of the major options. Six hundred thousand people commute daily by public transport which consists of more than 400 buses. There are approximately 500,000

¹: Census of India - Census Summary, Ahmedabad 1971
²: Ibid
³: Ahmedabad Municipal Corporation - General Department, Records
cycles on the road, another major option for commuters. Forty thousand motor cycles, 17,000 cars, 9,000 autorickshaws and 3,000 trucks with other vehicles and taxis make the total vehicles on the road some 70,000. The city also has quite a few animal driven carts and carriages. It is also connected to other major industrial cities and trade centers by railroads, highways and air service, thus enhancing its growth.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Mills</th>
<th>Average Number of Workers Daily Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1861</td>
<td>1</td>
<td>63</td>
</tr>
<tr>
<td>1879</td>
<td>4</td>
<td>2,013</td>
</tr>
<tr>
<td>1891</td>
<td>9</td>
<td>7,451</td>
</tr>
<tr>
<td>1900</td>
<td>27</td>
<td>15,943</td>
</tr>
<tr>
<td>1914</td>
<td>49</td>
<td>32,789</td>
</tr>
<tr>
<td>1922</td>
<td>56</td>
<td>52,571</td>
</tr>
<tr>
<td>1939</td>
<td>77</td>
<td>77,859</td>
</tr>
<tr>
<td>1950</td>
<td>74</td>
<td>124,232</td>
</tr>
<tr>
<td>1959</td>
<td>71</td>
<td>130,916</td>
</tr>
<tr>
<td>1971-72</td>
<td>67</td>
<td>119,376</td>
</tr>
</tbody>
</table>

The avenue connecting the Bhdra Fort (citadel) and the Friday Mosque was more of a processional route than a circulation artery. The Friday Mosque and its vicinity became a major public place. The streets around it served a commercial function. With the growth of the city, the commercial usage spread along all main streets of the city. Residential streets remained segregated from public functions. It is believed that corrupted administrators, during the Maratha reign, took bribes and allowed encroachment on the streets and public places. Many citizens took advantage of this situation. They encroached upon the streets, creating curves and windings to ensure security and ease of defense. Many residential developments had a separate entry gate which, when enclosed, assured the community complete seclusion and security.

1: Ahmedabad Municipal Corporation - Traffic Study 1971
2: Shankerlal Amirthray - Amdavadno Jivan Vikas (Expansion of Ahmedabad city) in Gujarati
3: Jhote, R. Amdavadno Parichay (Introduction of Ahmedabad) in Gujarati
In the late 19th and early 20th centuries the municipality undertook the job of widening existing streets and constructing new ones by removal of bottlenecks and purchase of new land. The administrative help of leading citizens was secured in purchase of the properties. Along with other minor roads, three major roads, one from the center to the northern periphery and two from east to west were built. New streets were laid out to cope with the immediate problem of traffic in the city. The municipality decided to open up the city by demolishing the fort wall, which was no longer a necessity for defense, and make a ring road around the city. This ring road became the first ring in a series of ring roads to be developed later on in the 20th century.

The political instability of the 18th century and before augmented the close ties of families. This was reflected in the density of neighborhoods. The available figures for house occupancy show 35,280 houses in 1872, an increase from 29,000 in 1824. The quality of the housing environment deteriorated after industrial development. Out of 84,400 houses recorded in 1911, many were shared by families who occupied a one-room shelter or a hut in the popular settlement. As per the 1971 census, 653 families out of 1,000 live in one-room households.

The density kept increasing as the houses were divided and subdivided to fulfill the growing demand for housing. The average density in the walled city reached 220,000 persons per square mile with certain neighborhoods having a density as high as 350,000 people per square mile by 1971. However, the suburban development remained at a low density with about 15,000 persons per square mile. Though the suburbs were more sparsely populated (7% of the population occupied 35% of the urban land) 60% of the city expenditures were made in this area in the last 25 years.

The formal administrative structure of the city, after its establishment in 1834, initiated efforts to provide a water supply network as one of its major programs. Provision of such infrastructure remains a focus of the city administration. As early as 1890 the municipality started laying out an underground drainage system to avoid serious problems of contamination surfaced in the existing system of the soak well. The city was introduced to a telephone system in 1897, electricity in 1915 and a bus service about 1921.

<table>
<thead>
<tr>
<th>Year</th>
<th>City Roads All roads (kms.)</th>
<th>Sewer Lines Total (kms.)</th>
<th>Street Lights Total</th>
<th>Sewer Lines Length of sewer lines (kms.) (at end of yr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>777.4</td>
<td>322.6</td>
<td>12735</td>
<td>380.4</td>
</tr>
<tr>
<td>1962</td>
<td>803.2</td>
<td>322.6</td>
<td>13549</td>
<td>417.7</td>
</tr>
<tr>
<td>1970</td>
<td>813.4</td>
<td>148.7</td>
<td>19987</td>
<td>674.6</td>
</tr>
<tr>
<td>1971</td>
<td>811.6</td>
<td>123.9</td>
<td>21028</td>
<td>726.3</td>
</tr>
</tbody>
</table>

1: Ahmedabad Gazetteer  
2: Census of India - Census Summary 1911  
3: Ahmedabad Municipal Corporation - General Department, Records  
4: Gillion, K. - Ahmedabad

Source: Ahmedabad Municipal Corporation - Special Reports
In this section a traditional residential development, designed and developed under the influence of ancient planning principles and traditions, is compared with a suburban development administered by modern building bylaws and town planning schemes.

The intention is to bring to light the fundamental properties of each set of principles and determine the influence of each as a preliminary investigation towards understanding as well as testing the validity of the ancient and contemporary planning principles.

As the scope and purpose of the comparison is to understand the principles and initiate a similar inquiry in more depth, various issues like site selection, land values and financing are not touched upon.

Streets have been reviewed with respect to physical and environmental issues.
INTRODUCTION

TRADITIONAL STREETS

The socio-occupational groups of the past and the prevailing political situation formulated the streets of the wall city Ahmedabad in its present condition. It was unusual to have the workplace away from one's living quarters in those days. However, the marketplaces were separated from the living places.

Though the character of a street remained the same, the shape and size of streets were transformed radically in the political chaos of the 17th and 18th centuries. Narrow and winding streets with crooked curves and unusual turns are the result of this situation.

The integrity of the socio-occupational groups which formed the caste system of today has left a clear influence on the development of a residential neighborhood, a "pol." Usually a pol is formed by a grouping of families of one caste and occupation.

1: Bhatt, P. - Ahmedabad in Time and Space

The city of Ahmedabad, although an urban center in its vicinity for more than four centuries, started growing physically after the construction of the first bridge over the river Sabarmati. As the migrants poured in from all directions to the center city, the city population increased at a very rapid rate; the citizens occupying the center city started moving out to suburbs which opened in the late 19th century on the western bank of the river.

The British influence reached its peak, at that time, affecting various fields, including those of architecture and planning. The city authorities, under British influence, developed new building codes and town planning legislations. Streets were planned with a grid-iron pattern in mind.

The societal structure which affected the development of the walled city also influenced, to a lesser degree, the suburban developments. People tended to form co-operative housing societies in the manner similar to the traditional one.

Source: Ahmedabad Municipal Corporation

CONTEMPORARY

Source: Shukla, H. - Ahmedabad Guide

CONTEMPORARY
### SOCIAL

<table>
<thead>
<tr>
<th>Composition</th>
<th>Lakha Patel's Pol</th>
<th>Brahmin Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>500 (100%)</td>
<td>355 (100%)</td>
</tr>
<tr>
<td>Brahmin</td>
<td>102 (20%)</td>
<td>284 (80%)</td>
</tr>
<tr>
<td>Patel</td>
<td>329 (65%)</td>
<td>21 (6%)</td>
</tr>
<tr>
<td>Vaishya</td>
<td>48 (10%)</td>
<td>45 (12%)</td>
</tr>
<tr>
<td>Muslims</td>
<td>4 (1%)</td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jain</td>
<td>8 (2%)</td>
<td>3 (1%)</td>
</tr>
<tr>
<td>Other</td>
<td>9 (2%)</td>
<td>2 (1%)</td>
</tr>
</tbody>
</table>

### ECONOMIC

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Lakha Patel's Pol</th>
<th>Brahmin Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>102 (100%)</td>
<td>90 (100%)</td>
</tr>
<tr>
<td>Business</td>
<td>16 (15%)</td>
<td>22 (25%)</td>
</tr>
<tr>
<td>Service</td>
<td>71 (70%)</td>
<td>49 (55%)</td>
</tr>
<tr>
<td>Household</td>
<td>10 (10%)</td>
<td>9 (10%)</td>
</tr>
<tr>
<td>Arts/Crafts</td>
<td>3 (3%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Profession</td>
<td>1 (1%)</td>
<td>6 (6%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (1%)</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Lakha Patel's Pol</th>
<th>Brahmin Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Middle</td>
<td>32 (35%)</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>26 (25%)</td>
<td>46 (50%)</td>
</tr>
<tr>
<td>Low</td>
<td>62 (60%)</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>Very Low</td>
<td>10 (10%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Lakha Patel's Pol</th>
<th>Brahmin Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile</td>
<td>3 (3%)</td>
<td></td>
</tr>
<tr>
<td>Motorcycle</td>
<td>16 (16%)</td>
<td>23 (25%)</td>
</tr>
<tr>
<td>Cycle</td>
<td>36 (35%)</td>
<td>13 (15%)</td>
</tr>
<tr>
<td>Public Transport</td>
<td>35 (34%)</td>
<td>51 (57%)</td>
</tr>
<tr>
<td>Pedestrian/Other</td>
<td>15 (15%)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Vinay Shah, Field Research
### VEHICLES IN THE CITY

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>70,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOTOR CYCLE</td>
<td>40,541</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOTOR CAR</td>
<td>17,215</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUTO RICKSHAW</td>
<td>8,738</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRUCK</td>
<td>3,074</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAXI</td>
<td>534</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS</td>
<td>409</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMPO</td>
<td>342</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ahmedabad Municipal Corporation, Traffic Study

### AREA

<table>
<thead>
<tr>
<th>Area</th>
<th>LAKHA PATEL'S POL</th>
<th>BRAHMIN SOCIETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3.0 acres (100%)</td>
<td>12 acres (100%)</td>
</tr>
<tr>
<td>Built up</td>
<td>2.4 acres (80%)</td>
<td>3.2 acres (27%)</td>
</tr>
<tr>
<td>Streets</td>
<td>0.6 acres (20%)</td>
<td>2.4 acres (20%)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>6.4 acres (53%)</td>
</tr>
<tr>
<td>Dwellings</td>
<td>96 units</td>
<td>87 units</td>
</tr>
</tbody>
</table>

Source: Vinay Shah, Field Research
SOCIAL

Composition
The caste system has had a great deal of influence on the residential neighborhood which of late has taken a more complex and rigid form. Though increasing education levels, changing economic structures and occupations have loosened these social ties, one still adheres to one's caste group to a large extent. For example, a pol named Lakha Patel's Pol after its developer who was Patel by caste, is occupied by the majority of the same community. Patels originally were involved in agriculture. This particular pol has 65% Patel, 20% Brahmin, 10% Vaishys and 5% from other castes and religious groups. Thus each neighborhood not only can be identified as Muslim, Hundus or Christian, but can also be identified by the particular caste of its occupants also.

Traditionally the King's Court allotted the lots on the basis of an ancient system. Large plots were sold to various communities which in turn subdivided the plots between the families of the communities. Each family purchased the lot to suit its needs and according to its economic ability to maintain the plot. This method encouraged the development of a multi-family unit popularly known as "Khadki." An area so chosen was subdivided with houses opening up on a small dead end street. Because of a long relationship with neighbors, the social ties were made stronger by the close spacing of dwellings. The ties were enhanced by social situations and unstable political conditions. A close community evolved developing spaces for use by selected groups of people. The community places were developed for the use of the community within close proximity.

Organizations
The system of "Mahajan" or guild system is dis-integrating since it does not carry any administrative responsibilities such as maintenance of the streets and cleaning of public spaces. New organizations have developed to fulfill new requirements surfacing in the present developments. A selected administrative body of few members is established to take care of the social function and services of the neighborhood. Though the whole neighborhood community does not participate in the celebration of a birth or a marriage as per the tradition of the past, for example, the joy is however shared symbolically by distributing sweetmeats throughout the neighborhood. The neighborhood gathers to console the bereaved family on the occasion of a death. The administrative body takes partial responsibilities for organization on such occasions.

Youth organizations to organize youth activities, various clubs to organize games and women's associations to look after women's specific needs are too few to name in the recent development.
Composition
The social organization of residential neighborhoods today reflects the influence of traditions. Recently formed societies and co-operative organizations hold concepts similar to the Caste System, that of the old developments. Professors' colony, occupied by professors, Jain Nagar (township of Jains) occupied by people who are Jain by religion, are just two examples which identify the prevailing system. The society named Brahmin Society is mostly occupied by Brahmins. The society has 80 per cent Brahmin occupants, 12 per cent Vaishya, 6 per cent Patel and 2 per cent other castes and religions. The occupancy pattern reveals a close similarity to the old city residential pattern.

The city authority has allowed developers to purchase large pieces of land for development which facilitates the citizens' action to formulate co-operative housing societies. The residents felt more comfortable with neighbors of the same community, caste and religion. This helped reconstruct old social ties. The communal agitations of 1911 and those of latter dates enhanced segregation by religion and increased the community ties of the same group.

Organizations
A society forms an administrative body to take care of such tasks as selling or purchasing of plots from the society. In various societies the range of the task covered by the administrative body varies between organizing social events and taking care of administrative details. The occasion of a death is still one of the most respected ones and each family of the neighborhood is represented by a person in gatherings for consoling the bereaved family. Other occasions like birth and marriages are becoming more and more personal. People of the same community move away from each other and establish different societies in far-spread sectors of the city, thus finding it difficult to keep in touch on the frequent festive occasions. On the other hand the new structure of neighbors and social ties is quite loose in comparison to the close knit system of the past.

Various clubs that enroll members, offer recreational activities like card games, entertainment like movies, and services of food, have substituted small scale traditional organization.

1: Bombay Government - Special Reports, Communal Riots
Services
The old system of building drinking wells, places of worship and other such similar services by a combined communal effort is still alive. The water supply is obviously taken care of by the city administration but other than that, the society has taken responsibility for the provision of recreational activities such as film shows, folk dances and educational activities such as libraries and evening schools for adults. The pol also provides large utensils for feasts and decorations for the various festivities. Thus a sense of close-knit community is generated by sharing feelings and participating in various activities.

This community feeling is reflected in the variety of activities occurring in open spaces, cul-de-sacs and streets. The living spaces of the houses are extended into these open spaces. The front porch (although limited in size by a portion of it being occupied by the water closet) is used by housewives in the afternoons in order to extend their household activities.

A courtyard, surrounded by dwellings, with elements like a bench [Top]
Houses, with steps and porches, extending into a cul-de-sac [Bottom]
Photograph: Patel, N.
Services
The community at a small neighborhood level does not offer recreational services as before. Commercial caterers have eliminated the need for communal properties such as large utensils for preparing food for festivities.

Loose social ties are also reflected in the use of public spaces and street activities. The physical separation of street and dwelling with 15' of front margin and 20' separation of dwellings by 10' side margin from the plot boundaries is augmented by the social structure. People know fewer of their neighbors as the city keeps expanding. The communication with neighbors, which was one of the major reasons for outdoor activities, is loosing its meaning.

The common plot, which is usually 15 percent of the plot area of the society, is a place for get-togethers for occasional festivals and for some occasional youth activities. It is not attached to any dwelling and so cannot be used as an extension of living space.

As noted before, since the streets are not protected from the sun, most of the daytime outdoor activities are discouraged. Young children also have to stay in their respective houses or enclosed spaces till late afternoon. Younger children are not given permission to go on the streets due to fear of their being run over.
ECONOMIC

Occupation
Neighborhoods were occupied by one occupational group. The caste system -- categories of socio-occupational groups -- was a major force in the creation of settlement patterns. This pattern changed with the changing economic condition of the city. The craftsmen could not survive in their small workshops working at home in the age of mechanization, industrialization and mass production. A new brigade of service workers and laborers sprang up in the last century, changing the occupational profile of the old neighborhoods. Again reflecting on the example of "Lakha Patel's Pol" one can see that the Patels have joined other professions. The occupation profile of the neighborhood shows 15% of the population involved in business, 70% in service, 10% in household jobs and the rest of the population in occupations such as teaching, arts and crafts.

Income
Moreover, many of the original occupants have moved out into the suburbs of the city and formed cooperative housing societies. This has changed the occupation patterns, as well as the range of income in the neighborhoods of the old city. The present population in these areas presents a varied pattern of income. The largest portion of the population falls in the lower income group, having incomes of about $500 per year, which is equivalent only to a subsistence level. This group represents 60% of the total. Another 25% of the population falls in the middle income range and 10% in the very low income group. Data for the rest of the population is not available.

Mode of Transport
The majority of the residents of these neighborhoods do not own automobiles. Many work in the center of the city within walking distance. Others use bicycles or public transportation (buses) to reach their work places. One hardly notices motorcycles and cars are rare. 16% of the working population use motorcycles, 35% use bicycles and the rest use public transportation or they walk to their respective work places. Top priority is given to daily needs, next a place to live and everything else is secondary. The population is anxious to increase the level of services and infrastructure above that available to them today. The idea of wide streets and tree-lined avenues does not appeal to them.
Occupation

The changing economic situation of the urban area is reflected in the settlement pattern. The old method of classification by occupation was outdated long before industrialization became a major force for urban growth. The settlement reflects the new class of occupation -- that of the service man and laborer. A glance at a society, for example, the Brahmin society, does not represent the intellectuals and administrators in the neighborhood as would have been the case in the past. This particular society has an occupation profile showing 55 percent servicemen, 25 percent businessmen, 10 percent household jobs and 10 percent in other occupations.

The suburban societies are formed largely by the groups of people moving out of the old city, who are economically more mobile than many old city residents. This is reflected in the overall economic pattern of the suburbs of the city.

Income

A large proportion of these neighborhoods are middle and upper middle income groups. On an average one finds less than 10 percent in the higher income category earning more than $1900 per month, 15 percent in the upper middle income bracket earning less than $1900 but more than $1000 per month. Thirty-five fall in the middle income range and 15 percent in the lower income group with 25 percent falling in the very low income group. The cooperative societies generally formed by middle income groups, represent a cross section of 35 percent in the upper middle, 50 percent in the middle and 5 percent in the low income groups. Data for the rest of the population is not available.

Mode of Transport

Though most of the autovehicles of the city are used by the residents of these areas, the majority of the residents of the sector use public transport and bicycles to commute to work. A glance at the Brahmin society suggests that the majority of the population uses public transport to work. Three percent use automobiles, 25 percent motorbicycles and 15 percent use cycles. The remainder of the working population use public transport to commute.

The residents, having established a stable income for taking care of daily needs and other necessities, look for other comforts and services which the urban area has to offer.
PHYSICAL

Hierarchy

The set hierarchy of the streets established beforehand, remained in the changing socioeconomic situation. The streets in the walled city can be broadly categorized in four ways:

1. Thoroughfares: major streets which run through the city in east-west and north-south directions, connecting the periphery to the city center, dividing the city into various sectors;
2. Commercial streets: these streets, known as "Bazaars," markets, are concentrated in areas located in the center of the city. Streets branch off from the center which consists of religious places and commercial areas, and penetrates different quarters, with stalls and shops flanking both sides of the street;
3. Residential/Commercial streets: many streets which are occupied are residences by artisans and professionals have workshops and shops on the ground floor to produce and sell goods;
4. Residential streets: "pol," "khancho," and "khadki" are the popular names of residential streets. The streets, which may be called residential neighborhoods, contain houses, largely of one community.

The city, which earlier had few residential neighborhoods, developed 372 pols by the year 1872. Pol is the word derived from the Sanskrit work "Pratoli" which means "access" and pols are


TRADITIONAL
Hierarchy
Besides having major highways and connectors between the cities, the roads in the suburban city can be categorized in three categories at large. They are:

(1) Ring roads: roads of width 90' to 120' circumambulate the city. A series of these ring roads developed and in the process of being developed divide the city in various rings.

(2) Main roads: major roads, about 60' wide, divide the rings into various sectors. The roads in commercial zones carry multi-story office buildings and other public buildings like shopping centers, European shops and other corner stores.

(3) Secondary streets and approach roads: the sectors are further divided into various neighborhoods by the grid of secondary streets. The street network created thus covers the residential area. The developed residential neighborhoods have a range of streets from 35' or more wide when the length of the road increases more than 1500' and 20' if less than 250' in length. However, streets narrower than 30' are rare in recent developments.

Dead end streets are avoided to ease circulation. Occasionally the major junction of roads has a few shops which supply basic amenities or some hawkers selling cigarettes.

Source: Ahmedabad Municipal Corporation
accesses to the residential neighborhoods. Later on, the entire residential neighborhood became a "pol."

Pols open up through entrance gates on the roads with widths of 12' to 24' and form a network of circulation in a sector. The city is divided into various sectors by a network of major roads, varying in width from 18' to 32'.

Spatial Shaft
Study of the physical organization of residential neighborhoods reveals a typical spatial hierarchy. The entrance gate segregates the public spaces, with roads connecting different sectors of the city from the residential spaces. Residential areas observe the hierarchy of semi-public space—an open space which is usually located near the entrance, to semi private space—a street lined with houses, leading into a gradually increasing sense of privacy, terminating in a private space, either a shallow dead end street or a cul-de-sac.

The physical hierarchy of the streets augments the spatial hierarchy since the width of the streets narrows as one penetrates the inner parts of the pol.

The street sections of the pol narrows as the houses project into the street limiting the exposure of the street to sun. It is recommended that a layout follow the cardinal direction to ensure a combination of shade and sun throughout the day. The combination of streets following the spatial hierarchy (expanding and contracting, creating a shaft which protects residents from the hot and dusty winds of the summer) along with the courtyard houses, creates a ventilation system for the dwellings.

The ancient system of deciding the height of a building and plinth is one of proportion. Height, which was used in the past to express social hierarchy, was restricted so that the average height of the buildings was two or three stories. The system of proportion prescribed earlier and followed religiously created a continuing facade. The plinths became a continuing and constant feature of the streets.

Density
The earlier residential developments, with 25 dwelling units per acre, grew denser because of the popular demand for housing in close proximity to work areas. Thus houses were divided and subdivided, increasing the density of residential areas to 50 units per acre. At present, some 240 people occupy one acre area. One will not find any reference to density in the planning manuals of the past. The size of the lot is also prescribed as a system of proportion rather than a specific size or area lot. This gives an opportunity to everyone to build a house which suits their needs and economic capability.
Spatial Shaft
There are more than 1400 co-operative societies registered with the city authorities, which does not include the old city area.

A study of the physical organization of a co-operative housing society reveals a two step spatial hierarchy with a distinct division of public spaces and private spaces, defined by the streets and lots. Semi-private space is a common plot—an open space—left aside for general use in the layout of the neighborhood. Thus the transition from public space to private is abrupt and generally direct.

The residential streets which are 30' to 40' wide with the 15' setback of the buildings from the property line create a shaft of space 60' to 70' wide. The purpose of the wide street and bye-law for the margin in front of the buildings allows easy circulation, fire truck accessibility and flexibility for future expansion of the width of the roads. City authorities plant trees to keep the streets shaded. Since the street is a public area, the residents feel very little for its condition, whatever that may be. This planting of trees demands a huge amount of investment and expenditure for maintenance in this semi-arid climate. The inability of the city authorities to maintain this vegetation and neglect by the residents have resulted in the failure of the program.

The orientation of a streets is in directions which developers find economically most advantageous on their layouts.

Density
The size requirement for a lot housing a dwelling which is 240 sq. yds. minimum, and the floor space index largely decide the density of developments. The density comes to an average of eight dwellings per acre, according to present laws. The majority of the population which falls in low, or very low income groups thus has limited access to the services which the city offers. The rural migrants who migrated for economic reasons can neither afford, nor are they willing to pay, the high prices for a piece of real estate just to have access to the services.
PLAN - LAKHA PATEL'S POL

GROWTH OF COOPERATIVE HOUSING SOCIETIES

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Societies registered as at the end of the year</th>
<th>No. of societies registered during the period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951-52</td>
<td>110</td>
<td>---</td>
</tr>
<tr>
<td>1955-56</td>
<td>243</td>
<td>133</td>
</tr>
<tr>
<td>1960-61</td>
<td>679</td>
<td>436</td>
</tr>
<tr>
<td>1966-66</td>
<td>1022</td>
<td>343</td>
</tr>
<tr>
<td>1969-70</td>
<td>1419</td>
<td>397</td>
</tr>
</tbody>
</table>

DISTRIBUTION OF HOUSING SOCIETY MEMBERS BY CASTES AND OCCUPATIONS

<table>
<thead>
<tr>
<th>Caste</th>
<th>Number of Members</th>
<th>Percentage</th>
<th>Occupation</th>
<th>Number of Members</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel</td>
<td>2,416</td>
<td>28.42</td>
<td>Cultivation</td>
<td>111</td>
<td>1.04</td>
</tr>
<tr>
<td>Brahmin</td>
<td>2,376</td>
<td>27.45</td>
<td>Business</td>
<td>2,790</td>
<td>26.21</td>
</tr>
<tr>
<td>Bania</td>
<td>2,053</td>
<td>24.15</td>
<td>Service</td>
<td>6,143</td>
<td>57.71</td>
</tr>
<tr>
<td>Lower-caste</td>
<td>898</td>
<td>10.56</td>
<td>Teacher</td>
<td>121</td>
<td>1.14</td>
</tr>
<tr>
<td>Khatri</td>
<td>305</td>
<td>3.58</td>
<td>Profession</td>
<td>211</td>
<td>1.98</td>
</tr>
<tr>
<td>Muslim</td>
<td>136</td>
<td>1.59</td>
<td>Housework</td>
<td>985</td>
<td>9.25</td>
</tr>
<tr>
<td>Jain</td>
<td>175</td>
<td>2.06</td>
<td>Art &amp; Craft</td>
<td>217</td>
<td>2.04</td>
</tr>
<tr>
<td>Christian</td>
<td>81</td>
<td>0.96</td>
<td>Not Working</td>
<td>67</td>
<td>0.65</td>
</tr>
<tr>
<td>Sindhi</td>
<td>59</td>
<td>0.69</td>
<td>Not working</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedules castes</td>
<td>3</td>
<td>0.04</td>
<td>TOTAL</td>
<td>10,645</td>
<td>100.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8,502</td>
<td>100.00</td>
<td>Information not available</td>
<td>808</td>
<td>--</td>
</tr>
</tbody>
</table>

Ahmedabad Municipal Corporation - Records

TRADITIONAL
Narrow and crooked street in the walled city neighborhood of Ahmedabad. Neglected street in recent Middle Income Co-Op development of Ahmedabad.

Source: Ahmedabad Municipal Corporation

ConTEMPORARY
Services
The high density development which occurred when the city limits were within walking distance are part of the problems of services and utility today. Utilities were hardly mentioned in the planning manuals of the past. Methods for ensuring a proper level of utilities for a small number of people were vaguely presented in the manuals. For example, a site with a grade of north/northeast was preferred due to the wind movement in that area and to insure adequate storm-water-drainage by means of a surface drain.

The tradition of having an underground tank for storage of rain water to use over the dry season was abandoned as the city took over control of its water supply. The underground drainage and water supply system introduced after 400 years of city development has restricted accessibility and limited use. The toilet is placed in the front verandah of the house to avoid extensive installation costs. Since water supplies are often low due to limited pressure, a faucet is usually installed in the front of the house to maximize usability. This, in turn, has resulted in narrower street space for circulation.

The municipality remains responsible for other services such as providing storm water drainage, paving and maintaining the streets, and refuse collection. Most walkways are not introduced alongside the narrow streets and are kept to a minimum in other streets to allow the maximum possible width for vehicular movement. The city authorities supply electricity to each registered dweller on payment of a service charge and installation fees. Street lighting is a municipal responsibility within the city limits.
Services
New residential developments, which must go through administrative procedure to procure approval of the city authority after laying out infrastructure, have adequate levels of services. Paved roads, drainage, water supply, street lighting and such services are provided before the occupancy of the dwellings. However, the developer can take advantage of the laws allowing him to gradually develop the services such as paved roads. Drainage and water supply are a must before one occupies a building.

The water supply is limited to a few hours a day. The dwellings have their underground water tanks to store enough water for use during a day.

The municipality remains responsible for its provision of electricity, storm water drains, paving and maintenance of streets, and refuse collection. The streets are wide. A 30' wide street has 14' tar paving for vehicular movement leaving an 8' shoulder on each side. The large portion of the shoulder is meant for a side walk. Having a limited budget, walkways are left unpaved. A few of the streets on the fringe of the city are still unpaved.
The plans represent a definite hierarchy of the streets. The street pattern of Jaipur shows a 'branch pattern' wherein streets terminate in a cul-de-sac or a dead end. The streets of Chandigarh have continuous street layout with controlled access to major roads. The difference in density is evident. Also note the variety of pockets of spaces in Jaipur and its absence in Chandigarh.

Source: Jain, K. - Jaipur City Administration - Chandigarh
It is observed from the study of streets in the preceding chapters that the social pattern has shown only marginal change over the years. Tradition has continued, with little alteration here and there. The Caste System is breaking its rigidity, but the traditional methods for grouping socio-occupational groups is becoming more common. Community efforts are still alive in one form or another in the old city neighborhoods for several reasons: a) length of acquaintance, b) socio-economic need for the successful continuity of community efforts, and c) physical configuration of spaces. The physical proximity compels residents to communicate and take an interest in each others' activity.

When similar occupational groups stay together, they have more common interests to share and thus unite to achieve their goals. Common economic interests and similar goals help generate social activities which are reflected in the spatial arrangement. The economic capacity to pay for social services makes a difference. The above does not tend to be true for high income groups because they have different means of communication as well as the economic means to pay for what they need.

Thus when the socio-economic situation has shown little change, it is appropriate to assume that the system of co-operative housing, thriving on the inspiration from the prevailing traditions, provides a reasonable solution for new developments. However the neighborhood studied, reflects a little success in developing a comparable environment to the traditional one. As other two factors - social, economic - have shown little change, the physical development guidelines used today can be considered as a major cause for the failure. It is an observation that national policies for economic development and other such programs providing services have far reaching effects on socio-economic conditions. The city authorities have little control over these issues. The city, however, does have direct control over the physical development through codes and legislation. The appropriate combination of socio-economic and physical guidance is required to have lively neighborhoods. The flexibility provided in the traditional design norms, which is a reason of the diverse and successful development of the old city neighborhoods, also needs due consideration in the present codes to create a dynamic environment in the new developments.
MODE OF TRANSPORT (In Use Today)

The illustrations from industrial townships

The illustration from the industrial township - G.S.F.C - located near Vadodara and I.F.F.CO - located near the town of Kalol represents two different designs by architect Mr. Doshi. Though the administration of the G.S.F.C. spends a large amount in maintenance of the vegetation on streets, one hardly notices action on the streets. The architect resolves the issue to an extent by creating a dead end street and providing the residents with its control.

Source: Reddi, S - Building Regulations
Doshi, B.
A great deal of consideration is demanded by the complex transportation situation which exists today as a result of the urban rural environment of the cities in India, where everybody has suitable transport available. (This ranges from pedestrians, bicyclists to double decker buses and trucks.) Everyone has acknowledged the importance of segregation of traffic movement, but no one has proposed a reasonable solution. Each residential street in the old city neighborhood has a very limited number of thoroughfares. Most of the residential streets are dead end streets, which means that strangers do not come to the neighborhood and traffic is limited to thoroughfares. Looking at the number of pedestrians on the street one feels the necessity for considering their "domain." With about 500,000 bicycles and about 20,000 private automobiles in the streets of Ahmedabad, one definitely should question the appropriateness of present street planning. One should think in terms of streets for slow moving vehicles and streets with limited vehicular access.

Residential neighborhoods need to be segregated by means of functional hierarchy. The existing arrangement of streets and the observations made in the traditional neighborhood suggest that a dead end street (of approximately 200' to 500' in length with about 12 to 30 lots opening onto it) creates a lively and intimate environment, with enough privacy. Firefighters can easily reach them in case of fire. However, the probability of fire is very low in the brick and concrete constructions. It is observed that dead end streets are better for control and have a reduced crime rate.

Though it is difficult to assert the degree to which mixuse developments are appropriate, the traditional method of mixing residential developments with non-residential developments at appropriate places needs a serious consideration. Dwellings are combined with workshops and shops in the old city development. This has reduced the commuting distance, in turn commuting time, giving some leisure time to the residents resulting in some street activity. The distance of work place has played an important role in the street development and its use by reducing or increasing traffic on the streets, too.

Religious institutions play their part in increasing communication between residents. A temple or a mosque in a neighborhood provides a common place to meet, discuss and voice their needs and demands. An easily accessible location of such institutions is desired.
The central location of business district in G.S.F.C. Township might work because the township covers a small area than a city. The central business district in Chandigarh fails to fulfill the need of the society due to its sheer size and proportion. Moreover the commercial activity adds life to the residential neighborhoods (the case of Jaipur). By eliminating this activity from a large portion of the city and concentrating it at one point (cases of New Delhi, Chandigarh) takes away the hustle, movements and life from the residential neighborhoods. This also creates traffic problem by increasing number of commuters in a direction.

Doshi, B.
Wide streets, large open spaces and walkups in the public housing project of Ahmedabad represent a serious environmental problem. The designer attempts to solve the problem by reducing public land, large open spaces and creating cul-de-sacs. He also recommends low rise-high density developments to promote use of the open spaces by extension of living spaces.

A. Portion of Tanjore Fort. The Municipal Council's proposals for the relief of congestion. Cost about Rs 30,000. Scale 1 cm. equals 100 feet.

B. Portion of Tanjore Fort. A "diagnostic survey."

C. Portion of Tanjore Fort. The congested area as it would appear after the application of "conservative surgery." Cost about Rs 5,000.

Patric Geddes once wrote, "Planning - to be successful must be folk planning." His "Folk-Place-Work" planning illustrates one way to improve environment of existing neighborhoods by the way of "conservative surgery". He recommended small pockets of open spaces. Tanjore Fort scheme illustrates his ideology. On the other hand the neighborhoods of Durgapur and Rourkela presents recent mode of planning. It is interesting to note that though all three plans show street hierarchy, the environment is quite different due to the width of the roads, system of access, size of open spaces, organization of open spaces and scale of development.

Source: Government of India - Town and Country Planning
"An automobile for every home" is a dream India can not realize even in the distant future. Because of this one should definitely question the existing width of the streets. If a 30' residential street is wide enough in the countries with a high rate of automobiles where on-street parking is permitted, Indian planners should think in terms of narrower streets rather than wider. Moreover, expenditures on maintenance of public spaces should be weighed against their use. The expense should be within the limits of the capacity of the residents. By reducing public spaces, a city can reduce the public responsibility for maintenance. This should also increase participation at the neighborhood level.

It is observed that an open space between 100 sq. yds. and 200 sq. yds. has the highest activity in a middle income neighborhood, with 5 to 10 houses sharing this space. The size and shape of the space is decided by the mutual understanding and the economic capacity to maintain it. Since the residents have control of their own environment, they create a variety of spaces to suit their needs. Communication between the neighbors increases in the process.

The cul-de-sacs surrounded by the houses provides a common place for young children to play. Parents prefer this kind of spatial organization as they can sit and do their household jobs, socializing with neighbors, while children play in the open space under their supervision.

The same space is used for community activities, feasts and games at other times. The space, surrounded by houses, provides a comparatively cooler open space with a combination of sun and shade. In the hot arid climate of the city shaded places remain one of the major factors when deciding the location of the activities even within a space.

The scarcity of the urbanizable land and the economic condition of the population creates a demand for high density development. There are various ways of achieving this with modern technology. Highrise buildings, apartments and duplexes are one way of dealing with the issue. However, these alternatives reduce the possibility of the extension of living spaces and increase the cost for maintenance of open land as well as vertical circulation. Another way of achieving high density is with low rise two and three story buildings spreading over the ground. Besides having possibilities for...
extension of living spaces, it has been observed that this type of development is more advantageous in the hot climate of the city. The residents will have fewer sandstorms in the summer by the reduction of ill maintained open spaces. Also the city has limited hours of water supply. With this scarcity of water the city authorities should not only discourage extensive gardening and planting by reducing open land around private dwellings, but should encourage the traditional method of storing rainwater for use over the year.

Courtyard houses and narrow streets are characteristic of the arid and semi-arid zones. The introduction of the floor space index with bye-laws for margins to facilitate wind circulation and achieve adequate standards of lighting in the dwellings hardly can be justified in the hot climatic conditions of the city.

Source: Housing and Urban Development Corporation Ltd.
"India is where centuries co-exist," the late Prime Minister Jawaharlal Nehru once said. The country is full of diversity and contrasting developments. On the one hand, the Indian sky is covered by jet liners, Indian scientists have placed satellites in space. On the other hand, the ground is covered by bullock carts, horse drawn carriages and bicycles. This diversity might provide enough inspiration to poets and intellectual food for writers, but it has been quite confusing and discouraging to the planners so far.

Street layout is one of the important aspects of planning. Streets in Indian cities can hardly be channels of circulation. Most activities, including living, occur or extend into the streets. Streets of the old cities are always full of the hustle of hawkers, festivities and procession. In the residential neighborhoods streets are an extension of the verandah, or living spaces for that matter.

Such observations should be the basis for planners and designers, planning legislation and building codes for the development of the network of streets and layout of residential neighborhoods.

The traditional method of planning, which cannot be considered quite appropriate for its time, cannot be adopted with the specific recommendations and a literal translation. On the other hand, recent planning practice cannot be viewed as appropriate for its time. There must be modifications on the basis of extensive observations and learnings from the old settlements.

Planning is not only a technical matter. The traditional method of planning has survived and has created lively cities due to its flexibility and capacity to accommodate the social, economic and physical needs of the society for which it was designed. It could not have survived for a period of 3,000 years if it had been presented as a technical matter. This does not mean that technical matters such as transportation networks and infrastructure are not important, or least important on the list of the designer, but suggests that one should design town planning legislation and building codes appropriate for the time and for the society they serve.

The brief study of the streets in preceding chapters has clearly reflected the following: planning manuals of the past were lacking in many technical matters which are important for the contemporary situation, but they have much to offer in other matters. The spatial hierarchy, creation of spaces, and micro climate created by the use of traditional methods have generated lively residential neighborhoods.
The streets can not be viewed only in terms of physical conditions and spatial environment, but should be viewed in the overall context of the city. In the city where 70% of the population lives either in one room dwellings or in shanties, the elaborated land use pattern, wide streets for automobiles, planning for garden suburbia, huge parks and such amenities make little sense. On the other hand, the dense neighborhoods of the old city with 600 persons per acre density and 8' to 20' wide streets can hardly be called appropriate.

The streets are becoming an expression of a transport engineer's skills rather than an expression of the spatial sequence, social hierarchy, and events of transition from one space to another. Such important factors of design which are forgotten, discarded or overlooked should be reintroduced in the planning.

From the material presented, one easily infers that the socio-economic status of the society indicates marginal change. People still like to stay in their community. They may be not as close as in the past, but togetherness is desired. They have shown preference for narrow, dead end streets, and cul-de-sacs. Most of the population, remaining below subsistence income level, requires special consideration. Climate, and other such physical constraints, have changed very little. Then why the absolute rejection of traditional methods of planning? One should have presented a profound rationale for the rejection of the old and the adoption of the new. Adoption without understanding the logic of existing developments has been proven futile.

Though indepth studies and research are required to modify the bye-laws, it is obvious that the authorities have to take a concrete action initiating the modification. Unless they decide to modify the policies, very little can be done. But once the move for modification is made, rest, remains in the hands of designer and intellectual --to achieve the goal-- remains in the hands of designers and intellectuals. They need to remember that should learn and understand the physical requirements of the society in its socio-economic set up.
BIBLIOGRAPHY

ACHARYA, P.
- ARCHITECTURE OF MANSARA. Translated from Sanskrit, London, 1933

ABRAMS, C.
- MAN'S SEARCH FOR SHELTER IN AN URBANIZING WORLD. Cambridge, 1964.

AHMEDABAD MUNICIPAL CORPORATION
- ANNUAL REPORTS, 1877-1920
- BUILDING CODE AND LEGISLATION
- MAPS, 1940, 1975
- PROCEEDINGS, 1824, 1921
- STATISTICAL OUTLINE OF AHMEDABAD CITY, 1975
- TOWN PLANNING SCHEMES, 1834-1875
- UNPUBLISHED OFFICIAL RECORDS

ALEXANDER, C.
- THE ATOMS OF ENVIRONMENTAL STRUCTURE. Berkeley
- A PATTERN LANGUAGE WHICH GENERATES MULTI-SERVICE CENTERS. Berkeley, 1968

ALI MUHAMMAD KHAN

ALTETAR, A.
- A HISTORY OF THE IMPORTANT ANCIENT TOWNS AND CITIES IN GUJARAT AND KATHIWAR FROM EARLIEST TIMES TO ABOUT 1300 A.D. Banaras, 1924
- THE POSITION OF WOMEN IN HINDU CIVILIZATION. Banaras, 1938.

ANNUAL TOWN AND COUNTRY PLANNING SEMINAR.

BASHAN, A.

BENEVOLO, L.

BENT, PRASAD
- THE STATE IN ANCIENT INDIA. Allahabad, 1927.
- THEORY OF GOVERNMENT IN ANCIENT INDIA. Allahabad, 1928.

BENNINGER, C.

BOGLE, LINTON
- TOWN PLANNING IN INDIA. London, 1929.

BOMBAY GOVERNMENT
- PROCEEDINGS, 1780-1817.
- UNPUBLISHED OFFICIAL RECORDS AND FILES.

BREESE, E.

BREESE, G.

BRIGGS, H.
- THE CITIES OF GUJARASTHRA. Bombay, 1849.

BURGEES, J.
- THE MUHAMMADAN ARCHITECTURE OF GUJARAT, PARTS I AND II. London, 1900, 1905.

CENSUS OF INDIA
- SPECIAL REPORT ON AHMEDABAD. Ahmedabad, 1961.

CHAVDA, A.V.

CHAVARRIA-AGUILAR

COMMISSARIAT, M.
- MANDELSLO'S TRAVELS IN WESTERN INDIA. London, 1931.

CRAWLEY-BOEVEY, A.
- A SCHEME FOR THE PROTECTION AND CONSERVATION OF ANCIENT BUILDINGS IN AND ABOUT THE CITY OF AHMEDABAD. Bombay, 1886.

DESI, P. AND PAREKH, H.

DUCHAR, W.
- REPORT ON THE WATER SUPPLY AND SEWERAGE OF THE CITY OF AHMEDABAD. Ahmedabad, 1885.

FARDUNJI, C.
- REPORT ON THE AHMEDABAD WATER-WORKS. Ahmedabad, 1892.

FORBES-LINDSAY, C.
- INDIA PAST AND PRESENT, VOL. II. Philadelphia, 1903.

FORREST, G.
- CITIES OF INDIA, PAST AND PRESENT. London, 1803.

FUJISAWA, H.

GEDDES, P.

GHURYE, G.
- CASTE AND RACE IN INDIA. Bombay, 1957.

GILLION, K.

HARRIS, M.
- PROBLEMS THAT URBANIZATION POSES. Ahmedabad, 1960.

HERDAUG, K.
- FORMAL STRUCTURE IN INDIAN ARCHITECTURE. Ithaca, 1967.
HOPE, T. and J. FERGUSSON

HOPKINS, B.

HYDRABAD TOWN PLANNING
- BUILDING BY-LAWS

THE INDIA OFFICE LIBRARY
- ADMINISTRATIVE RECORDS
- CENSUS 1872-1971
- MAPS - 1809

THE INDIAN TEXTILE JOURNAL
- VARIOUS ARTICLES, 1890-1965.

JHOTE, R.
- AHMEDABAD AND OTHER PLACES OF INTEREST IN GUJARAT. Ahmedabad

JOLLY, J.
- HINDU LAW AND CUSTOM. Calcutta, 1885.

KAPADIA, K.
- HINDU KINSHIP. Bombay, 1947.

LEWIS, D.

LINTON, B.
- TOWN PLANNING IN INDIA. London, 1929.

MAGAHAL, V.

MAJMUDDAR, M.

MAJMUDDAR, R.
- CORPORATE LIFE IN ANCIENT INDIA, 2ND. ED. Poona, 1922.

MELKELBAUM, D.

MAVALANKAR, G. AND C. DALAL

MEHTA, K.

MORTIMER WHEELER, R.
- THE CAMBRIDGE HISTORY OF INDIA, 6 VOLS. Cambridge, 1922.

NANDDAAS, H.
- THE COTTON MILL INDUSTRY OF AHMEDABAD. Bombay, 1941.

NEHRU, J.

PATEL AND SHAH

PATEL, N.

PAUK, R.

PIGOTT, S.
- PREHISTORIC INDIA. Harmondsworth, 1950.

PRAN NATH
- A STUDY IN THE ECONOMIC CONDITION OF ANCIENT INDIA. London, 1929.

RAMRAZ

RICE, A.

ROBINSON, C.
- THE IMPROVEMENTS OF TOWN AND CITIES. New York, 1901.

SAARINEN, E.

SENAIT, E.
- CASTE IN INDIA. London, 1896.

SETYA, R.
- AHMEDABAD - A GROWING METROPOLIS. A LECTURE. Ahmedabad, 1967

SHAH, A. AND C. R. RAO

SHAH, V.

SHANKERIAL, A.

SHUKLA, H.S.
- AHMEDABAD GUIDE. Ahmedabad, 1941.

SOVANI, N.V.

SRINIVAS, M.
- SOCIAL CHANGE IN MODERN INDIA. Berkeley, 1969.

SYED NAWAB A. AND S. N. SEDDON
- THE SUPPLEMENT TO THE MIRAT-I-AHMEDI. Baroda, 1924.

TALATI, A.J.
- SOUVENIR VOLUME. Ahmedabad, 1968.

TATER SERVICE LTD.

TOWN AND COUNTRY PLANNING ORGANIZATION
- TOWN AND COUNTRY PLANNING IN INDIA. New Delhi, 1962.

TURNER, R.

TYRWHITT, J.