Izmir Institute of Technology

The Graduate School

# WALKABLE STREETS

## (Evaluation of Streets in the Context of Urban Theory, Life and Form)

A Thesis in

City and Regional Planning

By

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Submitted in Partial Fulfillment

of the Requirements

for the degree of

Master of Science in Urban Design

June, 1998

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# ACKNOWLEDGEMENT

# ABSTRACT

This study aims; to determine evolving process of urban street and street design approaches through history, to examine general street design considerations and the pedestrian friendly street design policies, to introduce traffic calming measures as an effective new method in the revitalization of the urban streets; and to offer traffic calming techniques and policies as a new alternative in the restructuring of Turkish cities' streets.

The case study focused on the application of the traffic calming measures in an intensively urbanized central area in İzmir. Pragmatic approach indicated that the implementation of traffic calming techniques may work efficiently in Turkish cities if the wide range neighborhood traffic improvement programs can be applied. These programs may include following approaches in a wider sense: establishment of traffic safety education for children and adults, encouragement of city and neighborhood streets as community space rather than car space, implementation of new urban design methods for enhancing safety and livability, improvement of efficiency and effectiveness of traffic laws and legislate changes in funding and our traffic laws to provide safe and accessible conditions for non-car users.

On the other hand, the promotion of traffic calming measures throughout the country can only be provided with the construction of the model projects and the preparation of the traffic calming design guidelines by the significant municipalities.No doubt that, the application of the area-wide traffic calming schemes will have the major role in the creating of walkable streets in our cities and towns.

# ÖZ

Bu çalışma şunları amaçlamaktadır: kentsel sokakların ve sokak tasarımı yaklaşımlarının tarihsel gelişimini belirtmek, sokak tasarımı kavramlarını ve yaya-dostu sokak tasarımı politikalarını genel bir çerçevede incelemek, trafik sakinleştirme metodlarının sokak yaşamının yeniden canlandırılmasında yeni ve etkili bir yöntem olduğunu göstermek ve Türk kentlerindeki sokakların yeniden yapılandırılmasında, trafik sakinleştirme yöntem ve politikalarını yeni bir sokak tasarımı seçeneği olarak sunmaktır.

Örnek çalışma İzmirde yoğun kentleşmiş bir alanda trafik sakinleştirme tekniklerinin uygulanmasına yoğunlaşmıştır. Pratik yaklaşım göstermiştir ki, eğer uzun vadeli yerel trafik geliştirme programları uygulanabilirse trafik sakinleştirme metodları Türk kentlerinde de etkin bir biçimde gerçekleştirilebilir. Bu programlar geniş bir çerçevede şu yaklaşımları içerebilir: yetişkin ve çocuklara trafik güvenliği eğitiminin verilmesi, şehir ve mahalle sokaklarının toplumun kullandığı mekanlar olduğu otomobil alanı olmadığının gösterilmesi, güvenli ve yaşanabilir çevreler için yeni kentsel tasarım yöntemlerinin uygulanması, trafik kanunlarının etkinliğinin arttırılması, ve trafik kanunlarında ve fonlarında incinebilir sokak kullanıcılarının güvenliği ve erişimini sağlamak için yasal değişiklikler yapılması.

Diğer yandan, trafik sakinleştirme metodlarının ülke çapında yaygınlaştırılması için yerel yönetimler trafik sakinleştirme tasarım rehberleri hazırlamalı ve örnek projelerin uygulanmasını sağlamalıdır. Şüphesiz alan bazındaki trafik sakinleştirme şemalarının uygulanması kentlerimizde "yürünebilir sokaklar"ın yaratılmasında önemli bir role sahip olacaktır.

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## Chapter 1

## INTRODUCTION

Motor transport has revolutionized our lives but has brought with it many disadvantages. The loss of life upon urban streets will become more obvious in the near future. Therefore, there is immediate need to restore the priorities upon the street space in favor of the public transport, walking, and cycling that are the viable alternatives to car travel.

Today the use of urban streets, as a part of urban life, are in danger especially in developing countries because of the rapid rise in car-ownership, increase in population level, inefficient transportation system, poor quality urban design etc.

Many cities in developing world, including Turkey, have now exceed the population levels that were originally expected at the time of their development. Migration to urban areas could not be prevented. Motor vehicle ownership levels are also rising rapidly. Because of the inefficiently organized transportation system city centers and old historic quarters of many cities were invaded by motor vehicles. Therefore, urban design, like many other civic activities, is often neglected in practice. In the absence of good urban design, this can lead to town cramming with people living at unacceptably high densities in cities where the traffic congestion reduces economic efficiency and the quality of life.

Urban design assists to create urban areas that are livable, vital, safe, and democratic. This type of high quality urban environment will help to create a more sustainable environment. Good street design requires to meet sustainable urban design solutions for urban streets.

Traffic calming is a set of techniques and policies, which is an important part of sustainable transport policy. According to D. Sucher, it is the most significant new idea in city planning in the last 30 years. (Sucher, 1995) Its policies and objectives may not solve all the problems in our urban streets, but it will be the new beginning in order to achieve a sustainable future.

## 1.1. Methodology

The theoretical framework of the dissertation comprise the detailed literature survey about the definition and history of streets, basic principles of street design, and the introduction to the traffic calming techniques. Some terms that were used in the thesis are very new for our planning practice. Therefore, a brief description of these concepts were given in appendix section with Turkish suggestions.

Street design itself is a very broad topic for the scope of a rigorous study. Therefore the emphasize was given to a specific issue: Traffic Calming. Although traffic calming techniques has been known throughout the world for 30 years, it is almost an untouched topic for Turkey. Thus, it is too hard to find the comprehensive study and application projects related to traffic taming efforts in Turkey.

The use of urban streets for social and recreational activities has lost their functions due to the rapid rise in car-ownership and population in Turkey. In this thesis, traffic calming techniques and policies are proposed as the new method in the revitalization of our urban streets in favor of non-car users.

The case study section includes the application of theoretical approaches of traffic calming in the example of Bornova, that is an intensively urbanized center in İzmir, is under growing pressure from the increasing volume and use of motor vehicles.

The multiplicity of authorities in our big cities result in further chaos as each one acts independently in terms of design and location of their respective elements, and consequently integrated development and harmony of the overall environment are lost in the process.

The study further suggests a rational approach for provision of traffic calming measures by various local authorities to ensure desired harmony and integrated approach in this vital field of urban design.

The determination process of the case study comprises two phases: definition of the problems and the adaptability of the traffic calming techniques for the choosen area.

- Firstly, the problems that reduce the pedestrian priority in that area was examined and classified in eight main groups: general appearance of the site, streets and passages, vehicular circulation, car parking, quality of pedestrian spaces, infrastructure, land use, and planning problems.

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To decide the priority and seriousness of these variables preliminary site survey analysis were made and the necessity of the urgent solutions in vehicular circulation, parking, and pedestrian places was determined.

The production of a road hierarchy diagram is a useful design tool in traffic calming projects. It allows to make comparison between the ideal and actual case, and can identify deficiencies requiring immediate remedial actions. In order to achieve an appropriate road hierarchy following studies were made: the dimension of the roads, current traffic flows, and traffic speed. These inputs assisted to decide which roads need to be downgraded for environmental reasons.

After these studies the road hierarchy was constituted under three main road categories according to their traffic volume: Major roads (>1500 vehicle per hour), collector roads (>500 vehicle per hour), and local roads which traffic volumes are less than 250 vehicle per hour. However, the absence of official statistical datas about the traffic volume and accident reports and the lack of staff in the measure of traffic flows created numerous difficulties in the process of analysis.

The study area is the commercial and administrative center of Bornova. Therefore, parking demand is heavy throughout the district. Parking requirement of the area was calculated through the observations. In order to determine the parking priority of the roads, a comparison table was constituted which describes the differences between the actual demand and parking lots that were provided by local authority and proposed by physical standards.

After that, the problems of vulnerable road users were established in the study area: The health hazard issues were determined in terms of road safety. Common pedestrian routes and crossings were indicated and the availability of the street furniture and other public utilities were examined in order to measure the environmental quality of the site.

In the second phase, in terms of the effectiveness of the traffic calming projects the availability of the following conditions were checked:

- The boundary of the study area can be defined clearly by the major roads,
- For local roads, traffic flow should not be more than 300 vehicles per hour in each direction, or should carry a volume of less than 3000 vehicles per day,
- In order to provide intensive pedestrian activity the cross-section of the street should be at least 9 m. between buildings,

- For dense urban areas, trip distrubition ratios should be determined. If the ratios of the walking and public transport modes are high, the appilication of the project will be easier,

- The availability of the funds should be examined due to the high reconstruction costs of these projects.

Preliminary researches indicated that Bornova central district is appropriate for the area-wide traffic calming plan in many terms. However, the principal aim of this study is to introduce pedestrian priority street designs and policies to the Turkish cities and towns.

To see the benefits of the traffic calming techniques the construction process of the plan should be finished. The effectiveness of the proposal can only be measured with the after studies which determine the changes in traffic volume, traffic speed, number of accidents, level of noise and air pollution etc...

The study in this area may attract attention and be used as a guide for the new traffic calming improvements in İzmir as well as in the other big cities and towns.

# Chapter 2

# DEFINITION OF THE STREET

## 2.1. The Meaning Of The Street

The word "street", according to Kostof's description, is an entity made up of a roadway, usually a pedestrian way and flanking building." (Kostof, 1992; pp:189)

In the Oxford English Dictionary, the street is described as "a road in a town or village [comparatively wide, as opposed to a lane or alley] running between two lines of houses; usually including the sidewalks as well as carriageway. Also the road together with adjacent houses." (Ellis, 1991; pp:115) The significant point of this description is the street as a road and place and also inseparable from the buildings that flank it.

In the definition of the street paving is also important. Because the very word "street" derives from Latin "sternere" which means "to pave". (Kostof, 1992; pp:190) According to Rkywert, street is related to all Latin-derived words with "str" root that are connected with building, with construction. Street recurs in many European languages for example, Italian "strada" or German "strasse" "suggest an area set apart for public use and can include spaces with simple, limited demarcations without necessary connections to other streets. It does not necessarily lead anywhere in particular therefore, may finish a plaza or in blind alley. (Rykwert, 1991)

We may use several terms such as road, boulevard, street, promenade, avenue etc. which have similar meanings and have been used almost interchangeably. However, there is a main distinction between street and road. Road suggests movement to a destination and the transportation of people and goods on foot, by pack-animal or vehicle. "Ride", Anglo-Saxon root of the road, implies passage from one place to another. French word "rue" or Latin and Italian "via" have also similar meaning. (Rykwert, 1991) On the other hand, street may have these attributes, but its more common meaning in Moughtin's words "is a road in a town or village, comparatively wide as opposed to a lane or alley." (Moughtin, 1992; pp:129) One particular feature of the road or the thoroughfare which is incompatible with the street is the movement of fast-moving or heavy traffic with all its engineering requirements.

There are many other words to imply forms of passageway in English and in other languages. But these words whether described individually or classed into broader categories constitute the variation of the two main words: street and road. Alley, for example, always denotes a narrow passage; avenue is a wide street with one or more lines of trees; and the term boulevard again suggests simply a tree-lined street. The historical backgrounds of these terms will be discussed later in detail.

The isolation of three groups of words, according to Rykwert's classification, suggest three different ways of considering the street: The first group including terrace, row, arcade, embankment or gallery display the way in which the street is physically constituted by its context. The second group contains words like path, track, parade, or promenade, all of which are connected with ways of proceeding on food but with slight difference in meaning and physical features. For instance, when promenade is well-paved and broad the track has unmarked ground. The third group is related to vehicular traffic and it involves legal and engineering subjects: highway, thoroughfare, artery etc. (Rykwert, 1991)

According to Ellis, roads, highways and freeways, which is given as the third group words, fall outside the multiple nature of streets. (Ellis, 1991) However, today the transportation role of the street is the most significant among the others.

The street in Joseph Rykwert's phrase is human movement institutionalized. An individual may clear or mark out a path in a wilderness, but unless he is followed by others, his path never becomes a road or street, because the road and street are social institutions and it is their acceptance by the community that gives them the name and function. Street as an institution is an equally critical subject beyond its architectural identity. Because every street has an economic function and social significance. (Rykwert, 1991)

The purpose of the street can be examined into three broad categories: movement channels for traffic, the exchange of goods, and social exchange and communication. All three are inseparably related to the form of the street. There are complex levels of social engagement encouraged and hosted by the street. (Moudon, 1991) The use of street as a channel for traffic causes the decline of their social role in human life.

*Hierarchy of the Street:*

In transportation planning, street types are distinguished mainly as two parts: distributors and access roads. Distributors are continuous over long distances, allow high speeds and generally for vehicular traffic. Access roads are short, have low speeds and accommodate cars, people and cycles within the same channel. The street can be hierarchically evaluated into four levels according to Lynch's and Eisner and Gallion's classifications:

Minor streets (loops or cul-de-sacs): Take place at the bottom of hierarchy and fronted by low-intensity uses. Minor streets are open at only one and end, with provision for a turn around at the other.

Collector Streets: Minor streets connect to the collectors on which occur local centers, small-scale activities and uses of moderate density.

Major Arterials: They ensure unity throughout contiguous urban area and usually from boundaries for neighborhoods. Major arterials carry the large volumes of traffic and built with long intervals. Intensive fronting uses and access controlled but not excluded.

Freeway: Major arterials connected the freeway which designed only for motor traffic and crossed only by totally grade-separated intersections at wide intervals. Freeway does not allow fronting access. (Lynch and Hack, 1994) (Eisner et al., 1993)

Pedestrian street can be added into this road category. In contrast to other road types, traffic-free pedestrian streets have the greatest potential to support human activities and social interaction. These street categories may also be labeled according to their main function such as residential arterial, commercial collector etc. To constitute a careful road hierarchy have great importance in street design and analysis.

## 2.2. The Street as Public Space

According to Kostof, "the only legitimacy of the street is as public space. Without it there is no city." (Kostof, 1992; pp:194) Streets, squares and parks are the public open places of a city. Duplicity of streets, as Kostof pointed out, allow to access to adjacent property and passage of through traffic. But beyond these practical needs the fundamental reality of streets, as public space, is political. In his words "if the street was an invention, it set out to designate a public domain that would take precedence over

individual rights, including the right of building what one wants where one wants and the right to treat the open space as one's front yard" (Kostof, 1992; pp:192)

Public efforts throughout the history preserved the integrity of the street channel from the encroachments of private property. Street always implies the struggle between public and private property upon the urban scene. The public goods require that the street space be kept open, accessible to all and equipped for its function. The invasion of public street for one's own purposes can be done in two ways: through encroachments and through blockage or privatization. Encroachments are incremental over time. (Kostof, 1992)

For example, in traditional Islamic city, public right-of-way was determined by the agreements of their residents. Whereas in Western city public right of way and property lines were distinguished by regulations. (Yerasimos, 1996) On the other hand, private streets were seen in some 16$^{th}$ century renaissance streets and private streets of 18$^{th}$ century London. (Fig. 2.1) These streets were not open to all and the access was limited. However, in general context, the main reality of the street is its accessibility by all people, their machines and their goods.
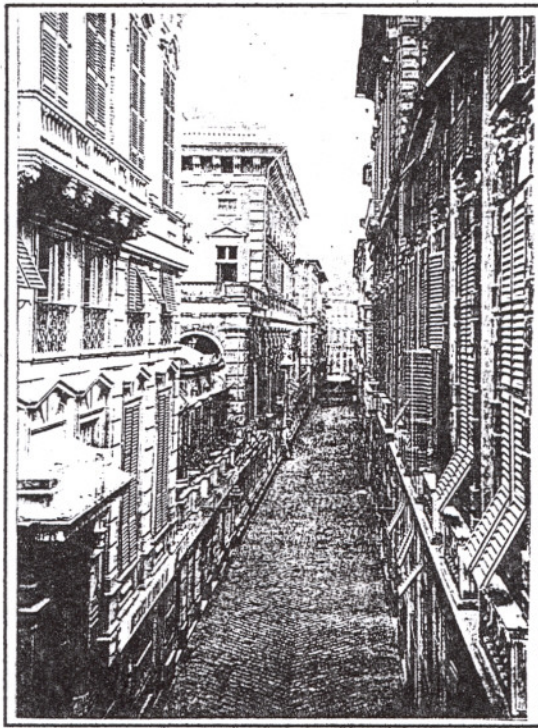


Fig. 2.1. Strada Nuova, a mid 16$^{th}$ century private street, (Kostof, 1992; pp:192)

## 2.3. Social Dimensions of the Street

As Gutman pointed out that, street is a social fact. According to him, a street has two social functions:

One of these is <u>instrumental:</u> the purpose of the street is to ensure a link between buildings and activity nodes, over which the goods and people necessary to sustain the agricultural, marketing, manufacturing, administrative, and military activities of the settlement can pass. Sometimes, the emphasis has been on the circulation of pedestrians, as in medieval, but from the beginning of urban civilization the street has also been designed to accommodate pack-animals and vehicles.

The other function of the street is <u>expressive:</u> the street as a link between people facilities communication and interaction, thus serving to bind together the social order of local community. Its expressive function also includes its use as a site for randomize social interaction, including recreation, conservation and entertainment. It use also contains the rituals of community. (Gutman, 1991)

Social function of the street is expressive rather than instrumental. In pre-industrial cities expressive function of street was more evident. The traditional street in Lynch's words "served many functions beyond that of passage. It was marked, workroom, and meeting hall. We have shouldered these functions out of the right-of-way, to the advantage of traffic and to society's loss." (Lynch and Hack, 1994; pp:202) In traditional way of life house was home or outside room, also often the workplace or very close to it, and the locus for recreation and leisure activities. For this reason, it makes sense to think that popular awareness and interest in the street environment were more complete and extensive in pre-industrial cities. Industrial revolution in Western countries brought new concepts, factory systems, the nucleus family an then finally modern transportation devices, especially the automobile. The definition and differentiation of systems of streets have grown increasingly complex as society itself, has increased in complexity. Kostof suggests that, the unique characteristics of any street derive from "the urban process". Social, political, technical and artistic forces generate the city's form and consequently effect the shaping process of the street. (Çelik at al.,1994) Rapid development caused the changes in social and spatial structure of the street in our age. Today the role of street

and the nature of social interaction vary with class, ethnic group, age structures and type of specialization of neighborhood.

Increasing specialization and division of society have removed many of the socially cohesive activities once found in the street. Entertainment, marketing, information, and personal services, once available on the street but now there are less than before. There are numerous reasons which cause the decline of daily social life that occurs in public urban spaces. These are; increasing rate of private car use, new information and mass media technologies, impersonal supermarkets and car-oriented shopping centers, increased crime and violence on the street etc. The decline of city streets according to Levitas, can only be explained in terms of the changing technological and sociopolitical configurations of the society. (Levitas, 1991)

An anthropologic view of the street's evolving role in society is summarized in six points:

1. The street in the context of settlement patterns helps to maintain social organization by providing controlled linkages that regulate social interaction. Historically the street as a center of information gained significance with increases in literacy and means of communication.

2. Concept of privacy with the emergence of the street seem analogous to increases in production and hence the emergence of the city.

3. With the development of social organization, an increase in specialization occurs that is reflected in the street. Institutions serve to connect people to their greater society but can also alienate through the rise of private organizations. This development is exemplified in segregated use of the street: i.e. commercial street, residential street and industrial street.

4. Within the city of the further specialization of streets results in the creation of separate neighborhoods for different classes. This result in different relationships and rituals available within particular neighborhoods.

5. Centralization of administration, beginning with Baroque Era, created expression of power and in the form of widened avenues a perspective views which will be mentioned in detail soon.

6. In the same way older street forms displayed social adaptation of cities, new technological adjustments will be expressed in the form of the streets; most likely

through automation. This tends toward the street functioning as linkage rather than locus. Also this relatively means that the reducing of street's function mainly to the carrier of motorized vehicles. (Presutti, 1996)

Charter of Athens (1933) declared the rejection of streets as places for people and gave credit to efficiency, technology and speed. This negative impact of automated society and technology were criticized by younger generations of modernist architects, planners and sociologists after 1960's. Traditional role of the street in our life was tried to restore by pedestrian friendly, sensitive projects. As Levitas suggests that "at best we use the radio as well as television, streets will remain with use because we need the variety of social as well as intellectual experiences they can uniquely offer" (Levitas, 1991; pp:239)

## 2.4. Street as Place for Communication

One of the great characteristics of cities is the strong notion of people in communication, because of the street function as a nodal point for both regional and internal communication from the beginnings of the urban development. (Presutti, 1996)

The street as channel of communication deals with the notion that people physically engaged in an exchange of ideas, goods or emotions and the street has the capacity to act as a physical locus on urban space for this exchange. Our economic, social and even environmental structure depends on the street, roads and highways as a means of movement, orientation and communication. The street through its process has always became a heavily built its artifact not only its surface but also in its subsurface for subway and infrastructure facilities and along its edges.

The street, among other communication tools, is the most sensitive one in terms of its role in the urban public life. Most public activities such as ceremonies, riots, historical events etc.. acted upon the urban streets throughout the history. Efficiently arranged network of the streets allow the quick access for strategic nodes. According to a military mind, control of the street means control of a portion of a city. This feature of the street was seen largely by Renaissance and Baroque city builders. (Czarnowski, 1991) Three factors greatly effecting the street as a place for communication are;

- The replacement of the street as an information source by new communication technologies
- The reliance of automobiles to travel on streets
- The development of new streets that do not facilitate pedestrian movement. (Presutti, 1996)

Advances in communication and new methods of production make it less necessary for people to live in close proximity to each other. Today communication among members of society can take place in locations and by means remote from the street. Despite its relative longevity among other communication devices the street is an process of continual transformation. The faster progress on the technology and information the more obsolescence is seen on the street scene. New technologies developments of our age such as motorized vehicles, radio and television network and growing importance and dominance of world-wide-web, mass media technology etc. that made possible communication removed from the street. (Czarnowski, 1991)

According to Mitchell "21th century capital will become a "City of Bits" whose places will be constructed virtually by software instead of physically from stone and timbers and they will be connected to logical linkages rather than by doors, passageways and streets." (Mitchell, 1995, pp:24) (Fig.2.2)

Impacts of new information technologies are relatively new concept upon the communication role of the street. However the effects of automobile on urban street is more evident. Private cars has become the locomotive power of communication and increase the range of movement of particular functions. Traditional street network, where the pedestrians and motorized vehicles used the same channel, could not support this transformation in the age of speed and success. The new streets are designed mainly for the comfort of cars and ground level communication damaged due to the grade separation. Due to the replacement of the street as a system of access and movement the role of the street as locus for communication were narrowed. (Czarnowski, 1991)

In sum, the street is under transformation process both physical and spatial sense. Even their role of communication has been changed streets will survive as the communication artifact in a different way.

Fig 2.2. A model of the cyber town

## 2.5. Street as Urban Space Element

All types of space between buildings in towns and other localities can be thought as urban space without imposing aesthetic criteria. But aesthetic qualities and geometrical characteristics of this space allows us consciously perceive external space as urban space. Internal space shielded from weather and environment is an effective symbol of privacy; external space is seen open, unobstructed space for movement in open air, with public, semi-public, and private zones. Public urban spaces are the places and facilities that are in public ownership: road, paths, civic paths, square. (Krier, 1979)

Streets are the elements of the exterior space. According to Ellis's definition "the exterior spaces of the city, and the built structures are the walls of those rooms. These walls are a responsibility to the formation of those rooms. The interior functional considerations of buildings can be coordinates to allow them to perform the function of creating exterior city space." (Ellis, 1991, pp:130)

Urban space can also be divided into two main precedents: hard space and soft space. According to Trancik, "hard space are these principally bounded by architectural

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walls, often these are intended to function as major gathering places for social activity." (Trancik,1986, pp:161) Streets, squares and urban parks constitute the hard spaces. In order to achieve successful hard urban spaces three factors are important;

1. The three-dimensional frame, which defines the edges of space and the degree of enclosure and characteristic of spatial wall. Human scale is important while designing the scale of the wall.

2. The two-dimensional frame, that refers to the treatment and articulation of the ground place, its material, texture and composition.

3. Objects in the space, which are the elements like sculpture, fountain, plantation etc. provide accent and focal points and make the space memorable. (Trancik,1986)

The most successful urban spaces are the perfect harmony of these hard space features. While traditional street and squares such as Uffuzi in Florence or Piazza Del Campo in Siena contain the harmonious combination of these features, especially in early modernists' proposals the idea of solidly defined urban streets were non-existent. (Fig. 2.3 )

a               b
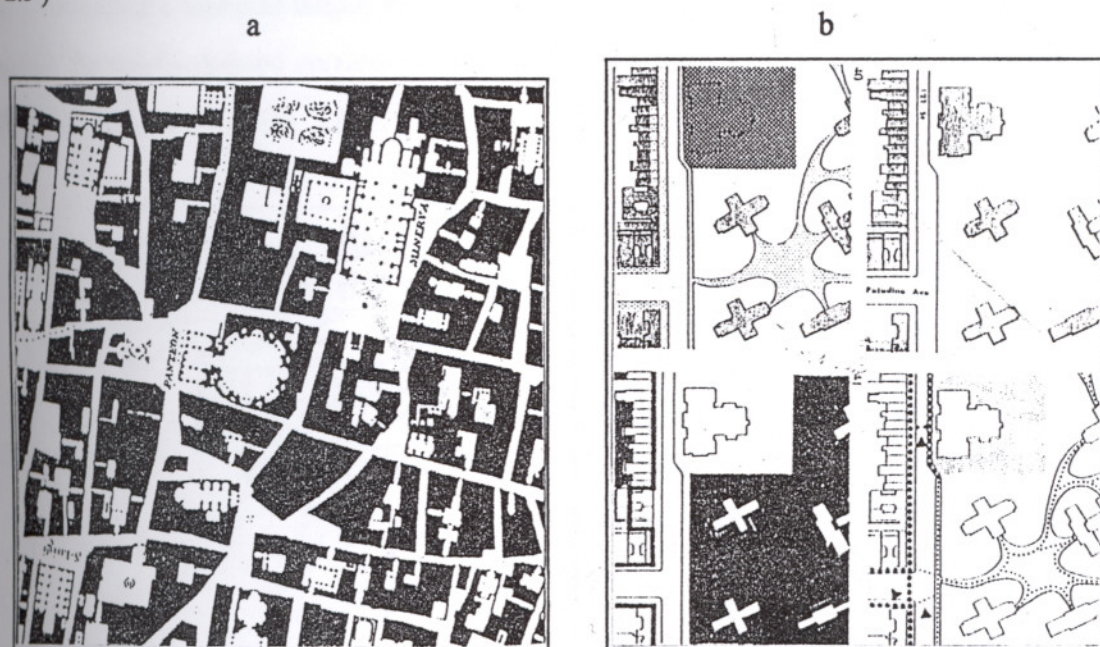


Fig 2.3. Solid walls as the definer of the street: Nolli's Rome (a),Wagner's housing project (b), (Trancik, 1986; pp:102)

The three dimensional frame of the street is important here. According to Gutman, "...Street is three dimensional. This may seem obvious, but it cannot be stressed too

strongly. Otherwise there is an inevitable tendency to confuse the street a two-dimensional link which represented by highway engineers and surveyors of today." (Gutman, 1991; pp:249) Generally speaking, successful street spaces, as Trancik states that, "though linear in form, will also have properties of three-dimensional frame, two-dimensional pattern and objects to provide interest and focal points." (Trancik,1986; pp:70)

A predominant field of solids and voids creates the urban pattern. Street and square, courtyards, public parks and gardens, and waterfronts, which play a part in the exterior city, constitute the urban voids. Streets, that were lost their social function and physical duality, were historically the unifying structure of the city. Urban streets and squares traditionally formed a systematic hierarchy of order from locally controlled space to city wide routes for communication. Throughout the urban history, the network of the street and square which are the important elements of urban void, functioned as the principal structure for civic design and spatial organization. (Trancik, 1986) However, this role of street and square replaced largely by modernist tradition. Le Corbusier, for example, was against the solidly defined corridor streets and he said "we must kill the corridor street." (Kostof, 1991; pp:95) (Fig. 2.4)
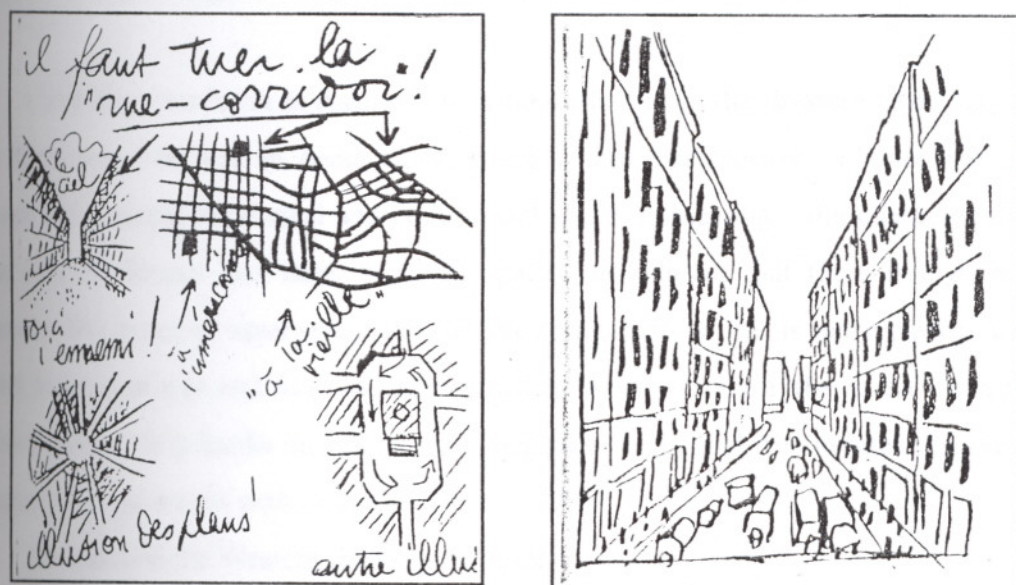


Fig 2.4. Le Corbusier's vision of the "corridor street", (Fishman, 1991)

On the other hand, public monuments, urban blocks and directional edge-defining buildings constitute urban solids. Directional or edge-defining buildings are the significant elements that can surround and define the axial lines of sight and also frame the important places. Berlage's perimeter blocks in Amsterdam (1915) is a good example in the terms of how to edge defining blocks form the figural street space and create a continuous urban fabric. (Trancik,1986) (Fig. 2.5)
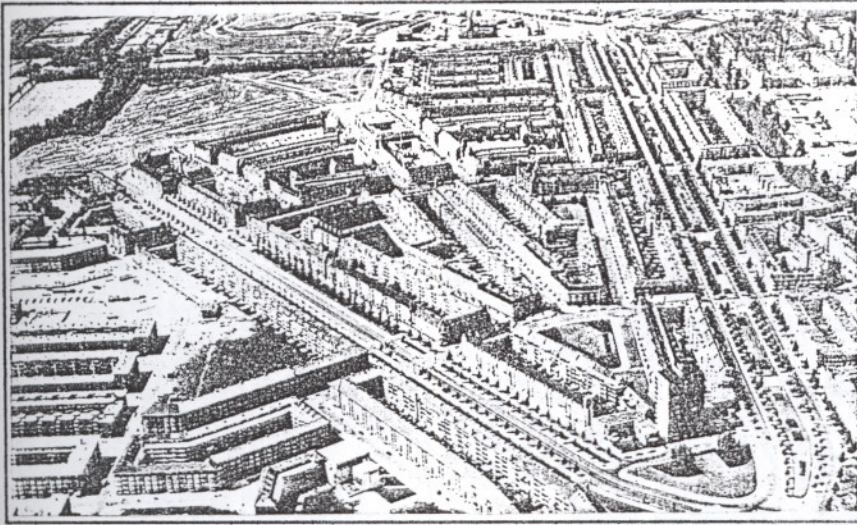


Fig 2.5. Berlage's edge defining perimeter blocks, (Trancik,1986; pp.104)

Urban street tradition of Asian cities distinguished from the Western cities according to Kurokawa. For him, in Asian cities, street spaces exist between private and public space and between residential and commercial space, possessing the characteristics of the both the former and latter types of space. He believes that there is a difference between this types of open space and the Western square which is more clearly defined both in terms of area and function. In contrast to Western square, the Asian street is not clearly defined it is harder to tell where it begins or ends, and it generates responses to innumerable variations with time. (Kurokawa, 1991)

He criticized the Western planning tradition:

"The street is thus undifferentiated, demarcated area of multiple functions but these dense and rich spatial qualities of the street were completely ignored in the function-oriented city planning of the West. There instead, the square or plaza developed, an open space of sun and greenery. I have no wish to deny

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the of functional city planning, but I am more and more certain that we must go back and reassess the advantages of space with an ambivalent or multiple meaning, spaces which have been sacrificed for the sake of functional priorities." (Kurokawa, 1991; pp:100)

## The Form of the Street

"The form of the street can be analyzed in terms of a number of polar qualities such as straight or curved, long or short, wide and narrow, enclosed or open, formal and informal." (Moughtin, 1992; pp:133)  (Fig. 2.6) The form and shaping process of urban street will be discussed in street design and history headings.



a                                            b
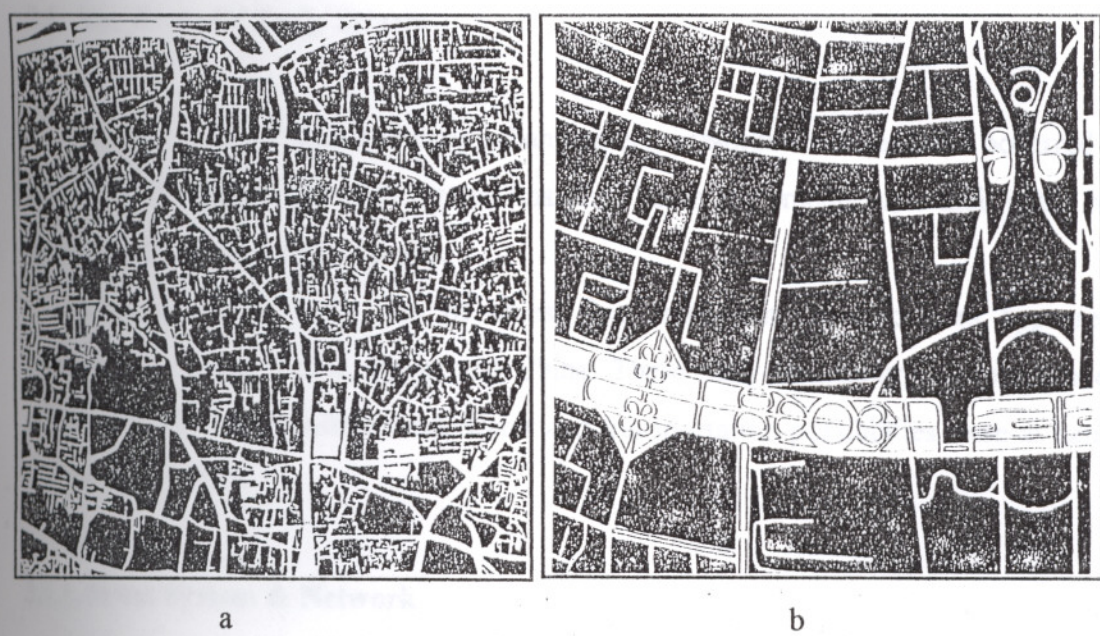
Fig 2.6. City form and the street pattern: Ahmeadabad-India, organically evolved maze-like streets (a), Brasilia-Brazil, Modernist city, its gigantic scale highways (b) (Jacobs, 1993; pp:205,217)

## 2.6. Conclusion

The continual transformation of urban streets is the result of economic, social, political, and technological changes throughout the history. To see the changes in meaning of the word "street" we need to look closer to the urban history which will be mentioned in next chapter.

# Chapter 3

# THE STREET IN HISTORY

Social, political, economic, and technical forces has impacted the shaping process of the urban street. The continual transformation of the street space will be examined in the chronological order in the sub headings of general characteristics of the period, street system & network, pedestrian- traffic relationships, the street scene, and the urbanists concerning with the street design.

## 3.1. The Roots Of Early Streets

Before the rise of cities and early urban centers, pre-urban villages were occurred in ancient world mostly in Bronze Age in Anatolia. These settlements have their paths but these were not always imply streets.

In the period of early rise of cities, four important urban centers appeared: Mesopotamia, Indus Valley, Egypt and China. These early civilizations were spreaded along the fertile valleys where food, water and transportation possibilities were at hand. (Eisner at al., 1993)

### 3.1.1. Street System & Network

The need for defense, climatic reasons and sometimes, religious beliefs were the shaping process of early civilizations' streets.

Defense:

In Çatal Hüyük, a Bronze age settlement in Anatolia, conglomerate of houses constituted a complex system without streets due to the need of protection against intruders and enemies. Outside walls of these tightly clamped housing groups did not split with doors and windows and thus served as "defense walls". The inhabitants had reached their houses from the roofs. (Aktüre, 1994) (Fig. 3.1)
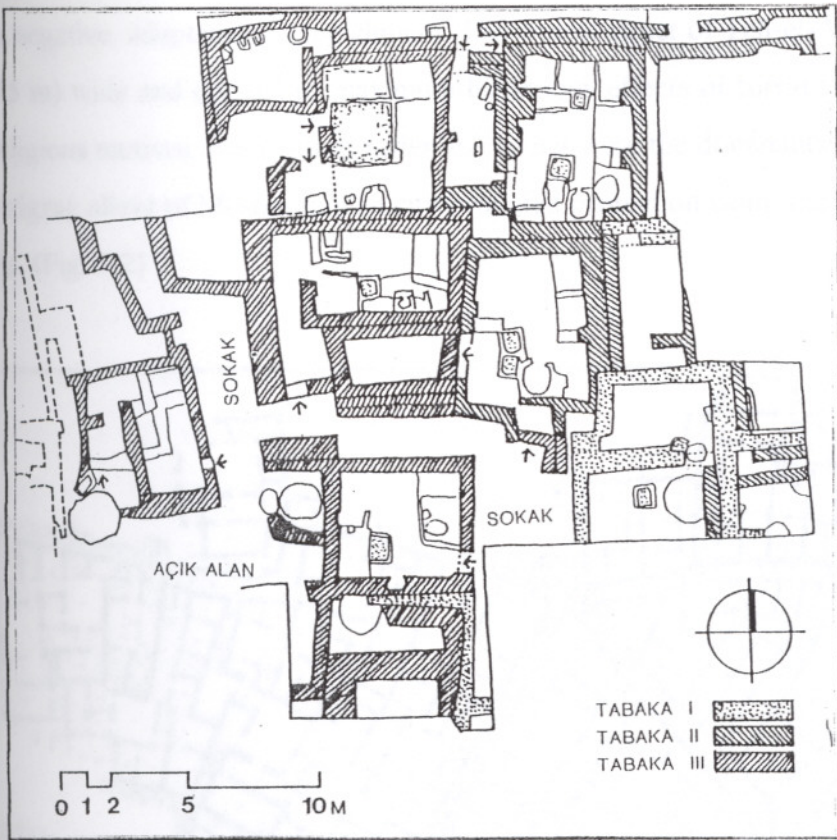
Fig 3.1. Çatal Hüyük 5790-5700 BC , (Aktüre, 1994; pp:31)

A little later in Hacılar , that is also in Anatolia, the town was fortified and thus the compact form of the settlement allowed narrow alleys for pedestrian between housing groups.

In early urban centers defense had also the great importance. "The determining factor of Mesopotamian city form to put the maximum number of people on a minimal amount of land. This was the result of the need for defense and for preserving lands for agriculture, and also reflected the social need of the residents for propinquity." (Golany, 1995; pp:71)

Climatic Reasons:

Compact form of Mesopotamian cities also created highly protected shadowed areas to their users. "Thus the compact city provided cooler streets and streets and dead ends with protection against hot and dusty winds during the day." (Golany, 1995, :71)

The main avenues which lead to city gates have oriented according to prevailing wind to tempering the heat. On the other hand, in the case of Tell-el-Amarna and Kahun

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there was a negative adaptation to the climate. The widest street of Tell-el-Amarna was 180 feet (55 m) wide and opened to maximum hazardous effects of torrid sun. In these instances religious motives, mechanized order and speed were the dominants. (Mumford, 1991) The zigzag alleys of Mesopotamian city provided protection from the intense heat and enemies. (Fig. 3.2)
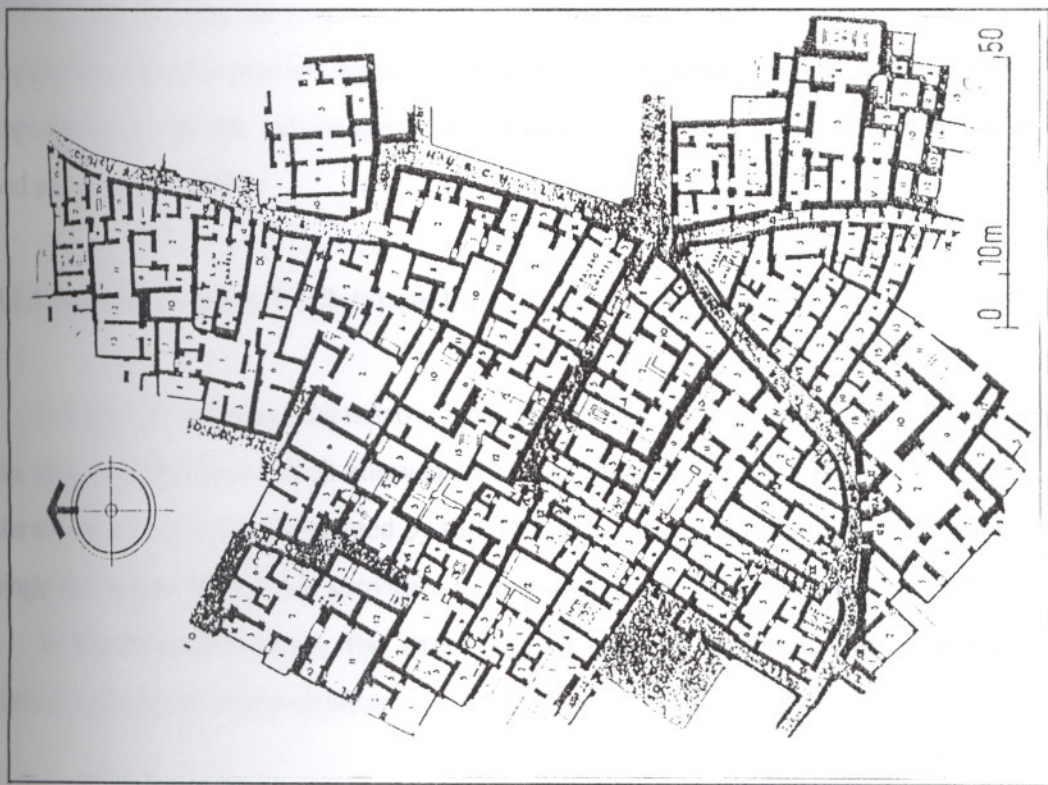


Fig 3.2. Street system in ancient Mesopotamia (Morris, 1994; pp:23)

Religious Reasons:

The early Chinese cities reflected the cosmic order. These cities were the reflection at the balance between human body and nature. In ancient Mesopotamian cities, the main avenue was leading to the major monumental buildings that were mostly the religious centers. The orientation of these avenues, according to Mumford, indicated the growing dominance of sky gods. (Mumford, 1991)

<u>Street network:</u>

For the first time in history, in Beycesultan and Hacılar that were the Bronze Age villages in Anatolia, the street were distinguished into the two hierarchical category in residential areas: a major artery and the local street. (Kostof, 1992)

Streets were developed as three levels in ancient Mesopotamia. The first level is the widest one and the main street of the city which leading to the major monumental buildings and dividing the neighborhoods. The second was narrower penetrating into the residential areas and provide limited pack animal transportation. The last and the most important one was the cul-de-sacs that provide privacy and protection from attackers and sun. (Golany, 1995)

### 3.1.2. Pedestrian & Traffic Relationships

In Karum of Kültepe, the narrow lanes that were used by pedestrians connected to the wide thoroughfares which allowed to movement of wheeled vehicles. The edges of the streets ,which were constituted by the outside walls of the buildings, were paved with single-line border stones that provide a narrow pedestrian walkway. (Aktüre, 1994)

In Mesopotamian cities, the streets which leads to residential areas ensured the limited pack-animal transportation.

### 3.1.3. Street Scene

The first conscious street, according to Kostof, appeared in Khirokitia dating from the 6th millennium BC Khirokitia's streets were built of limestone and raised considerably above ground level, with stone ramps leading down at regular intervals and was lined by houses on either side. On the other hand, in Beycesultan the streets were unearthed of a graveled, that is, "paved street." (Kostof, 1992)

In Indus Valley, Mohenjo-Daro's streets were all paved and regular in shape. The houses were arranged according to width of the streets. (Eisner at al., 1993) On the other hand, the average width of narrow alleys in Mesopotamian cities were no more than 8 feet (2.5 m) wide. (Mumford, 1991) Another important civilization was ancient Egypt: the street of Egypt settlements were not paved and drained. (Eisner at al., 1993)

The importance of privacy, associated with culture was affected the early civilizations' street scene. In Mesopotamia, ancient Greek and China, the family home turned is back on the street and focused around an internal courtyard. Another interesting point related to street scene was the absence of street lighting. "Since the streets of ancient cities were dark at night and did not ensure any entertainment for citizens, people spent their times in the evenings at home, often on the rooftops." (Golany, 1995, pp:92)

## 3.2. The Classic City

Early Greek cities of Aegean were irregular in form. During the early years of Athenian democracy in 5th century BC, Greek cities were naturally evolved. The planned Greek city were seen in the latter part of the 5th century BC in Hippodamus's Miletus plan. Than some Greek cities in Aegean costs were laid out according to systematic principals of gridiron urban form. (Eisner at al., 1993) Main urban form determinants of these cities were the topography and climate. The Greek city had clearly defined limits and compact in form.

The Romans having been impressed by the Greek architecture and planning. There were great engineers and aggressive city builders without purely aesthetic ideas as the Greeks had. But they improved and modified some Greek forms.

There was a great hierarchical order between Roman towns that connected directly to each other by provincial roads. This system was so efficient that "All roads leads to Rome" derived from there. The networks of roads were located the important and strategic military and trade activities. (Morris, 1994)

### 3.2.1. Street System & Network

Gridiron Street System:

Greek street pattern have been influenced by Platon's ideals and Euclidean geometry and irregular shape of urban form was replaced by Hippodamus, architect from Miletus, in the latter part of the 5th century BC.

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He was been credited with the origination of the gridiron streets system. Actually it was not an new invention of city planning. There was very early examples in ancient Egypt, Mesopotamia and Indus Valley. However, he effectively adapted the gridiron scheme to create a rational arrangement of buildings and circulation. (Eisner at al., 1993) (Fig. 3.3)
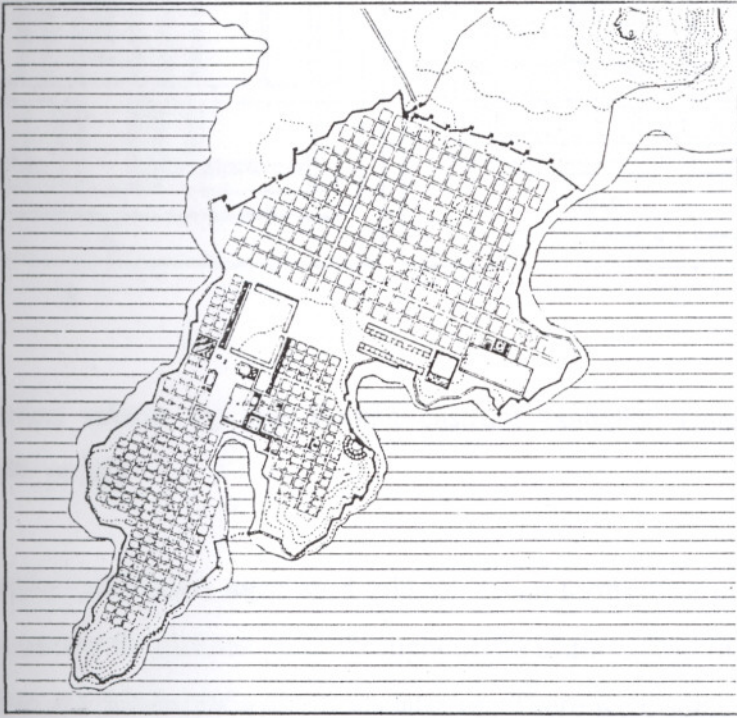


Fig 3.3. Hippodamus's Miletus plan (Kostof, 1991; pp:106)

The Romans also used gridiron street system in their new towns. There was a strict rational order in their street patterns. The Roman gridiron urban form comes from the Roman military camp "Castrum." In this scheme, the square or rectangular area is divided into four parts by two main streets intersecting right angles. The primary "Cordo" and the secondary "decumanus". The cardo, running from north to south which represents the axis of the world, and the decumanus the course of the sun from east to west. (Norberg-Shulz, 1993) The cardo and the decumanus were connected to the Roman cross-country high roads and moved these traffic to the center of the city. According to Mumford, this old-fashioned arrangement of the main axis created a needless congestion in central locations. (Mumford, 1991) (Fig. 3.4)

23
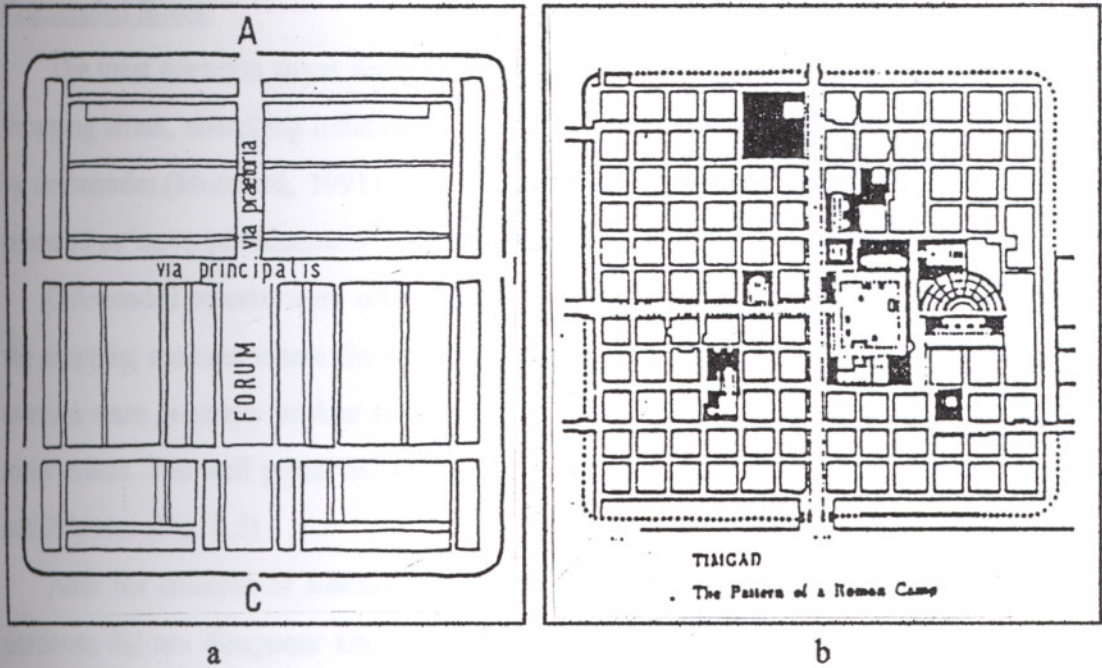
Fig 3.4. Castrum scheme (a) and Roman castrum example: Timgad, Algeria (b),
(Saarinen, 1949; pp:38)

Both Romans and Greeks were used gridiron urban forms. The grid, in fact, is the
most common pattern for planned cities throughout the history. Grid form also was used
in Colonial plans and Modernist's proposals later on. There were some practical reasons
that made grid popular:

- First, the grid is systematic. It allows flexible and diverse system at planning. In all
gridiron forms the streets pattern is orthogonal that are the right angles rules and
street lines in both direction lie parallel to each other.
- Second, it is easy to laid out. Greek and Romans land surveyors used the device called
"groma" passes from Egyptians. In this system, as Kostof defines "one of the lincals
was used for sighting a main direction and the other to determine the direction in the
field at right angles to it."(Kostof, 1991; pp:96)
- Third, it is expandable. Grid system allows expansion of towns and its quarters for
later developments within a same order. It also provides production of spaces within a
short period of time.

Colonnaded Street:

The most common street form in eastern provinces of Roman Empire was the wide shopping street, stretching indefinitely towards the horizon with its length often marked by colonnades.(Mumford, 1991) "The Roman word "particus" which can be simply be rendered as 'covered colonnade' refers to vaulted arcades." (Kostof, 1992; pp:216)

Colonnaded streets were often located near concentrated open market, and cover the shopping avenues where the individual shops take place behind them. The shopping avenues were generally broken visually by four-way arches at the crossing points of the main streets. The well preserved examples of porticoes can be seen in Ephesus, Timgad and Palymra. (Fig. 3.5)

After the collapse of Roman Empire closed facades gained importance. However, porticoes did not disappear altogether and survived within a degenerate form in some North Italian cities of Medieval. (Kostof,1992) Centuries later, 19th century Utopians were used covered arcades as the places of social amenities in their proposals.
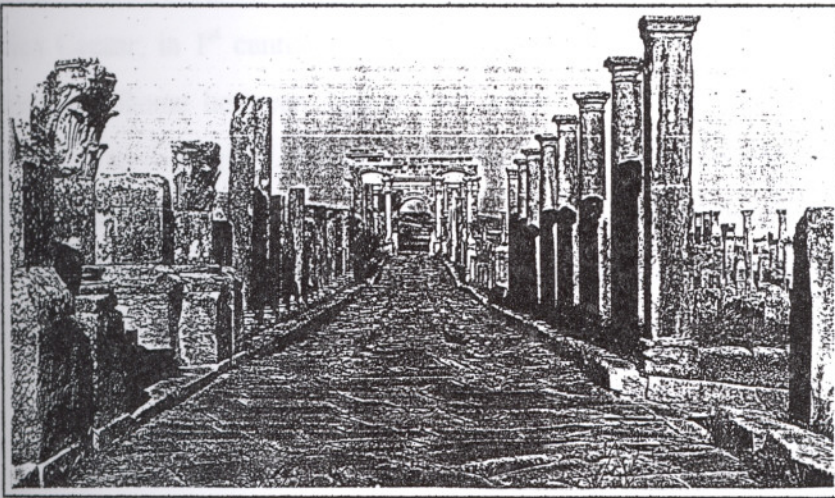


Fig 3.5. Colonnaded Street, Timgad (Algeria), (Kostof,1992; pp:263)

### 3.2.2. Pedestrian & Traffic Relationships

The gridiron form of Greek streets sometimes created access problems. "Superimposing the rigid geometrical form of the Hippodamus street system upon the rugged topography of the sites occupied by most Greek cities, created numerous streets

so steep they could be negotiated only with steps." (Eisner at al.,1993; pp:62) This situation also created some problems to pedestrians while reaching to the important public buildings located at the top of the settlement. In addition to this, transportation of freights by wheeled vehicles were very few due to the steepy principal traffic streets.

In the Greek city, "the functional uses of buildings and public spaces were recognized in the arrangements of streets. They provided for the circulation of people and vehicles without interference with the orientation of dwellings or the assembly of people in the market place". (Eisner at al., 1993; pp:61) Streets are the open public spaces as agora and forum and mostly used by pedestrians rather than wheeled vehicles.

In Roman cities there were sidewalks protecting pedestrian from the wheeled traffic. However, they had been forgotten until the late 17th century. (Hass-Klau,1990) "The Roman word for sidewalk was "semita" refers to 3rd century BC." (Kostof,1992; pp:213)

The street network was overloaded and congested due to the increase of population, continual conflict between pedestrian and wheeled traffic became intolerable in Rome. At last, traffic congestion became the subject of municipal regulation in the period of Julius Caesar; in 1st century BC according to regulation, the wheeled traffic would not enter the Rome between sunrise and sunset. However, the noise of these vehicles were moved to the night. Later than, the numbers of the teams and loads of carts were permitted to enter the city. Those regulations were applied to the new cities. But their orthogonal gridiron forms generated more traffic than the street network could cope with. (Mumford, 1991)

### 3.2.3. Street Scene

In ancient Greece ,as in Mesopotamia and in the cities of Islam, inturned residences were the dominant forms. The outer walls of houses lined the streets and created privacy to their users. In these cases the determining factor is culture. (Kostof, 1992)

The width of Roman roads varied from 8 feet (2.5 m) to 24 feet (7.5 m) wide on parts of the great trunk highways, but generally the standard width was 15 feet (5 m). (Mumford, 1991)

In the newer, smaller cities and as well as Rome street paving is widely applied, Roman settlements had paved streets, the water supply and the sewer. In Pompeii, the

pedestrian had raised sidewalks and stepping stones across the traffic thoroughfare. (Mumford, 1991) (Fig. 3.6)



Fig 3.6. Streets of Pompeii (Italy), (Kostof, 1992; pp:210)

### 3.2.4. The Urbanists Concerning with Street Design

Vitrivius And His Ideal City:

Vitrivius was an architect and urbanist in Roman period during $1^{st}$ century BC. By the time of Vitrivius, as Mumford points out, "a regard for hygiene and comfort further modified the layout of the Roman towns so that he even suggested that minor streets and alleys be oriented to shut out the unpleasant cold winds and the infectious hot ones." (Mumford, 1991; pp:241)

He used the radial scheme which indicates the prevailing winds and their directions. Vitrivius himself did not create radial streets but used the wind rose to create a safe grid. (Kostof, 1991) He also used a circular wall in his ideal town which make defense easier. However, in Roman military thought square and rectilinear forms were accepted as an ideal form for defense of cities and believed that a circular settlements could be besieged

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easily. Vitrivius proposal was circular in form and its streets was gridiron. (Fig. 3.7) In this context, his idea can be thought as revolutionary and utopic in comparison to their time. 1600 year later of his death the radial scheme was re-established in most Renaissance and Baroque cities in Western world. (Yaşlıca, 1996)



a                                                b
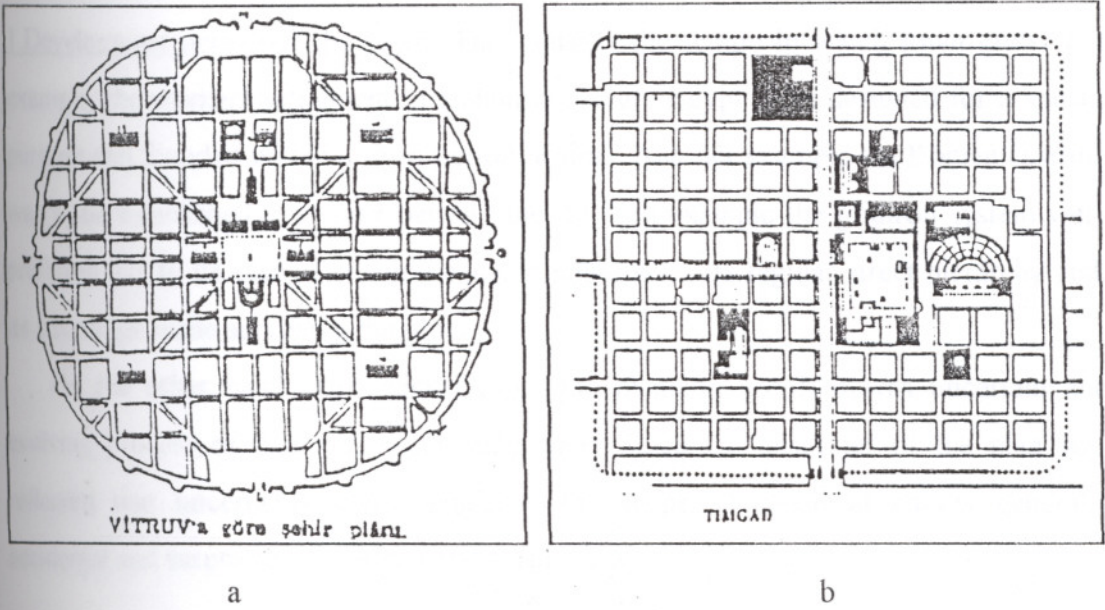
Fig. 3.7. Vitrivius's ideal city (a) versus Castrum plan (b), (Yaşlıca, 1996; pp:42)

## 3.3. Medieval

Most of the medieval towns had similar social, and political characteristics: the church was the powerful association of Western Europe and the feudalism was the local government managing the justice, legislation and army during 12th and 13th century. (Mumford, 1991)

The towns in later middle ages had common features; enclosure, density and intimacy. But in general, the medieval town can be thought as living organism where the city wall is hard shell and the church and marketplace are the nucleus of that town. (Norberg-Shulz, 1993)

### 3.3.1. Street System & Network

Most of the medieval streets were curving, irregular in shape and confusing. No doubt that, there were some practical reason that made streets so confusing. According to E. Saarinen, these factors can be considered in two broad categories;

1.Development period of the town: This consists the tempo in which town grew. For example, the workers settlement of Kahun in ancient Egypt were designed for a special purpose and founded within a short period of time. Another example the Roman castrum was again established in a short period time. In both example the gridiron system were preferred due to its ease of creating equal building sites, its regular street hierarchy and, its advantage while surveying the plots.

On the other hand, in medieval town the planning program was uncertain and evolving process of that was taken long time. Since the character of the plan was reflected that uncertainty and irregularity the shape of medieval streets generally accidental and surprising. (Saarinen,1949) (Fig. 3.8)



a                                                            b
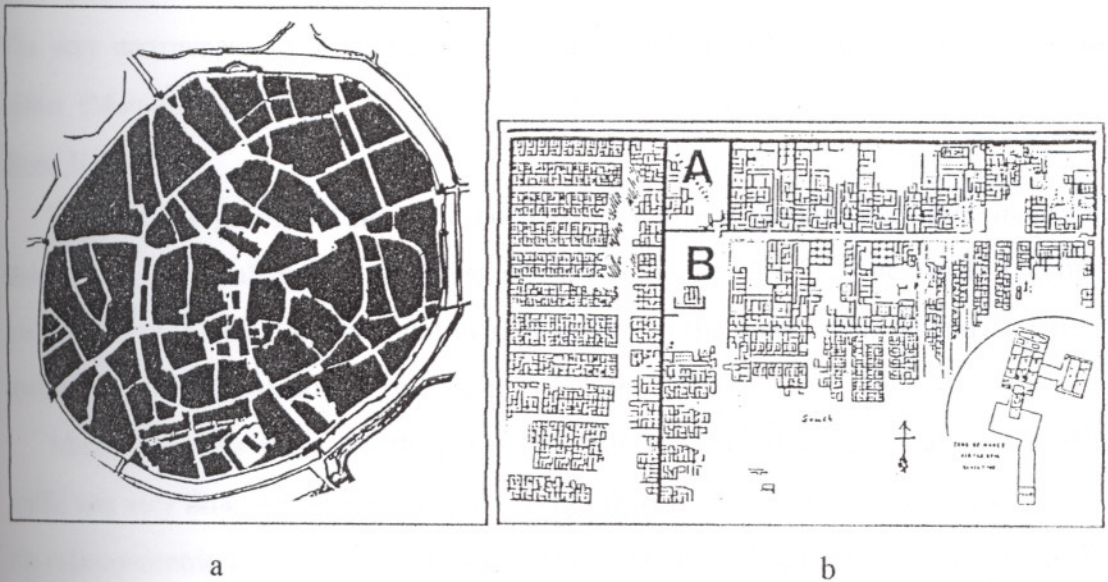
Fig.3.8. Time and evolving process of towns: a typical medial town, Noerdlingen ,Germany (a) and Egyptian working quarter, Kahun (b), (Saarinen,1949; pp:42)

2. Changing Conditions of Life: Medieval street was so confusing and often irregular in shape. Because they had some advantages in terms of defensive and climatic reasons.

Defense: Since straight and regular streets provided easy entering and spreading to the town Medieval streets were so confusing and a labyrinth in shape that brings some advantage to their inhabitants;

- provide advantage to defenders for hiding and surprising
- make enemy unfamiliar with the town arrangement
- behind a labyrinth of streets the public buildings and open spaces find security
- since hand to hand finding was the prevailing mode the confusing labyrinth of streets was the most appropriate. (Saarinen, 1949)

Climate: Medieval streets were not always narrow and irregular but sharp turns and closures were often occurred. "When the street was narrow and twisting, or when it came to dead-end, the plan broke the force of the wind and reduced the area of mud." (Mumford, 1991; pp:354)

Medieval townsmen consciously designed their towns to protect against cold winter wind. Since medieval life mostly went on outdoor, even cooking and manufacturing were done upon the street, the protection against the bad weathers was very significant issue. The very narrowness of medieval streets made such activities more comfortable in winter. (Mumford, 1991)

Street Network:

The wall, the gates and the civic nucleus -church and marketplace- determine the main routes of circulation in medieval plans. (Mumford, 1991) "The roads radiated generally from the church plaza and market square to the gates, with secondary lateral road ways connecting them." (Eisner at al., 1993; pp:77)

Medieval streets were mostly pedestrian oriented and therefore regular wheeled traffic was very little, the notion of traffic network was absent. The street network was the radioconcentric in most medieval plans. These continuous circular streets created the wall effect that surround the town center. (Mumford, 1991)

### 3.3.2. Pedestrian & Traffic Relationships

In a medieval town, except a few main roads between the gates and the market place, streets were used for pedestrian circulation rather than a main traffic arteries. Wheeled vehicles was generally absent from all but the main roadways. (Eisner at al., 1993)

In medieval towns, pedestrian needs were dominated. The urban fabric allowed to provide the intimate relationships and direct face- to- face communication. Streets were not designed to accommodate the wheeled vehicles and neither water pipes nor sewage drains needed to be provided. Therefore, to follow nature's contours while passing the streets was more economical. (Mumford, 1991)

As described previously, movement in medieval towns was largely on foot However, in late medieval period wheeled traffic increased with the rise of merchantile economy. (Eisner at al., 1993)

Today contemporary city streets are threatened by the expansion of wheeled traffic. In contrast to our times, medieval streets were in human scale, pedestrian friendly and the line of communication for pedestrians.

### 3.3.3. Street Scene

The accepted image of medieval city was constituted by the narrow built-up streets which provided walkers dynamic always changing and visually surprising 3-dimensional forms. As discussed previously, this structure was the functional resultant form of the need for defense and protection against the bad weathers. The short approaches to the great buildings, the blocked vistas, increase the effect of verticality and provided street scene was usually accidental. (Morris, 1994)

"Throughout the middle ages there was a tendency for buildings to encroach even further onto streets" (Mumford, 1991; pp:325) The one of the extreme examples of these trend in medieval age was the "bridge streets" in which the houses and shops lining the bridge. (Kostof, 1992) (Fig. 3.9)

Due to the defensive considerations houses had guarded access on the ground floor that served as domestic wall. (Mumford, 1991) "Thus mass and height were important

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symbolic attributes, the medieval builders tended to keep to modest human dimensions... Small variations in height and building material and roof-top profile and variations in window openings and doorways gave each street its own physiognomy" (Mumford, 1991; pp:355)

"Streets were usually paved and maintained by the owners of the property facing upon them. This may account in part for their narrow width" (Eisner at al., 1993; pp:79) In western Europe, streets were paved for pedestrians: for example, in Paris (1185) and, in Florence (1235) all streets were paved. But this spreaded so slowly to other medieval cities in Europe. (Mumford, 1991)



Fig. 3.9. Bridge Street, The Ponte Vecchio, Florence 1340's, (Kostof,1992; pp:226)

## 3.3.4. The Urbanists Concerning with Street Design

Leon Batista Alberti and Winding streets:

According to Mumford, Alberti was a typical medieval urbanist. His concern was to constitute winding streets due to the practical reasons for defense and health. He supported the dead-ends and alleyways to increase the defensive precautions in the city. He offered narrow and winding streets due to the climatic reasons. Alberti observed that the widening of streets the air is more bracing, breezes and some sun will reach all the houses and the face of stormy blasts will be broken. (Kostof, 1991)

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According to Alberti, "winding of streets will make the passenger at every stop discover a new structure and the front door of every house will directly face the middle of the street and whereas in larger towns even to much breadth is unhandsome and unhealthy in a small one it will be both healthy and pleasant to have such an open view from every house by means of the turn of the street." (Kostof, 1991, :70)

The slow curves he observed that were suitable for pedestrians and tried to overcome this tendency consciously in his arrangements. Although he found wide streets less healthy and unsuitable for climatic reasons, he proposed straight and broad streets for noble and powerful cities to increase the air of greatness and majesty. (Mumford, 1991)

## 3.4. Renaissance & Baroque

During the Renaissance there were several dominant aesthetic considerations which were common in all countries in Europe:

First, there was a great importance of symmetry to create a balanced composition with one more axial lines. Second, at the end of the major, straight streets to locate monuments, obelisks or statues as a terminating element that closing to vistas had big importance. Third, with the repetition of a basic elevational design, individual buildings had created a sense of single, integrated architectural ensemble. The last was the application of the perspective theory in the art that made street as a locus of 3-D design considerations. (Morris, 1994)

Baroque period had seen from 17th century to first half of the 18th in Europe, especially in two important capitals: Rome and Paris. According to Norberg-Shulz, baroque city started in Rome by Pope Sixtus V who applied a great program for religious reasons. The idea of new monumental buildings which were interconnected by a ring of boulevards and royal plazas was grown in Paris. These new ideas were originated from the French garden architecture. (Norberg-Shulz, 1986) However, beyond these developments there were some social, economic and political reasons. The transformation was occurred while realizing the baroque order of new life: "from medieval localism to baroque centralism, from medieval uniformity to baroque

universality, and from absolutism of church to the absolutism of centralized power of national state." (Mumford, 1991; pp:398)

The basic attitudes and form of life of Baroque age can be summarized with such terms; system, centralization, extension and movement. (Norberg-Shulz, 1986) On the other hand, Baroque brought new forms: in art, perspective and anatomy; in architecture, axial symmetry and formalistic repetition; and in city building, carefully detailed geometrical plan. (Mumford, 1991)

### 3.4.1. Street System and Network

In contrast to Medieval street, baroque street were regular and straight. These changes in street system can be examined in the three main categories:

1.Need for Defense: The use of gunpowder changed all the military strategies. The fall of Constantinople encouraged the military consideration in the design of ideal Renaissance city. (Morris, 1994)

Another development related to ideal Renaissance city is the interpretations of the works of Vitrivius. Vitrivuan theory generally applied in a radial-concentric forms, enclosed within an octagonal defensive wall and eight radial street lead out to the angle towers rather than the gateways. This was the asterisk plan that was one of the most important inventions of Renaissance and Baroque. In these plans, the radial, straight street were scattered from the center and such a central location, artillery could command every approach easily. The new orders of these ideal schemes dictated the radiating streets and avenues that cutting impartially through old tangles or new gridirons, moving towards the boundless horizon. (Mumford, 1991)

2. Ideology of Rulers: "The straight street can direct the social and practical advantages it passes into a discourse of ideology and with a suitable coding of architecture and decoration it can import a powerful representational message" (Kostof, 1991)

The rulers of this age had different purposes while dictating their system. For example, Pope Sixtus V's urban renewal in Rome (1563) had religious reasons. On the other hand, Napoleon III had military goals. The strong rulers of Baroque age forced the military streets. According to Alberti, "military streets-viae militares- should be straight to achieve maximum appearance of order and power on parade. It is necessary to

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provide a body of soldiers either within an open square or a long unbroken avenue." (Mumford, 1991; pp:422)

3.Changing tempo in social and economic life: In comparison with medieval time, the tempo in city life was so fast and irregular system of old historic quarters of the city could not support the increasing number of wheeled traffic. To make the movement of wheeled vehicles easier straightening and widening of streets in the age of absolutism became necessary. The straight street also has a practical superiority, in that it connects two points directly and so speeds up communication. (Kostof, 1991)

With the growing concentration of people especially in capital cities crooked streets and dark alleyways became the locus of crime. In order to provide some breathe for old quarters, new city designers of this period demolished old houses and other structures along crooked streets and built the straight street.

Street Network:

Renaissance street network was mostly based upon old medieval irregular streets and alleyways. On the other hand, baroque street network had two new components: avenue and boulevard.

Avenue: The avenue, according to Mumford, "is the most important symbol and the main fact about the baroque city." (Mumford, 1991; pp:421)

The origin of the avenue is largely rural. In 19th century French resources, avenues were described as "lined with tall trees to distinguish them for the surrounding landscape of leafy forests, low hedges and field of crops." (Kostof, 1991) They were designed according to the axis of the important monuments and straight in shape. 16th century version of this rural avenue became common all around the France with its planting trees along the principal post roads. Surrounding of Paris was structured by a network of radiating roads and geometrically ordered gardens after 17th century (Kostof, 1991)

Boulevard: The boulevard started as a boundary between city and country. According to Morris, "the boulevard is the line of fortification itself but when these converted into wide tree-lined streets. The designation of boulevard was kept today the word means simply a broad tree-lined avenue." (Morris, 1994, :201)

In 1670, with the destruction of the old city walls of Paris, these fortified sites converted to the broad, elevated promenades, planted with double rows of trees and accessible to carriages and pedestrians. These tree-lined ramparts -soon known as

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boulevard- became a system of connected public promenades which designed to facilitate the wheeled vehicles. (Kostof, 1991) (Fig. 3.10)



a



b

Fig. 3.10. Baroque Avenues and Boulevards: (a) Paris, Boulevard du Temple, (b) Parc Monceau , (Benevolo,1989; pp:69)

### 3.4.2. Pedestrian & Traffic Relationships

Military traffic was one of the most significant factor of the age beginning with Alberti's works and went on the boulevards of Haussmann in 19th century Paris. Grand avenues of Baroque also accommodated the wheeled traffic the carts and vagons. Increase in the number of carriages and coaches was the result of new technological improvements in the wheel design. After that period wheeled traffic became urgent in the 17th century. Though some protest were done by pedestrians against the existence of disturbing wheeled traffic in the city streets, the new spirit in society was in favor of rapid transportation.

Because crooked and narrow streets of medieval city was not designed for the access of wheeled vehicles, the geometrically ordered uniform avenues appeared in the baroque city. The movement of wheeled vehicles played a critical role in geometrizing of space. According to Mumford,

"Movement in straight line along an avenue was not merely economy but a special pleasure: it brought into the city the stimulus and exhilaration of swift motion and it was possible to increase this pleasure aesthetically by regular settings of buildings with regular facades and even cornices, whose horizontal lines tended towards the same vanishing point as that towards which the carriage itself was rolling. In walking the eye courts variety, but above this gait, movement demand repetition of units that are to be seen." (Mumford, 1991, :421)

The uniform avenues also brought movement and confusion to the quiet, self-sufficient urban quarters. In contrast to centralized and spontaneous marketplace of Medieval, in Baroque age commercial and entertainment activities started to take place along these broad avenues.

Pedestrian space were under pressure of increasing wheeled traffic, but a special strip was provided in grand avenues for ordinary pedestrian: "the sidewalk". On the other hand, the early examples of separation of pedestrian ways from heavy traffic arteries had seen in Leonardo da Vinci's proposal for Milan. In his ideal scheme, to provide multilevel separation of vehicular and pedestrian traffic special routes were reserved for the heaviest goods traffic. (Morris, 1994)
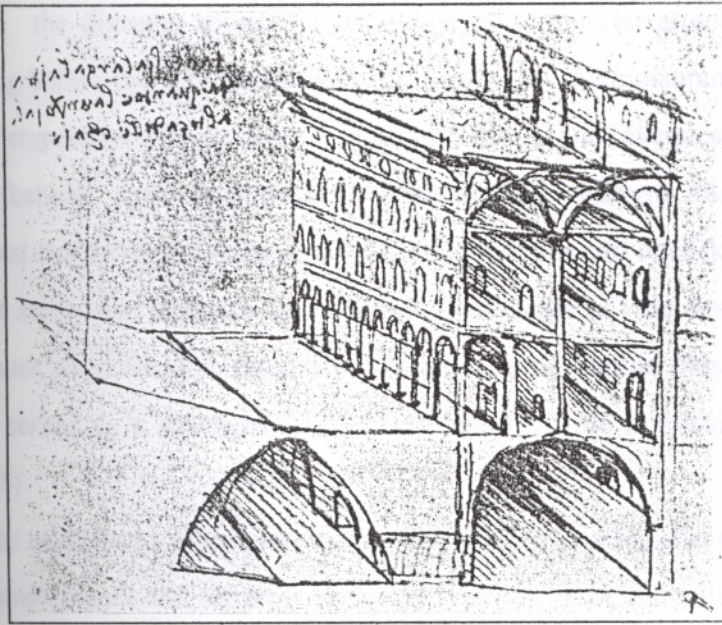
Fig. 3.11.Leonardo da Vinci's proposal for Milan, (Kostof, 1992; pp:237)

### 3.4.3. Street Scene

In renaissance street scene architectural landscape elements such as colonnades, screens, terraces, trees and scrubs were applied in various forms by Renaissance urbanists. (Morris, 1994) In renaissance period, since street scene dominated with old medieval structures, the new buildings creating a rich complex order, after more satisfying aesthetically than the uniform, single minded composition after 16th century. According to Mumford, Uffuzi in Florence is one of the best example of this visual achievement with its straight, narrow and complex character. (Mumford, 1991).

The symbols of new baroque street scene was the straight street, unbroken horizontal roof-lines, the round arches and the repetition of uniform elements. According to Alberti "streets will be rendered much more noble if the doors are built all after the same model and the houses on each side stand on even line, and none higher than the other." (Mumford, 1991; pp:399) The use of straight lines and uniform building lines brought the uniform motion and created monotonous street scene in visually limitless avenues of Baroque age.

Another development which affects the Renaissance and Baroque street scene was the innovation of perspective. "The study of perspective demolished the closed vista,

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lengthened the distance towards the horizon and centered attention on the receding planes, long before the wall was abolish as a feature of town planning." (Mumford, 1991; pp:418) Perspective effects were emphasized in grand avenues by the location of terminal features both architectural (monuments, uniform facades, repetition of architectural elements) and sculptural (statues, fountains and obelisk) (Morris, 1994)

Street scene also reflected the ideological message of the despotic rulers. "All the main avenues would lead to the palace, as often as not would close the vista. The axial approach served as a spotlight to focus attention on the political power." (Mumford, 1991, :445)

On the other hand, Baroque city can be thought as a big theater scene with its fine avenues, monuments and squares. However, beyond these magnificent scene there was no baroque order. There was only denied life of people who were suffering from the despotic rulers. In this great theater, as Norberg-Shulz pointed out, everybody assigned his role. (Norberg-Shulz, 1993)

### 3.4.4. The Urbanists Concerning with Street Design

Renaissance urbanists had three main design components at their proposals: the primary straight street, gridiron based districts ,and enclosed spaces-squares and piazzas. Another important design consideration was, of course, the need for defense.

Scamozzi and Palmanova:

Palmanova's street system is organized as a gridiron within the defensive perimeter. Its perimeter is a nine-sided polygon and its central square a regular hexagon. These shapes are resolved into an integrated pattern by a complex arrangement of radial streets. Six lead out from the center to angle of the wall. Additionally twelve radial streets start from the innermost ring of three concentric streets. "Palmanova is one of the most well preserved examples of such military originated renaissance cities of today." (Morris, 1994, :173) (Fig. 3.12)

Pope Sixtus V and Fontana:

Pope Sixtus V had different purpose according to those others concerning with military issues. His principal aim was to connect the main holy spots of the city with the network of wide straight streets. Sixtus V and his chief architect Fontana used sculptural

elements in the main intersections to emphasize the change of direction of the streets. Sixtus V's plan, according to Norberg-Shulz, "made Rome the prototype of the basic unit of Baroque architecture of the following century." (Norberg-Shulz,1993; pp:132) However, the new wide straight street networks of Sixtus V caused the demolition of the some old historic quarters of Rome. (Fig. 3.13)
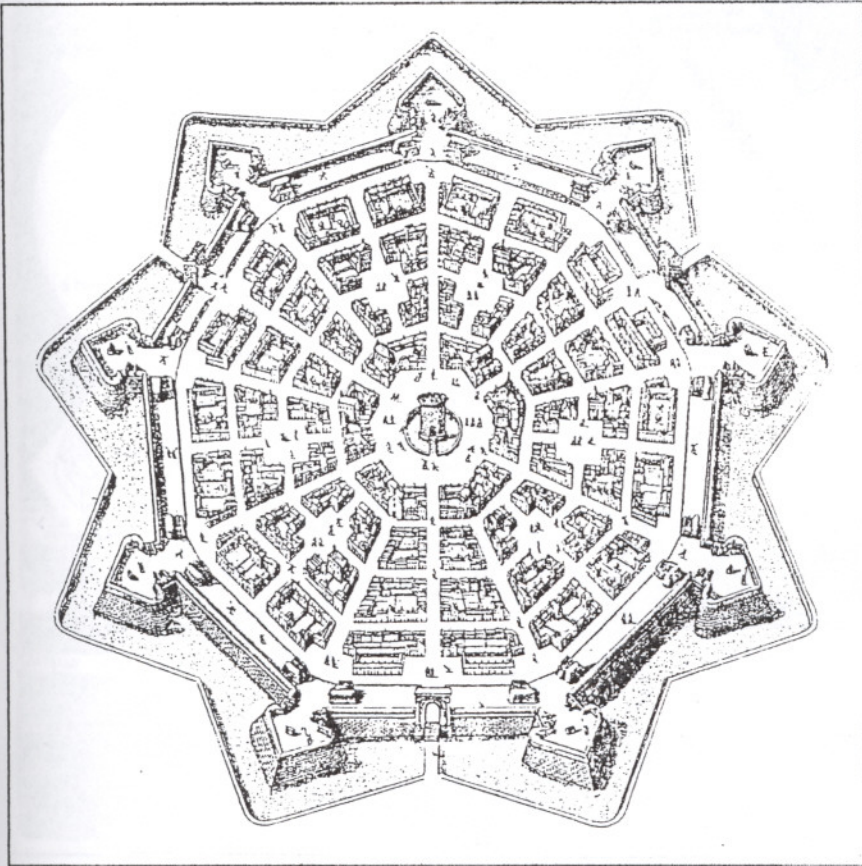


Fig 3.12. Scamozzi's Palmanova, 1593, (Moughtin, 1992; pp:32)


Sebastiano Serlio and the Theater of the Street:

Moughtin states that, "any classification of streets must start with Vitrivius and his description of the three street scenes for use as the backdrop in a theater." (Moughtin, 1992; pp:127) In the *Ten Books of Architecture* these street scenes described as tragic, comic scenes exhibit private dwellings, with balconies and views representing row of windows, after the manner of ordinary dwellings; satyric scenes are decorated with trees, caverns, mountains and other rustic objects delineated in landscape style.
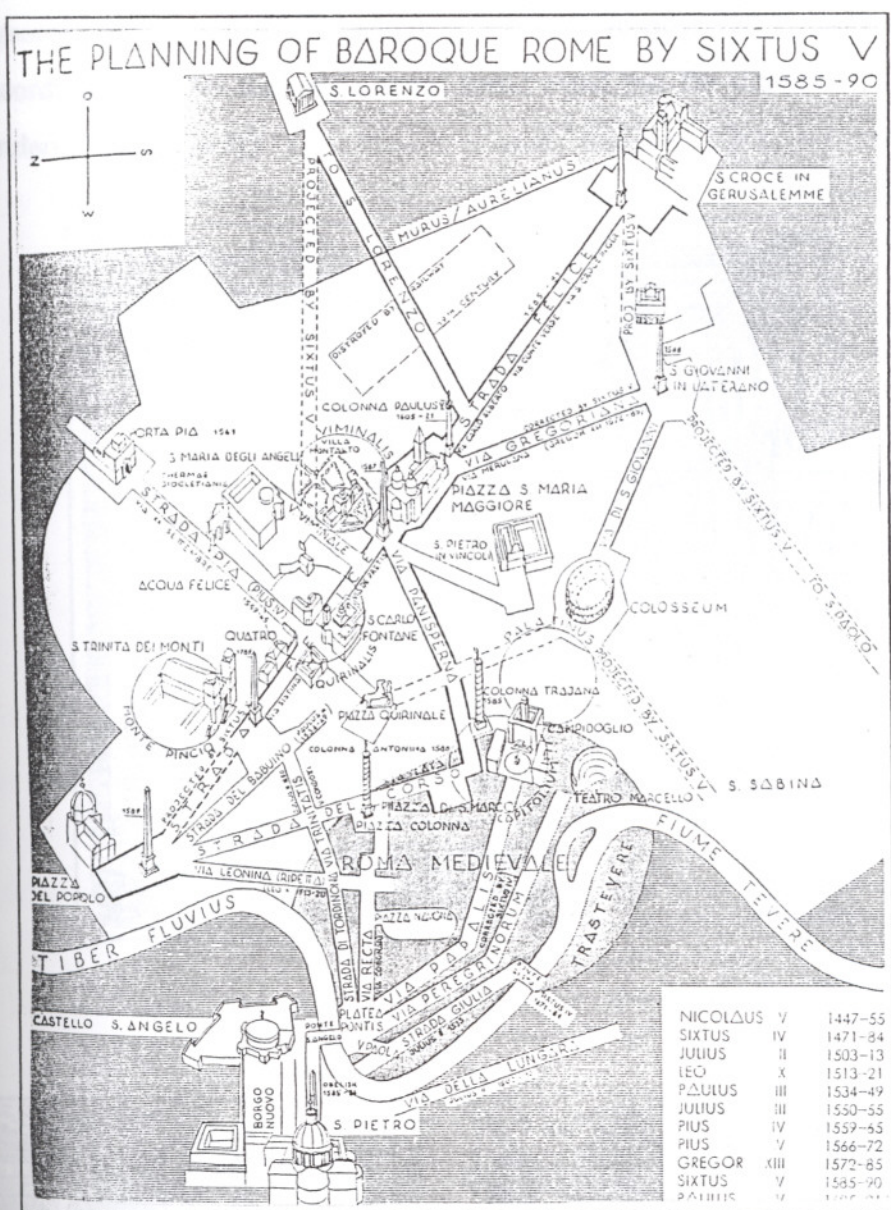
Fig. 3.13. The planning of baroque Rome by Sixtus V, (Giedion, 1967; pp:79)

Serlio interpreted these tree street types of Vitrivius in his book *The Five Books of Architecture*. Again as Moughtin pointed out "The scenes depicted by Serlio, using geometric perspective are a classical form of architecture for the tragic scene, Gothic for the comic scene, and a landscape outside the city for the satyric." (Moughtin, 1992; pp:127) (Fig. 3.14)

The geometric perspective of baroque streets can be observed in Serlio's tragic scene. According to Vidler the tragic street scene acted out the dramas of state: the power of rulers. (Vidler, 1991)
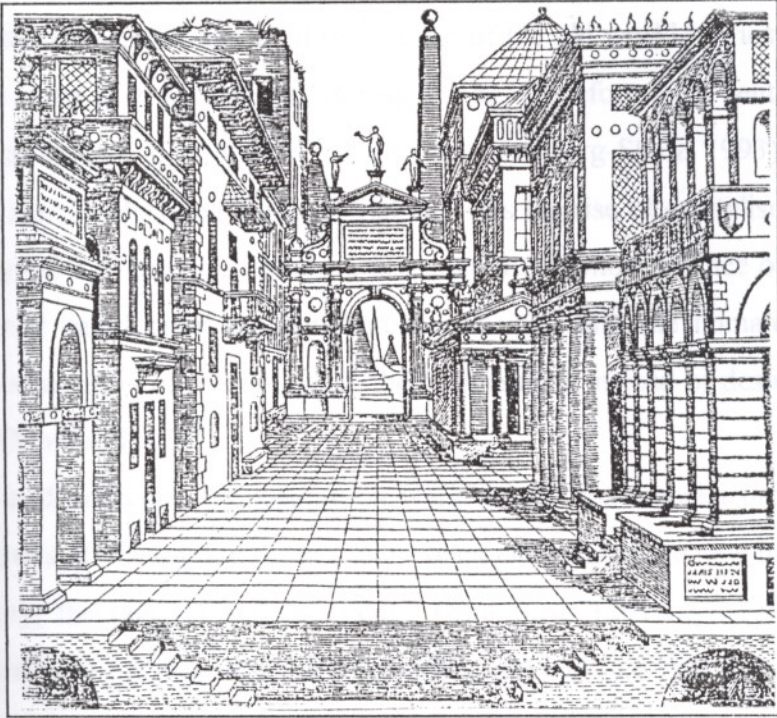


a



b



c

Fig. 3.14. Vitruvius's description of the three street scenes: tragic scene (a), comic (b) and satyric scene (c), (Moughtin,1992; pp:127-128)

## 3.5. Enlightenment

By the end of the power and influence of great Baroque system around 1750, a fundamentally new situation came into being: the industrialism. The industrial and social revolutions of this new period declared the decline of the old world but instead they did not bring a new order as in Medieval or Baroque ages. Therefore 19th century urbanism can be thought as the age of confusion and disorder. (Norberg-Shulz, 1993)

The prime reason which led the industrial city was the rise of capitalism. According to Mumford, by the 17th century capitalism had altered the whole balance of power. The city was designed based upon the commercial principles and the human needs were neglected. The new rulers of this era were the businessmen instead of despotic rulers of Baroque Age. (Mumford, 1991)

The rapid and unchecked concentration were caused some social problems in the new urban quarters of the expanding city. "The main elements in the new urban complex were the factory, the railroad and the slum." (Mumford, 1991; pp:522) The factory became the nucleus of the new urban developments; railroad provided extension of such developments, and the slum became the common urban picture of them. According to Patrick Geddes, " Slum, semi-slum and super slum to this has come the evolution of cities." (Mumford, 1991; pp:511)

Social reformists and scientists of this period saw the hygiene as the remedies of physical and social illness. To bring back fresh air, pure water, green open space and sunlight to the city became the first object of such hygienists. They discovered the difficulty of improving inner city and proposed dispersed multi-centered growth patterns. The result was the rise of suburbia which brought significant changes in both the social contents and the spatial order of the city. Hygienic superiority of the suburb was one of the major attractions. (Southworth and Ben-Joseph, 1996)

In this period, the ideas and principles of utopians, urbanists, and social reformers became so important in the shaping process of urban life and urban developments.

## 3.5.1. Street System & Network

In the industrial age, the disappearance of the unity of Baroque street can be observed. There were two important tools to provide expansion and growth of new cities: speculative grid , and suburban development.

<u>Speculative Grid and Rise of Mass Transportation:</u>

The extension of the speculative gridiron and the public transportation system, ,according to Mumford, "were the two main activities that gave dominance to capitalist forms in the growing cities of 19<sup>th</sup> century...All over the western world during this period, new cities were founded and old ones extended along the lines." (Mumford, 1991; pp:484-487)

"The gridiron pattern was used almost exclusively, being easy to survey and lay out and simple to subdivide." (Southworth and Ben-Joseph,1996; pp:28) Such plans were recognized with its standard lots, its standard blocks, its standard street widths, in short, with its standardized comparable and replaceable parts. Gridiron plans were appropriate for quick parceling of the land and a quick conversion of farmsteads into real estate and quick sale. (Mumford, 1991)

The grid also provided a framework which has infinitely expandable but which allowed small increments of growth within a well understood pattern. The grid system of city planning became the predominant urban form, especially in 19<sup>th</sup> century America. Its efficiency and ease of surveying made the gridiron popular to speculators. (Cohen, 1995) The New York Commissioners plan of 1811 was the typical one. The plan of New York provided for a uniform network of streets, crossing at right angles. The plan simply by placing buildings for activities of all kinds within the pre-arranged network of the regular gridiron street. According to Commissioners report: "a city is made up of houses and when streets cross at right angles houses are less expensive to build and more convenient to live in." (Benevolo,1989; pp:214)

The mistake in this idea was the acceptance of houses as major function of the city. Whereas the new industrial city constituted different kind of organizations and functions. Functional differentiation between the residential, industrial, the commercial and the civic quarters demanded blocks of different lengths and depths, with appropriate streets and

avenues to accord with their loads of traffic and their functionally different building layouts. (Mumford, 1991)

Another important development was the rise of mass transportation. With this new technological invention, as Mumford point out, "walking distance no longer set the limits of city extension was hastened, since it was no longer avenue by avenue or block by block, but railroad line, by railroad line, and suburb by suburb, raying out in every direction from the central district." (Mumford, 1991; pp:489) (Fig. 3.15)
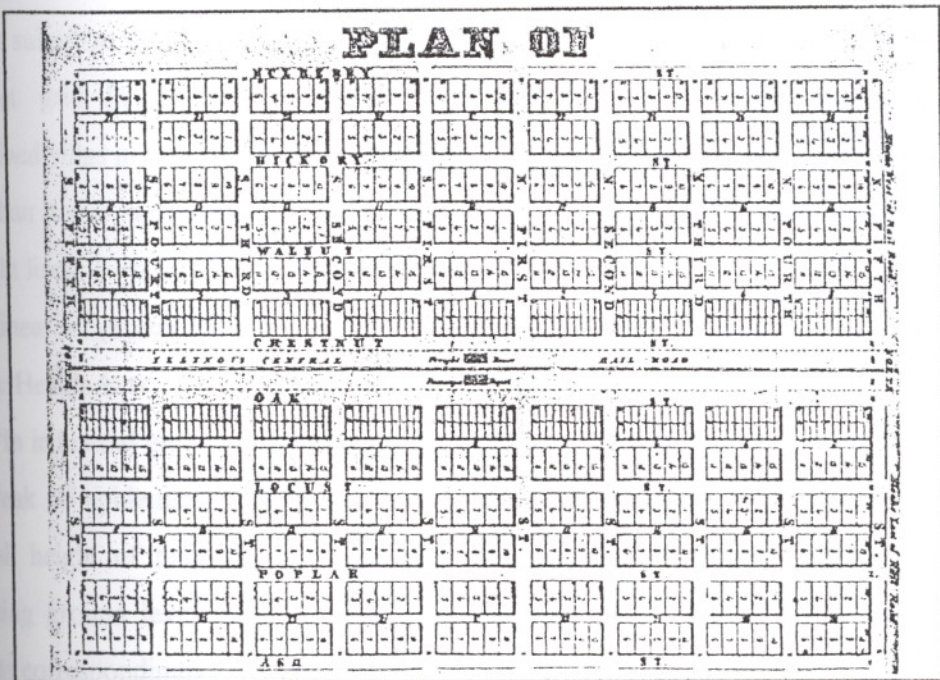


Fig. 3.15. A typical railroad development: This plan were used to make 33 different towns, (Southworth and Ben-Joseph,1996; pp:28)

"Rail transit also on a much smaller scale, by tramway or train was to be the main determinant of the two alternative models of the European garden city. One was the axial structure of the Spanish Linear garden city by Arturo Soria Y Mata in the early 1880's and the other was the English concentric garden city by Ebenezer Howard." (Frampton, 1992; pp:489)

Need for Hygiene and Public Health:

In Enlightenment period due to the overcrowding and insanitary conditions of the industrial town prime concern was hygiene. This led the public health acts in diseased

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urban centers, and produced some radical solutions: the surgical operations in old urban quarters. On the other hand, escaping from the evil of industrial towns was realized in the forms of suburbs.

Rise of Suburbia:

Due to the impacts of industrial revolution dead or infected parts, which called slums, were appeared in the overpopulated and crammed cities. This situation led the development of the idea of garden city and suburbization. After 1830, the picturesque suburbs were launched.

In suburban settlements, the planners abandoned the conventional terrace form along a street grid. In contrast to this, the curvilinear street scheme was supported by self contained villas in their own grounds. (Kostof, 1991) "Following romantic principles, the suburban house and plot and garden were deliberately deformalized. The street avoided straight lines, even when no curves were given by nature" (Mumford, 1991; pp:557) The curvilinear arrangements of streets were the most influential features of such settlements.

Public Health Acts:

"In industrial city ordinances related to public health were usually spurred on by the outbreak of epidemics... Congestion was perceived in terms of street width and the overall height of flanking buildings. Narrow canyon like streets kept sunlight from reaching ground level. The general remedies were to set height limits and to widen streets correspondingly." (Kostof, 1992; pp:205)

In 17th century especially in newly developed areas there was a great tendency for wide and straight streets due to the increase in usage of coaches and health matters. On the other hand, in 19th century crowded streets of old city quarters became the bed of many diseases. In England in order to control these illness 'bye-law street' was established with Public Health Acts between 1848 and 1866. (Kostof, 1992) "The vision of wide, straight, paved streets entranced the authorities who saw it as the best solution for the ills of their cities." (Southworth&Ben-Joseph, 1996; pp:37) As planning principle of such streets 17th century baroque uniformity and order were imposed. (Fig. 3.16)

"typically, bye-law streets are very long, straight and arranged within a grid of parallel streets. Rather monotonous in overall feeling, they are framed by brick row houses, two or three stories tall, identical, in layout and style. The main element that lends variety within a street is the color the brick facades are

painted. The major impact of Bye-law Street Ordinance was establishment of the right of way of 12.2-15.25 m as a standard configuration for residential street widths, a standard still used today." (Southworth&Ben-Joseph,1996; pp:39)



Fig 3.16. English Bye-law streets: Whitehall Road, Birmingham, (Kostof, 1992; pp:206)

On the other hand, in Germany the wide straight street was common in the mid 19th century which encouraged by the legislations concerning the public health.

"The situation was made worse by regulations regarding the height of abutting buildings. Codes normally set building height in proportion to street width. This meant that the wide streets of Germany condoned uniformly tall buildings, indeed encouraged them. Wide streets were more expensive to construct and since this cost was assessed to the owners of adjacent property, it had to be recovered by building as dense and tall as you could get away with" (Kostof, 1992, :206)

After 1880 instead of wide streets, narrow streets were advised for residential streets of Germany. Because of the enormous scale of such wide streets the intimate relationships in residential areas were broken. Wide streets also invited wind and dust to the residential quarters. Therefore, they were seen inefficient due to the health matters. (Kostof, 1992)

Street Network:

"Avenue and boulevard, that are the two significant road types, still had great importance but their usage was differentiated. First boulevards were formal footways designed for the promeneur." (Giedion,1967; :pp757) However, the 19th century Haussmann boulevards were designed mainly the carrier of heavy traffic.

Distinction between the avenue and boulevard became uncertain after the second half of 19th century:

"With the planted stretches of the old walls, the original boulevards, now within the limits of the expanding cities. As early as the 1830's the introduction of new design features popularized in Great Britain, both the interior avenue and to the original boulevards created a level of uniformity. These features included underground storm drains and sewers and visible to the eye, paving, house numbering, mail boxes and most important of all, sidewalks. The urban boulevard was divided into three distinct strips. The sidewalks were shoppers and shopping, the break between two functions." (Kostof, 1992; pp:254)

Although these large boulevards accommodate different kind of commercial and entertainment facilities they were too large to provide intimate relationships and closed vistas as in traditional streets. Boulevards also demolished the integrity and social structure of the old quarters and neighborhoods. (Kostof, 1991)

On the other hand, avenue and boulevard had different usage in America. Avenues were primary traffic arteries and not encouraged for social activities and boulevards were the green connectors of parks with the outer parts of town that were made popular by F. L. Olmsted. In the American suburbs boulevards were used as parkways. However, they transformed into traffic arteries by automobiles later on. But the origins of our times boulevard was largely constituted by the time of Haussmann under the brief autocracy of Napeleon III.

Haussmann Boulevards:

The reasons that made the rebuilding of Paris inevitable can be examined in three main headings:

1.The ruler's wishes: Napoleon III wished to make Paris the first great city of the Industrial age. His insistence upon grand boulevards came from the desire of to increase

his popularity and make further revolutions more difficult. To replace the old mediaeval streets with straight wide boulevards would be better for troop movements.

2. Traffic & Hygiene: Paris had reached about one million inhabitants under the rule of Napoleon III. "The streets of medieval an Baroque, were inadequate for the traffic, the old houses were ill suited to the sanitary requirements of the industrial city and the concentration of functions and interests in the capital raised the price of building land to such an extent that a radical transformation was inevitable." (Benevelo, 1989; pp:67)

3. Bourgeoisie's Pressures: The bourgeoisie's wanted to reshape the city in its own image to make its own business, residences and places of an entertainment the monumental care of the city. (Kostof, 1991)

Haussmann principles and achievements for the city of Paris can be summarized into three main headings;

1. The first principle was related to public health issues. Haussmann called this operation as eventrement which used in medical terminology and indicated that drastic cure, massive surgery, need to save badly infected urban organism. His method of approaching the subject were criticized not only by their contemporaries but also the historians of today. According to Kostof, Haussmann was the demolition artist and great expert of massive surgery. (Kostof, 1992) (Fig. 3.17)

2. The second was to assure peace by the creation of large boulevards which will permit the circulation not only of air and light, but also of troops (Giedion, 1967) Slum areas of old quarters were also a threat to public order. The dark alleys and dead ends are the hideouts of the majority of released prisoners. (Vidler, 1991,pp:91) While grand boulevards eliminated the danger of public demonstrations and riots also would clear spaces for imperial ceremonies. (Erder, 1986)

3. Haussmann's third principle was related to vehicular circulation. "To facilitate circulation to and from railway stations by means of penetrating lines which will lead travelers straight to the centers of commerce and pleasure and will be prevent delay, congestion and accidents." (Giedion, 1967; pp:745) Haussmann saw traffic and glory as a convergent goals in his later works. The boulevards that focused theatrically on his historic monuments were also meant to carry fast traffic. (Trancik, 1986)

Above all, Haussmann's boulevards replied the bourgeoisie desires. "These boulevards put on public display the new pastimes of fancily dressed cafe crowd, turning the entire city into a bourgeoisie spectacle." (Kostof, 1991; pp: 224)



Fig 3.17. Haussmann's demolitions for Boulevard St. Michel, (Çelik at al.,1994 ;pp:14)

Features of Haussmann Boulevards:

Haussmann boulevards had great lengths which sometimes three mile a long created the sense of endlessness. "He spread a uniform facade over the whole Paris. One can still feel a last touch of the unity that had marked baroque architecture" (Giedion, 1967; pp:769) Regularized facades and equally standard systems of street furniture such as the pissoirs, benches, shelters, kiosks, clocks, lamp-post, signs etc. was designed by Haussmann's engineers Eugene Belgrad and Alphand. These elements became the typical for Parisian boulevards later. (Frampton, 1992) (Fig 3.18)

"The avenues became continuous streets of ground-flour shops, with dwellings on the upper floors. Haussmann's scheme was gargantuan in scale, but it was too late become an effective monument to the ego of monarch and too early to solve the planning of industrial city. It was the swan song of the baroque city" (Eisner at al., 1993; pp:105)

Haussmannization in Europe:

Haussmann like regularizations became popular not only in other French cities but also in central Europe throughout the second half of the 19th century. (Frampton, 1992)

Ringstrasse, the prime avenue of Vienna, was one of such examples which developed with the principles of Haussmann's regularization. (Erder,1986) Engels called this process as Haussmannization. (Vidler, 1991)
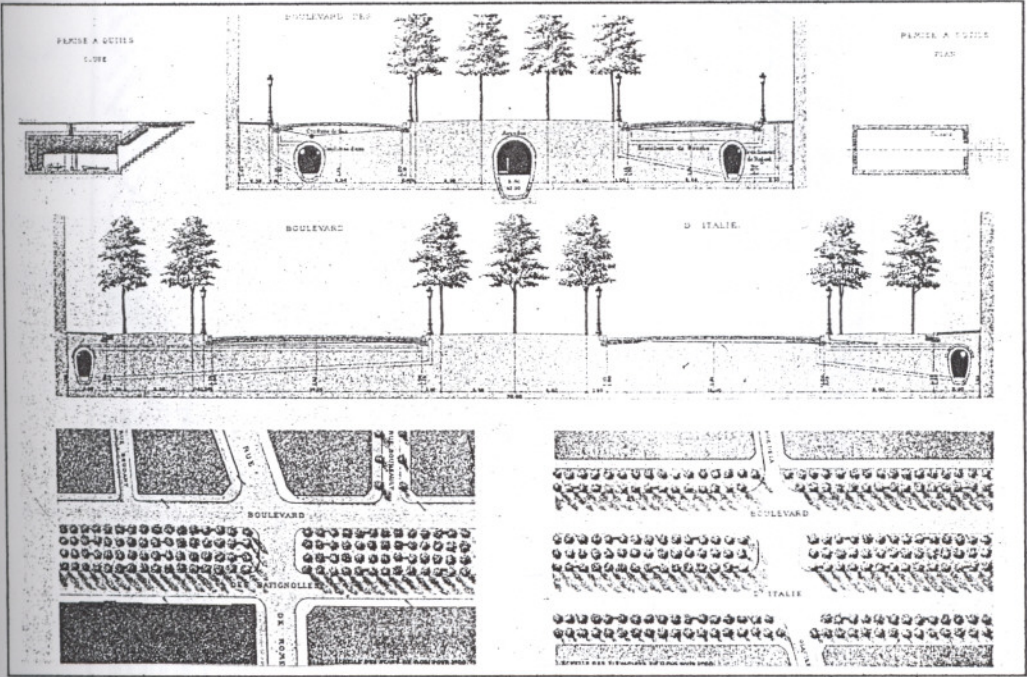


Fig 3.18. Features of Haussmann's boulevards: Alphand's Les Promenades de Paris, (Kostof, 1992; pp:228)

Covered (Arcaded) Street:

Glass covered shopping arcade was one of the new products of the commercial enterprise in 19th century. Shopping arcades were built of glass walls and iron frames which are the new achievements that new technology offered. (Mumford, 1991) Glass roofs and bilaterally symmetrical interior facades became the standard image of these pedestrian oriented 19th century arcades. (Kostof ,1992)

According to Mumford "these new structures had the special merit of taking shopping off the crowded street, with its confusion of vehicles and noise and admirable example of function planning" (Mumford,1991; pp:500) Another thinker Loyer suggested that "the arcade is the forerunner of the department store as well as the

modern enclosed shopping mall. The popularity of the passage can also be seen as a sign of the sad state of the normal Parisian streets." (Kostof ,1992; pp:231) (Fig. 3.19)



Fig. 3.19. Covered Street: Galerie d'Orleans, (Vidler, 1991; pp:79)

The covered street idea can also be seen in the works of some 19th century utopians: Ledoux porticoes and Fourier's gallery streets. In Ledoux's ideal city of Chaux, porticoes were covered outdoor rooms for citizens that provide protection from sun and rain and also the positive instrument for encouraging social activity. On the other hand, Fourier's gallery streets were the places for dwelling units and also the shelter against the rain and cold. (Vidler, 1991)

## 3.5.2. Pedestrian-Traffic Relationships

The rise of capitalism, increase in population in cities, and rapid rise in the number of wheeled vehicles created new traffic problems especially in medieval originated city quarters. Some of the old uses were lost their impetus in the city and sacrificed to fast moving traffic or to financial gain.

In commercial plans of 19th century, the corridor avenue was a linear thoroughfare which designed to carry large volumes of wheeled traffic. In suburban developments the planners mainly placed the shopping area along a corridor avenue rather than on compact market place. (Mumford, 1991)

In 19th century street regulations traffic volume of the street determined the width of street. At the bottom of the hierarchy, alleys provided access to the rear of properties. Quite residential street and at the top there was major traffic artery.

After the revolution, some street regulations were made in Paris to determine the street hierarchy: short routes, 6 m wide; inner arteries 12 m wide and the big thoroughfares were 14 m wide. (Kostof, 1992) In the reign of Haussmann, the street widening in the older parts of the city became inevitable.

On the other hand, sidewalk and street furniture for pedestrians came into being as the typical features of the street after 18th century. In England, a series of improvements in street design were introduced and popularized in the beginning of 18th century. These achievements were the macadam paving, storm drains and sewers, piped water, house numbering and sidewalks. (Kostof, 1992) Again in England, as Southworth states, the first modern street section was created in West Minister street improvement program in 1765. "Streets were lowered and leveled and footway on each side were elevated paved and defined by curbstones. The carriageway was paved with smooth granite sloping to small drainage channels on both sides of the curbs." (Southworth&Ben-Joseph,1996; pp:18) Such improvements in street design continued with Haussmann boulevards in Paris and became universal.

The uses of overpasses and underpasses were brought a new dimension to the pedestrian and traffic relationships in Olmsted and Vaux's Central Park plan. This plan, according to Mumford, "was superior to any conventional two dimensional city plan for, by using overpasses and underpasses wherever possible, it provided four independent

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traffic networks: footways for pedestrians, bridlepaths for horseback riders, carriage drivers for wheeled vehicles, and cross-town transverses for city traffic." (Mumford, 1991; pp:557)

Industrial revolution involved new technological changes in street design. However, these changes would be more radical in the motor age.

### 3.5.3. The Urbanists Concerning with Street Design

<u>19<sup>th</sup> Century Utopians and Their Ideal Cities:</u>

The utopian movements of the 19<sup>th</sup> century were a moral reaction to the overcrowding and filth of the industrial age. Utopians; Ledoux, Laugier, Patte, Fourier, Owen and others "thought of remedies they believed that the present irrational forms of settlement would have to be replaced by the other completely different ones, dictated by pure reasons, in fact, side by side with the real city they set the image of the ideal one." (Benevolo, 1989; pp:148) "They had all in common an impulse to treat social ills with large doses of lights, air and greenery." (Cohen, 1995)

According to Vidler, *Morelly* (1750) was the forerunner of the utopian socialist of the early 19<sup>th</sup> century. He defends the geometrical arrangements of streets by means of order. (Vidler, 1991) According to him, if the regularity became dominant, confusion, chaos and disorder would be eliminated. When the labyrinth shaped medieval streets opened and straightened the social disorder would be dispelled. He saw the crooked streets which accommodate criminals and rebelist as a danger for state. (Vidler, 1991)

*Laugier* (1755),on the other hand, recommended the large avenues for the beauty and order of cities. According to Laugier there were tree main elements that make a city magnificence; its entries, its streets and its buildings. Primary function of the street according to him was to render communication easy and uncomfortable. In his time, Paris was so tortuous, so full of bends and senseless angles and traveling from one quarter of city to another with wheeled vehicles even by walking was almost impossible. His remedy was clear: "Almost all the streets should be straightened and enlarged. They should be extended as much as possible to eliminate too frequent windings. New streets should be driven through all blocks that are longer than 600 feet (180 m). At all intersections of streets the corners should be rounded: at all crossroads there should be

squares" (Vidler, 1991; pp:37) Laugier's vision of limitless wide avenues were realized later in the reign of Haussmann.

*Patte's* (1765) approach was surgical. According to him "the city as a body in varying states of sickness and disease and to be cured by arts of medicine. If the city was to rebuilt in the image of man and the city was exhibiting severe problem, it was no more than a sick body, to be diagnosed and treated as any man" (Vidler, 1991; pp:39) Patte suggested that the streets are the distribution system of cities, if once they infected they need to be a surgeon knife to defeat their illness.

Actually, the notion of city as an organism derived from the modern biology after mid 17th century. The pairing of human organs thought as the elements of urban form. Open spaces like squares are parks were the heart, pumping blood (traffic) through the arteries (the street). (Kostof, 1991) Patte's surgical treatments on the urban forms was similar to the term eventrement that used by Haussmann.

On the other hand, in *Owen's*(1820) proposal the street eliminated or at least transformed into a court.(cloister) According to him "As court alleys lanes and streets create unnecessary inconveniens are injurious to health and destructive to almost all the natural comforts of human life, they will be excluded" (Vidler, 1991; pp:60) He saw the streets of industrial town as the place of every social ill and replace them with cloisters in his ideal scheme.

Olmsted and American Suburbs:

The English picturesque tradition of design strongly influenced American architects and urbanists. Frederick Law Olmsted was one of who criticized the gridiron system for rectangular blocks with overcrowded row houses where poor living conditions went on. "His rejection of grid and the adaptation of the of the curvilinear road and single family house instead crowded row houses was the contrast with the mechanistic order of the urban environment." (Southworth&Ben-Joseph,1996; pp:30) His remedial solution was the suburban development far from the evil of industrial town. Then Olmsted and Vaux designed the first suburb in Riverside Illinois in 1868. (Fig 3.20)

"At Riverside, tree-lined roads, gracefully-curved lines, generous spaces and the absence of sharp corners were laid in deliberate contrast to the prevailing city street grid. Houses were set back at least 9.2 m. with pedestrian walkways on both sides. Trees were planted in a strip between the path and the

roadway, the first time Olmsted systematically carried out this feature in the suburban context. This form of road planting as a physical and visual separator between road and pedestrian that influenced by the Haussmann boulevards" (Southworth&Ben-Joseph, 1996; pp:31)
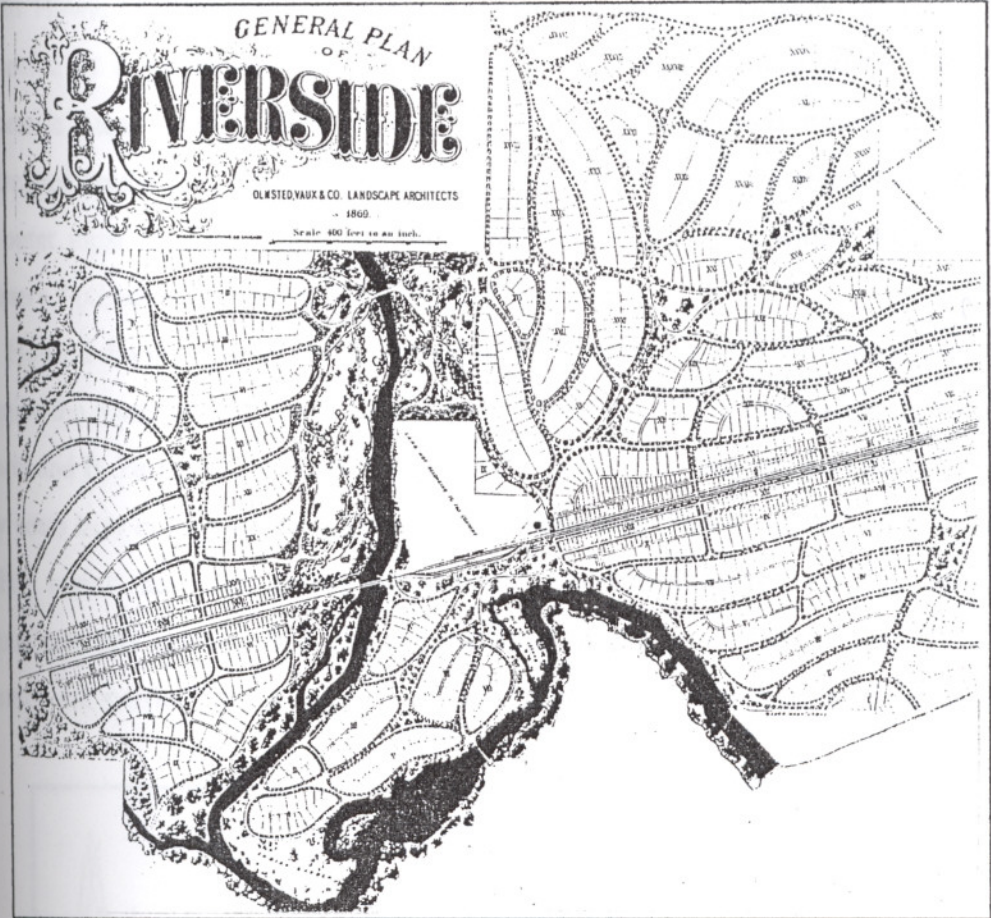


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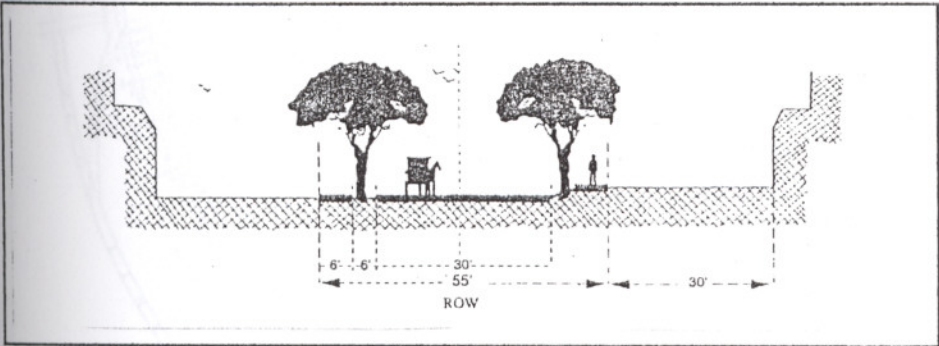


b

Fig. 3.20. Riverside plan (a) and the typical cross-section of the residential street (b), (Southworth and Ben-Joseph, 1996, pp:32)

## Ebenezer Howard and Garden City:

Ebenezer Howard in his book "Garden City of Tomorrow" of 1898 came a new idea of gardencity. In this book, he promise on earth "beauty of nature. Fields and parks easy access. Pure air and water. No smoke, no slums." (Trancik, 1986; pp:51)

In Howard's scheme small circular cities surrounded a circular central city and connected to it by spokes of railroad and to each other by main roads. The radial, concentric plan focused on a central park and was originated around a series of landscaped boulevards and avenues. (Trancik, 1967) "Midway between the center and the outer most circle is a grand avenue, 400 feet (120 m) in width, with trees and greenery." (Giedion, 1967; pp:783) (Fig. 3.21)

Howard did not specify curved streets and cottage houses for the Garden city, but in practice the result was different. Howard's idea was realized in Letchworth (1904) by R. Unwin and B. Parker.(Kostof, 1991) Howard's garden city diagram was partially applied fifty years later in English New Towns and in Greenbelt Towns in USA after world war I. His notion has encouraged the gradual disurbanization of housing prototypes throughout this century. But the original idea of the garden city "where town and country are married" according to Giedion, this was doomed to failure. (Giedion, 1967)



Fig. 3.21. E. Howard's Garden City Diagram, (Trancik, 1986, pp:51)

Arturo Soria Y Mata and Linear City:

The highway engineer Arturo Soria Y Mata designed a linear suburb around Madrid in 1882, which is based on the idea of open but ordered linear growth and on a new active interrelationships between settlement and nature. According to him, "the medieval idea of walled city ought to be replaced by the idea of open and rural city." (Norberg-Shulz,1993;pp:170) "He recognized transportation as an element of the highest importance for city planning. His starting point was the street railway track" (Giedion, 1967; pp:786) A tree-lined boulevard along which ran a private street car was the main component of his proposal. (Moughtin, 1996) The streets of his ideal city was laid out and old grid system but the buildings were placed in isolation from each other. Soria Y Mata's dynamic and interdependent linear city included, in his own words of 1882 "A single street of some 500 m width and of the length that may be necessary (a city) whose extremities could be Cadiz or St. Petesburg or Peking or Brussels." (Frampton, 1992; pp:27) (Fig. 3.22)

According to Rykwert, "there has been a correlative attack by those followers of Haussmann who have subordinated all functions of urban settlement to the street itself, particularly to the street as carrier of traffic. The most extreme of these was the Spanish urbanist Arturo Soria Y Mata." (Rykwert, 1991; pp:15)
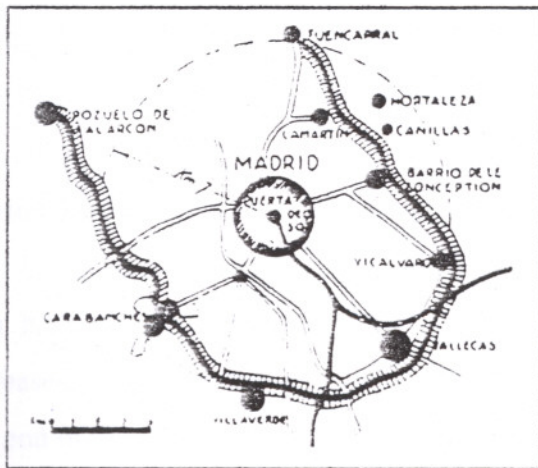


Fig. 3.22. Arturo Soria y Mata's Linear city (Krier, 1979; pp: 78)

<u>Camillo Sitte and Medieval Aesthetic:</u>

"Haussmann's Paris set the style for other European cities of industrial age. Long, wide streets, lined with rows of similar buildings became the prototype which has applied to the old centers." (Erder, 1986; pp:140) The critical reaction to this progress came from architect and urbanist Camillo Sitte.

Sitte was the admirer of Medieval and Renaissance forms. He suggested that the remedy was to be found in a return to methods of the medieval town a way humanizing the contemporary city. (Giedion, 1967)

He offered an image for older cities "as a relatively undifferentiated solid mass with public spaces carved out, a set of designed voids connected by streets, providing a rhythmic choreographic sequence, a continuity of spaces, where the street and square are three-dimensional rooms for public life and public space is the starting point for city design." (Brill, 1989; pp:16)

Sitte was against the street widening because in his opinion it very often had nothing to the with traffic flows but was only a fashionable thing to do. "The ideal street was picturesque, curved instead of being straight, and had to form a completely enclosed unit... Moreover, the winding character of ancient street kept sealing off perspective views in them while offering the eye a new aspect at each succeeding turn..." (Hass-Klau,1990; pp:31)

Sitte had many supporters both in England and Germany. His influences had seen in the later works of Unwin and some German urbanists like Stübben, Henrici and Jansen during the early decades of 20$^{th}$ century.

## 3.6. Streets in the Motor Age

Traffic congestion had become a serious problem after the middle of the 19$^{th}$ century. It further increased by two major inventions: bicycle and automobile. Bicycle developed towards the end of the 19$^{th}$ century. The period, between 1890 and 1895 often referred as the "Bicycle Craze Era." (Southworth&Ben-Joseph, 1996) Then the car invented firstly in Europe in 1885 than became universal after the mass production of Ford's model 'T' in 1907. (Hass-Klau, 1990)

With the rise of the use of automobiles the early protests and discussions against them started. To solve the chaotic use of urban streets some laws, ordinances and regulations were arranged in the early years of 20th century. Most of these laws aimed to limit the development of the automobile. However, invasion of automobile completely changed the economic, social, and political structure of modern society. (Southworth&Ben-Joseph ,1996)

Automobile impacts upon built-up environment were so destructive. Its use changed the road design and its storage changed the design of the houses. Automobile became the powerful tool of urban extension, decentralization and social alienation. Futurists celebrated the advent of automobile. "A roaring car, ratting along like a machine gun is more beautiful than the winged victory of Samothrace." (Kostof, 1985; pp:720)

The rapid rise in number of car-ownership involved better roads which allow the comfortable movement of the cars. Asphalt, the all-purpose street cover, became standard in Europe and United States after 1885. (Kostof, 1992) Better roads brought faster and advanced automobile design, also higher road construction standards.

To eliminate the chaotic street space in urban areas after 1920's many familiar traffic signs today were created. But for many planners traffic regulation was not the solution of the future demands of traffic. New ideas came from utopians' projects which were the early responses of the demand of the motor vehicles. No doubt that, street layouts and road building became the essence of planning and development and a determining factor in shaping the pattern of the environment.

In order to regulate the pedestrians and traffic relationships early solutions of separation of traffic modes were adapted in utopians' plans for large cities in Europe. Majority of these utopic projects included the separation of pedestrian areas and motor traffic routes. One of the first plans, in terms of relieving street congestion, were the underground railways in England in the latter part of 19th century. However, these projects were too expensive to construct. (Hass-Klau, 1990)

Except British ideas to ease traffic congestion by separating traffic in the form of grand arcades, the French developed even more seriously the idea of separating different traffic modes in urban areas. Eugene Henard advocated the multilevel separation of traffic modes in the 'Town Planning Conference' of 1910 in London. (Fig. 3.23)
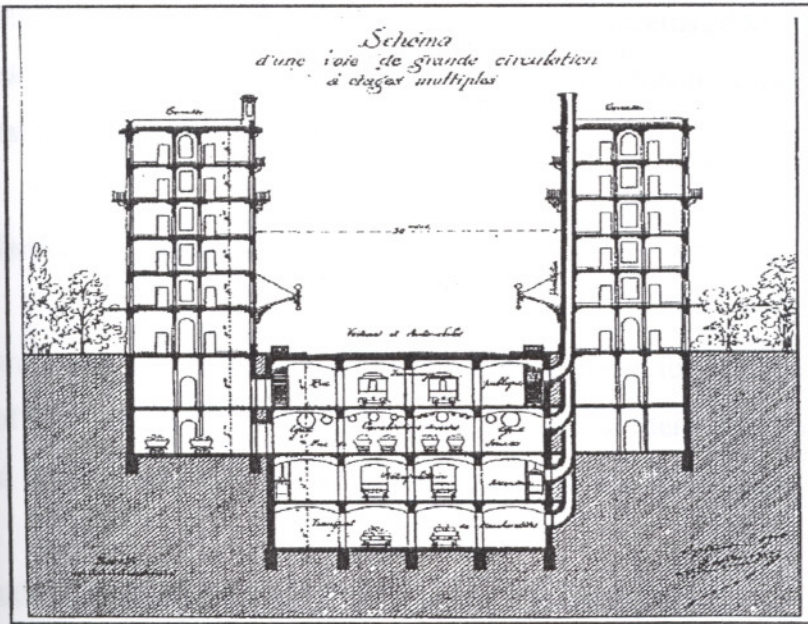
Fig. 3.23. Eugene Henard's multi-level circulation scheme, (Cornell University Planning Archive)

In his point of view it would be possible to have three or four superimposed platforms according to the level of traffic flows. The French idea of separating transport modes into different levels was used in particular during and after 1920's by various designers but significantly by Le Corbusier. (Hass-Klau, 1990)

## 3.6.1. Street Design in 20th Century

The twentieth century has seen the development and widespread acceptance of two major city design manifestos: Garden City Movement and Charter of Athens. According to A.B. Jacobs both were in large measure responses to the building excesses and resultant foul living conditions of the 19th century industrial city. The Garden City Movement became the models of suburban development that emphasized central green areas rather than streets as the means of achieving face-to-face communication and buildings well set back, if possible, divorced from streets. On the other hand, in the Charter of Athens (1933) the rejection of streets as places for people and for the making and expression of community was even stronger in favor of efficiency, technology and

speed. Public health was also one of the most important concerns of Modernist. *The city in the park* notion made streets unnecessary and orientation to street was seen as a fundamental wrong. (Jacobs, 1993)

### 3.6.1.1. Garden City Movement

Howard's and Sitte's ideas became the starting point for various architects and planners of 20th century. Unwin and Parker of England, Stein and Wright of United States and Stübben and Goecke of Germany became the forerunners of garden city manifesto.

British Garden City Movement and Raymond Unwin&Berry Parker:

Unwin and Parker saw the Classical English Village as a model for a community against the inhuman living conditions of industrial city. Village's green, groups of houses and long village street surrounded with clusters of cottages attracted them. (Hass-Klau, 1990)

Unwin found his architectural inspiration in the German town planning principles of Stübben and especially the writings of Camillo Sitte. Unwin and Parker also influenced the ideas of Ebenezer Howard. Howard's statements of "the marriage of town and country" attempted to realize in their design for Hampstead Garden Suburb. Also Parker and Unwin won the competition to design the first Garden City: Letchworth (1904) (Southworth&Ben-Joseph, 1996) According Kostof, Letchworth explored the possibility of a marriage between formal and informal planning, but with clumsy results. (Kostof, 1992) (Fig. 3.24)

In 1906 Parker and Unwin prepared a plan for a garden suburb in Hampstead. In Hampstead Garden Suburb the formal arrangements of elements proposed by Unwin and Parker: stately squares, radial streets, straight avenues. (Kostof, 1992) (Fig.3.25) In 1911, Unwin was convinced that the formal street layout was better: "I believe that with care and imagination beautiful streets can be built on quite formal lines by simply manipulating the building line a little." (Hass-Klau, 1990, pp:59)

Unwin's conception of the street was modern, but not Modernist. He thought street design as an 'art'. In his work *'Town Planning in Practice'* he suggested the mechanics of spatial perception and the requirements of traffic and sanitation as the driving forces

behind of streets. (Kostof, 1992) He interested in to create a series of street pictures (closed vistas) in both Letchworth and Hampstead Garden suburb.
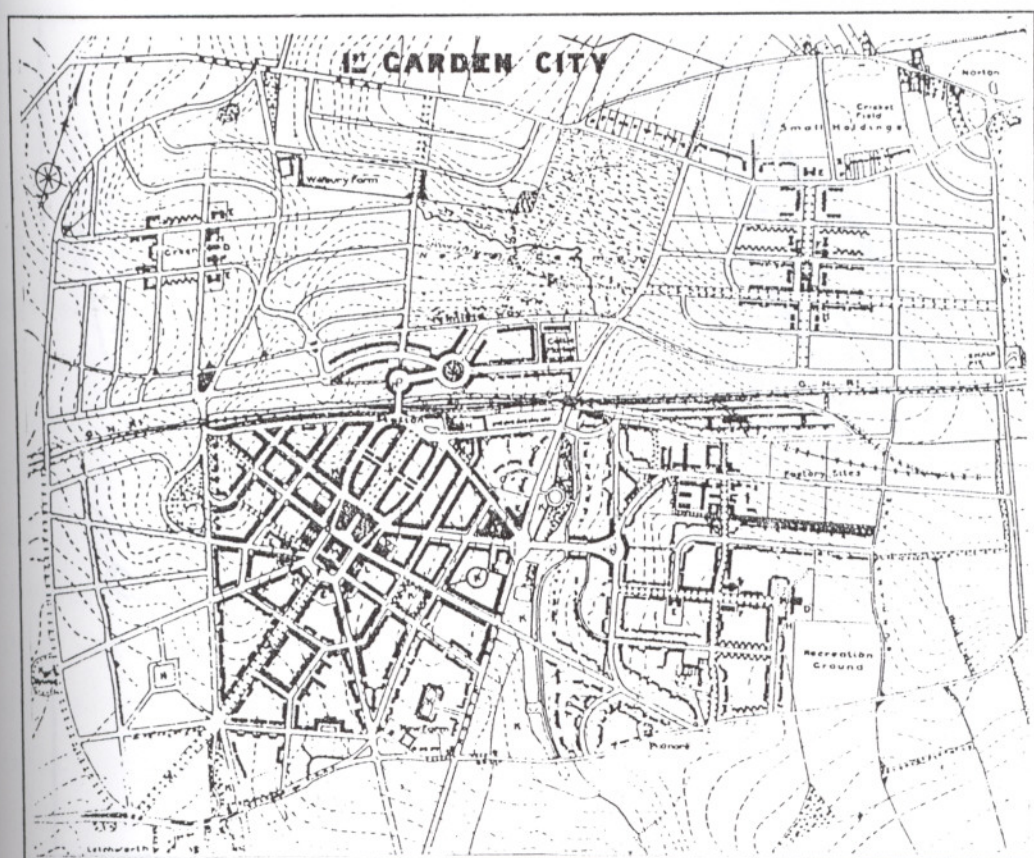


Fig. 3.24. Parker and Unwin's plan for Letchworth,1904, (Southworth 1996; pp:42)

The requirements of motor traffic was entirely alien to the thinking of Unwin. He wrote "the less area given over streets, the more chance one has of planning a nice town" (Kostof, 1991, :77) According to Unwin, if cutting down on the number of the needless streets the more chance could be given to create internal parks and play areas. (Mumford, 1991)

The street layouts designed by Parker and Unwin influenced the most street designs in the coming decades.

German Garden City Movement: Quasi-Romantics:

In the beginning of the 20th century the most important new ideologies concerning the urban environment in Germany was the Garden City Movement or 'Quasi-Romantics'. Quasi-Romantics were to reform the existing urban housing structure,

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where as the Garden city representatives were not interested in this aspect. The ideas of these group were strongly influenced by Camillo Sitte.
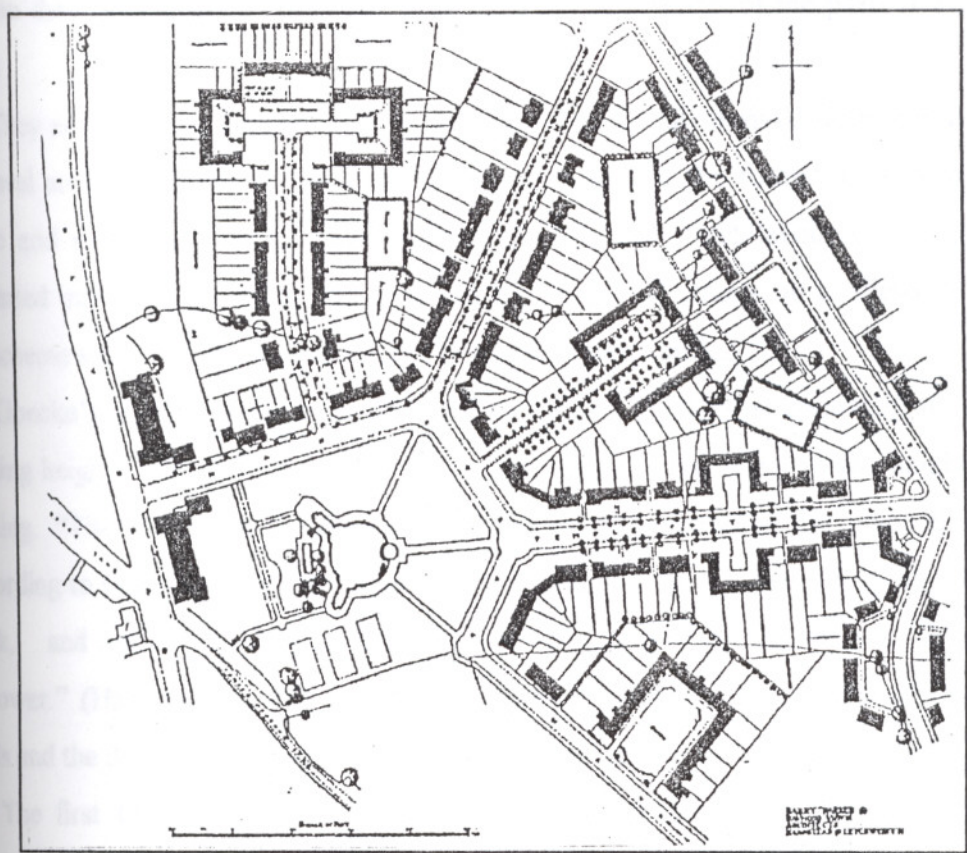


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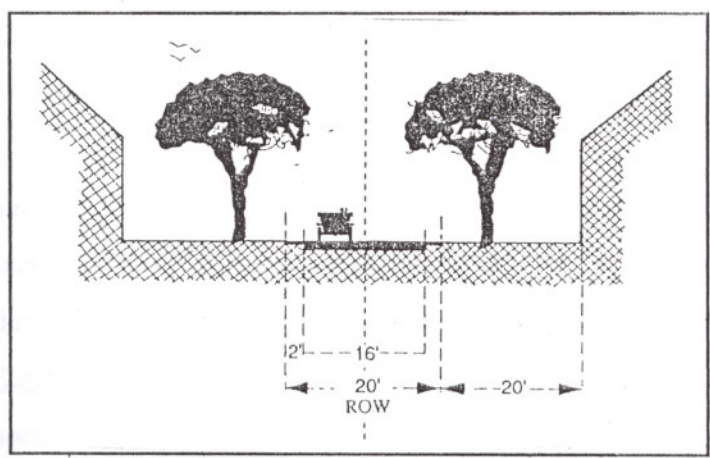


b

Fig. 3.25. Hampstead Garden Suburb plan(a) and a typical street cross-section (b),1907, (Southworth and Ben-Joseph, 1996, pp:44)

Quasi-Romantics, Theodor Goecke, Walter Curt Behrendt and Hermann Jansen, aimed to ensure open green space, healthy living environment and many new modern aspects of urban planning, such as land-use plans, building at different heights. According to them they would all be combined with some romantic ideas of the past. (Hass-Klau, 1990)

They advocated a categorization which was ideologically derived from and idealized medieval street network. In 1893, Goecke argued against the formal division between traffic and residential streets. According to him formal street layout could easily be converted into a traffic street. He designed his residential streets on medieval lanes. In this scheme some residential streets contained no vehicle traffic.

Goecke's main idea was to develop urban housing blocks that consisted of different building heights. His principle was to relate the width of the street to the height of the building. "The lower the height of the buildings the narrower the planned roads." According to Goecke "a traffic street would surround a four or five storey-high housing block, and inside the block, the buildings would become lower and the streets narrower." (Hass-Klau, 1990; pp:65) In Germany narrow street widths of residential roads and the designing of footpaths were largely influenced by Sitte and Goecke.

The first German garden city was applied in Hellerau near Dresden. In 1906, Richard Riemenschmid who was an admirer of Sitte took over the overall planning and construction started in 1909. In his overall street plan Sitte's influence was more evident. After that, another garden suburb, Falkenberg, designed by Bruno Taut in Berlin in 1913.(Fig. 3.26) In contrast to Hellerau, Falkenberg had much straighter streets. (Hass-Klau, 1990)

As in Britain, in Germany, new street designs were developed by supporters of Garden city society and the Quasi-Romantics. The works of Herman Jansen will be discussed later due to the importance of first Turkish planned city: Ankara.

Radburn Street Layout and American Experience:

In many respects street planning in United States was not so fundamentally different from the European examples. But in USA since number of automobile and use was much higher a new street layout design idea which includes protection of pedestrians from the flood of motor traffic came from this country: Radburn Street Layout.

Before Radburn, a group of planners and architects in USA founded the Regional Planning Association of America (RPPA) in 1923. It included the urbanist such as Lewis Mumford, Clarence Stein, Henry Wright, Catherine Baure, Alexander Bing and so on.



Fig.3.26. Plan of the Falkenberg Garden Suburb, Berlin, 1913, (Hass-Klau,1991; pp:68)

The RPPA believed in the garden city principles and the ideas of their members were closest to concepts of some of the most important British and German planners. In regional context, garden cities were seen as the main settlement forms of America by the RPPA.(Hass-Klau,1990)

The RPPA was strongly in favor of anti-urban development against the gigantic metropolis. Most of the members were influenced by Unwin's anti-car thinking in urban areas they wanted to protect community life from the adverse effects of cars.

One of the first practical achievements of the RPPA, as Hass-Klau pointed out, was the formation of a private company: the City Housing Corporation formed in 1924. (Hass-Klau,1990)

The City Housing Corporation started with Sunnyside, New York and after the financial success of Sunnyside, Radburn project was launched. The Corporation chief

architects, Clarence Stein and Henry Wright, designed Radburn (1928) after Sunnyside. Stein and Wright succeeded to adapt the garden city principles into their projects that can respond to American living conditions and growing use of automobile. Stein saw Radburn a reaction to the American metropolis:

"The automobile was a disturbing menace to city life in the USA. The flood of motors had already made the gridiron street pattern, which had formed the framework for urban real estate for over a century as obsolete as a fortified town wall... The checkerboard pattern made all the streets equally inviting to through traffic. Quite and peaceful repose disappeared along with safety... Parked cars, hard gray roads and garages replaced gardens. Radburn's design was a reaction against traffic and impact of cars on residential living and as such it had to accept the role of suburb rather than that of a garden city." (Southworth&Ben-Joseph, 1996; pp:63)

Radburn contained a new street layout and hierarchy. It consisted of four level street hierarchy:

- "service lanes for direct access to buildings,
- secondary collector roads around the housing blocks,
- main through roads, connecting the various neighborhoods and districts,
- Express highways or parkways to provide inter-urban transport links." (Hass-Klau, 1990; pp:105) (Fig. 3.27)

In Radburn, pedestrians and cars were separated by overpasses and underpasses. As Stein pointed out, none of their ideas was specifically original. Their road system hierarchy was derived from Olmsted's route separation in New York's Central Park. Also some of the ideas were borrowed from Europe. Several authors and Stein himself suggested that Parker and Unwin's street layout was inspired in Sunnyside and Radburn's designs. The use of cul-de-sacs in Radburn was largely coming from the English tradition. (Southworth&Ben-Joseph, 1996) (Hass-Klau, 1990)

In terms of pedestrians, Radburn scheme ensured pathways leading to the continuos park strip opened to large common open spaces within the center of the superblock. Traffic roads and pedestrian walks was strictly separated.

Due to the impacts of 1929 economic crisis Radburn project not fully completed. However, Radburn recognized the car's presence. It was "The Town of Motor Age".

Radburn's residential character and street access systems have been a prototype of sound community in many notions ever since. (Eisner at al., 1993)



a
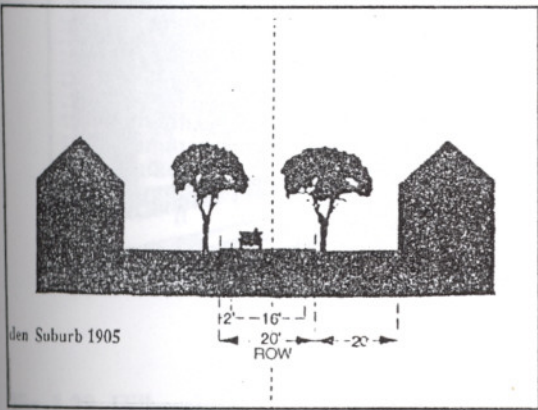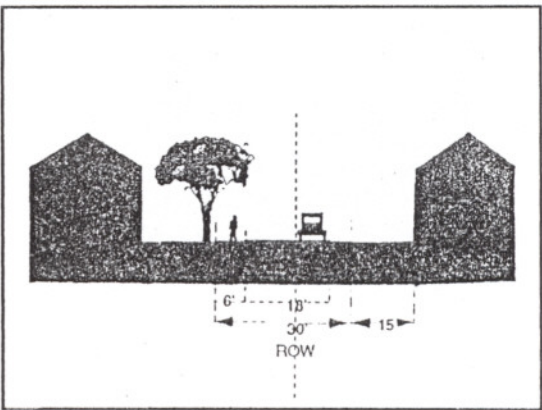


den Suburb 1905

b                                                    c

Fig. 3.27. Radburn plan (a) and the comparison of street sections of Hampstead Garden Suburb (b) and Radburn (c),  (Southworth and Ben-Joseph, 1996; pp:63)

### 3.6.1.2. European Modernism

European Modernist architects found traffic protected superblocks the key to creating their ideal cities. Famous architects and urbanists such as Le-Corbusier, Walter Gropius, Ludwig Hilberseimer and their followers saw the automobile and technology as the forces that would shape the new modern city. They rejected the traditional and historic patterns and worked on a new scale which emphasized speed, movement and efficiency with a strict separation of cars and pedestrian. This was, with Le Corbusier's words, "the machine-age revolution". (Southworth&Ben-Joseph, 1996; pp:71)

In 1920's, some German urbanists, such as Hilbersiemer, Scheibe and Hegemann, thought the idea of elevated footways as a best solutions. Ludwig Hilbersiemer represented his ideal city in this decade. (Hass-Klau, 1990) In his ideal city, high-rise building was in straight, parallel rows. Traffic system of streets rigidly separated. Ground was reserved to the cars and pedestrians was on the platforms which connect to the blocks each other. (Trancik, 1986) (Fig. 3.28)
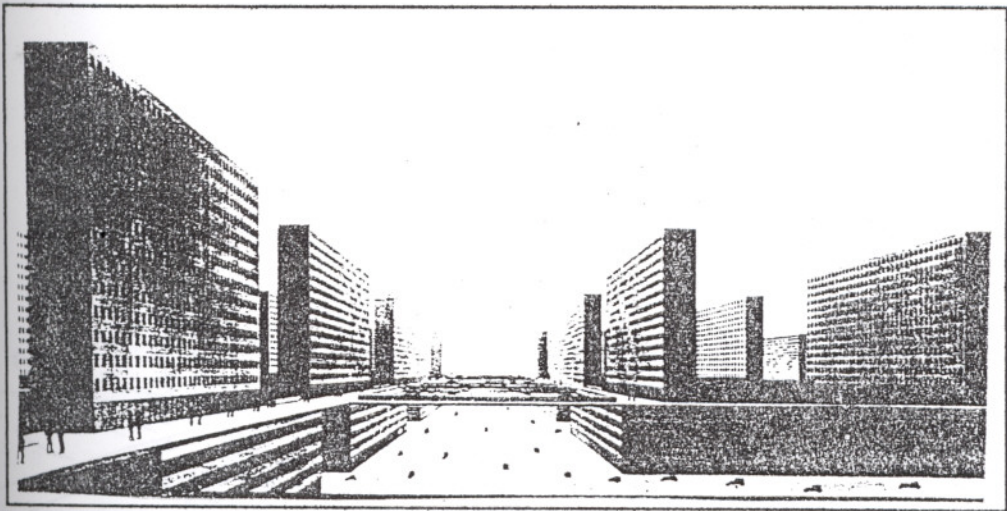


Fig. 3.28. Hilbersimer's ideal city in 1920s, (Trancik,1986, pp:23)

But the radical changes in urban pattern came from Le Corbusier who is the famous architect of French urban design movement and one of the creators of functionalist design program. There were three important principles behind Corbusier's influence on

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modern urban space: "First, the linear and nodal building as a large scale element; second, the vertical separation of movement systems and the third was the opening up of urban space to allow for free-flowing landscape, sun and light." (Trancik, 1986; pp:27)

According to Le Corbusier, traditional city could not be the body of fast moving traffic. "A city made for speed is made for success" he claimed, and recognized the presence of automobiles in his street picture. Segregated street systems and auto-oriented design was applied by him in "A Contemporary City for Three Million People" of 1922. In this project the city is bisected by elevated highways for fast traffic, 40 m wide; other main roads cut across the grid. (Fig. 3.29) Between them, the ground is reserved for pedestrians. In many ways this project was the polar opposite of Unwin's ideal town.
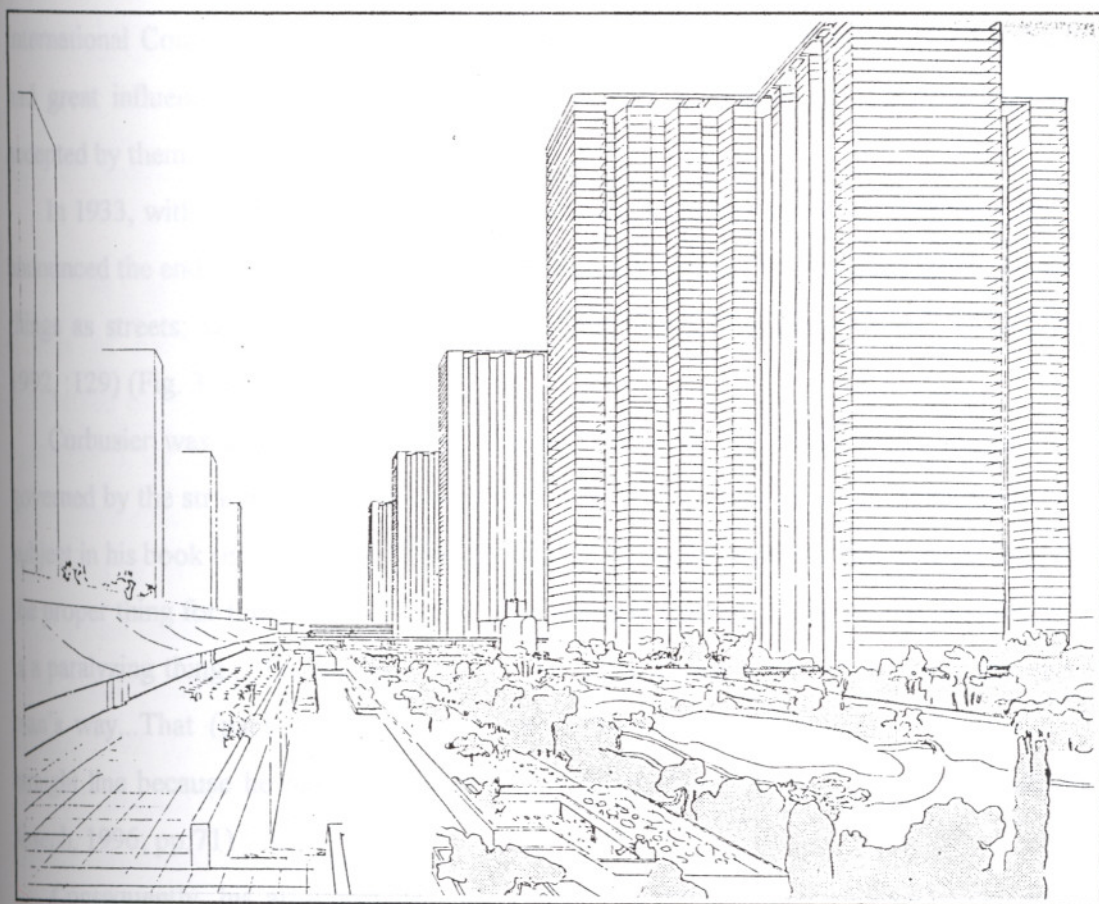


Fig 3.29. A contemporary city for 3 million inhabitants, (Trancik, 1986; pp:29)

All traditional formulas of streets were rejected by Corbusier. According to him "streets in narrow trenches walled in by seven-storied buildings set perpendicular on the pavement and enclosing unhealthy courtyard, airless and sunless wells..." and he proposed instead "great blocks of flats opening up on every side to air and light, and looking, not on the puny trees of our boulevards today, but upon greensward, sport grounds and abundant plantations of trees. This means the isolation of buildings from the street lines." (Kostof, 1992; pp:233)

Le Corbusier's vision of this new streetless urbanity was also ignored the features of street as an environment for their inhabitants. The street turned out to be the channels for traffic. As Hass-Klau pointed out, he had little time for the needs of the pedestrians. His cities were places for motorists who could drive at high speed and not be held up by any traffic congestion. (Hass-Klau, 1990)

Corbusier's term "machine age revolution" was launched in 1928 with the first International Congress for Modern Architecture (CIAM) in Switzerland, Le Corbusier had great influence on the members of CIAM and his vision of streetless city was accepted by them.

In 1933, with the publication of his project "La Ville Radieuse" or Radiant City, he announced the end of streets. "Streets are an obsolete notion. There ought not to be such things as streets; were have to create something that will replace them." (Moughtin, 1992, :129) (Fig. 3.30)

Corbusier was against the organic pattern. For him, the modern city ought to be governed by the straight line for efficient traffic circulation. He gave the examples in this subject in his book on Urbanism: "The circulation of traffic demands the straight line; it is the proper thing for the heart of the city. The curve is ruinous, difficult and dangerous; it is a paralyzing thing... The winding road is the 'Pack-Donkey's way' the straight road is man's way...That (pack-donkey's way) cannot to be way of humans. Man walks in straight line because he has a goal and knows where he is going." (Southworth&Ben-Joseph, 1996; pp:71)

Consequently, his argument of 'man walks in a straight line' required right angles streets set at right angles to one another. (Kostof, 1991) If the analogies of the machine and the right angle were applied to the ordering of exterior space, the resulting grid could be used us a method for eliminating accidental and juxtapositions. On the other

hand, Le Corbusier and most of the functionalists tended to use grid as means of segregating activities into defined zones. (Trancik, 1986)
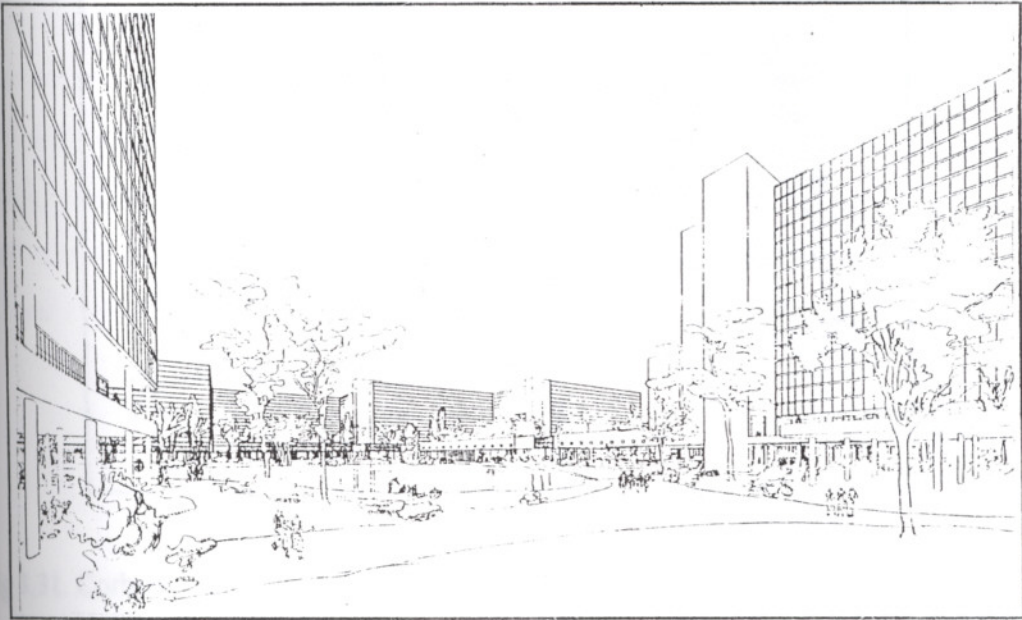


Fig 3.30. A perspective from La Ville Radieuse (Trancik, 1986; pp:29)

In 1947, his unite d'habitation (large residential unit) at Marseilles he brought the concept of rue interieure or interior streets. Two types of interior streets were categorized as $V_5$ and $V_6$ in his seven level road hierarchy. Le Corbusier's universally applicable '7 Vs" had seven different road types: "$V_1$ is a regional thorough roads; $V_2$ a major urban road; $V_3$ a road for motor traffic only, without sidewalks; $V_4$ the traditional main street of shops and daily life; $V_5$ a minor street branching off toward housing; $V_6$ either a path leading to the house door or the interior street of an apartment block; and $V_7$ is a path leading through linear parks, containing schools, sports grounds etc." (Kostof, 1992; pp:237) (Fig. 3.31)

Le Corbusier dominated modern architecture in the period from 1920 to 1960. He brought anti-street concept at the scale of urban design. Later on his ideas were criticized by later modernists, sociologists and younger generation of urbanists.
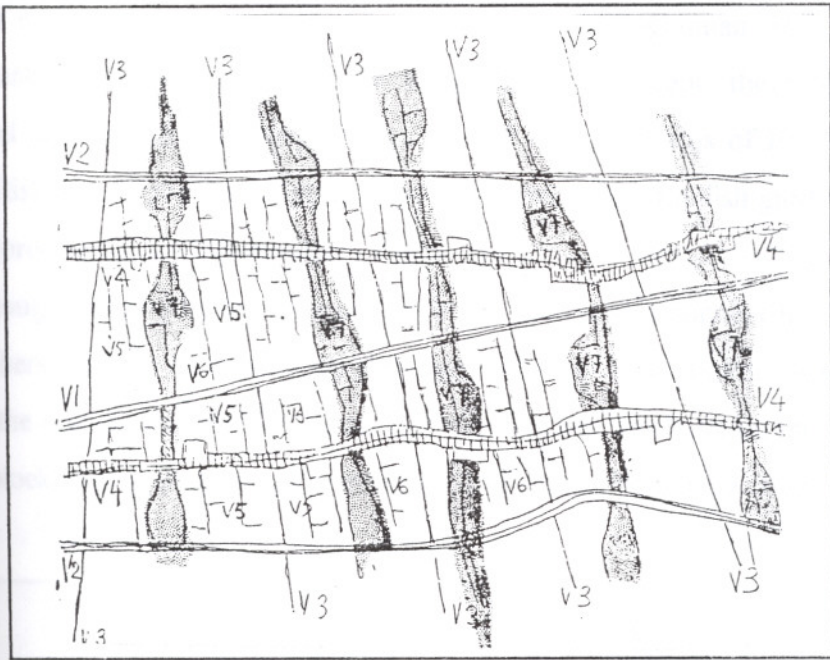
Fig 3.31. Corbusier's "7 Vs", (Kostof, 1992; pp:237)

### 3.6.1.3. Critics of Modernist Street

In the 1950s CIAM's preoccupation with function, structure and standardization were criticized by a young group of second generation European modernists, especially the English members of CIAM. Alison and Peter Smithson, Jacob Bakema, Aldo Van Eyck and several others formed "Team 10" in order to re-establish the human needs and activities in space. The key word in their vocabulary was humanism. (Trancik, 1986)

They were in favor of large-scale developments and order, to create a sense of place used edge-defining perimeter walls, cluster blocks and the concepts of pedestrian net over the street net or streets in the air. (Trancik, 1986)

Team 10 tried to rehabilitate the street as a part of community design. According to the Smithsons, "The street is not only a means of access but also an arena for social expression." (Gutman, 1991; pp:252) Their aim was to replace of emphasizing three dimensional quality of street instead of two dimensional modernist street grid and also believed the importance of defining street as a multi-use space. However, their analysis led to the Corbusier's notion of streets-in-the-air. For Golden Lane housing projects the Smithsons wrote "The principal of identity we propose is the basis of Golden Lane

Project a multilevel use of residential *streets-in-the-air*." (Gutman, 1991; pp:252) This project unbuilt and failed to success. Because, as a concept, the multi-level use of residential streets was not acceptable within the cultural norms of British society. For ages, British idea of residential street was fully devoted the English garden city tradition and anchored to the land. (Moughtin, 1992)

Although the Smithsons were never able to realize this concept in large-scale built work, others did. For example, Candilis-Josic and Woods at Toulouse-Le Mirail (1962) realized the organic city building process. Street system was basis on the linkage theory. Cluster blocks and pedestrian net were applied. (Kostof, 1991) (Fig. 3.32)



Fig. 3.32. Toulouse Le Mirail, France, (Kostof,1991, pp:90)

Idea of multi-level use and streets-in-the-air was reflected to North American cities as *elevated pedestrian circulation systems*. In Houston, Toronto and Montreal especially in commercial areas took the form of network of subsurface passages and skyway

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systems. However, these examples brought the privatization of public space against the street as the primary place for social interaction. The controlled environment of American skyways criticized due to the class and ethnic segregation. The walkways were generally used to connect office, hotels and department stores along a corridor which surrounded by shops. They were not fully public and not a true alternative to the street network. (Kostof, 1992)

Another attack to CIAM and modernist street came from the sociologists significantly by Jane Jacobs in United States. As Moughtin states, she is a great apologist for the street. According to her, "Streets and their sidewalks, the main public places of a city, are its more vital organs. Think of a city and what comes to mind? Its streets. If a city's streets look dull, the city looks dull" (Moughtin, 1992; pp:130) She saw the dangers of modernist anti-street notion. The publicly unowned spaces between blocks were the main generators of the crime. According to her, in order to create a safe environment, "there must be eyes upon the street, eyes belonging to those we might call the natural proprietors of the street... and the sidewalks must have users on it fairly continuously, both to add to the number of effective eyes on the street and to induce people in buildings along the street to watch the sidewalks in sufficient numbers." (Moughtin, 1992; pp:130) Similar ideas can also be seen in Oskar Newman's Defensible space.

After 1960's New Rationalism headed by Aldo Rossi of Italy, Ricordo Bofill of Spain, Leon and Rob Krier of Luxembourg. The Kriers' main mission was to reconstruct the traditional urban block as the definer of streets and squares. The formula for Krier's reconstruction of the European city was : "A city can only be reconstructed in the forms of streets, squares, and quarters. The street and squares must present a familiar pattern. Their dimensions and proportions must be these of the best and most beautiful pre-industrial cities." (Ellin, 1996; pp:17)

According to R. Krier, modern movement is so limited in their scope and so lacking in substance that they lost all credibility in a very short period of time. Early Modernists were often considered the planning of urban paths in regional context and lost the human scale in space. The Kriers defended the poetic content and aesthetic quality of space. They also suggested that the real public open space elements; streets and square, were

omitted in the modernists' regional context. The integrity, uniformity and continuity aspects of the traditional streets were not taken into consideration.

The Kriers and their followers were fully recognized the importance of historic street concept within the modern city. Rob Krier, in his work Urban Space, wrote: "The asphalt carpet which serves as a channel for the movement of cars is still called a street. It retains no connection with the original significance of the term. Certainly the motorized transportation of people and goods is one of the primary functions of the town, but requires no scenery in the space around it." (R.Krier,1979; pp.22)

### 3.6.1.4. The Return to the Street

Early modernism years, the 1920's and 1930's, "death of the street" was declared by the masters of the Modernist Movement. Le Corbusier exclaimed "To breathe-To live! Homes to inhabit. The present idea of the street must be abolished: DEATH OF STREET! DEATH OF STREET!" (Southworth&Ben-Joseph, 1996; pp:72) But 1960's and 1970's were recognized the return of the street.

Urban design theory since the 1960's proposed the changes includes providing a more human scale, offering more personalized and personalizable living space, and adding visual interest to the landscape. "The concerned efforts to create quality public space has also produced some welcome result. In many instances, the return to the street from the shopping mall has been successful in bringing a vitality back to street life." (Ellin,1996; pp:164)

The early efforts in favor of non-car users was the *pedestrianization*. In post-war decades city planners had attempted to transform business streets into pedestrian thoroughfares. These projects were successfully adapted across Europe but especially in Germany. (Kostof, 1992)

In the post-war period pedestrianization started quickly in Germany, but was in modest scale. In these decades some successful examples of traffic-free routes were occurred in Nuremberg and Munich (1963). Between 1960-1966 in Germany, there were 63 pedestrianized street but was no other policy to restrain the traffic. (Hass-Klau,1990)

Another well known example is Stroget which is the busiest pedestrian street of Copenhagen. The development plans of 1950's and 1960's created a mass transit

network which encircles Copenhagen's central areas. This create a public transportation network which is connected to Stroget by trams and street cars. This allows people to commute into the city's CBD without the use of automobiles and encourages the re-arrangement of Stroget as a pedestrian street. Also this efficient mass transport system helped to preserve Copenhagen's medieval center character. Stroget works because it is located in densely populated area; has close access to mass transit; major urban spaces are scaled at a pedestrian level and has a pedestrian based culture. In this case, in contrast to commercial interests, general thought the decrease of private car use in the center has brought an improvement for business. (CLIP, 1997) (Fig. 3.33)
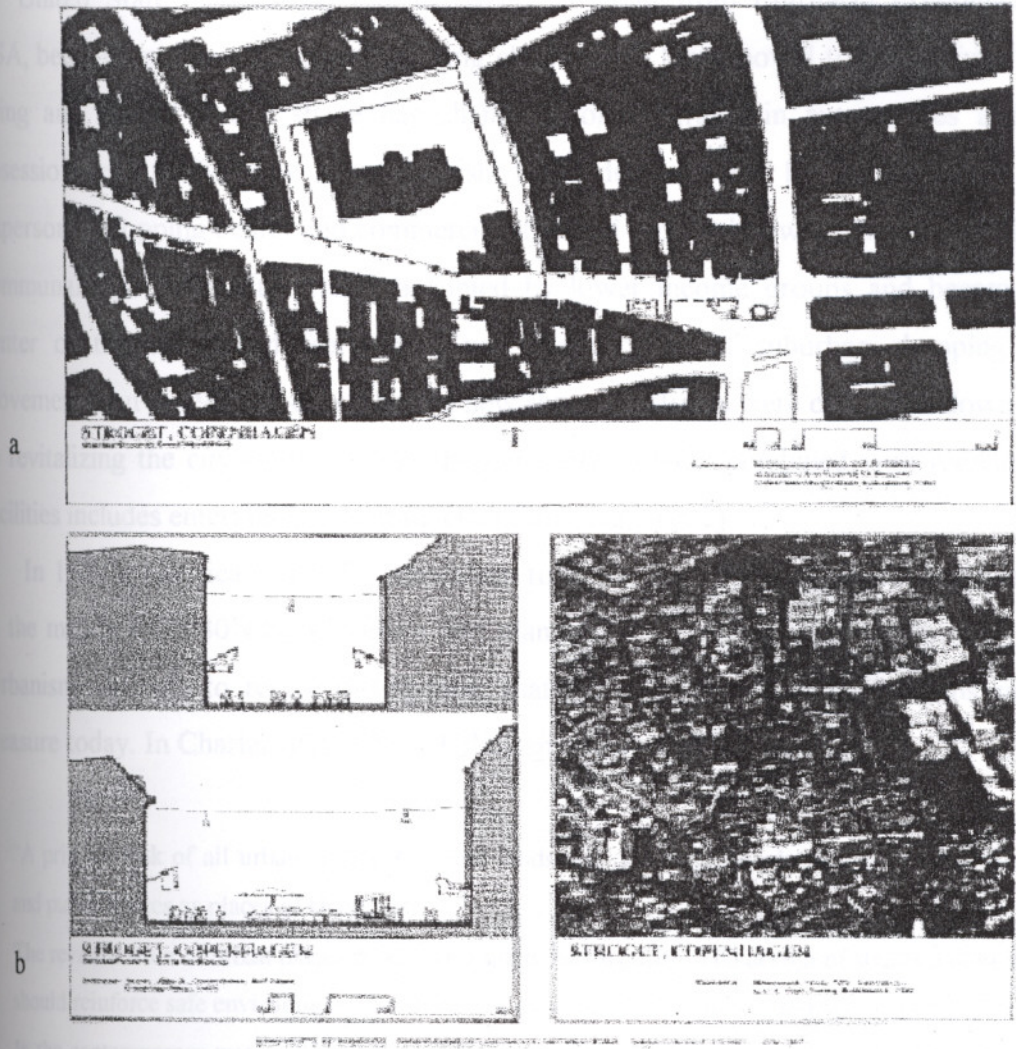


Fig. 3.33. Stroget, Copenhagen's main pedestrianized street plan (a), street sections and aerial- view of the site (b), (CLIP, 1997)

The new style of pedestrianization was launched in Germany with Munich Olympic Games in 1972. This project supported the larger pedestrianized areas. In major German cities large-scale pedestrianization was combined with an effective mass transit system that was seen as crucial. Public transport would ensure accessibility into the heart of the city. This concept was supported with large car parking facilities in close proximity of the city center and improved roads. (Hass-Klau, 1990)

The most important development in favor of residents and pedestrians was improvement of Dutch Woonerf concept and area-wide traffic calming policies gaining importance after 1980's all over the world. The background of these approaches will be examined in following chapters.

United States experience was extremely different from European experience. In USA, because middle classes and working class people have moved to the suburbs their living and use of public space has changed isolated travel in automobiles and the obsession with traffic flow have diminished and degraded the life of the street. The impersonal shopping center and commercial strip had replaced downtown as a setting for communal life. Inner city streets occupied by lower income groups and became the center of the crime and fear.1950's was the decades of suburban shopping mall movement. But in 1980's pedestrianized new shopping streets were created in downtown to revitalizing the city center. These shopping streets were combined with recreational facilities includes entertainment, eating etc. (Carr at al., 1992)

In 1980's American Neo Traditionalism took the lead. New Urbanism has founded in the middle of 1980's by architects and planners in California and Florida. The New Urbanism attempts to revive the features that make pre-World War II towns such a treasure today. In Charter of the New Urbanism, new urbanists wrote:

- "A primary task of all urban architecture and landscape design is the physical definition of streets and public spaces as places of shared use.
- The revitalization of urban places depends on safety and security. The design of streets and buildings should reinforce safe environments but not at the expense of accessibility and openness.
- In the contemporary metropolis, development must adequately accommodate automobiles. It should do so in ways that respect the pedestrian and the form of public space.

• Streets and squares should be safe, comfortable and interesting to the pedestrian. Properly configured, they encourage walking and enable neighbors to know each other and protect their communities." (CNU, 1997)

They are also against the general street layout of traditional American suburbs. All streets were made as wide as possible because the zoning ordinance and traffic engineers whose concerned solely with the movement of cars and trucks. According to Kunstler, "In the new urbanism the meaning of street as the essential fabric of the public realm is restored. The space is created understood to function as an outdoor room, and building facades are understood to be street walls." (Kunstler, 1996)

The founders of New Urbanism, Andres Duany and Elizabeth Plater-Zyberk developed the Traditional Neighborhood Development ordinance (TND) which is set of principles against the encroachment of the automobile on pedestrian territory. (Kostof, 1992) TND ordinances included revolutionary ideas in street network, pedestrian network and street sections and layout for American suburbs. Firstly Seaside Florida was designed by Duany/Plater-Zyberk and after the success of this project the others followed. (Fig. 3.34) Advocators of new urbanism largely profited from area-wide traffic calming policies and adapted the most calming devices in their projects.
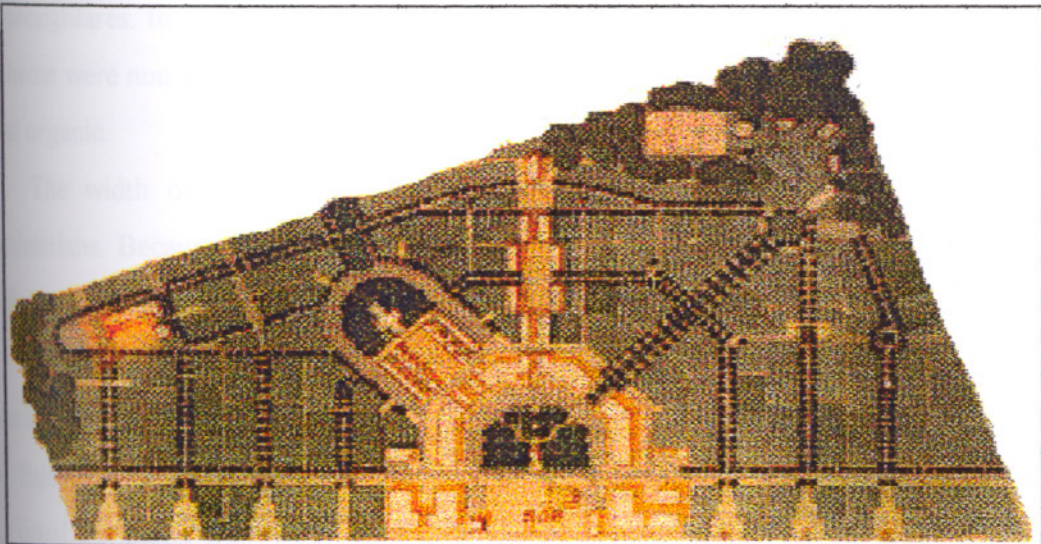


Fig 3.34. Seaside Florida, (DPZ Homepage, 1998)

## 3.7. Brief History Of Turkish Streets

Throughout the history, Anatolia has become the center of numerous cultures and civilizations from the Bronze Age settlements to Hippodamus's Miletus, from Selçuk and Ottoman towns to Modern Turkish cities. Selçuk and especially Ottoman settlements in Anatolia, evolved under great influence of Islam culture.

In traditional Islam city, the city is organized along a spatial continuum ranging from private, semi-private/semi public to public space. In the case of Islam settlements while main thoroughfares is public residential cul-de-sacs emphasize the semi-private or sometimes private characteristics. The excess of the dead end streets in the city is associated with the various ethnic and religious groups. These groups tend to isolate their neighborhoods to the other ethnic groups. In some cases property owners along the cul-de-sac could close the entry of the street with the gate in terms of absolute privacy.

The Islamic principle of privacy of women was also another significant factor in the formation of the neighborhood structure. The search for the maximum segregation of individual houses within a dense urban setting led to the organization of residential pockets around cul-de-sacs which acted as semi-private paths. (Çelik, 1993)

Religious reasons had great impact upon medieval Ottoman settlements. Mosque and marketplace were in the core of the city and placed at the crossroads of the main thoroughfares. In Ottoman city forms influences of Hellenistic and Roman gridiron plan scheme were non-existent. The evolving process of the city was completely spontaneous and organic.

The width of the street was suited to the crossing of the pack-animals and pedestrians. Because horse-carts were not used till the end of 19$^{th}$ century due to the religious beliefs street widths were relatively narrow. (Fig. 3.35)

According to a research comprises West Anatolian streets between 17th. and 19th. century indicates such results;

• Buildings have direct relationships with the street. Encroachments to the street is usual. Perimeter walls of the inturned houses surround the street.

• Overhangs of the buildings generally very close to each other which shelter passer-by from the rain and torrid sun and creates the passage effect.
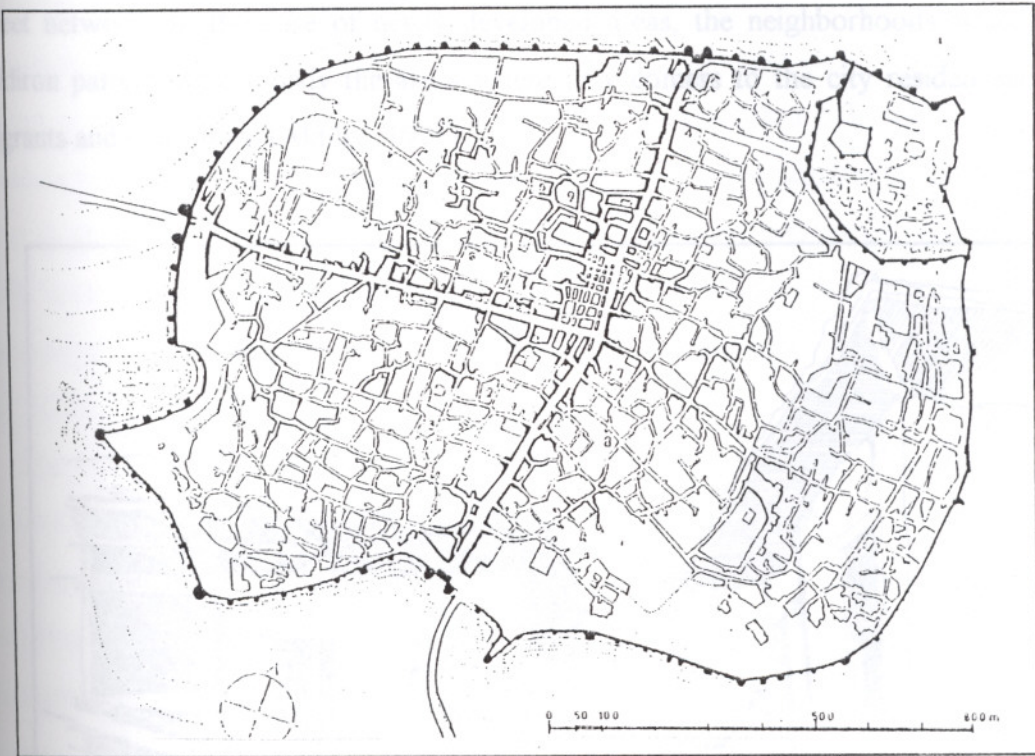
Fig. 3.35.Historic core of Diyarbakır, (Kuntay, 1996; pp:9)

- The stones of the street, adjacent to the building and garden walls, are larger. This large stones can be thought as sidewalk on which the pedestrian walk.
- Ground floors of buildings along the street are reserved to the storage, stable and such uses. The interaction with the street begins after eye-level.
- Drainage channel which collect the rain water is located according to axis of the street.
- Streets are not intersects each other at right angles. In steepy sites instead of stairways zigzag paths were used due to the ease of horse-cart access.
- The variations in street width continue throughout the street. Street lengths are also not too long due to the crumpling and curves. (Tosun, 1983; pp:85) (Fig. 3.36)

At the end of the 19th century we see the transformation of central functions and residential areas of Anatolian cities as a result of changes in socio-economic structure, relative high densities, new mode of transportation both regional (railroad) and urban road (horse-cart) scales and the differentiation of urban land uses. The use of horse-cart and some other changes brought geometrical gridiron pattern which was used as the

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street network. In the case of newly developed areas, the neighborhoods which had gridiron pattern were mostly the areas where new comers to the city resided such as migrants and minorities. (Aktüre, 1978)
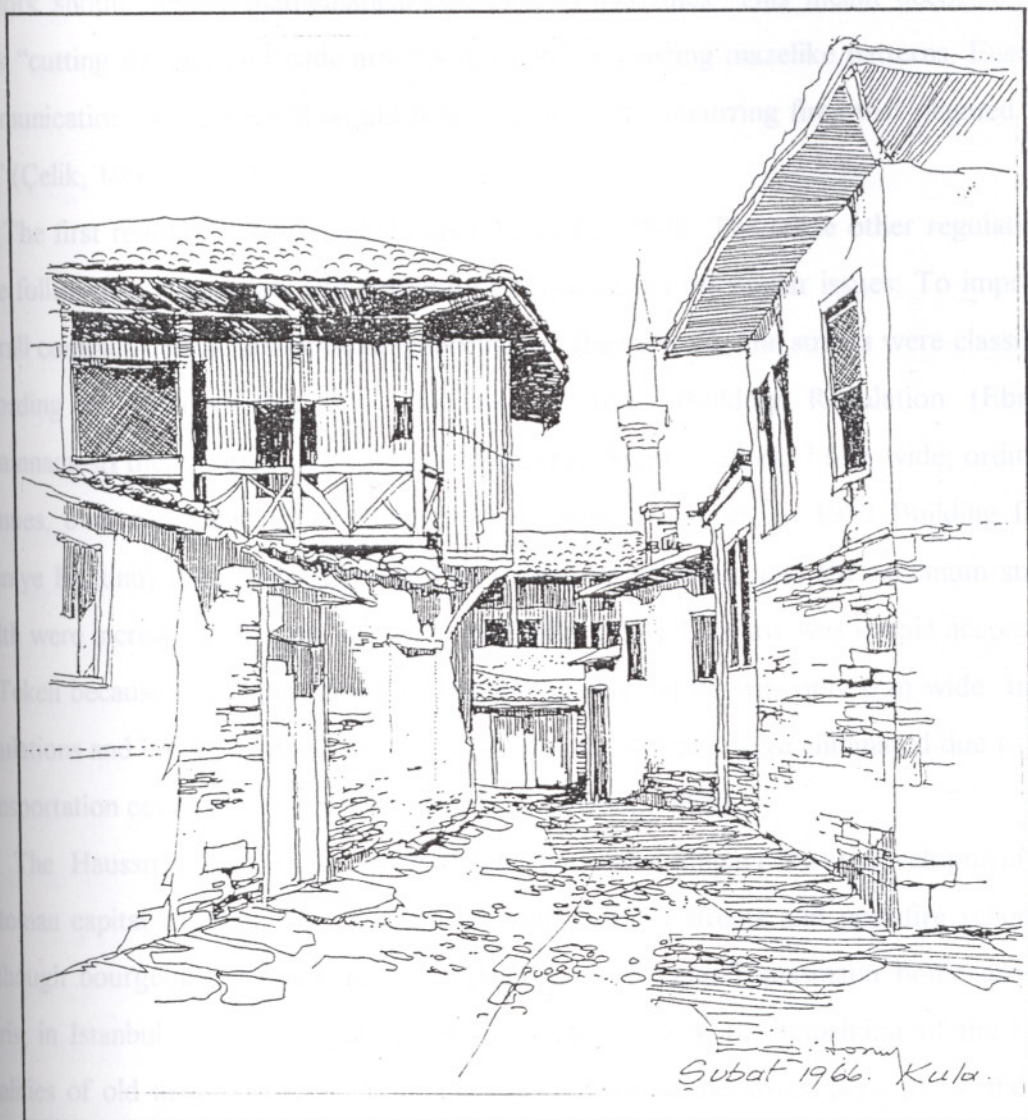


Fig. 3.36. A street perspective from Kula, (Tosun, 1983, pp:132)

The institutional reforms set in motion by the declaration of the Tanzimat Charter found their extensions in the built forms. The result was the transformation of classical Ottoman-Islamic urban image and the adaptation of elements and form of Western models. The new urban design philosophy came as part of the Tanzimat Reform package. In the background of the Western style urbanization there was the great

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influences of some bureaucrats whose diplomatic missions were in important western capitals such as Paris, Vienna and London. For instance, Mustafa Reşit Paşa, one of the authors of Tanzimat Charter, had grown to admire the European cities and wanted to Ottoman capital to meet their standards. He argued that the regularization of the street network should follow mathematical and geometrical rules. This meant according to Çelik "cutting straight and wide arteries through the existing mazelike patterns. Ease of communication thus achieved would help to control the recurring fires that plagued the city" (Çelik, 1993; pp:49)

The first regulation for Istanbul was prepared in 1848. The some other regulations were followed it. These law and regulations concentrated on similar issues: To improve overall communication and citywide uniformity in the network, the streets were classified according to their widths. For example, in 1848 Building Regulation (Ebniye Nizamnamesi) there were three category of streets: Main avenues, 7.6 m wide; ordinary avenues, 6 m wide; and other streets, 4.5 m wide. However, in 1882 Building Law (Ebniye Kanunu) there were five-category street classification and the minimum street width were increased from 4.5 m to 7.6 m (Çelik, 1993) This law was utopic according to Tekeli because the widest street of Istanbul in this period was only 6 m wide. In all regulations and laws between 1848 and 1882, the cul-de-sacs were eliminated due to the transportation concerns and the danger of fires. (Tekeli, 1996)

The Haussmannization of Europe had particular impact on redevelopment of Ottoman capital especially in the form of wide uniform streets and post-fire schemes. Although bourgeoisie moved into the spacious flats lining Haussmann boulevards in Paris, in Istanbul no such displacement were made due to the remaining of the basic qualities of old neighborhoods. With the opening up of the street network in the re-planned neighborhoods and especially the eliminated of dead ends the street lost their semi-private character and became thoroughfare. The building regulations of Istanbul was extended to the other Anatolian cities towards the end of the 19th century. (Çelik, 1993)

Ankara, center of the War of Independence, took the lead after the establishment of new Turkish Republic in 1923. Western style urbanization beginning with the redevelopment of Istanbul and continued with the making of new capital Ankara. The new capital would be the model of the new social life in the direction of contemporary

western standards. This physical environment and social life would also reflect the ideology of young Turkish Republic would be the model in the development of other Turkish cities.

Between 1923 and 1927 there was a chaotic and unchecked urban growth in Ankara. In order to regulate urban environment and to achieve the new Republic city model an international competition was arranged. In the competition's specifications there were two important point in terms of streets:

- Existing streets and buildings before the competition would be preserved, if necessary little corrections could be made.
- High-rise, prestigious buildings were recommended on the both side of the Ankara's two major streets: Cumhuriyet Street and Gazi Mustafa Kemal Boulevard. (Tankut, 1993)

German planner Hermann Jansen had won the first prize in the master plan competition of Ankara in 1927 after that presented the exact scheme in 1932. Jansen's plan pay attention to the existing built-up structure and property lines his plan suited to desires of bureaucrats in terms of economic criterion.

Jansen was largely influenced by Camillo Sitte. He was in favor of the preservation of old historic cores and quarters and was one of the advocators of garden city movement in continental Europe. As mentioned previously, he was one of the most important masters of Quasi-Romantics.

Jansen's planning principles for Ankara can be summarized in five main parts;

- Aesthetic of the city was his main concern.
- In order to ensure economy from the road construction, streets were designed short, straight and compatible with topography. Similar ideas also can be seen in Unwin's works for some garden cities in England.
- Jansen plan proposed maximum three stories buildings for whole Ankara. He thought low-density garden houses as the major building type in detached and semi-detached style and oriented them to sun for health considerations.
- As Hass-Klau suggested that, Jansen understood the danger of the road traffic in residential areas. According to Jansen, residential areas should be kept free of through traffic and sufficient underground lines should be built to keep the historic city center

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free of it. The residential street layout of Jansen's proposals for German cities were the closest copy of Radburn layout. (Hass-Klau, 1990) His general concept was also valid for Ankara plan with some slight changes. (Fig. 3.37) As Tankut states, Jansen saw cars as a health hazard because they were carrying pollution and dust to quite residential quarters. He minimizes the number of thorough traffic roads which allow speed and uninterrupted traffic flow. He thought the other roads as subordinate and keep them short, straight and narrow in order to ensure economy. He proposed pedestrian axes as the major path ways that connect the nodal points of the city.

• For the latter implications like street widening, he proposed frontyards for any sort of construction although the streets generally arranged narrower in the plan. (Tankut, 1993)
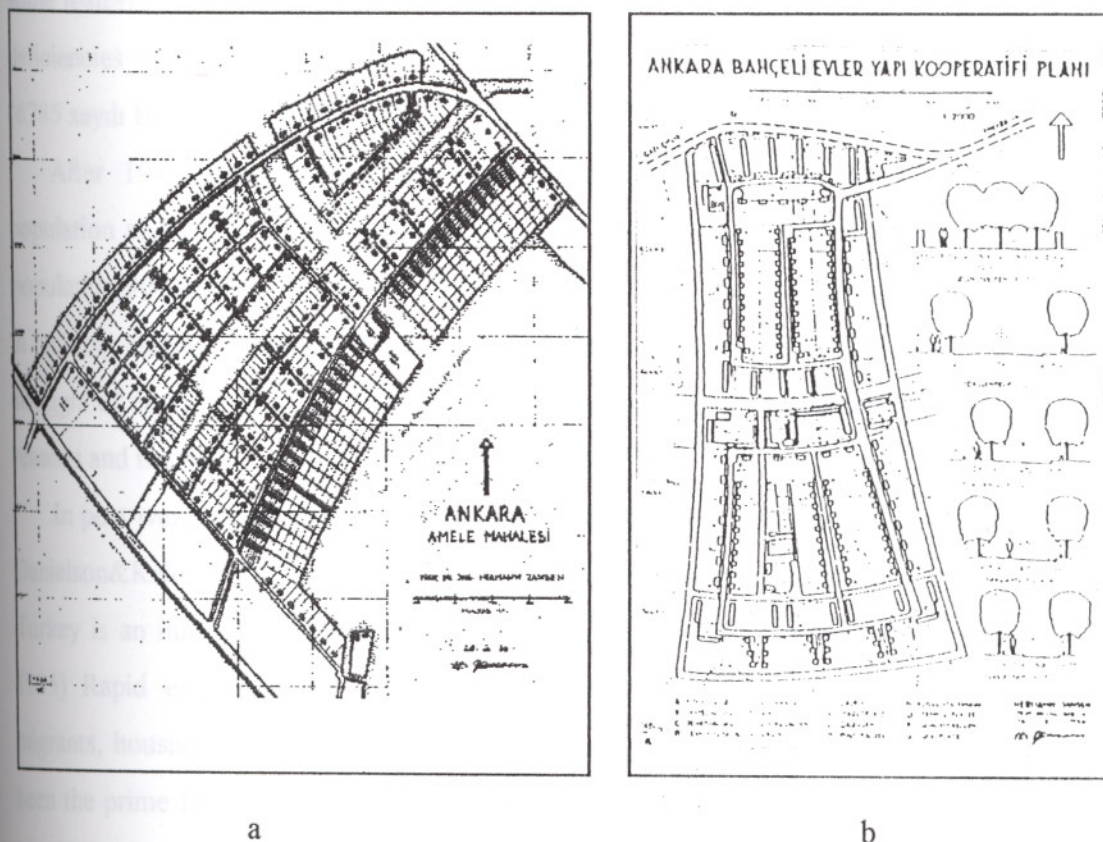


Fig. 3.37. Jansen plan of the Workers' Quarters (a), Plan of the Bahçelievler Quarter (b), (METU Planning Archive, 1998)

Jansen had some problems in the adaptation of the plan. The first problem was the dead end streets. Jansen's cul-de-sacs were not accepted by the administrators due to remaining of old traditional neighborhoods of Ottoman Empire. The other problem was the lack of cadastre maps. This caused the changes in direction and routes of many streets that proposed by Jansen.

As parallel to Jansen's aesthetic concerns, the city council, who saw the uniformity as an aesthetic factor, applied the uniform building heights and rooflines in major streets and avenues. (Tankut, 1993)

In 1933, a new building regulation (Yapı ve Yollar Kanunu) was prepared. This law consisted the regulation of single buildings, and building lots and also the streets classifications. In this law, dead end streets were prohibited and the maximum width of the street was determined at least 9.50 m. 1933 Building Regulation also contained some features of 1882 Ottoman Building Regulation.(Ebniye Kanunu) Despite its major deficiencies 1933 Building Regulation became the background of Law 6785 of 1956 (6785 sayılı İmar Kanunu) (Tankut, 1993)

After 1935 Jansen's plan was forced by speculators pressures, rapid rise in population and its direct impact on land prices. In 1950's Ankara had reached its final population 30 years ahead of time. As a result of this process it was allowed to increase in building heights an important street and avenues. Traffic congested in its streets. The struggle of creating new Turkish Republic city model was interrupted by the economic reasons and the danger of war.

In post war period we see the rapid urbanization in Turkish major cities. Turkey, as Danielson&Keleş state, has been transformed by rapid urbanization. Urbanization in Turkey is an inherent component of the process of modernization. (Danielson&Keleş, 1985) Rapid extension of cities brought some negative urban images: masses of migrants, housing shortages, traffic jams, polluted air, fouled water etc. Migration has been the prime factor in rapid urban growth. Large numbers of people moved to these big cities but the existing social and physical infrastructure of the city could not absorb the new comers. Booming in population and migration created squatter settlements that surround the big cities. Also transportation preference of Turkey was dramatically changed after 1950's. "Turkey's highway construction program was designed to increase the army's mobility but roads can be used in both directions, and many villagers seeking

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to better their lives used the improved highway system to move from rural areas to the cities." (Danielson&Keleş, 1985; pp:17) This rapid transformation in Turkish economic, social and political life influenced the urban streets directly. These conditions can be discussed into three main parts:

1. Rapid Rise in Car-ownership:

Railroad policy, which continued till the World War II, was diminished and after 1950 highway policy became the government policy. In major Turkish cities rapid urbanization has greatly demand for transportation at the same time spreading development far beyond the reach of established services and facilities. With the high rates of urban growth travel on streets and highways has expanded far more rapidly than has the capacity of the transportation system.

After 1950's inadequate public transportation has attracted large numbers of private operators (dolmuş) and private car-ownership. Explosive growth of this trend is a reflection of economic prosperity an expanding middle class and Turkey's substantial investment in automobile production. More and more private cars crowded onto outmoded road systems. This traffic problems were usual because the streets of such cities were still remaining character of pre-industrial neighborhoods. Invasion of major Turkish streets by automobile was recognized after the 1970's.

Door to door transport capability of trucks and buses caused radical changes in transportation of freights and people. At the end of 1966 the first mass-product automobile "Anadol" appeared and followed by Fiat, Renault and others. After this period number of car-ownership changed the scale. For example, while only 3400 automobile exist in 1945, after mid 1970's in second Five-Year Development Plan (1968-1972) automobile production goal was announced as 57.000 auto-per year, today it is extended to 800.000 auto-per year. Automobile mania was launched by narrow-minded governmental policy in the form of industrialization and consumption. But the mass production of automobile in Tekeli's words has completely different results on society and their social life habits apart from some other industrial products. Because cities of Turkey has yet indicated the features of pre-industrial period and the functional hierarchy of living and working areas could not provide the mobility of the society. Since our street pattern were no longer carry the large amounts of automobile, city wide

urban renewals and upgrading of existing street network became inevitable. (Tekeli, 1971)

Till the 1970's the inadequate organization of the transport modes in the city did not allow the decentralization of urban functions. Therefore, the city grew as high density compact form some changes were occurred in the urban scene:

- Demolition of historic parts of the city centers,
- Inadequacy of social facilities,
- Increase in density and the loss of green spaces,
- Decline of quality in public open spaces.

After mid 1970's the first examples of pedestrianization of city center occurred in Ankara in modest scale than spreaded to the other major cities. Streets and even pedestrian sidewalks in the city center has become the storage for private cars. The intolerable traffic chaos forced the major municipalities to consider on the high capacity and more efficient transport alternatives (metro&LRT) in this decade. One reason for the high demand for light rail transportation (LRT) is that " it costs less than a full metro, but has a higher image than bus system" (Gardner, 1995; pp:22)

The main failure of the transportation projects in developing countries the World Bank found that is the institutional problems. (Gardner, 1995) In Turkey, the central government acts a dominant role in traffic control and transportation policy.

Above all, increasing numbers of traffic accidents became one of the unending problems for big cities' streets and highways. People are killed by cars in traffic while walking or crossing more than they are killed by a stranger with a gun.

2. Modernization of Urban Public Space:

Modernization was the driving force of Turkish revolution. In urban scene we see the boulevards as the most important symbol of modernization of Türkiye. Since 1920s for almost all major cities and towns a boulevard, a ceremonial square, and provincial government unit have been constituted. According to Korat, this is the reflection of the ideology on urban scene. (Korat, 1997)

Open space, human scale and historic areas have all suffered from the unending pressure of expansion in the major cities. In order to built new boulevards hundred of buildings and organic evolved traditional neighborhoods were demolished. We see the

such implications for Istanbul in the reign of Adnan Menderes in 1950's. He sought to stimulate private economic development which meant tunneling more state resources into İstanbul. A splended city hall was constructed, and new boulevards installed. Menderes's remedial actions for İstanbul was resembled to Haussmann's urban renewal for Paris: "Menderes attacked the narrow, hilly streets of İstanbul to give the city a look of Haussmann's Paris." (Danielson&Keleş, 1985; pp:57) Again similar redevelopments for Istanbul were done by mayor Bedreddin Dalan on urban street network at the beginning of 1980's. Semi private cellular division of old neighborhoods were connected to each other with efficient urban street network and the every part of city opened up to all classes and ethnic groups. The components of modern city such as large boulevards and avenues, wide sidewalks, and car-free areas with squares, public art objects and fountains enhance the social life of the city. The bright lights of these boulevards and car-free shopping streets attracted all sort of people in the same place together with their oppositions. (Göksu,1996)

According to Ayca-Güven Bilsel, rant pressure, loss of quality in architectural and urban design projects and overpopulation degenerated the urban public spaces. (Bilsel at al., 1989)

3. Reshaping of Residential Areas:

All the changes in urban pattern and social life also affected the physical structure of residential areas. With the rapid increase in car-ownership new sub-centers for upper classes began to occur far from the central locations. High land cost and rapid rise in population brought rant pressure on residential areas. With 1965 Condominium Law, "high rise apartments replaced smaller buildings on precisely the same lots, with precisely the same road system that once served low-density areas." (Danielson&Keleş, 1985; pp:183) In building market private constructors has converted many traditional low-rise single houses to the alike apartments. High density, uniform and monotonous residential streets were occurred as a result of this process. Because much of the new housing was in apartment units residential densities increased rapidly in big cities and brought overloaded public facilities, mounting traffic congestion and anarchic parking. Once quite peaceful residential streets were sacrificed the unending demands of motor traffic.

But some good implementations also has seen to preserve the historic sections of old Turkish streets: Soğukçeşme Street. Starting in 1976 the old buildings on the street

were taken in hand by the Automobile and Touring Club of Turkey, and their restoration completed in 1986. (Fig. 3.38)
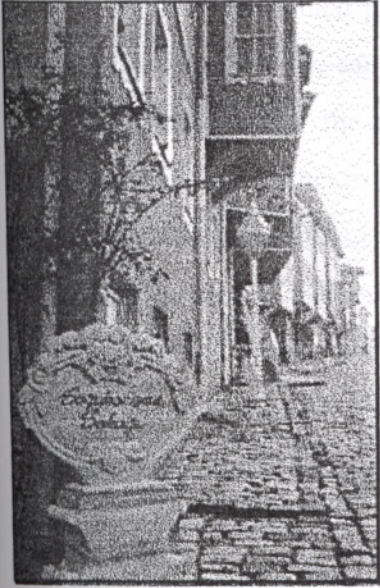


Fig 3.38. A view from Soğukçesme Street, İstanbul, (http://hcgl1.eng.ohio-state.edu)

The oldest houses in the street are typical of those built in Turkey prior to the Ottoman modernization program of the 19th century. In the design of the street window frames were renewed and gas lamps installed to light the street. Soğukçeşme Street is a traditional Ottoman street now, the flowers in marble pots all along the Hagia Sophia fence giving off their fragrance. In opening Soğukçeşme Street to public use, great care has been take to preserve its archeological and historical features, and its setting. The street is off limits to motor vehicles of any kind, and perhaps this is the most welcome news for the visitor who wishes to pause a while and savor Istanbul that was.

These factors that were mentioned above acted the tranformative role on the Turkish city streets. However, the impacts of automobile seem the most destructive one among the others. Our major concern should improve the quality of urban streets and make them livable, outdoor rooms of the city.

## 3.8. Conclusion

In early civilization's cities, both regular and irregular forms of streets existed. Narrow irregular ones which provide protection from enemies, sun and dust would be imitated in Medieval for the same purposes.

In Hellenistic period, the concept of the street as an architectural entity was the result of conscious aesthetic aims rather than of compelling functional grounds. In Roman period the street layout was functional rather than aesthetic.

Special qualities of medieval were the small structures, small numbers and intimate relations. Medieval towns and streets affected some 19th. century urbanists such as Camillo Sitte and advocates of car-free city concept today.

In Renaissance and Baroque periods, the concepts of discipline, order and geometry shaped the urban streets. In contrast to pedestrian friendly medieval streets, baroque street was in favor of the new absolute powers: bourgeoisie and autocracy.

Enlightenment was the age of disorder, chaos and revolutions. Baroque uniformity was broken and town planning was mostly ignored due to the industrialization and uncontrolled growth. Preappearance of modern street and section occurred after mid 18th. century. But the advent of contemporary street would seem with the rise of automobile in the early 1900's.

In the past, the street was the place where social classes and social uses mixed. However, the streets of motor age mostly served as the channels of motor traffic.

1960's and 1970's reflected the revival interest to return the street. Modernist anti-street concept strongly criticized by wide variety reaction groups. The importance of street in social life was recognized and attempted to restore again.

Turkish cities, as in many developing country, were transformed by rapid urbanization after 1950's. Invasion of the Turkish cities by automobiles was recognized after mid 1970s. There is an immediate need to change the priorities in our streets in favor of vulnerable road users.

In recent decades, traffic calming and pedestrian priority street design gained importance in reviving the urban streets. Techniques and specific polices which comprise pedestrian safety and priority will be discussed in following chapters.

# Chapter 4

## STREET USE AND DESIGN

This chapter includes the factors that are influence the use of street space for various user groups, and the basic variables of street design and management.

## 4.1. The Use Of The Street

Throughout the history, urban streets has become the important part of everyday life. People live on a street and have always lived on streets. Daily activities such as travel, shopping, socializing etc. continue on streets. Streets have places where children first learned about the world, where friends and neighbors met and where the social centers of towns and cities. However they have also been the channels for transportation and access. (Appleyard, 1981)

Since the rise of mass transportation especially the increase in numbers and speed of automobiles streets are distinguished as pedestrian space and motorist space. The strict segregation influenced the physical characteristics of streets and the daily street activities. Non-car users were forced to live narrower sidewalks. New streets were designed for the comfort of motorists not for pedestrians and cyclists. The result has been the decline in the attractiveness and the desirability of urban streets.

However last three decades has seen increased interest in the role of public space and the street can play in shaping the public culture. The reviving interest on streets and street activities has brought some new ideas in reshaping the street environment. New forms of have emerged including pedestrian streets, auto-restricted zones, shared streets etc. which aim to take back the street activities and make the street outdoor room for community.

The use of the street have different meaning for various user groups and social classes. Many cities have districts where special qualities and ethnic characters were observed. In terms of different social classes the use of the street space tend to be vary. For example, while in upper class areas often the streets are quite and empty even walking is ignored in poor quarters the interaction among people is much more higher.

Cultural diversity is one of the factors which influences the use of street space. Social norms, rules and habits are the deterministic factors in the use of street for various activities. (Rapoport, 1987)

Also the user groups have different expectation in the use of street space for various activities. For instance, while adults ,as Moore states, see the street as channel for traffic or access children see the street as playground. (Moore, 1987)

Major street space uses can be categorized into two broad group according to Eichner and Tobey's classifications: functional uses and social uses. (Table 4.1)

TABLE 4.1. Major Street Space Uses

| FUNCTIONAL USES | | |
|---|---|---|
| **Vehicular Circulation** | **Pedestrian Circulation** | **Urban Life Support** |
| Through movement | Through movement | providing space and access for utilities |
| Picking up/dropping off passengers | waiting for vehicles (buses, taxis , cars) | controlling traffic |
| access to parking | crossing street | providing for emergency services |
| curbside parking | entering-leaving buildings | lighting the streetscape |
| buses | | |
| emergency vehicles | | |
| **SOCIAL/AMENITY USES** | | |
| strolling and window shopping | | |
| resting and people watching | | |
| vendors | | |
| telephones, newspapers, art works and banners | | |
| eating and waiting | | |
| orientation/ information | | |
| street performers | | |
| drinking fountains etc. | | |

(Source: Eichner and Tobey, 1987; pp:280)

### 4.1.1. The Use of the Street by Pedestrians

There are many variables which influence the use of the street by pedestrians. According to Rapoport these can be examined as follows:

1. Impacts of technology: e.g. in pre-industrial world walking was extremely prevalent.
2. Availability of safe environment against the danger of automobile and crime
3. Environmental variables such as noises, fumes, congestion, quality of paving etc.
4. Climate and weather
5. Topography: hills, hard slopes etc. affect vulnerable users and people with physical disabilities.
6. Distance to a given goal.
7. Availability of services such as kiosks, seats and toilets.
8. Culture, which defines settings, rules for appropriate behavior etc.
9. Physical and perceptual characteristics. (Rapoport, 1987; pp:81)

The last two variables are more important than others according to Rapoport. Culturally established rules determine the use of the street. But these rules may change according to different classes and ethnic groups. As Rapoport points out, cultural variables are primary for any activity, including walking and others, occurring in streets. It is the culture that structures behavior and helps explaining the use or non-use of streets and other urban spaces. In addition the cultural variables, people can also be influenced by physical variables. The particular physical, especially perceptual, qualities of the urban spaces have great impact in activities as inhibiting or supportive. (Rapoport, 1987)

### 4.1.2. Street Activities

The use of street by large numbers of pedestrians brings the variety of activities to that street. Activities in the streets, according to Moughtin, increase when densities are high enough to inhibit the use of the automobile and to support a range of facilities such as shops and schools that are within walking distance from a sustainable catchment area. Also the land-use mix encourages many activities which is vital for livable streets. The elimination of non-conforming uses from the residential area reduces the propensity for social contact and interaction in the street. (Moughtin, 1992) But as outlined above the

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uses of street for activities varies from one culture to another. According to Rapoport these highly varied set of activities and their characteristics can be discussed in two broad classes:

1. Non-pedestrian Movement: This consist mainly of wheeled vehicles (especially in modern culture, motorized vehicles) In other cultures and historical periods pack-animals may be involved.

2. Pedestrian Activities: We can subdivide it into two groups:

a. Dynamic Pedestrian Behavior: contains mainly walking and strolling. These are comparatively constant in nature and culture influences how acceptable walking is, who walks, where, when, how fast and with whom.

b. Static Pedestrian Activities: include sitting and standing, squatting, lying down, eating, playing, working etc. The cultural variety play a larger role in static pedestrian activities rather than the dynamic ones. (Rapoport, 1987)

Recreational Activities on the Streets:

Streets are also the places for recreational activities. Advance of urbanism in twentieth century brought the decline in the utility of streets and thoroughfares as recreational spaces. There is a great relationship between the road capacity and recreational utility. (Fig. 4.1)

| Road Category | Significance as a Route | Recreational Utility |
|---|---|---|
| Motorway | National | Low |
| Primary distributor ⌐ | | |
| Secondary ⌐ | Regiona | |
| Local streets | | |
| Cul-de-sac (dead | Local | |
| Pedestrianized areas ⌐ | | High |
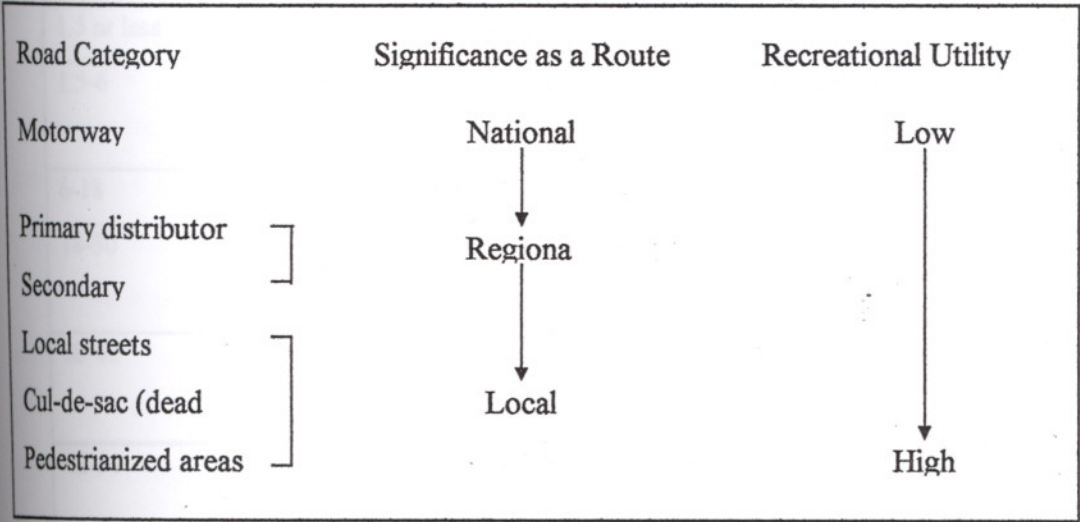
Figure 4.1. Theoretical relationships between road capacity and recreational utility, (Williams, 1995)

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While in local distributor roads the availability of recreational activities are high urban motorways have limited recreational potential. Traffic free routes have perhaps the greatest potential to support outdoor activities. Pedestrianized streets and traffic calming zones offers the best opportunity to pedestrians for such activities. (Williams, 1995)

1. Walking and Cycling:

Walking can be thought at the head of the list of common outdoor activities. Although walking tend to be vary with culture and class according to some researchs, eighty percent of journeys of less than a mile are conducted on foot. Walking distance changes according to age groups, and also the level of mobility which is ensured by private car or availability of public transport services.

One common problem in large cities is that because of the very large numbers of pedestrians, a nominal 2 m sidewalk is often insufficient for walking. An estimate of a required pavement size can be obtained from Table 4.2.

Table 4.2. Calculating pedestrian sidewalk widths

| Rate of flow Pers/min/m width of walkway | Quality of flow |
|---|---|
| 1.5 or less | completely open |
| 1.5-6 | unimpeded: free movement, walking groups are easily maintained |
| 6-18 | impeded: groups must change and reform |
| 18-30 | constrained: groups cannot be kept, cross flows cause conflicts |
| 30-42 | moderately congested: bodily contact inevitable, frequent conflicts throughout the steam |
| 42-54 | heavily congested, even when the slowest walkers are obstructed |
| >54 | Jammed: enforced movement at a standstill |

(Source: Gardner, 1997; pp:23)

Walking in cities occurs in a range of circumstances. While some walking have functional nature and the travel between two locations, in a fastest way some walking will be seen as recreational such as strolling, people watching, socializing with other residents etc. (Williams,1995)

Walking, according to Rapoport, is mainly a function of the two variables: culture and physical perceptual qualities. Physical comfort, levels of society, and the attraction and diversity of the townscape have great influence on the walking. (Rapoport,1987) Road safety is another significant issue for walking. Especially in developed countries, street crime acted a larger role in the decline of walking in city streets.

2. Shopping:

Especially in cold climate zones and in some European countries indoor shopping malls as a corridor shopping street became popular in last decades. However, in most central areas shopping remains an important activity that brings people to the streets. (Williams, 1995)

3. Children's Play:

Children, according to Moore, see the elements of the street such as mailboxes, signs, benches, trees, cars, gates etc. as an opportunity to play. Children measures the environmental quality of the street by the presence or absence of these objects. Research emphasized that most common playgrounds for children are the streets, pathways and associated hard-surface circulation areas. (Moore, 1987)

4. Socializing:

Streets have always been the places for social contact and interaction throughout the history. But anti-street attitude of Modernists have caused the decline in the social role of urban streets.

People watching is popular recreation in many public places and the activity of the street. For the widespread social uses streets ensure contacts with friends and neighbors. (Williams, 1995) In recent projects, as in Woonerf, to encourage interaction among the community members is one of the prime concerns.

## 4.1.3. Physical Planning Variables and the Use of the Street

According to Schumacher, in the planning of a street the physical factors that appear most to influence street use are: user density, land-use mix, pedestrian-vehicular interaction, and configuration of street and context. (Schumacher, 1991)

Mixed land-use might encourage bicycle and pedestrian access, but without a convenient and safe non-motorized system it may do little to invite people out of their cars. A quality urban environment includes safety, proximity and access, and not simply mobility. (Mozer, 1994)

Pedestrian/Automobile Interaction: The Modernist attitude of grade separation forced the pedestrians to walk narrower sidewalks, overpasses and underpasses. While separation of high speed movement from pedestrian activity may seem inevitable total separation is generally not desirable for street activity. The prime concern in separating pedestrians from vehicles is to ensure personal safety. Although full pedestrianized streets or multi-level solutions (skyway system etc.) may particular success in downtown areas, for residential areas instead of strict separation between cars and people interaction among them should be taken into consideration. (Schumacher, 1991) Calmed streets have great success in slowing down the traffic in residential areas consequently the safe interaction between people and motorists.

Configuration and context: "In contemporary planning practice, the public street environment is what remains after private planning for individual land parcels along the street takes place. When public open space is considered it is usually with the intention of creating plazas around buildings or removing streets to create superblocks" (Schumacher,1991; pp:137) This anti-street attitude of twentieth century notions erodes the traditional configuration of urban street as 3- dimensional volume and figural ground.

Land-use planning objectives for livable cities and urban public spaces can be outlined in three headings:

• Regional development based on decentralized concentration

• Local neighborhoods which contain a fine grain mix of uses

• public streets and spaces which are accessible, legible and attractive (Gardner,1997; pp:13)

### 4.1.4. The Factors Influencing the Recreational Street Use

According to Williams, the recreational uses of urban streets is affected by these three sets of problems: (Williams, 1995)

1. Road Traffic& Quality of Design:

Road traffic is the most important factor that prevents the pleasurable use of streets for recreational street activities and creating a number of difficulties. Especially the use of large numbers of private car caused the environmental, social and aesthetic problems in cities. Urban automobile according to Cities for People Report;

- Inhibits the social contact that binds communities together,
- Endangers other street users,
- Disturbs people with its noise,
- Causes air pollution,
- Wastes energy and natural resources. (Cities for People,1997)

Automobile pollution is the main cause of terrible air quality in many cities. For the pedestrians, cyclists, window shoppers or the retailers vehicle fumes are a noxious health hazard that quickly devalues other pleasures that may be associated with being on the street. In sum non of these factors enhance the capacity of the street as a place of leisure, indeed the effect is quite the opposite. (Cities For People, 1997) (Fig. 4.2)
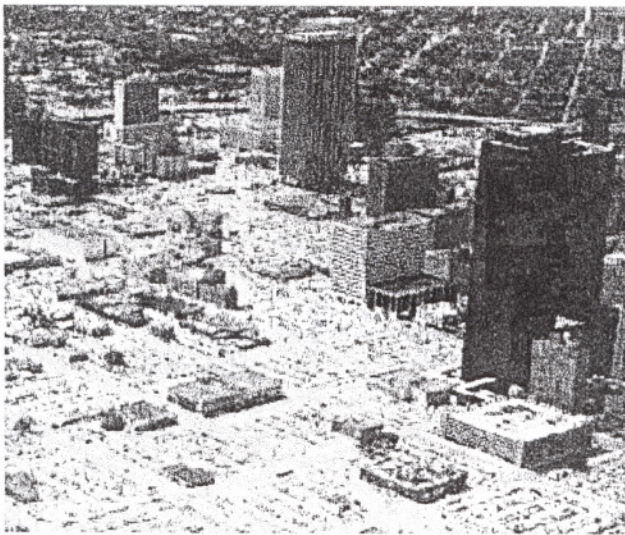


Fig. 4.2. Downtown Houston, Texas, (Cities for People, 1997)

Cars cause social isolation. Appleyard's "Livable Street" research of 1981 indicates that the impact of automobile on informal social contacts within neighborhoods. Appleyard clearly implies that the level of traffic is inversely correlated with the level of social contact in the block. The removal of automobile from the urban environment will do much to build community. (Appleyard, 1981) (Fig. 4.3) Studies have shown that as automobile traffic on a street increases social life on the street dies. The noise, danger and pollution slowly drive people from the street.
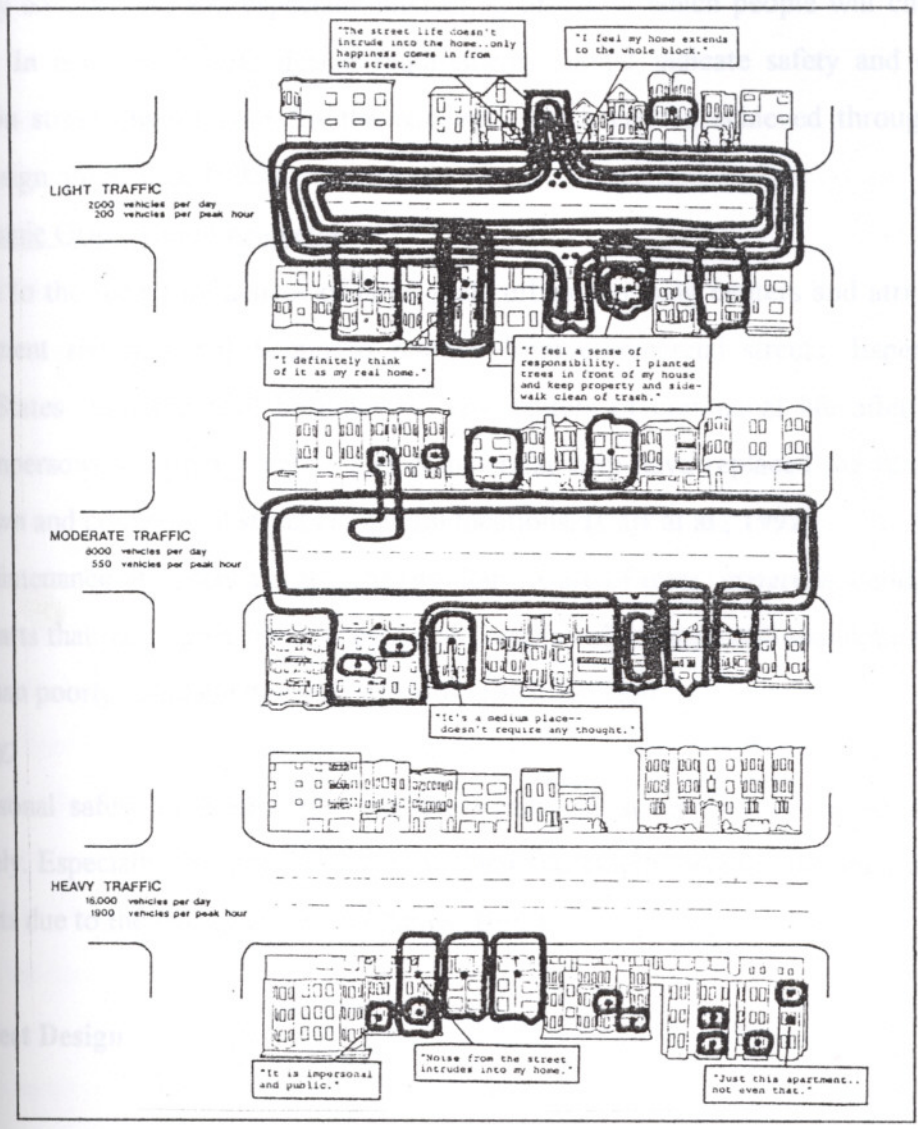


Fig 4.3. Appleyard's Livable Street project, San Francisco, home territory on three streets, (Appleyard, 1981; pp:23)

Traffic noise makes conversation at normal levels difficult or impossible. Traffic prevents the normal opportunity to interaction on the street and causes the decline in social life.

Traffic accidents are the another significant problem. The threat of injury and that in traffic accidents is the most serious problems of many cities and towns. In some developing countries including Turkey, death-by-auto is the leading cause of death.

Quality of design is also important issue. Poor urban design will also limit recreational utility of streets and other public spaces. In the city centers, streets should be physically comfortable and especially interesting places in which people will choose to recreate. In residential areas design requirements should indicate safety and creating interest in street environment for the residents which can be achieved through good urban design. (Williams, 1995)

2. Economic Organization problems:

Due to the recent influences of large-scale urban shopping centers and atrium style development shopping has begun to remove from commercial streets. Especially in United States shopping mall became the new centers of communal life after 1950's. These impersonal shopping centers and commercial strip have replaced the function of downtown and commercial streets in central locations. (Carr at al., 1992)

Maintenance of streets are also the problem. "Care of trees, materials, buildings and all the parts that make up a street is essential. People will choose well-maintained streets rather than poorly maintained ones." (Jacobs, 1993; pp:289)

3. Safety:

Personal safety problems influence the vitality of street and the street activities negatively. Especially the groups such as women and elderly people limit their activities on streets due to the fear of crime. (Williams, 1995)

## 4.2. Street Design

Safety, health and traffic: these three important variables has become important considerations in the street design but not the all. The aesthetic concerns including special design features landmark and marker points, fountains and trees or the uniformity has also played an important role in the design of streets.

In early civilizations special architectural features upon the street scene had significant religious and aesthetic values. For example, in Vedic city plans, as Kurokowa points out, there was a holy bodhi tree at the intersection of two main thoroughfares. The tree was a spiritually powerful cosmic symbol. (Kurokawa, 1991) In Hellenistic period there was conscious aesthetic aims rather than of compelling functional grounds in the concept of the street design. Street design and the establishment of efficient street network became the basic unit of urbanism.

In renaissance we see the full uniformity in street frontage and the importance of street network due to the religious and military reasons. Baroque period recognized with the uniformity of streets and wide straight streets again became an important goal in street design. Endless avenues and boulevards were emphasized the power of despotic rulers. In the design of these streets public buildings, palaces and churches were the focal points that terminating the vista.

Industrial revolution brought new ideas to street design. Especially in some 19th century utopians' schemes streetless communities were proposed or replaced with covered streets. Boulevards of Haussmann also introduced the gigantic scale in the design of streets and for the first time recognized the presence of wheeled traffic. Haussmann preferred the baroque's uniform building frontages in his boulevards in terms of public order and the aesthetic beauty.

Appearance of cars in the cities and towns has caused radical changes in street design. Early Modernist' anti-street attitude has removed life from the streets. Street design has been considered in terms of engineering standards and comfort of automobiles by them. Grade separation has forced pedestrians retreat from the streets. The vulnerable users of the modern streets were sacrificed to smooth, straight highways. Both in Garden City Movement and Modern Movement building line was separated from street line with set-back distances.

However, this trend was slowly reversed. In last three decades all over the world there are some conscious efforts to restore life and activities on the streets. To ensure safe, comfortable and functional street environment for people again became the major concern in the street designs. In Europe, the Dutch Woonerf of 1970's, area-wide traffic restrains of 1980's, in United States, D. Appleyard's Livable Street Project of 1981, P. Calthorpe's pedestrian pockets and Transit Oriented Development (TOD), and A.

Duany-E. Plater-Zyberk's Traditional Neighborhood Development (TND) has brought new perspectives to the street design. These projects have recognized the pedestrian priority in the design of streets.

### 4.2.1. Street Design in Urban Design Context

1.Context:

The character of a street should be determined by its context within the surrounding street structure and its place within a street hierarchy. To prepare a classification of street types according to their pedestrian character, economic potential and transportation capacity will be useful.

2. Definition:

According to A.B. Jacobs a good street has definition. Scale, proportion and spacing of buildings determine the degree of definition.

Scale: The scale of street should accord to its context within the street hierarchy. Dimensions tend to be vary due to the cultures and conditions, but in Gardner's list general relationship between street type and corridor width may be thought as an example; (Gardner, 1997, :18) (Table 4.3)

Table 4.3. Street types and corridor width

| Street Type | Corridor width |
|-------------|----------------|
| Boulevard | 25-40 m. |
| Avenue | 20-25 m. |
| Main Street | 15-20 m. |
| Side Street | 10-15 m. |
| Pedestrian Alley | 6-10 m. |

(Source: Gardner, 1997; pp:18)

Human scale is another prime concern in  the definition of the street. Buildings must relate first of all to human proportions. Maertens and Blumenfeld are heavily concerned in their works with human scale. (Fig. 4.4)

"They (Maertens and Blumenfeld) use distances at which they report it is possible to recognize people (human scale) and distances at which facial expressions can be seen (intimate human scale) together with angles at which objects can be seen clearly to judge to scale of buildings. They conclude that a building height of three stories and width of 36 feet with a street width of 72 feet are the maximum dimensions for a building of human scale. The smaller intimate scale requires a building height of 21 feet a building width of 24 feet and a street width of 48 feet." (Jacobs, 1993; pp:278)



a                                           b
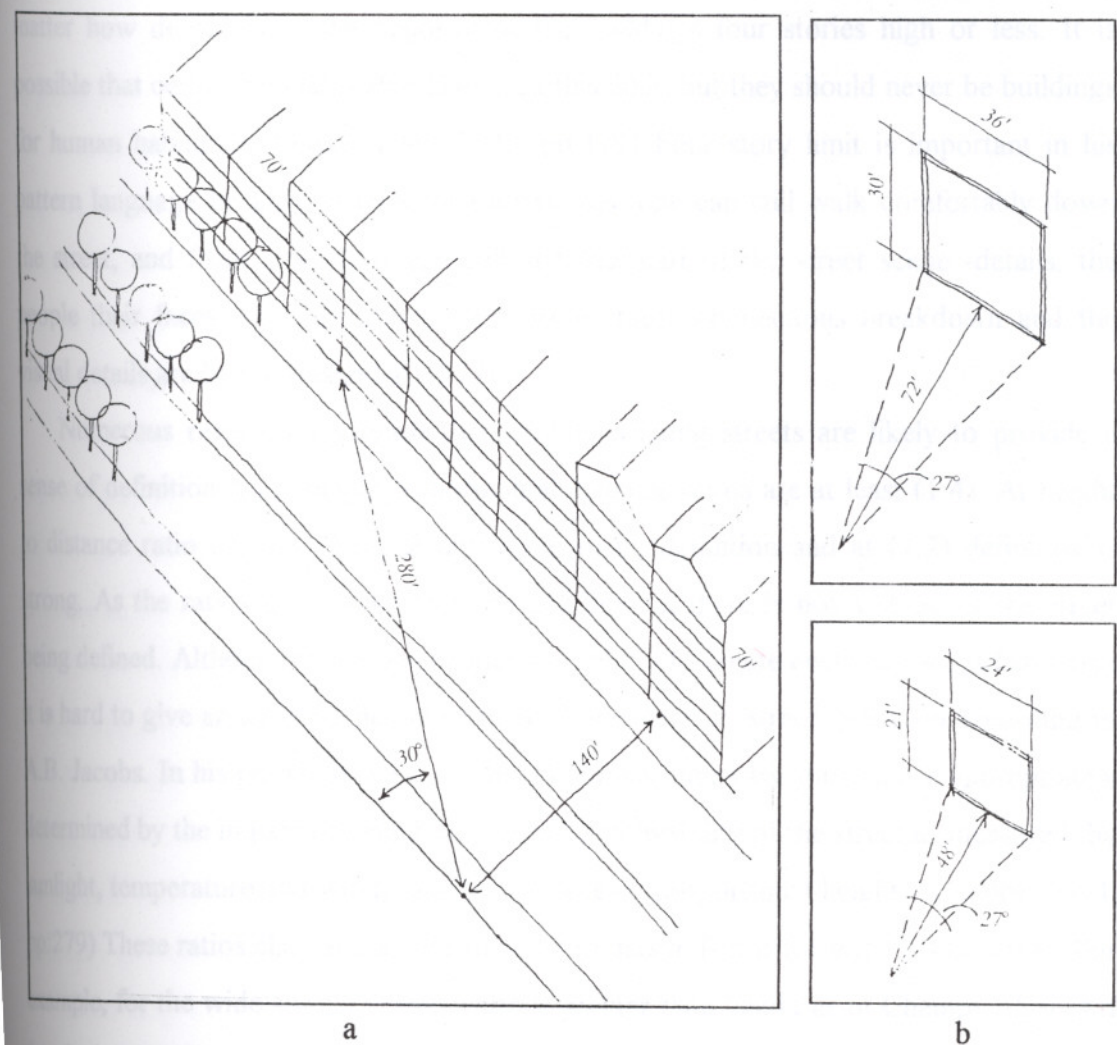
Fig. 4.4. A sense of definition can  be provided when height-to-horizontal distance ratios are 1:4 when the viewer is looking at a 30-degree angle to the street direction (a) Human scale and intimate human scale (b), (Jacobs, 1993; pp:278)

Proportion: It is simply defined by the ratio of width of street to height. The proportion of street according to Moughtin is critical for good street design: "When, for example, a street is long and wide with two-storey houses ranged along a common frontage all sense of space enclosure is lost." (Moughtin, 1992; pp:141)

According to Gardner, the height of the buildings bordering the street should be sufficient to visually contain the space. While quite narrow streets can be pleasantly defined by five stories development, low rise is quite unsuitable for a wider street-type. (Gardner, 1997)

Building height is critical here. In Christopher Alexander's book *Pattern Language*, pattern 21 refers to four-story limit. It states that "In any urban area, no matter how dense, keep the majority of the buildings four stories high or less. It is possible that certain buildings should exceed this limit, but they should never be buildings for human habitation." (Alexander, 1977; pp:119) Four story limit is important in his pattern language because at three or four stories, one can still walk comfortably down the street, and from a window you can still feel part of the street scene -details, the people their faces etc.- but above four stories these connections breakdown and the visual details are lost. (Alexander, 1977)

Numerous researches suggest that, buildings along streets are likely to provide a sense of definition when height to horizontal distance ratios are at least (1:4). At height to distance ratio of (1:3) there always seem to be definition and at (1:2) definition is strong. As the ratios get smaller to (1:5) and beyond there is not a sense of the street being defined. Although these proportions are helpful to create enclosure for urban street it is hard to give an absolute height or upper-lower limit to street definition according to A.B. Jacobs. In his points of view, " it may be upper limits are more more appropriately determined by the impact of height on comfort and livability of the street as measured by sunlight, temperature and wind, than by absolute or proportional height." (Jacobs, 1993; pp:279) These ratios also are not the only deterministic factor for good urban street. For example, for the wide streets where width is greater than height as in Champs Elysees it has the intervening trees which create optical width and provide definition.

Spacing of Buildings is another significant factor in the definition of the street. Tighter spacing is more effective than looser in achieving street definition. (Jacobs, 1993) (Fig. 4.5)

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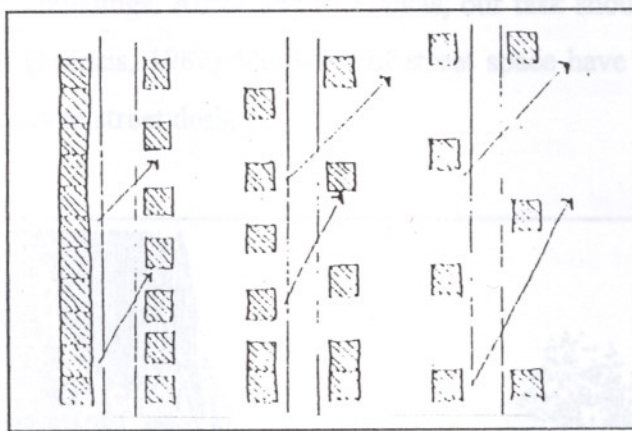
Fig 4.5. Greater horizontal spacing and less definition, (Jacobs, 1993; pp:281)

3. Land Use:

The land-uses bordering the street will influence its character through the types of use, the subdivision into different frontages and the activity of the edge according to the number of entrances into buildings. As Gardner points out, "pleasurable streets for pedestrians have many, narrow frontage buildings, many entrances, and display areas, and public uses." (Gardner, 1997; pp:19)

According to Whyte, dead uses such as businesses without display windows, banks, offices, parking garages and storage areas with blank walls should not be placed along the public street. On the other hand, some uses such as kiosks or cafeterias may enhance street environment. (Francis, 1987) Champs Elysees is one of the best examples that attract human interest through their outdoor cafes and shops. (Fig. 4.6)

4. Activities within the Street:

Streets may provide space for traders, markets or fairs. These uses can conflict with traffic, but can also often be managed by keeping them within a specific area or restricted to specific times of the day or week. Street activities despite their traffic problems are generally attractive to pedestrians. (Gardner, 1997)

According to Francis, healthy streets are used by different people for a variety of activities. Streets are generally designed for walking and driving but a lively and successful street constitutes from a balanced mix of different user groups and activities. Activities such as walking, talking, eating and sports should be encouraged for diverse street life. However today these activities often channeled through urban parks,

restaurants and public buildings. According to Francis, our task should bring them back to the public streets. (Francis, 1987) Multi-use of street space have obtained particular success in woonerven type street designs.
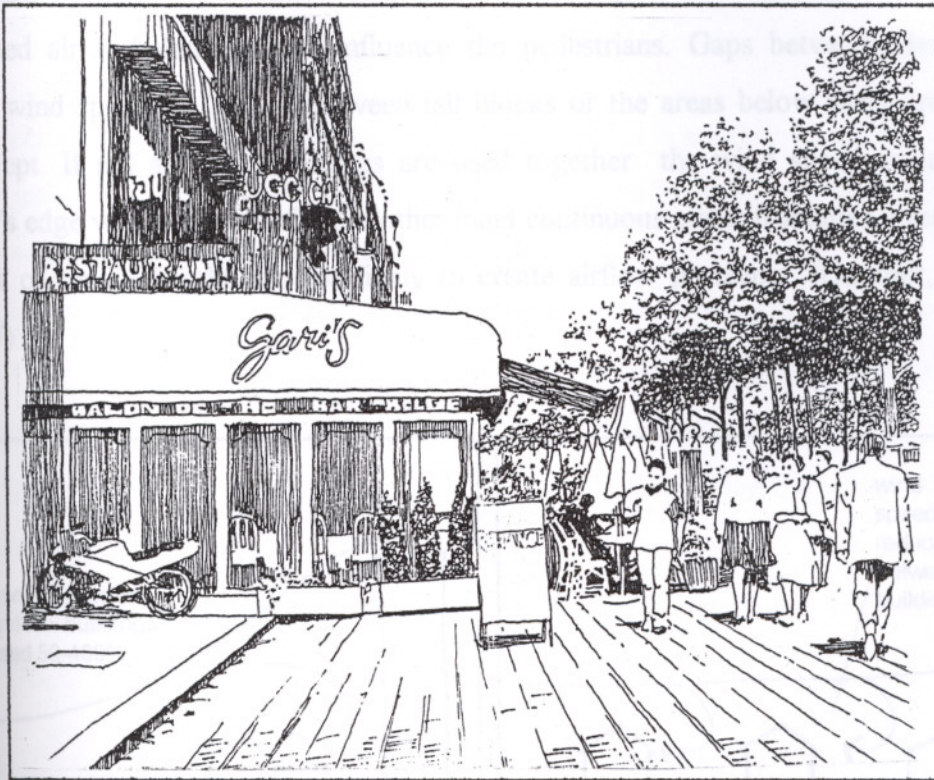


Fig. 4.6. Champs Elysees's cafes and shops: a livable promenade, (Jacobs, 1993; pp:78)

## 5. Climatic Factors:

Streets, as Gardner suggests that, should be oriented according to their climate. For example, it may be possible to orientate important streets against prevailing winds in cold climates and with prevailing winds in hot climates. (Gardner, 1997)

The idea of to design streets in accordance with the wind directions went further to Vitrivius, and renaissance urbanists Alberti and Palladio. Palladio, for example, said : "For those of a temperate and cool air, the streets ought to be made ample and broad; considering that by their breadth the city will be much wholesomer, more commodious and more beautiful..." (Moughtin, 1992; pp:142)

Streets in hot climates, natural (tree planting) and architectural, (colonnades, canopies) may ensure protection from the sun. Arcades create transition zone between

building an street space. They provide shade from both sun and rain, and preferable especially for shopping streets. Eastern Roman provinces, as discussed previously, had such arrangements (porticoes) through their major shopping street.

Airflow is another climatic factor in street design. Tall buildings can create unexpected air turbulence which influence the pedestrians. Gaps between elevations increase wind speed, so spaces between tall blocks or the areas below them are often wind swept. If tall and low buildings are used together  the wind speed around tall building's edge will be higher. On the other hand continuous street frontages comprising buildings of similar height are less likely to create airflow problems. (Gardner, 1997) (Fig. 4.7)



wind speed between high and low buildings increased 50-400%

wind speed reduced between buildings
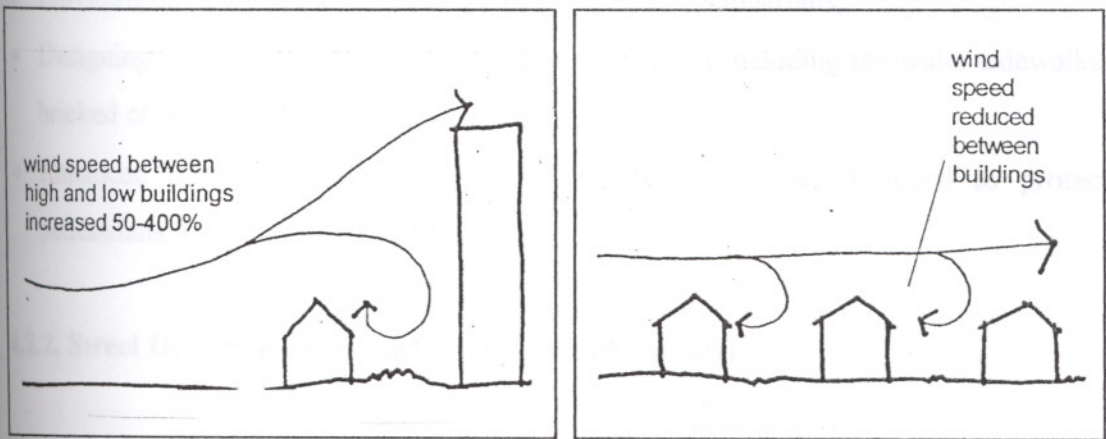
Fig. 4.7. Air-flow, (Gardner, 1997; pp:20)

## 6. Personal Safety:

The buildings watch out the public streets may increase the personal safety. According to Jane Jacobs "there must be eyes upon the street, eyes upon the street, eyes belonging to those we might call the natural proprietors  of the street." (Moughtin. 1992; pp:130)

Cities, as Gardner points out,  designed to be used 24 hours a day thus help avoid certain areas becoming dangerous zones.

The safety measures may include:

• "Replacing pedestrian underpasses and bridges with controlled surface crossings,

- Providing low level pedestrian street lighting,
- Maximizing the numbers of windows and doors which ensure natural surveillance,
- Maximizing the linkages between new and existing developments,
- Locating important facilities such as public transport stops in busy, well surveilled areas."
  (Gardner, 1997, :20)

Protecting pedestrians and cyclists from motor traffic is another significant issue in personal safety. The variety of actions, according to Mean Streets Pedestrian Report, to make streets safer for community includes;

- Traffic calming: the installation of speed bumps, traffic circles or other devices in residential neighborhoods that slow cars down, and ensure that pedestrians are safe,
- Providing separate walkways and another spaces for pedestrians,
- Designing public spaces to be more pedestrian friendly including the wider sidewalks, bricked crosswalks etc.
- Enhanced public education on pedestrian safety and laws designed to protect pedestrians. ( Mean Streets, 1997)

## 4.2.2. Street Design in Transportation Planning Context

Transport objectives to improve the street space in favor of pedestrians includes;
- "Optimizing the network for the movement of people not vehicles,
- Restraining car-use,
- Establishing an appropriate road hierarchy." (Gardner, 1997; pp:21)

We may constitute three groups of measures to apply these objectives: measures to optimize the network for the movement of people not vehicles, measures to restrain the car use, and measures to establish an appropriate road hierarchy.

### 4.2.2.1. Measures to optimize the network for the movement of people

Today in most cities, especially in developing nation's city streets, natural priority is used by the largest and fastest vehicles. To restore this situation in favor of the vulnerable road users should be the aim of the street design. These measures can be

thought in three parts: Public transport priority measures, pedestrian priority measures, and the two-wheeler priority measures. (Gardner, 1997)

1. Public Transport Priority Mesures:

Public transport should take a greater priority because these modes have a higher carrying capacity. Mass transit is used for high-capacity public transport systems includes heavy rail (metro), Light Rail Transit (LRT) and busways. A metro system can have a very high capacity but is the most expensive one. LRT costs less than a full metro but has a higher image than a buses. LRT can comfortably share space with other road users, including pedestrians and it has no on-street emissions. But LRT is also relatively costly according to bus system.

A network of busways with bus-only streets and tracks can provide a comprehensive transit system at very low cost. Buses are more efficient users of road space than private cars. "If used only by cars, even a six-lane highway will have a lower transport capacity than a 3.5 m. busway." (Gardner, 1997; pp:10) Buses may also carry thirty times as many passengers as a car. The freeing of buses from delays caused by other traffic can in many cases produce a net economic benefit.

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**Bus priority measures**

1. With-flow bus lanes

2. Contra-flow bus lanes (lanes reserved in a one-way street for buses travelling in the opposite direction to the general traffic)

3. Reserved bus lanes on freeways

4. Bus-only streets

5. Busways (segregated roads for buses only)

6. Priority at traffic signals(automotic adjustments of timings yo favour approaching buses)

7. Other bus priority measures such as parking restrictions near bus stops and stops and traffic manegement measures applied to bus-routes

8. Comprehensive schemes incorporatings bus priority and town planning

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Figure 4.8. Bus priority measures, (Gardner,1997; pp:22)

In bus priority measures ,that were listed above, bus-only streets and with-flow bus lanes are the most common. In order to increase the efficiency of buses;

- "integrate bus routes with other modes of transport,
- provide high-density uses close to public transport stops,
- ensure convenient, well designed bus stops with good accesibility,
- optimizing levels of service and cost will be useful." (Gardner, 1997; pp:23)

On the other hand, the location and design of public transport stops can have a major impact on decisions about which mode of transport to use. Public transport stops should be provided as close as possible to destinations such as housing, shopping centres etc. (Queensland Department of Transport, 1997) The land uses that support public transport are given in Appendix C.

2. Pedestrian Priority Measures:

There are some pedestrian priority measures to reduce the conflict points between pedestrians and vehicles. These are;

Pedestrianization:

"The true selected pedestrianization schemes can bring environmental improvements and can be acceptable in areas where pedestrian-vehicle conflict is extemely high." (Gardner, 1997; pp:23)

The majority of pedestrian schemes, as Simpson states, should be associated with predominantly shopping uses. But the restrictions of traffic may create some concerns on retailers in terms of their profits. However, numerous researches suggested that the successful pedestrianization applications provide greater benefits both customers and retailers. Pedestrianization should be supported by careful design of pavements, street furniture and lighting in order to enhance the environment. (Simpson, 1988) In busy shopping streets pedestrian zones are often welcomed by both traders and the public. Stroget, the busiest pedestrian street in Copenhagen, is one of the well-applied examples of pedestrianization.

On the other hand, some points are critical in pedestrianization schemes in terms of safety. As Fieldhouse points out "too much pedestrianization can cause dead zones that become *no go* areas in the evenings. Specific effort must be put into the scheme to avoid

this." (Fieldhouse, 1997) Full pedestrianization should therefore take place only within a framework of a carefully planned road hierarchy. (Gardner, 1997)

Vehicle Restricted Area (VRA):

It is simply an area where the movement of vehicles on its highways is restricted or prohibited by means of formal Traffic Orders. (Fieldhouse, 1997) But service vehicles and public transport may be considered into the scheme. Service access can be restricted in certain times of the day. If it is not possible to pick up or set down public transport passengers within 400 m of a pedestrian area, permitting public transport entry to the scheme will have to be considered. (Gardner, 1997)

Vehicles discouraged and street traffic calmed:

This approach ensure priority to pedestrians and discouraged the vehicles. In shared surfaces vehicles are only acceptable if traveling at walking pace. Vehicular access is maintained through restricted in numbers, and speeds limited to that of walkers. To slow down the traffic is more applicable in residential areas rather than the busy commercial areas. Automobiles will be discouraged if traffic calming schemes can be combined with public transportation and traffic management measures. (Gardner, 1997) The objectives and techniques of traffic calming in residential and shopping areas will be discussed in following chapter.

Pedestrian measures according to Gardner should only be used after the alternatives of discouraging or restricting traffic have been explored. The design of street in favor of motor cars, especially in residential and shopping areas, makes street undesirable and less attractive for pedestrians especially at night. Where the waiting time to cross a road is no more than 10 seconds surface crossings remain preferable. (Gardner, 1997)

3. Two-wheeler priority measures:

The bicycle is one of the perfectly efficient road users throughout China, Europe and some African cities. In Turkey bicycle use as a transportation device is not preferable but should be encouraged in the system of multi-modal transportation policy.

Practical measures to promote cycling as follows;

• Cycling should be recognized as an important means of transport , as well as a popular recreational activity.

- Barriers to greater use of bicycles in urban areas including lack of safety, poor road design and road condition, the deterrent effect of steep grades and lack of facilities should be eliminated. (Queensland Department of Transport, 1997)
- Improved cycling parking facilities should be provided at major employment centers, retail centers and recreational centers. (Gardner, 1997)

## 4.2.2.2. Measures To Restrain Car Use

"Cars will take all the space you give them." (Bytrafik, 1997) It is generally agreed that the more road brings the more traffic. To provide balance between demand and supply Traffic Demand Management (TDM) or restraint has recently increased its importance. "In congested conditions each vehicle trip imposes delay(cost) on the other vehicles in the network which in total may exceed the net value of trip to the individual concerned. The individual does not pay for such community costs himself and thus they have no bearing on his decision to travel or choice of mode." (Gardner, 1997; pp:24)

There are some policies to restrain the car use:

1. Parking Control:

Parking control is the most common form of demand management. It includes the limitation of the total number of parked vehicles in a central area. Short term parking for economically important activities is not significantly affected but longer term parking, particularly for the period covered by the working day, is discouraged.

2. Supplementary Licensing:

This requires a vehicle to display an additional license when using the restraint area. Licenses can be obtained on a monthly or daily basis from a licensing office or various trade outlets. One of the most successful example of this is in Singapore. (Gardner, 1997) Singapore introduced a form of area-wide traffic restraint by introducing a pass system for entering central portion of the city. All vehicles entering the central city during certain hours must have first purchased a pass. (CART, 1989)

3. Congestion Pricing:

In this system, on street or in-vehicle detectors sense when congestion is occurring and a charge is levied accordingly. Detectors can operate so as to generate a charge related to the distance traveled within the area. This technique applied to Hong Kong and

its benefit is HK$ 4 million per day. But the scheme was shelved highlighting the importance of political acceptability of such a scheme. (Gardner,1997)

Another traffic restraint policies is occured; for example, in Ottowa, Canada introduced variable work hours and a dedicated busway service and in five years saw public transport patronage climb by 36%. Stockholm also has restricted all vehicles weighing over 3.5 tons fully laden to a special road haulage network from 10 pm to 6 am. The result has been a 60-70% drop in heavy trucks in the city center at night. (CART, 1989)

There are some other restraints such as reduction of parking spaces in the inner city, increasing parking fees in peak periods, and marketing of public transport which are succesfully applied all over the world.

### 4.2.2.3. Measures to Establish an Appropriate Road Hierarachy

To encourage sustainable modes of transport and restraining car use is not sufficient on its own. The use of private car is inevitable and therefore measures must be taken to ensure that it is accommodated appropriately. This involves, according to Gardner, "making decisions about which streets are suitable for through-traffic and on which streets through traffic should be discouraged. The production of a road hierarchy diagram is a useful design tool in this respect." (Gardner, 1997; pp:25)

The advantages of preparing a hierarchy for a town are;

• illustration of the existing road layout which identify omissions, irregularities and duplications,

• it allows the existing pattern to be compared with and ideal pattern in which all roads are used optimally for a road safety, movement, social and environmental requirements,

• comparison between the ideal and the actual case can identify deficiencies requiring immediate remedial action,

• it provides a useful mechanism for examining elements of the streetscape.

The road hierarchy assists us to determine which streets are upgrading and which street are downgrading. There are variety of measures available to this:

Street upgrading includes improving vehicular flows on through routes. Junction design, parking controls, traffic signals and urban traffic control are the tools of it.

Street downgrading consists restricting vehicular flows on local routes. Traffic calming techniques assist the street downgrading actions. (Gardner, 1997)

## 4.3. Conclusion

Street use, as Rapoport states, mostly depends on the cultural and physical variables. But today the decline in the use of streets are mostly influenced by the contemporary social and political systems which encourage privatization of people. Pedestrians, the real users of traditional cities, were removed from street activities and life. In some developed nations streets became the center of crime.

After 1960's positive impact of street on community life has recognized. The new designs took pedestrians, cyclists and multi-modal transportation as the prime actors in creating livable streets. On the other hand, traffic calming policy and techniques are the commonest among these new approaches. Because it contains from area-wide street improvement policies to comprehensive transport planning and urban design considerations. Therefore, this study will be focused on traffic calming techniques and applications. In the next chapter, theoretical framework of traffic calming will be examined in detail.

# Chapter 5

## TRAFFIC CALMING

### 5.1. What is Traffic Calming

The term "traffic calming" is open to interpretation and described by various sources in such ways;

"Traffic calming is a form of traffic management based upon urban design properly applied on a community-wide basis." (Halifax Regional Municipality, 1996)

"Traffic calming can be defined as restraining of automobile traffic through the use of measures which physically alter the operational characteristics of a roadway". (Jacobson, 1996)

"Traffic calming refers to the practice of designing streets to reduce traffic vehicle speeds, ensure that drivers are more careful, or take safer roads" (Mean Street, 1997)

"Traffic calming is the management of traffic to improve safety and circulation, for both pedestrians and vehicles, and quality of life" (Genesis Group, 1998)

Under these circumstances, traffic calming is fundamentally concerned with reducing the adverse impact of motor vehicles on built-up areas.

According to Munn and Patterson, the traffic calming concept implies that the balance of power between motorized and non-motorized vehicles needs to be tipped in favor of pedestrian and cyclists. (Munn and Patterson, 1998) However, traffic calming, as Southworth and Ben-Joseph suggest, is not an anti-car policy. It consists of redesigning of physical aspect of streets on the side of pedestrians social and physical needs. (Soutworth&Ben-Joseph, 1996) It involves streets redesigns which guide or restrict the physical movement of motor vehicles. (Samuels, 1996)

The main objective of traffic calming is to reduce the adverse effects of road traffic. The other significant objectives of traffic calming may be summarized as follows;

- "To improve safety and convenience for vulnerable road users, including pedestrians, cyclists and handicapped people,
- To reduce number and severity of accidents,
- To decrease noise and air pollution,

- To provide space for non-traffic activities includes rest and play,
- To enhance street appearance and reduce the number of traffic signs,
- To provide more planting and greenery,
- To promote local economic and cultural activity,
- To implement improvements in public transport,
- To achieve an overall improvement in the environment,
- To discourage non-essential use of unsuitable routes by motor vehicles." (Devon County Council, 1991; pp:12)

Traffic calming aims to create safe and pleasant environment for non-car users through some specific measures. However, traffic calming measures will be more effective if they can be combined with regional scale sustainable land-use and transportation objectives.

## 5.2. Background of Traffic Calming Concept

Traffic calming has its origins in the Dutch "Woonerf" schemes of the 1970's, and since then has been further extended and refined throughout northern Europe but particularly in the Netherlands.

Early Stages of Traffic Calming:

Early responses to slow down the traffic in residential areas can be seen in Alker Tripp's works, Buchanan Report in Britain and writings of Jane Jacobs in United States.

Jacobs, in her book 'The Death and Life of Great American Cities' advocated the strict control by making sidewalks wider, slowing down the traffic down, discouraging traffic intrusion in areas where it is not required. According to Moughtin, this was the traffic calming policy that is written in 1960's and perhaps she was one of the first forerunners of the Woonerf concept. (Moughtin, 1996)

In Britain, as Hass-Klau suggested, Alker Tripp was the first person who developed an overall approach of traffic calming in residential, shopping and working areas in 1950's. His concept implied substantial road construction and road widening for his arterial and sub-arterial roads. However, in residential and shopping areas where the pedestrian density is extremely high, adverse effect of motor traffic would be reduced.

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The street in such areas should be restrictive in order to discourage through traffic. Although he did not use traffic calming measures as the area-wide techniques he thought a major part of the traffic calming concept for the first time in history. (Hass-Klau, 1990)

Again in Britain, Colin Buchanan and his team prepared "Traffic in Towns" report of 1963 which had much more impact in Europe. Buchanan's team came up with a technique for evaluating and restructuring the urban traffic system by creating specific zones, which they called " environmental areas" or "Urban rooms". These areas or rooms were different character according to traditional street in term of their traffic levels and their functions. Streets would not only be evaluated according to their capacity to carry traffic, but also environmental quality as measured by noise pollution, social activity, pedestrianization and visual aesthetics, while others would allow pedestrians and vehicles to mix safely in the street. The public domain would be recreated for pedestrian by redesigning the physical features of the street. (Southworth&Ben-Joseph, 1996)

However, Traffic in Town report was misunderstood in Britain. While most British planners saw the report as the promoter of large-urban road building program, German and Dutch planners saw Buchanan as "the father of traffic calming." (Hass-Klau, 1990; pp:175)

In the 1960's and early 1970's , in a number of cities around the world, angry residents demanded reductions in the level of traffic in their residential areas. This movement combined with the lessons learned from the pedestrianization of city centers. First of all, Local Area Traffic Management (LATM) began in many cities in the world. In this technique streets were classified into a hierarchy and then through traffic discouraged from local residential streets. LATM included: Turning some local streets into cul-de-sacs; speed bumps; narrowing of entries to streets or placing *neckdowns* mid block; and tight roundabouts. (CART,1989) Although LATM contained some of the traffic calming devices the implication of traffic calming measures became common with the Dutch Woonerf schemes of mid 1970's.

The original "Woonerf" schemes introduced the concept of shared space between vehicle and pedestrian. Shared street was first developed and executed in Netherlands, but its philosophical roots depended on Buchanan's Report of 1963 as discussed

previously, Buchanan's theoretical concept was inspired by Niek De Boer ,Professor of Urban Planning at the University of Emmen. (Southworth&Ben-Joseph , 1996) (Fig. 5.1)

1. Clearly marked entry
2. Sitting area/bench
3. Bend in driving lane
4. Parking space
5. Varied paving materials
6. No continuous curb
7. Chockers/planting beds
8. Typical Right-of-Way

Typical plan of a shared street

Typical cross section of a shared street

20'    12'
50'
ROW
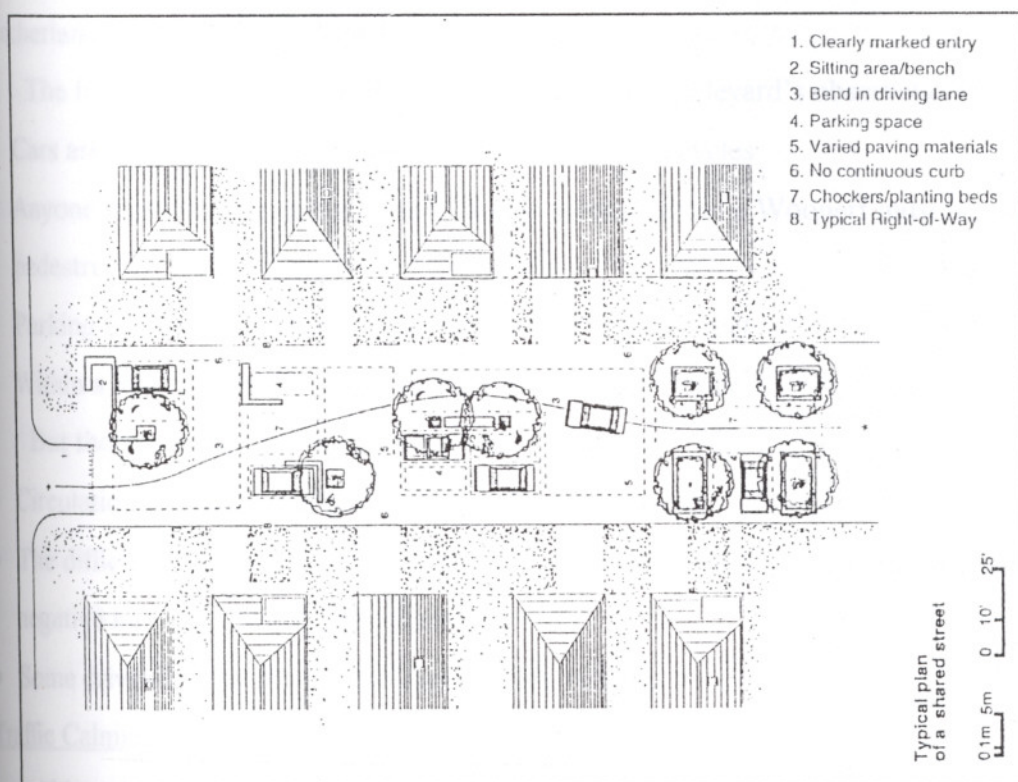
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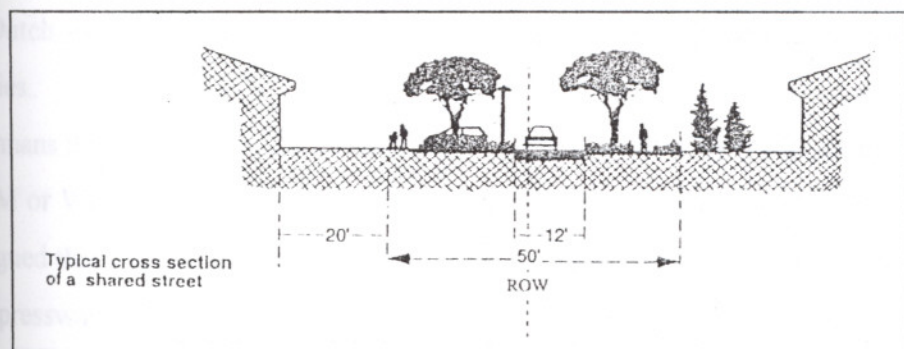
b

Fig. 5.1. Typical woonerf street plan (a) and street cross section (b) (Southworth and Ben-Joseph, 1996)

His discussion was on how to overcome the contradiction between children playing and car use in urban streets by his design suggestions for the new town of Emmen in the Netherlands. "He designed cul-de-sacs streets with additional streets for pedestrians. The

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cul-de-sacs were designed in such a form that motorist felt as if they were driving in their own garden  and he gave these streets a different name: Woonerf" (Hass-Klau, 1990; pp:212) Then, woonerf or residential yards was applied by the municipalities all over the Netherlands. (Southworth&Ben-Joseph , 1996)

The five basic principles of Woonerf according to Appleyard's observations:

- Cars are driven at a walking pace, as are mopeds and cycles
- Anyone who drives a car or rides a bike or moped within a Woonerf must not impede pedestrians
- Parking is forbidden except where P is painted on the street
- Within a Woonerf traffic from the right always has priority.

But there were some critics on the idea of Woonerf:

- Circulation problems, parking problems for service vans.
- The difficulty, strangers have finding their way around streets, the concept can have a negative impact on adjacent residents.
- Some drivers fail to respect the speed limits. (Carr at al.,1992)

Traffic Calming in Germany:

Although there are some negative impacts of woonerven principles, other countries watched the Dutch experiment with interest. Germany in particular took a keen interest in the Dutch experiment because of their own success with pedestrianization of their inner cities.

Germans introduced the idea of area-wide traffic restraints or traffic calming instead of LATM or Woonerf schemes that only consists of local streets with low traffic flows. They argued that traffic must be calmed on all roads including major roads, highways and even expressways. The devices that used in area-wide traffic calming technique were road narrowing, closing traffic lanes and planting trees.

Traffic Calming in Other Countries:

German traffic calming experience was in larger scale and provide great success. Other cities and countries have now followed the German lead. The result of these applications was successful. For example, in Holland, Sweden and Japan daily traffic has been decreased by 30-50%. (CART,1987)

## 5.3. Traffic Calming Techniques

Wide variety of traffic calming techniques are available to decrease the impact of vehicular traffic and improve to pedestrian environment. These techniques can be applied in residential and shopping streets. (Gardner, 1997)

In Traffic Calming Guideline of Devon County Council specific traffic calming measures described as two main categories;

- First, the measures to reduce vehicle speeds(speed reduction measures)
- Second, the supporting measures which help to create an environment conducive to calm driving. (Supporting environmental and safety measures) (Devon County Council, 1991)

In order to achieve safe and traffic calmed environment these calming devices should be used in combination. For example, road hump alone is not sufficient to create calm driving style or to change the street environment on the side of pedestrian activities.

Specific measures can also be designed to serve multiple functions. A round top hump, for example, is mainly for speed reduction whereas a flat top hump can be integrated with the sidewalk to provide a better pedestrian and wheelchair crossing facility. (Devon County Council, 1991)

Fifteen specific measures are given in the under the following sub-headings: objectives, design features, application, advantages, and disadvantages.

### 5.3.1. Speed Reduction Measures

1. Vertical Shifts in the Carriageway

Vertical shifts in the carriageway are the most effective and reliable of the speed reduction measures currently available. (Fox, 1997) This may be an appropriate to use in local streets where traffic is traveling at 20 mph (30 kph) and below, although they may be used at speeds up to 30 mph (50 kph) and along bus routes if vertical shifts are reduced. (Gardner, 1997) There are currently several different techniques available to achieve this; Road hump, plateau (speed table), and cushion.

Road Humps: "A raised proportion of carriageway laid at right angles to the direction of traffic. Can have flat top integrated with the footway to assist crossing movements." (Devon County Council, 1991; pp:31) The width of humps may be restricted to allow the retention of existing carriageway drainage. If parking spaces are at a premium road humps may be preferable to other measures. Road humps are not recommended on bus routes due to the discomfort caused to passengers. (Hass-Klau, 1990)

Plateau:

Plateau extend the full width of the carriageway between the kerbs and extend over a longer length of road than humps. The surface should be of a different material to the carriageway and sidewalks. Plateau are more suitable than road humps when the measures are implemented on bus routes. The length of the plateau should be sufficient to accommodate the full wheelbase of the bus to reduce passenger discomfort to a minimum. (Fox, 1997)

Cushion:

"Cushion is the portion of carriageway with flat top, extending over part of carriageway width allow exemption for certain emergency vehicles, other large vehicles and two wheelers." (Devon County Council, 1991; pp:31)

Objectives:

The main objective of these devices is to improve safety by reducing vehicle speeds. Plateaux and flat top hums are also designed to allow pedestrians and wheelchairs to cross without any change of level.

Design Features:

Vertical shifts in the carriageway might be constructed in materials different from or similar to the rest of the carriageway. Material changes help to create speed reduction effect visually but they should be placed at regular intervals to provide effective speed reduction. Where the carriageway is raised to sidewalk level, vertical elements such as trees and bollards may need to be provided to keep vehicles out of the pedestrian areas. If the road humps and plateaux are constructed from kerb to kerb the satisfactory arrangement for drainage can be made. (Fig. 5.2)

Applications of Vertical Shifts:

Vertical deflections are generally applied in local streets where the desired speed limit below 30 kph. Flat top humps are more useful than round top humps at places

where the pedestrians cross. Cushions can also easily be installed and not create problems for emergency vehicles, buses and bicycles.

To get successful results, the dimensions and placement of vertical shifts should be chosen properly. The effectiveness of such devices, at a given target speed, depend on three factors;

• Height of shift

• Gradient or ramp or profile of slope

• Distance between measures. (Devon County Council, 1991)

For example, to achieve an 85 percentile traffic speed of 30 kph less severe ramps with dimensions of 80 mm or 100 mm (height) are recommended.
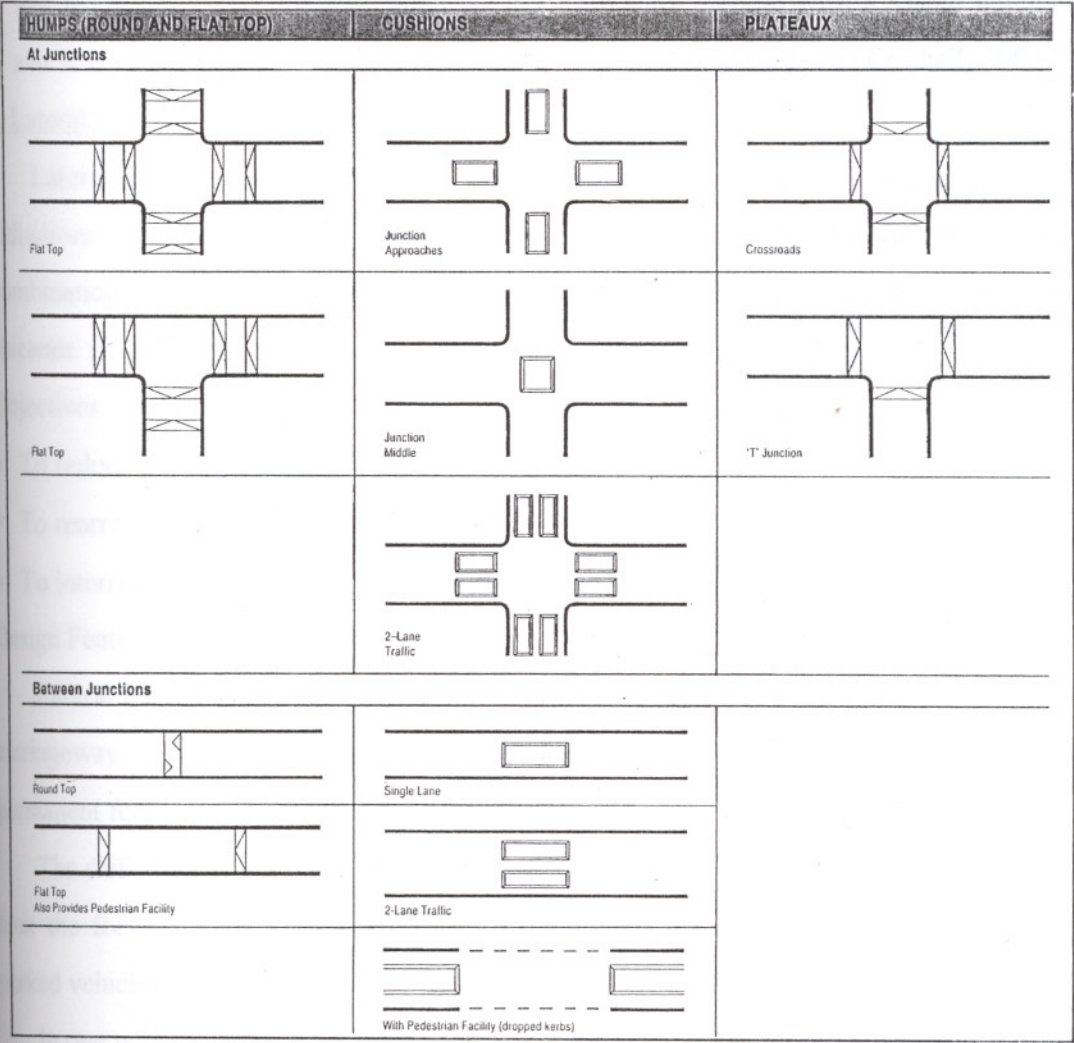


Fig. 5.2. Vertical shifts, (Devon County Council, 1991; pp:32)

Advantages:

- Vertical shifts reduce reckless high speeds
- It is easy to install the items without needing re-paving or reconstruction of street
- It can be applied to every section of street
- Cushions can provide exemption for certain emergency vehicles, other large vehicles and two wheelers and do not interfere with drainage.

Disadvantages:

- Vertical shifts can not be provide environmental improvement if they are not support by other devices.
- Road humps do not discriminate between classes of vehicle and can be unpopular with bus operators.
- Flat top humps and plateaux need careful design for people with a visual handicap, and may require partial reconstruction of the street. (Devon County Council, 1991)

2. Lateral Shifts in the Carriageway

Lateral shifts in the carriageway are less effective than vertical ones in achieving reductions in speed, but their impacts can be significantly increased when used in combination with a vertical shifts. Essentially all lateral shifts may be classified as chicanes. (Fox, 1997)

Objectives:

- To reduce traffic speeds and thus improve safety
- To rearrange street space, such as parking and sidewalks
- To interrupt long views (Devon County Council, 1991)

Design Features:

Lateral shifts are created by building alternate sidewalk extensions or islands on the carriageway. It also included alternate angled parking which provided and defined with permanent features such as planters.

The shift of lateral axis must be sufficiently severe to enforce the physical turn, or to limit the forward view, and must not be dependent on the presence or otherwise of parked vehicles.

In one way street limiting long forward views with lateral deflections is not normally effective thus they can be supported with vertical shifts. On the other hand in two-way

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streets because sufficient carriageway width provided at horizontal shifts this allows drivers to take a racing line and have negative impacts on speed reduction. The problem can be eliminated by dividing the carriageway at the shift. (Devon County Council, 1991) Applications of Lateral Shifts:

This is an appropriate technique to use in local streets where traffic is traveling at 30 kph and below. The more severe forms are not suitable along bus routes. The carriageway may be laterally shifted both at junctions and between junctions. Techniques include pavement extensions central islands and chicanes. Chinaces are a form of pinch point implemented on alternating sides of the carriageway. Road widths need to be wider than at normal pinch points because of the difficulty involved in manoeuvring around them. (Gardner, 1997) (Fig. 5.3)
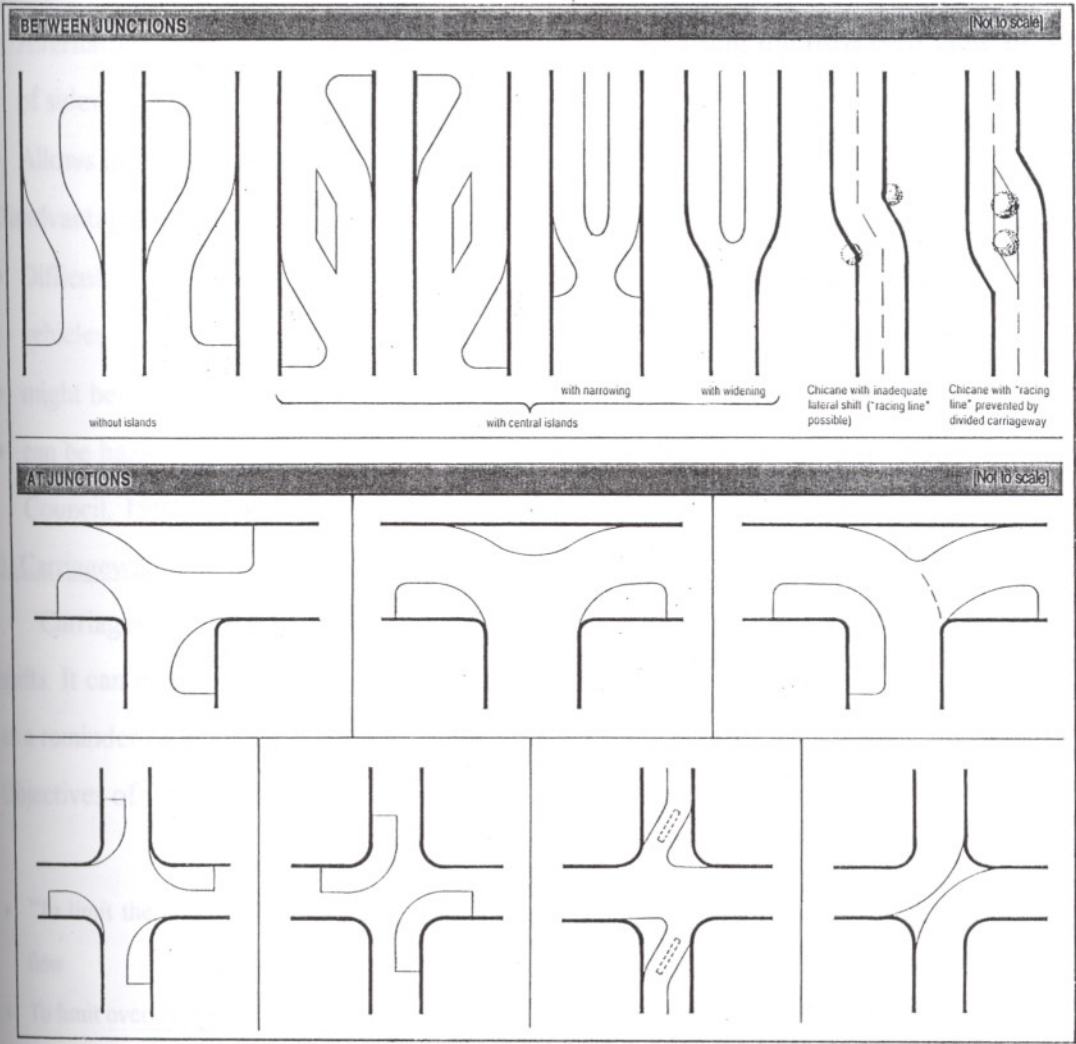


Fig 5.3. Lateral shifts, (Devon County Council, 1991; pp:37)

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View blocking by lateral shifts help to create speed reduction and they are useful mainly for limiting long forward views in 30 mph (50 kph) roads.

The horizontal shift in the carriageway should not be less than the width of a traffic lane to produce an effective "forced turn". Drivers ought to be required to make a turn of at least 45°. In order to provide narrow carriageway widths, traffic 3 m to 3.6 m and two-way traffic 4.5 m to 6.5 m are recommended. Lateral shifts might be combined with vertical shifts to ensure speed reduction. To lessen the impacts of islands, to reduce visual impacts of parked cars and to limit the view planting can be used. (Devon County Council, 1991)

Advantages:

- Lateral shifts can be cheap and easy to construct if no rebuilding of the carriageway is required
- Alternative parking reduces pedestrian danger by ensuring unobstructed view of 50% of sidewalk
- Allows interesting street design features

Disadvantages:

- Difficult to achieve good speed reduction effect whilst allowing access for larger vehicles
- might be uncomfortable for bus passengers
- can be hazardous for cyclists if speeds are higher than about 25 kph. (Devon County Council, 1991)

3. Carriageway Narrowing

Carriageway narrowing may be considered as another supportive measure to vertical shifts. It can not be considered as a speed reducing device in itself, but it can be thought as a reminder or encouragement to drive slowly. (Fox, 1997)

Objectives of Carriageway Narrowing:

- "To limit the ability of vehicles to pass one another, and thus to limit speeds or to interrupt traffic flow
- To limit overtaking
- To reduce pedestrian crossing distance
- To restrict the size of vehicle

- To provide priority for buses
- To prevent on-street parking
- To define or shelter on-street parking spaces" (Devon County Council, 1991; pp:40)

Design Features:

Carriageway narrowing or constrictions are spot measures at intervals along the street. They can be achieved on one or both sides of the road, or by the inclusion of a central island. Constrictions will have different effects and design requirements in one-way and two-way streets. They are an important features of multi-objective traffic calming design, but need to be combined with other measures for effective speed reduction. (Fig. 5.4)
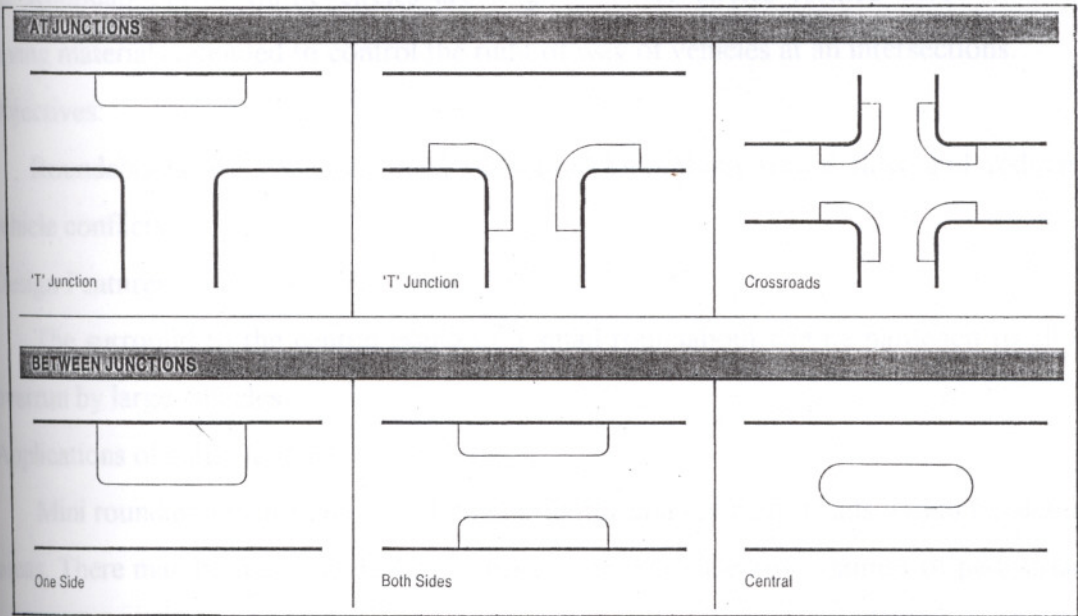


Fig. 5.4. Carriageway narrowing, (Devon County Council, 1991; pp:41)

Applications of Carriageway Narrowing:

Carriageway dimensions will depend on the volume and type of traffic, the speed limit in force and the road classification. Constrictions or narrowing are useful in both living and mixed priority areas where traffic volumes are less than 500 vehicles per hour. They are suitable for one-way and two-way streets and useful in associations with prohibitions relating to large vehicles. (Devon County Council, 1991)

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Advantages:

- Road narrowing greatly improve the safety of pedestrians resulting from the shorter distance to cross the street.
- Assists pedestrian crossing the road
- An important supporting measure for other speed reduction measures (Jacobson, 1996)

Disadvantages:

- Not always reliable as a stand alone speed reduction device
- Can use problems for cyclists unless smooth materials are used, which in turn makes the narrowing less effective. (Fox, 1997)

4. Roundabouts:

Roundabouts or traffic circles are large diameter circles formed curbs or other paving materials intended to control the right of way of vehicles at an intersections.

Objectives:

Roundabouts are used to speed reduction, smoothing traffic flow and reducing vehicle conflicts.

Design Features:

The surround to the central island of a small roundabout can be hardened to allow overrun by large vehicles.

Applications of Roundabouts:

Mini roundabouts are often used on distributor and collector roads within residential areas. There may be useful in 30 kph zones where there are low volumes of pedestrians and cyclists. The design of roundabouts should be supported by planting and other features to soften the appearance. (Fig. 5.5)

Advantages:

- Ensure smooth flow of traffic where traffic flows are moderate
- All turning movements possible
- Can reduce traffic speeds if properly designed

Disadvantages:

- Danger and/or inconvenience for pedestrians and cyclists
- Uncomfortable for bus passengers (Devon County Council, 1991)

Fig 5.5. Roundabout, Sheffield, (Devon County Council, 1991; pp:44)

### 5. Small Corner Radii

Objectives:

The objectives of small corner radii are, to slow turning movements at junctions, to assist pedestrian while crossing the street, and to provide greater safety for cyclists.

Design Features:

Small corner radii ought to be used according to type of streets. Ramped corners can be used to slow cars while still allowing access by large vehicles.

Application of Small Corner Radii:

Small corner radii can be applied to both local and mixed priority streets and where turning movements would be too fast. On the other hand, small radii are not necessary where slow speeds are achieved. Suggested maximum kerb radii are stated in table 5.1.

Small radii should be supported by bollards which prevent overrunning of sidewalk at corners. In addition to this ramped corners may be used to slow down the traffic at junction and can be adapted in mixed priority and traffic areas. Central islands may also be needed in the mouth of junction to prevent vehicles taking a racing line. (Fig. 5.6)

Table 5.1. Suggested maximum kerb radii (m)

| Road Class | Local | Collector | Mixed |
|------------|-------|-----------|-------|
| Local | 2 | - | - |
| Collector | 2 | 3 | - |
| Mixed | 3 | 4 | 6 |
| Traffic | 4 | 6 | 8 |

( Source: Devon County Council, 1991; pp:45)



| SMALL RADIUS (eg. 1 metre) | LARGE RADIUS (eg. 7 metres) |
|---|---|
| – Pedestrian desire line [— — —] is uninterrupted<br>– Vehicles turn slowly [10 mph–15 mph in second gear] | – Pedestrian desire line involves longer crossing distance<br>– Short crossing distance involves detour<br>– Vehicles turn fast [20 mph–30 mph in third gear] |
| – Pedestrian does not have to look far behind to check for turning vehicles<br>– Pedestrian can normally establish right of way because vehicles turn slowly | – Pedestrian must look far behind to check for fast turning vehicles<br>– Pedestrian cannot normally establish right of way against fast turning vehicles |
| – Kerbs at right angles to pedestrian desire line<br>– Especially convenient for prams buggies and trolleys | – Kerbs askew to pedestrian desire line<br>– Especially difficult for prams buggies and trolleys |
| – Cycle and car speeds compatible | – Danger from fast turning vehicles cutting across slower cyclist |

Fig 5.6. Effects of corner radii on pedestrians and cyclists, (Devon County Council, 1991; pp:46)

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Advantages:

- Assists pedestrians to establish right of way over turning vehicles at junctions
- Reduce danger of cyclists being cut across by turning vehicles

Disadvantages:

- Create difficulty for large vehicles while turning (Devon County Council, 1991)

6. Road Markings

Objectives:

Road markings assist drivers and to improve predictability of vehicle path for the benefit of pedestrians, cyclists and state priority.

Application of Road Markings:

Road markings are useful in traffic areas for safety and can be also used for mixed priority areas. They are applied according to regulations of the municipality. (Fig. 5.7)



Fig. 5.7. Road Markings, (Devon County Council, 1991; pp:49)

Advantages:

- "Simple, cheap and usually effective,
- Useful at night

Disadvantages:

- Some markings, for example center lines, encourage speed." (Devon County Council, 1991; pp: 49)

## 5.3.2. Supporting Measures

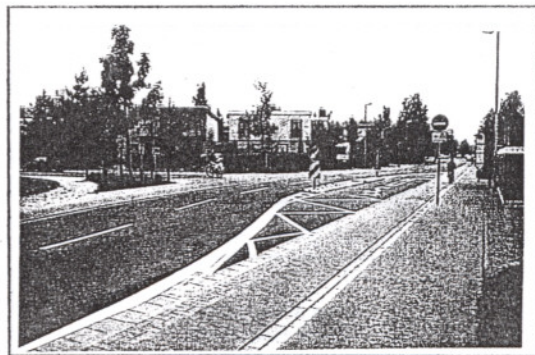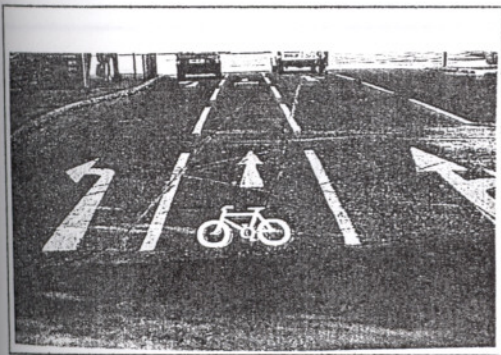A number of supporting measures are commonly used to support the speed reducing techniques. However, as independent measures they generally have little impact on speed reduction. (Fox, 1997)

1. Optical Width

Objectives:

Optical width is used to encourage slow driving and to enhance street character.

Design Features:

Width of the street and height of the vertical elements influence drivers' perception and make them slower visually. This effect can be created by a combination of measures like road narrowing, tree planting close to carriageway on some other vertical features. (Fig. 5.8)
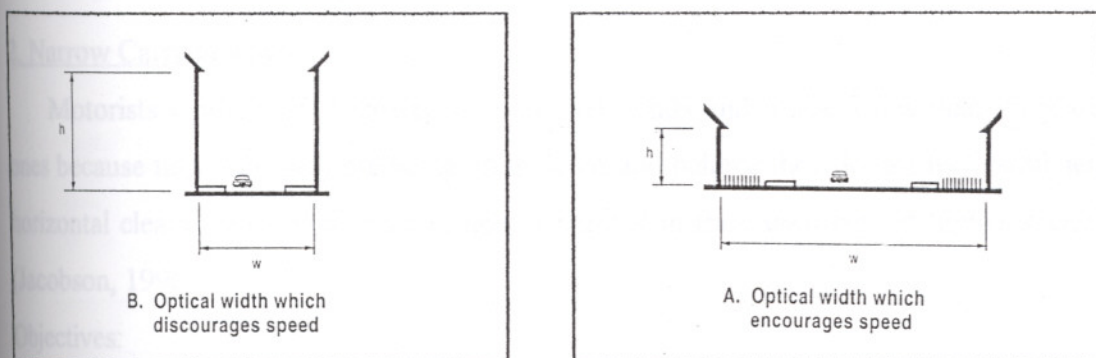


Fig. 5.8. Optical width (Devon County Council, 1991; pp:52)

Application of Optical Width:

It can be applied to the streets which show wide an open character that encourage speed. Speed reduction can be significant when the height of buildings exceeds the width of street. Also it should be combined with horizontal shifts and speed humps. (Fig. 5.9)

Advantages:

• The use of trees to ensure optical width also help the enhancing of environment and create micro-climate

Disadvantages:

- When trees are used the effects may be reduced in winter when they are without foliage. (Devon County Council. 1991)
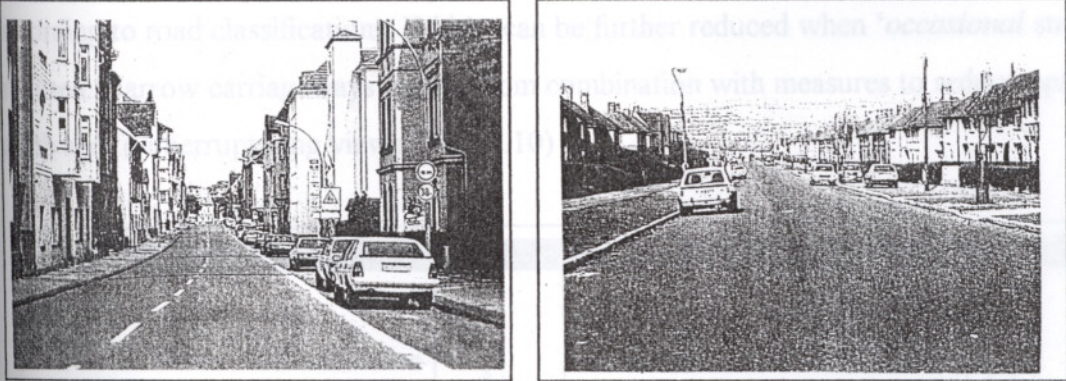


Fig. 5.9. Optical width, (Devon County Council, 1991; pp:51)

## 2. Narrow Carriageways

Motorists tend to drive slower on narrower roads and traffic lanes than on wider ones because they feel they are being constricted and believe they do not have sufficient horizontal clearance to pass other vehicles or travel in their own lane at higher speeds. (Jacobson, 1996)

Objectives:

- "To emphasize low speed and priority to pedestrians and cyclists
- To discourage overtaking
- To reduce the width of the carriageway which pedestrians have to cross
- To create space for non-traffic activities
- To reduce optical width
- To provide defined on-street parking and loading space."(Devon County Council,1991; pp:53)

Design Features:

To reduce carriageway width allows to use releasing space for different purposes. However access requirements to individual properties need careful consideration.

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Application of Carriageway Narrowing:

Excessive carriageway width is best on all roads in built-up areas, but narrow carriageways are especially valuable where extra space is required for pedestrians, cyclists and for frontage activities. Carriageway width and layout should be determined according to road classifications. Widths can be further reduced when '*occasional* strips' are used. Narrow carriageways benefit from combination with measures to reduce optical width and to interrupt long views. (Fig. 5.10)
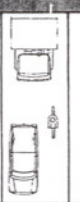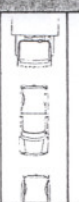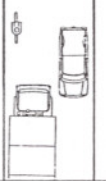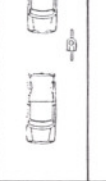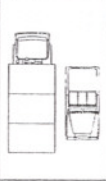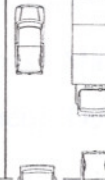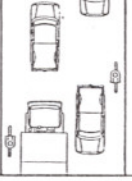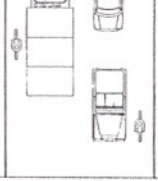


| 20 mph STREETS | | 30 mph STREETS | |
|---|---|---|---|
| One-Way<br>≤ 1000 vph<br>HGV/Bus ≤ 5%<br>Cycles<br><br>Cat: L C M | 3.25m | One-Way<br>Any volume<br>HGV/Bus ≤ 10%<br>Cycles separate<br><br>Cat: M | 3.25m |
| Two-Way<br>≤ 500 vph<br>HGV/Bus ≤ 5%<br>Cycles<br><br>Cat: L | 4.5m | One-Way<br>≥ 500 vph<br>HGV/Bus ≤ 10%<br>Cycles<br><br>Cat: M T | 4.0m |
| Two-Way<br>500-1000 vph<br>HGV/Bus ≤ 5%<br>Cycles<br><br>Cat: C M | 5.0m | Two-Way<br>≤ 1000 vph<br>HGV/Bus ≤ 5%<br>Cycles separate<br><br>Cat: M | 5.5m |
| Two-Way<br>500-1000 vph<br>HGV/Bus ≤ 10%<br>Cycles separate<br><br>Cat: C M | 5.5m | Two-Way<br>≥ 1000 vph<br>HGV/Bus ≤ 5%<br>Cycles separate<br><br>Cat: M T | 6.5m |
| Two-Way<br>500-1000 vph<br>HGV/Bus ≤ 10%<br>Cycles<br><br>Cat: C M | 6.5m | Two-Way<br>≥ 1000 vph<br>HGV/Bus (any percentage)<br>Cycles<br><br>Cat: M T | 7.3m |
| KEY: L Local streets | C Collector streets | M Mixed priority streets | T Traffic priority roads |

Fig 5.10. Carriageway widths, (Devon County Council, 1991; pp:54)

Advantages:

- Can be adapted to all roads

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- Allows reclamation of space for other uses

Disadvantages:

- Potential for conflict between motor vehicles and cyclists, unless separate provision is made for the latter

- Reduced width when a vehicle breaks down and for certain maintenance operations. (Devon County Council, 1991)

3. Changes of Surface, Texture or Color:

The changing of the road surface the standard asphalt to interlocking brick, concrete pavers, or colored and stamped asphalt can influence driver behavior and reduce speeds. (Jacobson, 1996)

Objectives:

- "To distinguish between different surface functions

- To improve street appearance

- To reinforce speed reduction measures

- To simplify construction of traffic calming measures in the carriageway

- To improve visual impact, particularly in poor light and under street lighting." (Devon County Council, 1991; pp:60)

Design Features:

Texture changes in rough road surface can produce a rumble to alert drivers to their surroundings. Smooth surfaces ought to be used in pedestrian crossings. Materials should be used according to the existing street character and townscape merit. Different colors can be carefully designed and constructed. (Fig. 5.11)

Application:

Surface changes and colors are generally used to define a ramped entrance into a side road, and may also be used for decorative purposes. It is not suitable where traffic speeds are higher than 50 kph.

Advantages:

- Can create visual interest and improved street appearance

- If combined with vertical shifts can be create speed reduction effect

- Different uses and purposes can be separated easily with these devices. (Devon County Council. 1991)

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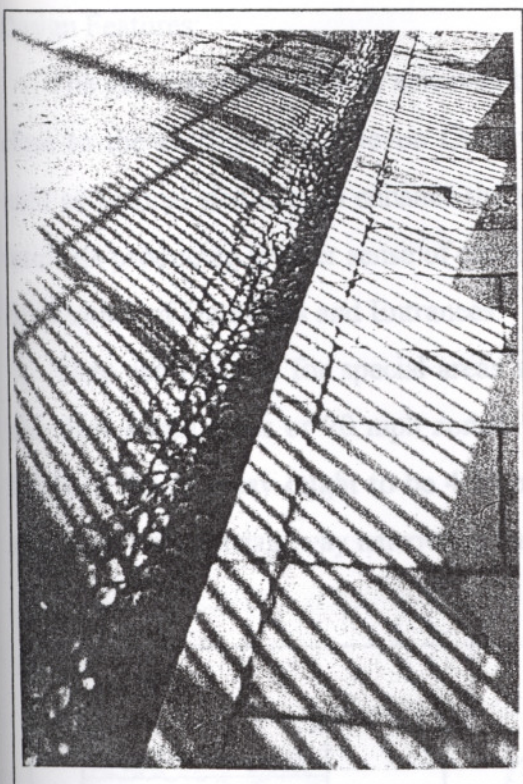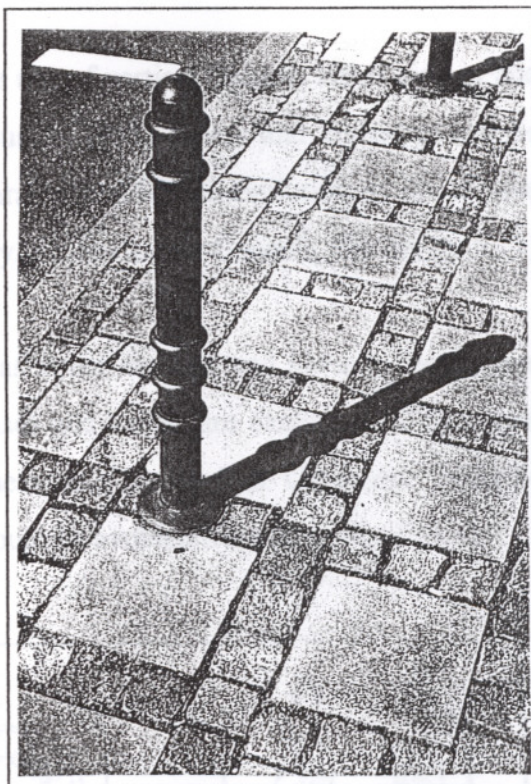
<div align="center">a           b</div>

Fig. 5.11. Surface changes in calmed streets: Lichfield, England (a), and Cologne, Germany (b), (Devon County Council, 1991; pp:62)

Disadvantages:

- Rumble strips are a traffic calming measure that often cause problems due to the noise levels. It has been shown that granite sets result in noise levels between 3-5 dBA higher than smooth asphalt.

- Rough surfaces are potentially hazardous for cyclists and pedestrians. (Fox, 1997)

4. Entrances and Gateways

Gateways can be used at the entrance way to a community to define the neighborhood and give it a distinct identity. While most gateways do not actually physically restrain motorists, they ensure psychological impact on driving behavior of motorists. (Jacobson, 1996)

Objectives:

- To provide visual and tactile cue to drivers of entry into a specific area or environment. (Clark County Council, 1997)

**Design Features:**

The gateway effect can be achieved by the use of vertical features either side of and close to the carriageway. (Devon County Council, 1991) Pillars and archways can be used as vertical elements to enhance the appearance and lift the evolution of drivers and residents producing greater sense of community.(Clark County Council, 1997)(Fig. 5.12)

**Application of Gateways and Entrances:**

They can be used for special areas such as street markets and historic centers and also slow speed areas or 20 mph zones. If buses and lorries are excluded the minimum height of the gateway ought to be 4.25 m otherwise it can be 5 m. Gateways might be supported with carriageway narrowing and should be avoided from large dimensions.

Arch formed by climbing plants on wires

Free-standing trellis arch

Entrance to 20 mph zone using high planting

Gateway effect with planters and low shrubs

Entrance to village

Village entrance with divided carriageway and side and central planting
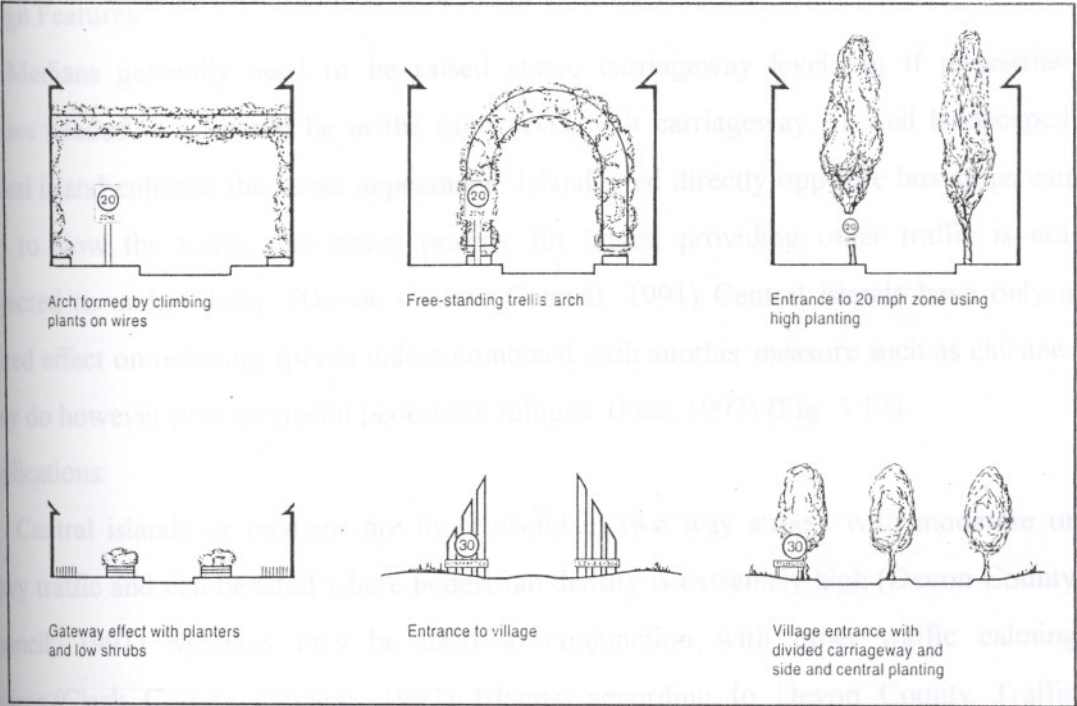
Fig 5.12. Entrances and gateways, (Devon County Council, 1991; pp:63)

**Advantages:**

• Effects drivers behavior in change of street priorities

• Adds visual enhancement to the streetscape.

• Poses no access restrictions for road users. (Clark County Council, 1997)

**Disadvantages:**

• High cost for device installation

• If all classes of vehicles allowed the device might be too large for the scale of the street. (Devon County Council, 1991)

5.Central Islands(Medians)

Central islands or medians are generally center street located and used to separate opposite lanes. (Clark County Council, 1997)

Objectives:

• To provide visual cue of change in roadway environment
• To make crossing easier and safer for pedestrians
• To interrupt forward views
• To assist in the creation of gateways
• To prevent overtaking. (Clark County Council, 1997)

Design Features:

Medians generally need to be raised above carriageway level but if pedestrian crosses needed they should be in the same level with carriageway. If well landscaped central island enhance the street appearance. Island sited directly opposite bus stops can help to slow the traffic and retain priority for buses, providing other traffic is not subjected to undue delay. (Devon County Council, 1991) Central islands have only a limited effect on reducing speeds unless combined with another measure such as chicane. They do however provide useful pedestrian refuges. (Fox, 1997) (Fig. 5.13)

Applications:

Central islands or medians are most useful in two way streets with moderate or heavy traffic and can be sited where pedestrian density is extremely high.(Devon County Council, 1991) Medians may be used in conjunction with other traffic calming devices.(Clark County Council, 1997) Islands, according to Devon County Traffic Calming Guidelines, "should be at least 2 m wide and about 4 m long if tree planting is to be included. Level areas where pedestrians are encouraged to cross should be of generous length, and the case of long central islands should be repeated at frequent intervals, especially in shopping streets." (Devon County Council, 1991; pp: 67)

Advantages:

• Prevent passing
• Separates opposing vehicles travel lines

- Provides visual enhancement of roadway

Disadvantages:

- Cause major parking removal
- If landscaped, it can be expensive
- Limits access and movement (Clark County Council, 1997)
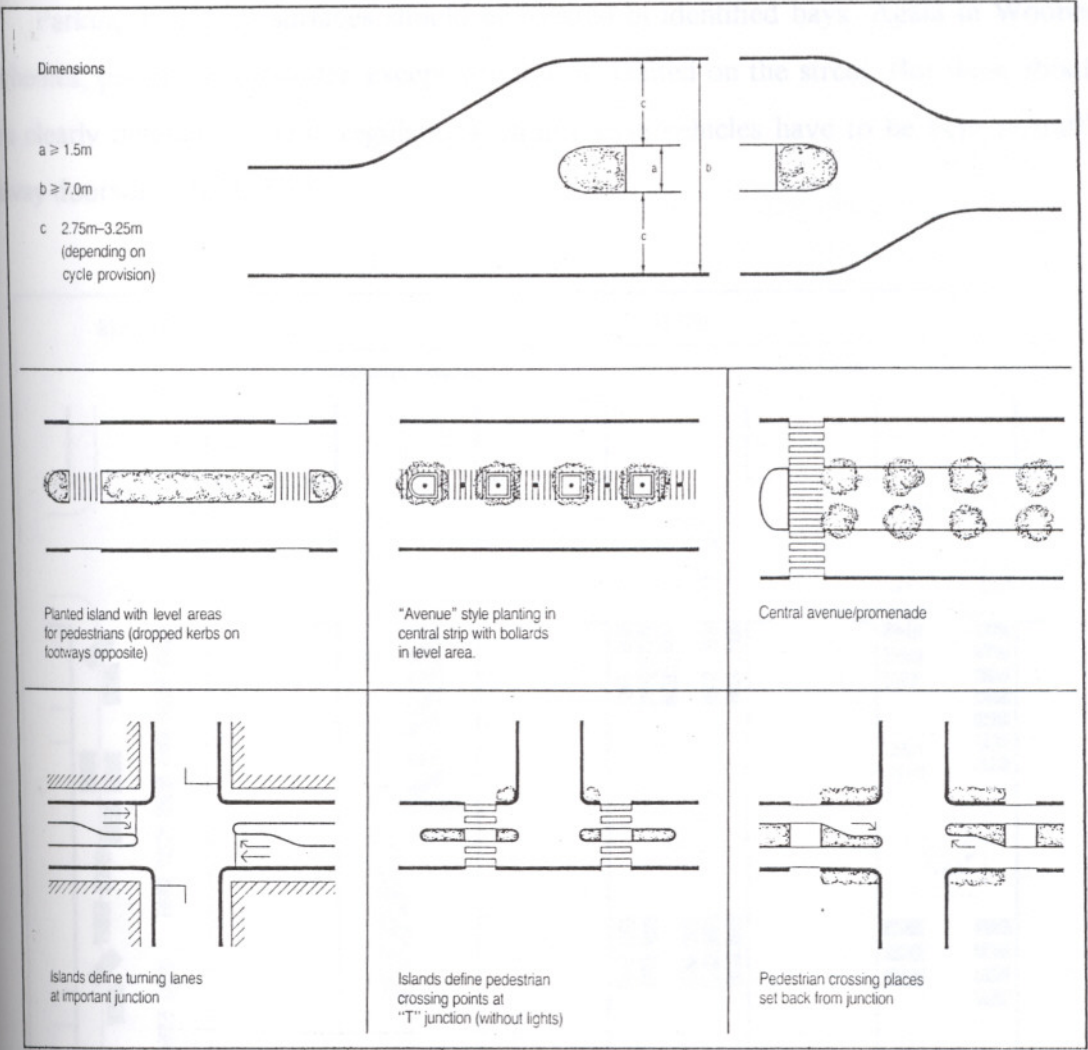


Fig. 5.13. Central islands in mixed and traffic priority areas, (Devon County Council, 1991; pp:66)

6. Shared Surfaces:

Objectives:

Shared surfaces aim to allow pedestrians freedom of movement within the street.

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Design Features:

In original woonerf schemes there was no separation between pedestrian and motor traffic. However this can create feelings of insecurity for pedestrians especially people with a visual handicap: Some separation may be often be desirable and can be created with bollard or low kerbs or street furniture consequently demarcation of people walk and carriageway is ensured.

Parking in shared surfaces should be located in identified bays. Again in Woonerf schemes, parking is forbidden except where P is painted on the street. But these should be clearly defined in traffic regulations. In any case vehicles have to be kept in traffic away doorways. (Fig. 5.14)
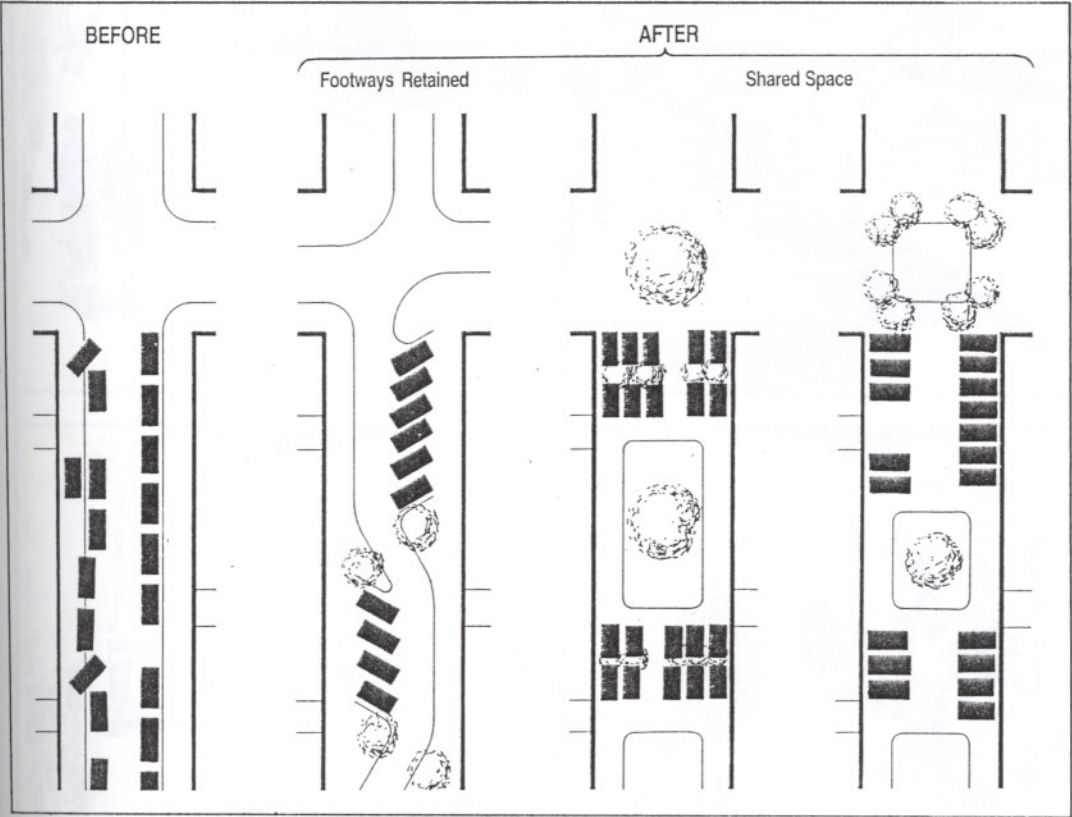


Fig. 5.14. Example of shared surface layouts, (Devon County Council, 1991; pp:69)

Applications of Shared Surfaces:

Shared streets are suitable to local streets where traffic flow is less than 300 vehicles Per hour. Shared surfaces, are one of the best solutions where average traffic flow is less

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than 100 vehicles per hour and where the pedestrian density is extremely high. Intensive pedestrian activity may possibly available in shopping streets, railway stations, at hospital or school entrances etc. Shared surfaces can be applied to junctions and links.

In order to ensure shared surfaces or shared street the space should not be so large and allow the presence of parked or moving vehicles to dominate the street scene. The distance between speed reducing elements should not be greater than 30 m.

The designing of shared surfaces required planting, paving, street furniture and other elements to create a pedestrian friendly environment. (Fig. 5.15)



Fig 5.15. Shared space, before and after, (Devon County Council, 1991; pp:71)

Advantages:

- Well designed schemes enhance street environment provide pleasure and safe spaces for their users.

Disadvantages:

- Can be expensive to provide
- Can create circulation problems if parking space is not properly designed and regulated. (Devon County Council, 1991)

7. Sidewalk Extension

Objectives:

- To ensure more space for pedestrians and reduce carriageway crossing distances
- To prevent parking at or near junctions, to define bus stops, pedestrian crossings and permitted parking areas.

Design Features:

The enlarged area should not be cut across by surface drainage channels. Extensions at corners ought to be avoid the problems for pedestrians created by large kerb radii. Extensions also be defined on-street parking areas sufficiently. Sidewalk extensions should especially ensured in focal points where people meet, chat and rest.

Application of Sidewalk Extensions:

Sidewalk extensions can be provided in junctions, pedestrian crossing, bus stops and on-street parking areas if needed. (Fig. 5.16)

Extensions which define on street parking areas should be a minimum of 1.8 m from the original kerb line, normally 2.25 m is preferred. Planted are as and bollard are supported this device and ensure security for pedestrians. The design of on-street parking should also be associated with sidewalk extensions. (Devon County Council, 1991)

Advantages:

- Widely applicable and relatively cheap according to other devices in pedestrian safety issues
- May influence positively the activities in street space such as shops, restaurants etc.
- Can imply permitted parking areas

Disadvantages:

- None (Devon County Council, 1991)

Extensions at crossroads

Extensions on non-priority route

With larger turning dimensions (to be used only with vertical shifts)

Extensions at side road ("T" Junction)

"T" Junction

"T" Junction

BETWEEN JUNCTIONS

Parking

One side

Parking

Parking

Both sides; with tree planting

At Zebra (or Pelican) crossing

Parking

BUS

BUS

Parking

At bus stops
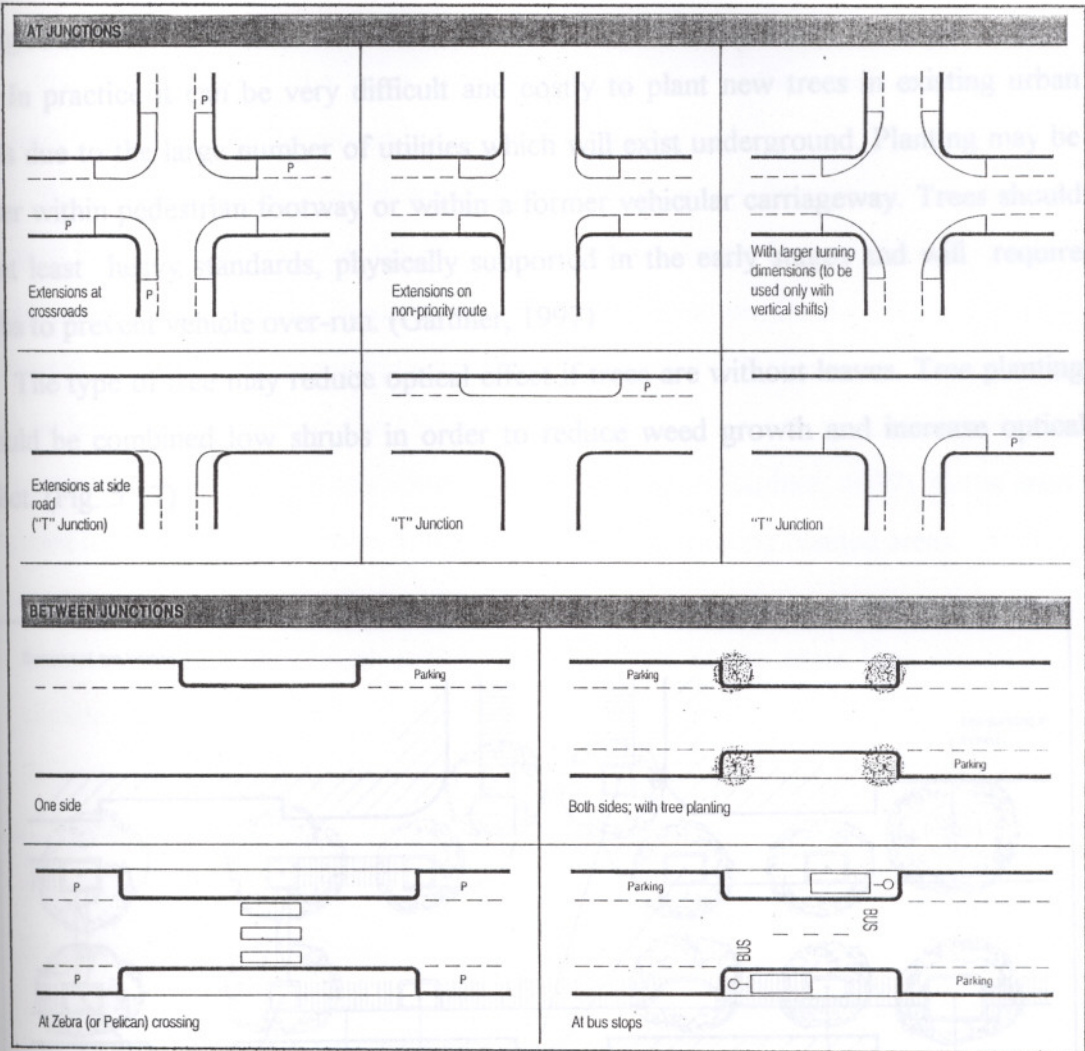
Fig. 5.16. Sidewalk extensions, (Devon County Council, 1991; pp:74)

## 8. Planting

Tree planting can be a very effective speed reduction measures. (Gardner, 1997)

Objectives:

- To limit forward views

- To reduce physical and optical width

- To define street space and activities

- To enhance streetscape and create microclimate, noise and dust absorption. (Devon County Council, 1991)

Design Features:

In practice it can be very difficult and costly to plant new trees in existing urban areas due to the large number of utilities which will exist underground. Planting may be either within pedestrian footway or within a former vehicular carriageway. Trees should be at least heavy standards, physically supported in the early stages and will require kerbs to prevent vehicle over-run. (Gardner, 1997)

The type of tree may reduce optical effect if trees are without leaves. Tree planting should be combined low shrubs in order to reduce weed growth and increase optical effect. (Fig. 5.17)

Examples of tree location

free-standing in footway

[Not to scale]

Kerbline          defines junction

integrated with flat top hump

integrated with kerb and parking area

free-standing in carriageway

integrated with carriageway (parking) and footway

Support using 3 or 4 stakes
Tree compost etc
Roots
Ventilation/water channel with surface access
0.1m
1.1m
1.6m
2.0m      Loosened soil

Height
20m
10m
5m

2.2m      4.5m

1.0m

Spacing     5   5   5   5   10   10   20   m

Fig. 5.17. Planting: trees in the street, (Devon County Council, 1991; pp:77)

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Application of Planting:

Planting is one of the most important device for traffic calming schemes. But suitable species should be chosen in tree planting applications

Shrubs and planters should not view of drivers and pedestrians. Trees should be located in a planting area of at least 2 m$^2$ if possible. (Devon County Council, 1991) the distance the tree is planted from the kerb line will depend on the size the tree will grow to and the height of the canopy in relation to passing traffic. But any case distance should not be less then 0.5 m from the kerb street lighting may have to be redesigned to take account reduced lighting levels caused by tree planting. (Gardner, 1997) Kerbs need to be used to prevent surface water from the carriageway entering planted areas.

Advantages:

- Planting enhance the visual quality of streetscape, at the same time ensure micro-climate
- Trees provide vertical features at relatively

Disadvantages:

- May increase maintenance cost if not sponsored. (Devon County Council, 1991)

### 9. Street Furniture and Lighting

Lighting and street furniture have very important impact on the quality of the built environment.

Objectives:

- To increase the functional and aesthetic qualities of the street
- To encourage the use of public space
- To enhance the safety and security of pedestrians
- To ensure vertical elements adjacent to the carriageway. (Devon County Council, 1991)

Design Features:

Bollards may effectively be used to separate carriageway and pedestrian areas. To keep motor vehicles out, bollards have to be spaced about 1.5 m apart. Lockable bollards are more suitable for access in restricted area required. Bollards can also be use different purposes such as cycle parking or market stalls. (Fig. 5.18)
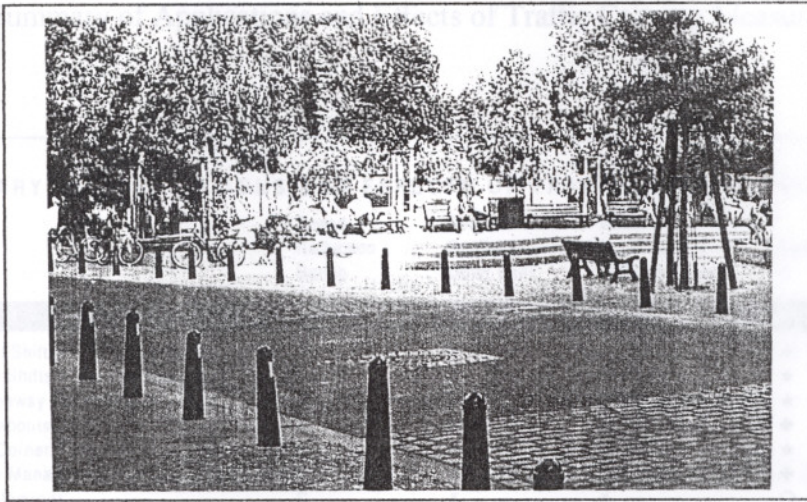
Fig. 5.18. Application of bollards, (Devon County Council, 1991; pp:80)

Street furniture, including seats, telephone kiosks, bus shelters etc. can be designed and grouped to create attractive focal points within the street. Seating should be provided at regular intervals.

In local and mixed priority streets standard traffic furniture and road markings are generally inappropriate. Lighting requirements are also less important in low speed areas.

Application of Street Furniture and Lighting:

Street furniture and lighting should be applied to enhance living quality in built-up areas and to impact traffic calming measures positively. The design needs and location of street furniture ought to be associated with other calming measures in the traffic calming scheme.

Advantages:

• Assists to increase the functional and aesthetic qualities of the street and support livability.

Disadvantages:

• None, if properly designed and sited. (Devon County Council, 1991)

Traffic calming devices, as outlined above, can be very effective if they are used in a combination. The contribution of each measure and its suitability for each category of road is summarized in Table 5.2.

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# Table 5.2. Summary of Applications and Effects of Traffic Calming Measures

**SUMMARY OF APPLICATIONS AND EFFECTS OF TRAFFIC CALMING MEASURES**

| | Speed Reduction Rating | Space Reallocation for Other Uses | Visual Enhancement of Street Scene | Suitability L | C | M | T |
|---|---|---|---|---|---|---|---|
| **SPEED REDUCTION MEASURES** | | | | | | | |
| 3.7 Vertical Shifts in the Carriageway | A | ✗ | — | ★ | ★ | + | ○ |
| 3.8 Lateral Shifts in the Carriageway | B | ✓ | — | ★ | ★ | + | ○ |
| 3.9 Carriageway Constrictions | B | ✓ | ✓ | ★ | ★ | + | ○ |
| 3.10 Roundabouts | B | ✗ | ✗ | + | + | + | + |
| 3.11 Small Corner Radii | B | ✓ | — | ★ | ★ | ★ | ○ |
| 3.12 Priority Management | B | ✗ | ✗ | + | ○ | ○ | |
| 3.13 Road Markings | C | ✗ | ✗ | ○ | ○ | + | ★ |
| 3.14 Electronic Enforcement | C | ✗ | ✗ | ○ | + | + | + |
| **SUPPORTING ENVIRONMENTAL AND SAFETY MEASURES** | | | | | | | |
| 3.15 Optical Width | C | ✗ | ✓ | ★ | ★ | ★ | + |
| 3.16 Narrow Carriageways | C | ✓ | ✓ | ★ | ★ | ★ | + |
| 3.17 Occasional Strips | C | ✓ | ✓ | ○ | + | ★ | + |
| 3.18 Surface Changes  - type/colour/location | C | ✗ | ✓ | ★ | ★ | + | ○ |
| 3.19 Entrances and Gateways | C | ✗ | ✓ | ★ | ★ | + | + |
| 3.20 Central Islands | C | ✓ | ✓ | ○ | + | + | + |
| 3.21 Shared Surfaces | C | ✓ | ✓ | ★ | ○ | ○ | ○ |
| 3.22 Footway Extensions | C | ✓ | ✓ | ★ | ★ | ★ | + |
| 3.23 Planting/Greenery | C | ✗ | ✓ | ★ | ★ | ★ | ★ |
| 3.24 Street Furniture and Lighting | C | ✗ | ✓ | ★ | ★ | ★ | ★ |
| 3.25 Regulations | C | ✗ | ✗ | + | + | ★ | ★ |

**KEY**

SPEED REDUCTION RATING:
A  Guarantees 85 percentile traffic speeds below desired maximum
B  Reduces speeds but does not guarantee 85 percentile level
C  Serves as a reminder or encouragement to drive slowly and calmly

SUITABILITY: ( FOR DIFFERENT STREET/ROAD CLASSIFICATIONS)

| L | Local streets | ✓ Positive effect | ★ Suitable |
|---|---|---|---|
| C | Collector streets | ✗ Negative effect | + Possible |
| M | Mixed priority streets | — Neutral | ○ Not recommended |
| T | Traffic priority roads | | |

(Source: Devon County Council, 1991; pp:28)

## 5.4. Effectiveness Of Traffic Calming

<u>Social Benefits:</u>

1. Calmed or shared streets are more than transportation channels. They are places suited for pedestrian interaction. Shared street encourages communication between neighbors. (Ben Joseph, 1995) (Fig. 5.19)

2. Shared streets especially benefit children's activities. They provide play options and increase social contact within a safe home-base territory.
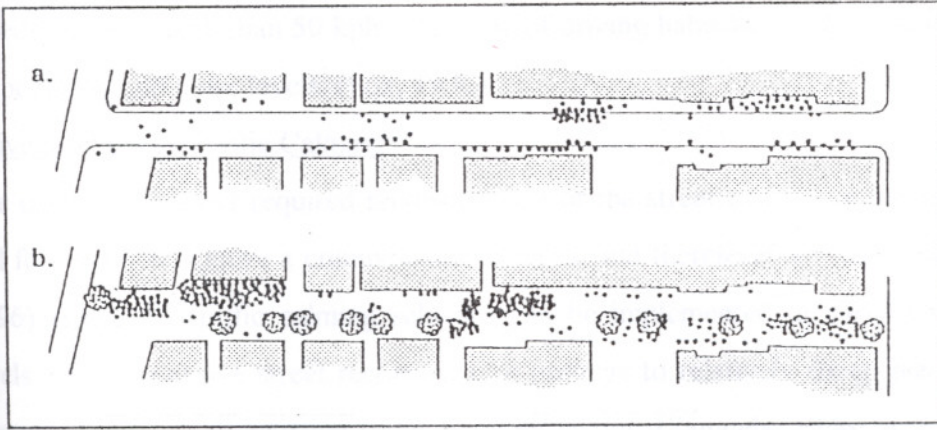
Fig. 5.19. Change in the incidence of use of a street area: (a) prior to and (b) after traffic calming, Hannover, Germany, (Williams, 1995)

3. The impacts of traffic calming schemes on accident levels is generally related to both speed reduction effect of the scheme and on any reduction in traffic levels as a consequence of it. Studies have shown that traffic calming can reduce accident levels by up to 40% and have significant impact on reducing the severity of accidents. (Fox, 1996) Even though it might seem that vehicular traffic and pedestrians would be in conflict, the physical design of calmed area subordinates the traffic. As a result this, much safer environments for pedestrians are achieved according to the usual street layout. (Southworth&Ben-Joseph, 1996) The surveys found that mothers as well as children consider the shared streets safer than an ordinary street. ( Ben Joseph, 1995)

4. Human scale is restored in the traffic calming schemes. The general layout of shared street aesthetically more pleasing than the traditional one and have positive impacts on the increase of quality of life.

5. Residents of shared streets tend to view the street as an extension of their personal space and often maintain and landscape the planting beds near their homes. With the participation of residents, local authorities will therefore have fewer maintenance costs and better traffic safety and control.

6. Using traffic calming techniques it can be ensured reduction in noise and pollution. Noise reduction through traffic calming is mainly related to reductions in traffic volumes and in vehicle speed. The impact of traffic calming on air pollution is similar to its effect on noise levels. Air pollution has been shown to be less when vehicle

speeds are at 30 kph than 50 kph. The style of driving habit has also great impact on air pollution and noise levels. (Fox, 1996)

Negative Impacts of Traffic Calming:

1. The original Woonerf required reconstruction of the street and the removal of kerbs and footways to achieve a common shared space and therefore very expensive. (Fox, 1996) However, traffic calming schemes can be implemented in various costs and levels: from expensive street reconstruction projects to relatively cheap placement of temporary devices on existing ordinary street layout. (Samuels, 1996) Although it is said that "the initial cost of constructing shared street is higher than the cost of asphalt road" recent analysis suggests that the design with the lowest initial cost (e.g. asphalt) may not be the best choice in long run. With the use of pavers , street repair is simplified , as streets can be opened for utility line repair and the pavers replaced with no need for patching material. (Ben Joseph, 1995)

2. Traffic calming implications may sometimes inadequate in reduction of motorcycle's and moped's speeds to the desired speed levels. Increase in number of such vehicles can influence the shared street negatively. (Kaplan, 1992)

3. It is hard to apply traffic calming in densely developed built-up areas. For these areas the modes of transportation is critical.. If the level of walking-public transport based trips is much more higher than the private car use the adaptability of traffic calming would increase. (Kaplan, 1992)

4. Residents and retailers may fear the potential loss of on-street parking spaces. But if traffic calming techniques are combined other traffic restrains their negative impacts will be reduced.

## 5.5. Conclusion

Traffic calming derived from the need for safer, more livable communities at the end of the 1960's. Traffic calming has its origins in Dutch *Woonerf* schemes of the 1970's. By the late 1970's traffic calming had become the planning and transport policy everybody seemed to be interested in. Early 1980's has become the years of area-wide traffic calming techniques that is developed in Germany. Area-wide traffic calming schemes seek to calm both main streets and residential streets but main street traffic

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calming is still relatively new concept. Also in this period the cheapest form of traffic calming (30 kph speed limit) was largely implemented due to the expensive construction costs of woonerven streets. In the late 1980's other car restraining policies and promotion of public transport and bicycle use are becoming part of the whole concept of traffic calming.

In early years of traffic calming, design of shared streets is largely seen in the field of traffic engineering. However, according to Hass-Klau, traffic calming can only be implemented successfully if traffic engineers and planners work closely together. Environmental engineering involving the measures of speed, noise and pollution became important too. (Hass-Klau, 1991) On the other hand, Southworth and Ben-Joseph suggest that, "because residential streets are less influenced by traffic their domain lies more in architecture than in engineering, and thus should be under the design jurisdiction of the architect, landscape architect and planner." (Southworth&Ben-Joseph, 1996, pp:120)

Traffic calming measures ,while simple in concept, are a complete change in direction from conventional traffic planning of the past three decades and became popular throughout Europe and some other countries. By 1990 over 3500 shared street had been constructed in the Netherlands and Germany, more than 300 in Japan and 600 in Israel. Traffic calming, in contrast to conventional implemented street, gives a new balance between traffic service and important neighborhood values such as safety, walking and interaction among neighbors.

Traffic calming has the ability to improve the quality of life for a wide range of people and has a critical role play in making and keeping city streets safe. Türkiye has not yet adapted traffic calming as outlined in world-wide examples. Since traffic calming measures requires wide-range transportation policies and cooperation between local authorities and other governmental institutions, the developing process of traffic calming measures may take long time in Turkish experience.

The heavy costs of redevelopment of the area is another critic issue. On the other hand, the cheapest form of traffic calming now can be adapted in both towns and cities of Turkey. Traffic calming, while not answer to all transportation problems, will assist in improving the quality of life within Turkish cities and towns. The case study will be focused on such issues in detail.

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## Chapter 6

## CASE STUDY: Bornova Central District

The quality of life in our big cities and towns is under growing pressure from the increasing volume and use of motor vehicles. As more space is given for automobiles, less space is available for other street activities. Our streets should not be the places where people retreat because of traffic. There is a need to change priorities in the way our streets and public spaces are designed and managed so that they can play a useful role and make life more enjoyable in our dense urban quarters.

In the theoretical framework of traffic calming, Bornova central district was choosen as an case example. Bornova takes part in the east axis of Izmir. It is a dense urban center where the pedestrian density is extremely high. There is an urgent need to introduce traffic calming techniques in Bornova and as well as the other big cities and towns.

### 6.1. Existing Structure Of The Study Area

Existing physical structure of the project area will be examined general characterics, main functions, problems and potential values sub-headings.

### 6.1.1. General Characteristics of the Study Area

Bornova is a county of İzmir with a population of about 370.000 people. It contains a dense structure of mixed residential, commercial and industrial activity. Important long distance road connections, some regional scale industrial institutions and existence of Ege University has made Bornova rapidly grown settlement after 1960's. Bornova also includes the some parts of the CBD of İzmir Metropolitan area that has been proposed by İzmir Master Plan.

The northern part of central area of Bornova includes the old town center and residential areas. The area that was choosen for the area-wide traffic calming plan covers the main parts of this center. Study area also constitutes the most crowded parts of the central district that contains mixed high density shop top housing, offices, public

buildings and recreational facilities. This intensive cental district is an area where the pedestrians and motor vehicles are in conflict.

In the area-wide traffic calming projects to avoid shifting the problem from one street to another, boundary of the area is determined by major throughfares. Therefore, project area is defined by two major arteries: Mustafa Kemal Street and Fevzipaşa Street; and a collector: 159 street. (Fig. 6.1)

Bornova has a detailed plan which was approved in 1982. (Fig. 6.2) The success and failure of this plan as follows;

1. The traffic restraint methods, except full pedestrianization, were not taken into consideration in all over the plan.

2. Although the project area was shown as an special district with its conversation areas and pedestrianized routes the basic decisions in pedestrian-motor vehicle relationships were not based on reliable field survey results.

3. Activity nodes and safe routes for pedestrian and cyclists were designed superficially although the whole central area is pedestrian oriented.

4. In spite of the heavy demand of parking space, different car parking alternatives such as multi-storey or underground parking were ignored.

5. Major roads were not designed wide enough to allow to arrange public transport lanes and separate cycleways. On the other hand, local roads are open to through traffic and were designed as if they were parking places for motor vehicles.

6. Two important traffic routes, 159 Street and Fevzipaşa Street, were fully pedestrianized with the plan. It seems as if they have positive impact for pedestrian circulation and activity in project area, the feasibility of this idea was not supported by field studies. On the other hand, site survey results indicate that Fevzipaşa Street is a mixed priority road which traffic volume is more than 9000 vehicle / a day. At the same time 159 Street is a collector road which full pedestrianization decision should be considered carefully.

7. The old marriage registration office lost its function therefore land use change decision of this area is correct. However, in the plan it was shown as the surface car-parking place. Because of the being crossroad of the major pedestrian routes, it needs more creative solutions.

people. It contains a dense structure of mixed residential, commercial and industrial activity. Important long distance road connections, existence of Ege University and some regional scale industrial institutions has made Bornova rapidly grown settlement after 1960's. Bornova also includes the some parts of the CBD of İzmir Metropolitan Area that has been proposed by İzmir Master Plan.

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Project area is defined by two major arteries: Mustafa Kemal Street and Fevzipaşa Street; and collectors: 159 street and Zafer Street. Because the single calmed street transfers the traffic problems to the other streets in the area-wide traffic calming projects, the boundary of the study area is determined by the major traffic routes.

### LEGEND

| | Proposed Light Rail Transport Route and Stops |
| | Proposed Highway |
| | Ring Roads |
| | Major Urban Roads |
| | Minor Urban Roads |
| | Area Calmed |
| | Road Calmed |
| | River |

Scale: 1/10000

3. Existing Street Elements:

Parking:

   The heavy demand of parking space is occured all over the study area. In working hours commuter parking and in the evening hours residents' cars demand more parking lots. However, parking problem was unsolved and no proper solution has been produced by the local authority yet. Parked vehicles often obstruct the pedestrian crossings and sidewalks. Especially in major roads traffic is interrupted by sometimes doubled on-street parking. Lorries are not prohibited on local roads. Thus they create some difficulties in the vehicular circulation and on-street parking. Unfortunately, urban streets are perceived as the natural storage places for motor vehicles. On the street, activities are prevented by parked cars. Even the frontyards and rear gardens of some apartments are used as parking spaces. (Fig 6.8)

Road Signs and Paving:

   No special road markings and paving materials have been considered to guide pedestrian crossing, parking lane, direction of travel etc.. by the local authority. Most of the streets were covered by asphalt. Only in pedestrianized Sanat Street paved concrete blocks were used.

Vegetation and Street Furniture:

   Bornova Central Park ensures the largest amount of recreative green space of the study area and as well as the whole Bornova. In the project area, edges of streets are mostly planted with pine trees and palm trees. However, taking care of the trees is often neglected.

   Existing street furniture in the project area is shown in Fig. 6.8. The placements of street furniture are not arranged properly and their numbers are inadequate for an intensive pedestrian area.


## 6.1.3. Problems of the Study Area and Its Potential Values

   Problems in the project area can be summerized in eight groups:

1. General Appearance of the Site

• Visual confusion originated from pillars, wires and advertisement boards,

• The lack of aesthetic view and vista points engaging the eyes

2. Streets and Passages:

- Tighter major roads to provide public transport corridors, cycleways or parking requirements,
- Poor quality street surface, paving
- The maintenance problems of streetscape

3. Vehicular Circulation:

- Crammed or slowed down traffic in major streets especially in rush hours,
- Inappropriate circulation system. Especially in one-way local streets drivers failed to respect to direction of travel.
- Uncontrolled lorry traffic in the whole study area

4. Parking:

- Difficulties in loading and dropping points along the major traffic roads
- Inadequate parking bays in all types of streets
- Unattractive and badly designed parking lots
- Insufficient lighting for parked vehicles especially in side streets

5. Pedestrian Spaces:

- Narrow sidewalks for different street activities and even walking
- High kerbs that create difficulty for handicapped people, children and elderly people,
- Invaded sidewalks and pedestrian way entrances by parked vehicles,
- Uncontrolled or unmarked pedestrian crossing points
- Dark side streets which create safety problems at night
- Inadequate street furniture and public utilities for outdoor activities

6. Infrastructure and Road Signs:

- Inadequate surface drainage system,
- In local and cul-de-sac streets the lack of vehicular and pedestrian lighting,
- Dangerous traffic signs hanging on the sidewalks or pedestrian places.

7. Land-use:

- Increase in number of the shopping centres that compete the old retail centre in the project area in terms of variety of products and level of service
- Absence of off-street playgrounds for children

## 8. Planning Problems:

- Absence of a local action plan to enhance the environmental quality of the study area.
- Unable to find the guidelines or standards for better communities and better streets prepared by the local authority.

Potential values which influence the determination process of the study area as follows;

1. The study area is appropriate for pedestrian priority streets design because of being pedestrian oriented,

2. Existence of important public buildings and commercial activities which attract the large numbers of people to the project area,

3. Street cross-sections are suitable for sidewalk widening and different street activities.

4. Infrastructure investments in the study area were mostly completed. This may help to save some redevelopment costs of the calmed streets. Also there are potential underground and multi-storey car parking locations in order to solve the heavy demand of parking lots in the central area.

5. There are conservation areas and listed buildings that protect the general character of the study area.

6. Because of being the center of commercial, cultural and recreational activities the study area is a desireable space for entertainment activities.

7. The major and local streets are appropriate in the application of many traffic calming devices.

## 6.2. Plan Goals

The goals of the area-wide traffic calming plan can be examined in nine broad headings:

### 1.To Provide a Pedestrian and Cyclists Priority and Accesssibility:

The road classification should be given priority to pedestrian and cyclists over motor traffic. One of the important aims of this project is to identify ways of encouraging these modes of travel as alternatives to car. Traffic calming strategies help to limit growth in the living areas by discouraging the use of unsuitable roads by through traffic and give priority to other vulnerable road users. Pedestrian accessibility also provides the ease and

convenience to reach a destination by walking or bicycles. Traffic calming measures promote the pedestrian accessibility and priority.

## 2. To Provide A Safe Environment:

A safe environment minimizes the danger of vehicle accidents and other hazards, and enhances people's sense of comfort. Creating a safe environment requires controlling negative impacts of traffic, pollution, crime and other undesirable impacts. The definition of a road hierarchy will determine the degree of safety improvements on selected road for vulnerable road users. For example, while in living areas more restrictive types of traffic calming devices are applied in traffic priority areas more conventional methods are prefered. To provide a safe environment also encourages public social contracts and helps to create a livable street.

## 3. To Create Safe Routes To School:

To ensure reduction in child pedestrian injuries is a specific target of traffic calming. Special attention will be given in designing of safe and enjoyable routes to school.

## 4. To Support Public Transport:

To encourage public transport priority shold be determined in regional context. Public transport and other multi-modal transport alternatives will decrease the private car dependency. In major traffic routes of the project area public transport priority will be supported.

## 5. To Control The Lorry Traffic:

Lorries create a particular difficulty in vehicular circulation and on-street parking in the project area. Especially in living areas heavy grade vehicles will be discouraged.

## 6. To Provide Adequate Parking Space:

"Traffic calming schemes should include provision for on-street and other parking, but should not be devised soleyly to increase parking capacity." (Devon Traffic Calming Guidelines 1991; pp:17) However, the project area is a dense commercial and residential district and parking demand is heavy. Therefore imaginative parking solutions will be required in appropriate locations.

## 7. To Provide Environmental Enhancement:

Traffic calmimg measures change the way in which streets are used. To slow down the traffic and in changes in road surfaces create a comfortable and attractive environment for pedestrians, cyclists, residents, and others. If an environment is

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physically uncomfortable and unattractive people will do only necessary outdoor activities. The fundamental aim of this project is to create livable streets where the variety of outdoor activities are occured.

8. To Support the Economic Vitality of the Study Area:

Areas free from the dangers and disruption caused by traffic have greater potential for economic growth and development. For the study area full pedestrianization, vehicle restricted areas and vehicle discouraged calmed streets will be used in combination to encourage the shopping and the other commercial activities. In the project area, redevolopment of the old shopping center is required in order to compete other big shopping centers and commercial districts in near locations.

9. To Provide High Quality of Construction and Maintenance:

High quality design and construction provides many benefits;

- it enhances the quality of the physical environment,
- it supports human comfort and safety,
- it can provide identity to a street and it can support public social activity. (Creating Livable Streets: Street Design Guidelines for 2040, 1996)

Maintenance also preserves current public investment for future public use. It enhances the quality of street environment and can increase the economic value of adjacent properties. The redevopment of some streets in the project area will create high investment costs. Thus, the maintenance of calmed streets will become important to protect the identity and public social activity.

## 6.3. Introduction to Traffic Calming Project

In this section, the streets in the project area were classified as major, collector and local street and were also described by the sub headings of context, objectives, and description. On the other hand, general traffic calming strategies for the study area were outlined in traffic calming concept plan. (Fig. 6.9.)

Fig. 6.9. Traffic Calming Concept Plan

**LEGEND**

**1. Measures**

- 50 kph Streets
- 30 kph Streets
- Pedestrian Zone

**2. Supporting Measures**

- O   Lorries prohibited
- P   Parking Control
- ▲   Vehicle Restricted Area

**3. Narrowing**

- One side
- Both sides

**4. Calming Techniques**

- (1)   Vertical Shifts
- (2)   Lateral Shifts
- (3)   Entrance and gateways
- (4)   Sidewalk Extension
- (5)   Shared Surfaces
- (6)   Central Islands

**5. Traffic Flow**

- One- way
- Two- way
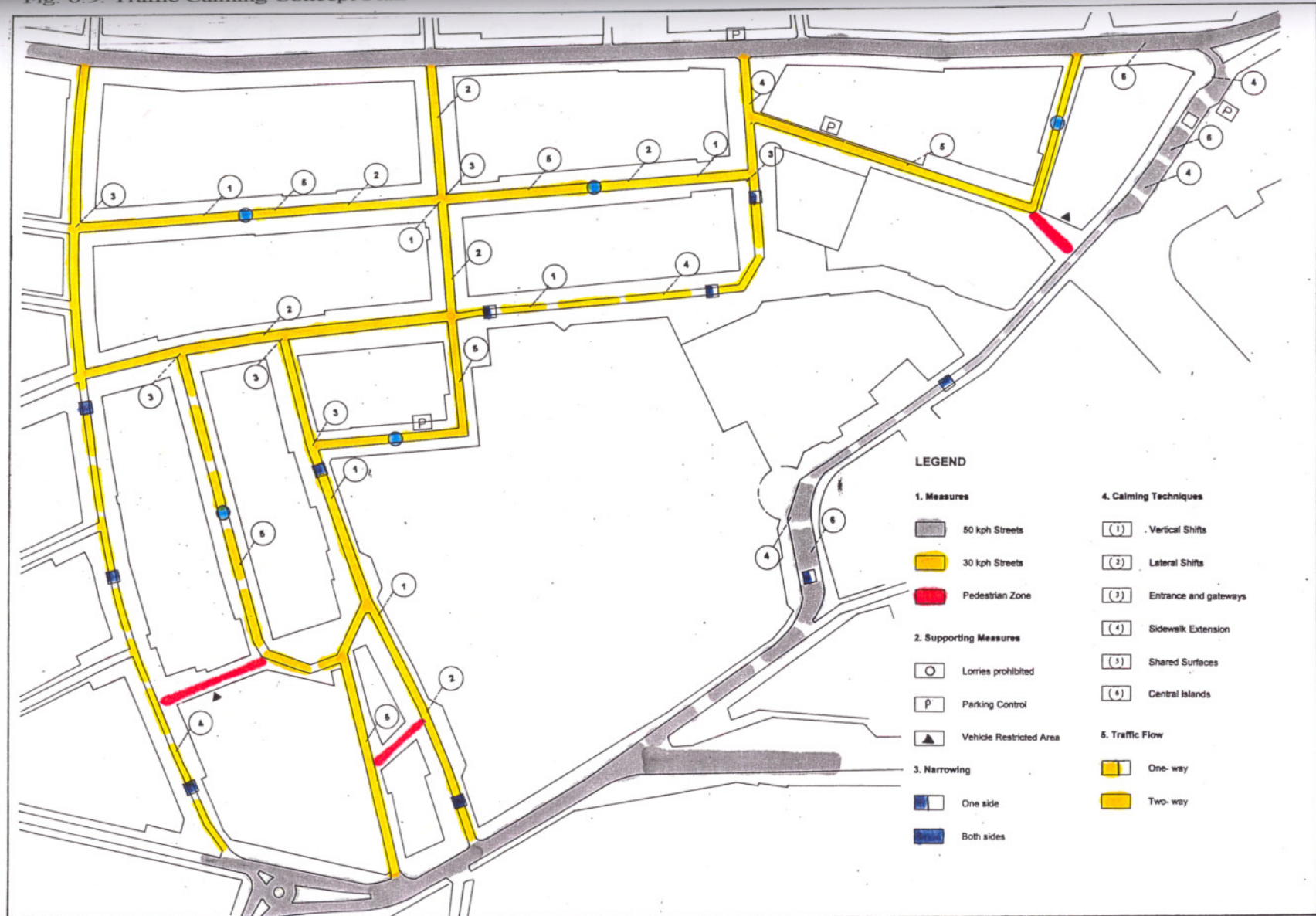
## 6.3.1. Major Streets

There are two major roads in the study area: Mustafa Kemal Street and Fevzipaşa Street. (Fig. 6.10)
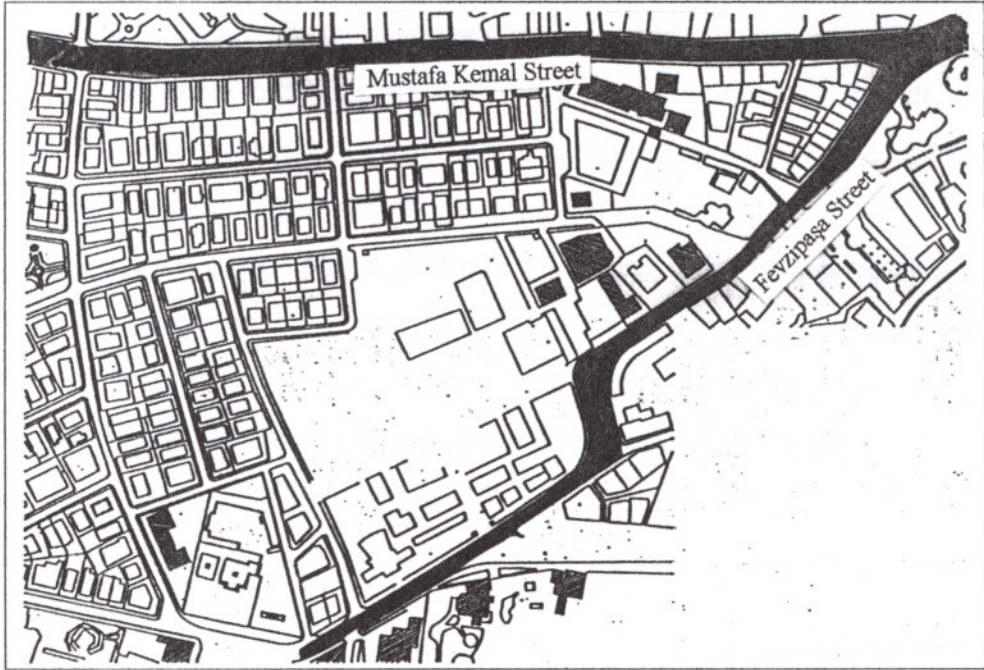


Fig. 6.10. Location of the major roads

1. Mustafa Kemal Street:

Context:

Mustafa Kemal Street is the main artery Bornova central district with intensive shopping, commercial, and residential uses. It is also a primary county road carrying heavy volume of through traffic.(more than 1500 vehicle per hour)

It is an important bus route with 50-70 buses per hour in each direction. Building along the street are generally 7 to 9 stories high and it is roughly 21 m. wide between buildings. There is an immediate need for environmental and safety improvements for pedestrians particularly at the common crossing points along the street. Undesirable on-street parking should also be prevented near pedestrian crossings.

Objectives:

• to provide safe crossings in front of the primary school and near intensive pedestrian zones,

- to provide activity pockets in appropriate locations along the road,
- to create controlled on-street parking bays and bus stop shoulders.
- to provide separate cycleway in each direction in the wider parts of the street.

Description:

Because of the fact that Mustafa Kemal Street is a traffic priority road more conventional accident prevention treatments such as light controlled crossings were used. Except this, pedestrian crossings were set back from the junctions and defined with surface changes. Almost every point of the street has been commonly used by pedestrians for crossing. Therefore, former central island was preserved. (Fig. 6.11)

Activity pockets were arranged near public buildings and uses to increase the staying functions of the street. To encourage the use of cycles, a separate cycleway was designed along the wider parts of Mustafa Kemal Street. On-street parking bays were clearly defined by trees and planters which were placed within the carriageway.
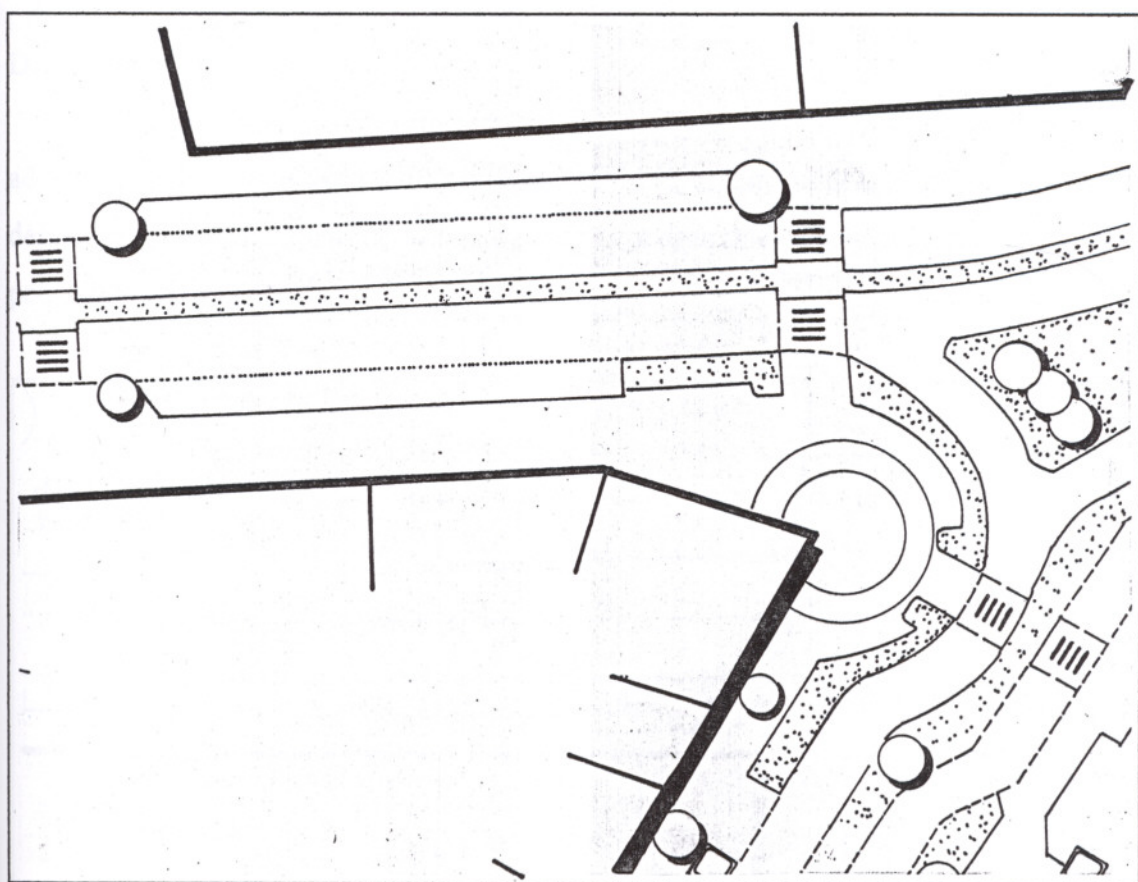


Fig. 6.11 A detail from Mustafa Kemal Street

## 2. Fevzipaşa Street:

Context:

Fevzipaşa Street is an one-way mixed priority road that carries about 8000-10000 motor vehicles per day. It is also a major bus and dolmuş route.

The northern part of this street is surrounded by shop top housings and offices. On the other hand, in the eastern parts there are large parceled public institutions, listed buildings, and Bornova Central Park. In both sides of the street pedestrian density is extremely high and there are problems in pedestrian crossings near primary school and at the entrance of the pedestrianized side street. The locations of public transport stops and on-street parking areas should be reconsidered along the street. The environmental enhancement of Fevzipaşa Street is also required.

Objectives:

- to increase safety at common pedestrian crossings and school entrances,
- to enhance the street environment,
- to widen the sidewalk where the majority of pedestrian activities are occured.

Description:

The carriageway width was reduced from about 8-9 m. to 4 m wide with an additional 2.5 m. sheltered parking was provided at both sides. Parking bays were defined by sidewalk extentions where parking is undesirable,namely at junctions and near pedestrian crossings. (Fig 6.12)
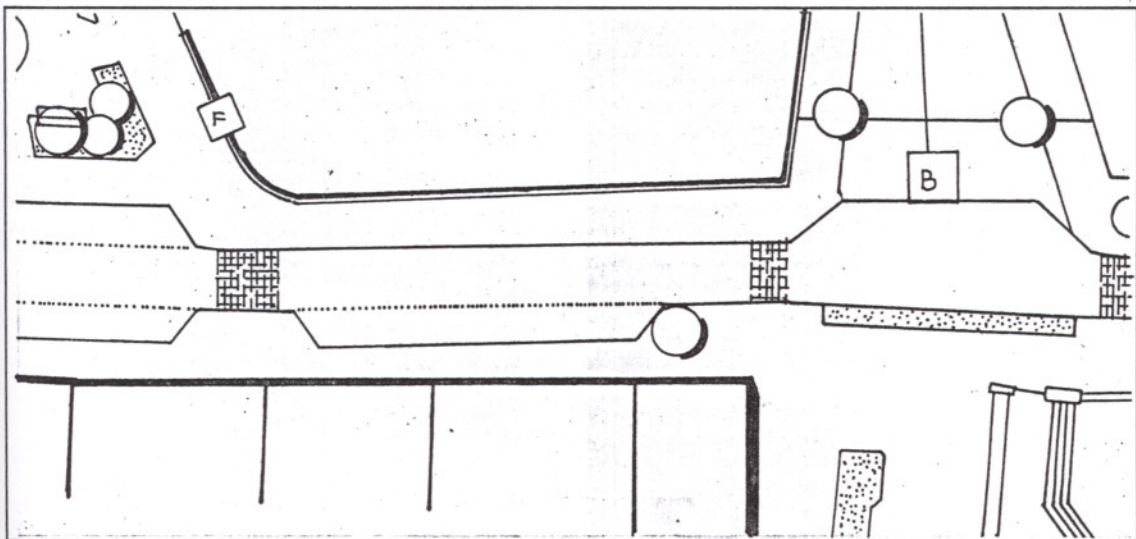


Fig. 6.12. A detail from Fevzipaşa Street

Dense pedestrian activity occured throughout the street. Therefore, additional crossings for pedestrians were proposed. Extended sidewalk, trees, and activity pockets were also provided between the primary school and Bornova Central Park to create a pleasant zone for pedestrians. The appearance and furnishing of the area will encourage pedestrians to stay or have a rest in the street rather than just hurry through as before.

Former bus stop was shifted to the redesigned traffic-free area in order to make pedestrian circulation easier and to revitalize this route.

A public plaza was created to provide a focal point that indicate the entrance of the Municipality, Bornova Central Park, and its playground. Along the road environmental enhancements such as repaving of some footway sections and landscaping were proposed.

## 6.3.2. Collector Streets

There are two collector roads in the project area: 159 Street and Süvari Street. (Fig. 6.13)
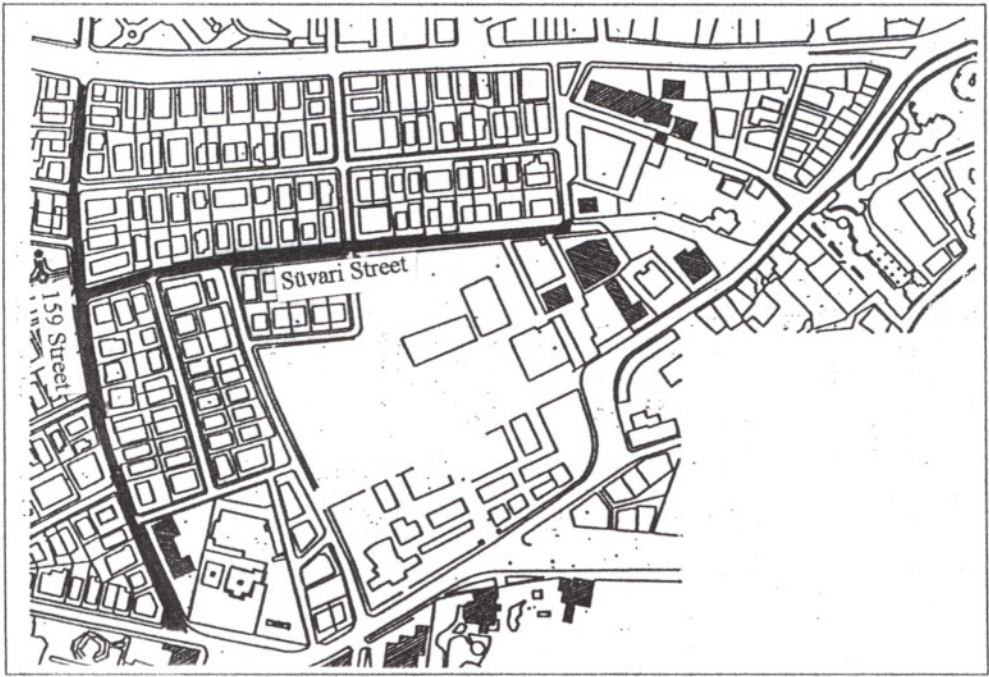


Fig. 6.13. Location of Collector roads

## 6.4. Conclusion

Apart from  some traditional approaches area-wide traffic calming scheme was proposed for Bornova central district. The  effectiveness of the proposal can only be measured by before and after studies which include  the comparative results between former and further traffic volume , speed, number of accidents, level of noise and air pollution etc... To evaluate the positive and negative impacts of the scheme the construction process of the plan should be finished. However, some expected benefits from the scheme as follows:

- the increase in social activities which support communication among the people,
- variety in play options for the children,
- decrease in accident level,
- participation of the residents in taking care of their streets,
- reduction in noise and air pollution through traffic taming efforts,
- the environmental enhancement of the streets so that the increase in economic vitality of the area.

The full reconstruction of the study area through traffic calming measures might be more expensive according to traditional traffic restraint methods. However in most cases the full reconstruction of the street is not necessary. It would be better if the construction of the scheme is realized by manegable parts. Under these circumstances, the area-wide traffic calming scheme could be implemented in two stages:

The first stage is the creation of a slow speed area where the traffic speed is under 30 kph (apart from major roads and collectors). This can be achieved with the installation of vertical shifts and road signs indicating the slow-speed areas. It is necessary to install speed reduction measures  in order to achieve desired speed limits.

Stage two involves more differianted physical measures to improve both the functional and aesthetic elements of the streets. This includes the provision of new surfaces and lighting at all entrances, emphasizing pedestrian crossigns at important junctions, carriageway narrowing and repaving, redesigned on-street parking, public art elements, and better facilities for pedestrians and cyclists. This stage is relatively costly according to the first one. However it can be implemented step by step.

The techniques,which were proposed for the first stage, are the effective speed reduction measures and guarantees 85 percentile traffic speeds below desired maximum. This cheapest form of traffic calming has been implemented for 20 years. However, these tools have a poor visual effect and require a good combination with the supporting measures which were mentioned in the second stage.

Traditional methods may have lowest initial costs but it could not be the best choice in long run. Traffic calming measures can pay off themselves with some specific policies that will be discussed in following chapter.

# Chapter 7

## CONCLUSION

Streets, as Kostof suggests, as mutable as life itself. The continual transformation in the physical and social structure of the street is the result of economic, technological, social, and political changes throughout the history. However, in the age of information the future will be more uncertain for urban streets.

According to M. Batty, by the year of 2050, everything around us will be some part of computer. There is no doubt that, the decline in the use of urban streets for communication and social interaction will be more obvious in privatized information societies.

Contemporary street mainly serve as the channel for the motor vehicles. For the individual, its functions are reduced to an access route to home. Once quite and friendly streets of the past were replaced by the inhuman highways and traffic roads for the comfort of automobiles.

There is an urgent need to bring back life to our urban streets once before. In this context, 1960s reflected the revival interest to return the street. In late sixties, in a number of cities around the world, angry residents demanded reductions in the level of traffic in their streets. This movement was combined with the lessons that were learnt from the pedestrianization of city centers in post-war period. After that, the Dutch "woonerf" concept, that is the very beginning of traffic calming, was launched and was extended throughout the Europe in late 1970s.

Woonerf's basic principles were; to slow the traffic down (in walking pace) into local roads so that to create safe living areas for people, to provide pedestrian and cyclist priority, and to enhance the quality of street environment to foster the social activities among the residents.

In German lead, woonerf principles were widened and considered as the area-wide traffic restraint methods, or traffic calming. These techniques have been largely applied successfully in many countries about 30 years.

On the other hand, as in most developing countries, cities has been transformed by rapid urbanization in Turkey. Rapid rise in car-ownership, modernization efforts upon public urban space, and the reshaping of residential quarters has become the prime actors

public urban space, and the reshaping of residential quarters has become the prime actors in the vanishing of traditional streets. Once quiet residential streets of Turkish cities were sacrificed to the unending demands of motor vehicles especially after mid 1970's.

The overwhelming economical and social problems have caused the neglectance of urban design issues especially in big cities. In this context, traffic calming can be an effective way in the restoration of street environment for the benefit of non-car users in Turkish cities.

In order to increase the effectiveness of traffic calming measures radical changes are required in both regional and urban scale. If traffic calming policies are combined with urban planning and transportation planning objectives the resultant environment will be more attractive for those living in the cities. The objectives in urban and regional context as follows:

In urban planning scale, the objectives should be; to avoid sprawl and high density devolopment through policies of decentralized concentration, to reduce automobile dependency through a mixed use urban development with the sustainable modes of transport, and to make urban areas more attractive to vulnerable road users.

In transportation planning context, the objectives should be; to optimize the existing network in favor of non-car users, to discourage car usage by the Traffic Demand Management (TDM) which includes parking control, congestion pricing etc..., and to optimize the efficiency of the road network through the establishment of appropriate road hierarchy.

Urban design objectives require the combination of such efforts in the efficient organization of urban streets. Traffic calming measures will be more effective with the help of public transport priority and traffic demand management policies.

Local authorities have major role in order to create walkable streets in our cities. Municipalities, that are to be expected as the most significant interest group related to urban design issues, leave the urban streets to the justice of the vehicular traffic. The superficial solutions of municipalities, which involve the strict separation of pedestrian and motor vehicles, were failed to success in the designing of walkable streets: Sidewalks were constricted, kerbs were heightened, and pedestrian places were invaded by parked vehicles.

There is a need of introduction to new techniques like traffic calming instead of inefficient conventional traffic restraint methods. Local authorities in Turkey should prepare traffic calming design guidelines and apply these techniques in their urban streets. They should also encourage the traffic calming studies which might be the model for following traffic taming efforts to other cities and towns.

Full reconstruction of the street can be relatively expensive according to traditional road building methods. Most of the time, local authorities avoided the costly projects because of the inadequate budget complaints. However, if it is compared with the wasting money, that are given to the repaving of sidewalks and kerbs, the redevelopment of the street through traffic calming measures can pay off itself in long run. Also, some residents and shop owners have taken on sponsorship of planted areas and street furniture. On the other hand, the costs can be kept much lower than full reconstruction of the street by adapting techniques phase by phase and by retaining kerbs and surface materials in particular locations.

Specific budget provisions should be made for traffic calming schemes by the local authorities. In the case of area-wide schemes, it may be appropriate to phase the construction works over more than one financial year. The quality of the workmanship and materials are also another significant issue. High quality design and materials can often reduce future maintenance costs of the scheme. Besides this, in order to reduce probable extra costs, traffic calming plans should be associated with the other improvement programmes, such as housing improvements, infrastructure investments etc...

After construction process, the monitoring of the scheme should be ensured in order to measure positive and negative impacts of the design upon the study area. Numerous after studies suggested that implementation of traffic calming schemes provide reduction in noise and air-pollution levels. As Whitelegg pointed out that, reducing speeds in German cities through traffic calming has produced dramatic reductions in both injuries and pollution. According to him, a simple policy like traffic calming can bring about substantial gains to the environment and improvements for pedestrians and cyclists but only if used as part of a comprehensive attack on overall levels of car use. (Whitelegg, 1993)

One of the significant tasks of the local authorities and public institutions are the establishment of public involvement. The key to successful traffic calming is acceptance by local community. In the preparation, design and implementation of schemes the participation of the local interest groups should be ensured. Such involvement serves several purposes:

- the different and sometimes conflicting interests in the area need to be fully considered during the design process of the scheme,
- the designers themselves need to have the benefit of local knowledge and ideas,
- and a wider undestanding and acceptance of the purpose and benefits of the scheme can be promoted.

As the part of the local community, we should also establish interest groups such as community action groups, civic societies and other representatives of particular interests in order to act a larger role in the development of walkable street environments.

Area-wide traffic calming studies are relatively new issues in urban design. There are some comprehensive area-wide traffic calming "models" that have been bottom-up community-based products built out of frustration with aspects of the automobile and/or malfunctioning intersections are: In England, Brattleboro (1994) and Manchester(1996) and in Germany, Buxtehude -Hamburg and Frankfurt City Centre and so on. These studies address downtown urban and traditional strip commercial issues, addressing vehicle, pedestrian, bicycle, intersection and streetscape issues. The traffic calming model proposal, that is shown in Fig. 7.1, was produced under the guidance of Devon County Council Traffic Calming Guideline, Clark County Neighborhood Traffic Calming Program and Halifax Regional Municipality Traffic Calming Policy. (Fig. 7.1)

The another key success feature of the traffic calming plans is the education. Educational opportunities for children and adults ought to be provided in the context of traffic safety. A comprehensive approach for livable neighborhoods and walkable streets can be achieved through a combination of education, encouragement, engineering, enforcement and legislation steps.

Unless there is encouragement of regional and urban scale policies, traffic calming measures can not solve all the traffic and urban design problems. However, it can be the starting point in order to create safe, and livable streets in our cities and towns.

Fig. 7.1. Traffic Calming Model proposal

The need of traffic calming by

Municipality

Individual and/or Citizen Association and other local interest groups

Public consultation process with the different range of bodies

NO

The rejection of traffic calming request

Police, bus service

Fire-ambulance

Citizen advisory committee

Municipality stuff etc...

YES

Design process

The examining of other environmental enhancement strategies

Arrangement of Public meetings

Construction Phase

Approval of Plan by local County Council and/or related government institution and/or greater municipality

Trial period (at least 6 months)

Acceptance of traffic calming plan by the residents and other groups

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# APPENDIXES

## A. TRAFFIC VOLUMES OF THE SELECTED ROADS

Traffic volume data was given for selected major, collector and local roads that consist peak hourly volume (PHV), and the hourly volumes (HV) according to vehicle types. The aim of this study is to measure the appropriateness of the selected roads in the study area in terms of application of basic traffic calming devices. In traffic volume study, an intensive weekday was choosen for per streets and studies were conducted for a duration of working hours (8.00 am- 18.00 pm). Average daily traffic was calculated as 12 hour day. No doubt that, weekly and monthly counts will increase the reliability of the study. However, average hourly traffic volumes and peak hour traffic will give an idea about which streets are need to be downgraded.

### A.1. Major Roads

The traffic flow of two major roads, Mustafa Kemal Street (Fig. A.1) and Fevzipaşa Street, (Fig. A.2) were indicated in table A.1, and table A.2.

Table A.1. Traffic Flow of Mustafa Kemal Street

| Mustafa Kemal Street | | | | | | |
|---|---|---|---|---|---|---|
| VehicleTypes/ Hours | Automobile | Light Commercial Vehicles | Lorry and Trucks | Dolmuş | Public Bus | TOTAL |
| 8.00-9.00 | 946 | 253 | 137 | 167 | 109 | 1612 |
| 9.00-10.00 | 1029 | 124 | 140 | 161 | 101 | 1555 |
| 10.00-11.00 | 1083 | 192 | 153 | 115 | 64 | 1607 |
| 11.00-12.00 | 928 | 227 | 178 | 129 | 63 | 1525 |
| 13.00-14.00 | 1081 | 147 | 168 | 138 | 63 | 1597 |
| 14.00-15.00 | 964 | 187 | 147 | 147 | 84 | 1529 |
| 15.00-16.00 | 917 | 218 | 143 | 147 | 73 | 1498 |
| 16.00-17.00 | 933 | 166 | 101 | 143 | 73 | 1416 |
| 17.00-18.00 | 1095 | 203 | 82 | 140 | 91 | 1611 |
| TOTAL | 8976 | 1717 | 1249 | 1287 | 721 | 13950 |

Table A.2. Traffic Flow of Fevzipaşa Street

| Fevzipaşa Street | | | | | | |
|---|---|---|---|---|---|---|
| VehicleTypes/ Hours | Automobile | Light Commercial Vehicles | Lorry and Trucks | Dolmuş | Public Bus | TOTAL |
| 8.00-9.00 | 411 | 60 | 56 | 132 | 71 | 729 |
| 9.00-10.00 | 380 | 55 | 68 | 123 | 61 | 687 |
| 10.00-11.00 | 387 | 60 | 73 | 125 | 52 | 697 |
| 11.00-12.00 | 403 | 73 | 89 | 116 | 56 | 737 |
| 13.00-14.00 | 423 | 64 | 81 | 109 | 61 | 738 |
| 14.00-15.00 | 439 | 108 | 67 | 113 | 64 | 791 |
| 15.00-16.00 | 449 | 80 | 75 | 103 | 53 | 760 |
| 16.00-17.00 | 379 | 79 | 61 | 123 | 59 | 700 |
| 17.00-18.00 | 496 | 63 | 65 | 141 | 47 | 812 |
| TOTAL | 3767 | 642 | 635 | 1085 | 524 | 6651 |

## A.2. Collector Roads

The traffic flows of the two collector roads, Süvari Street (Fig. A.3) and 159 Street (Fig. A.4) were given in the table A.3. ,and table A.4.

Table A.3. Traffic Flow of Süvari Street

| Süvari Street | | | |
|---|---|---|---|
| VehicleTypes/ Hours | Automobile | Light Commercial Vehicles | Lorry and Trucks | TOTAL |
| 8.00-9.00 | 178 | 22 | 17 | 217 |
| 9.00-10.00 | 129 | 23 | 15 | 167 |
| 10.00-11.00 | 152 | 23 | 17 | 193 |
| 11.00-12.00 | 190 | 10 | 31 | 232 |
| 13.00-14.00 | 194 | 28 | 19 | 240 |
| 14.00-15.00 | 219 | 23 | 23 | 265 |
| 15.00-16.00 | 170 | 29 | 20 | 219 |
| 16.00-17.00 | 210 | 20 | 34 | 263 |
| 17.00-18.00 | 230 | 26 | 18 | 274 |
| TOTAL | 1671 | 205 | 194 | 2070 |

Fig. A.1. Traffic Flow Diagram of Mustafa Kemal Street
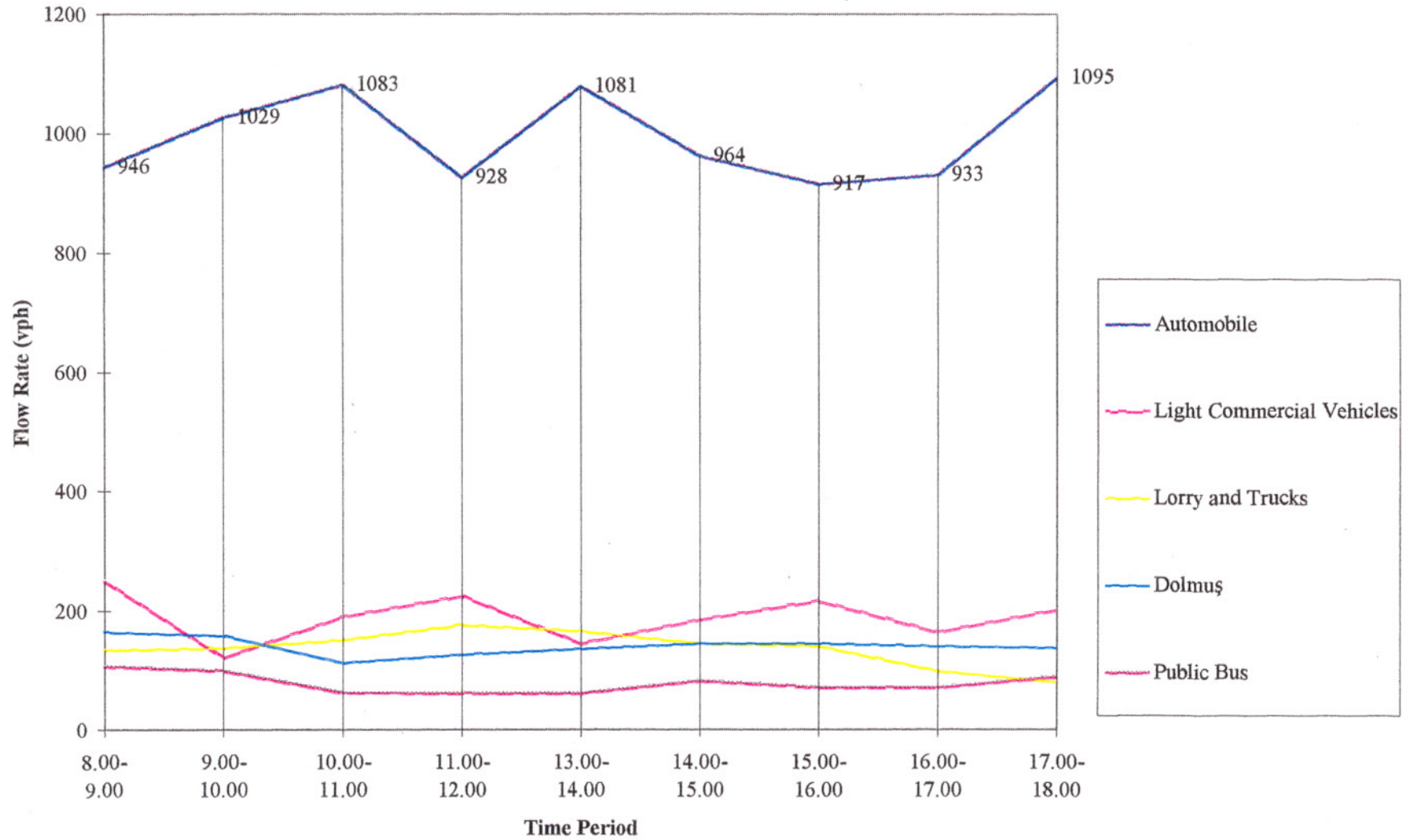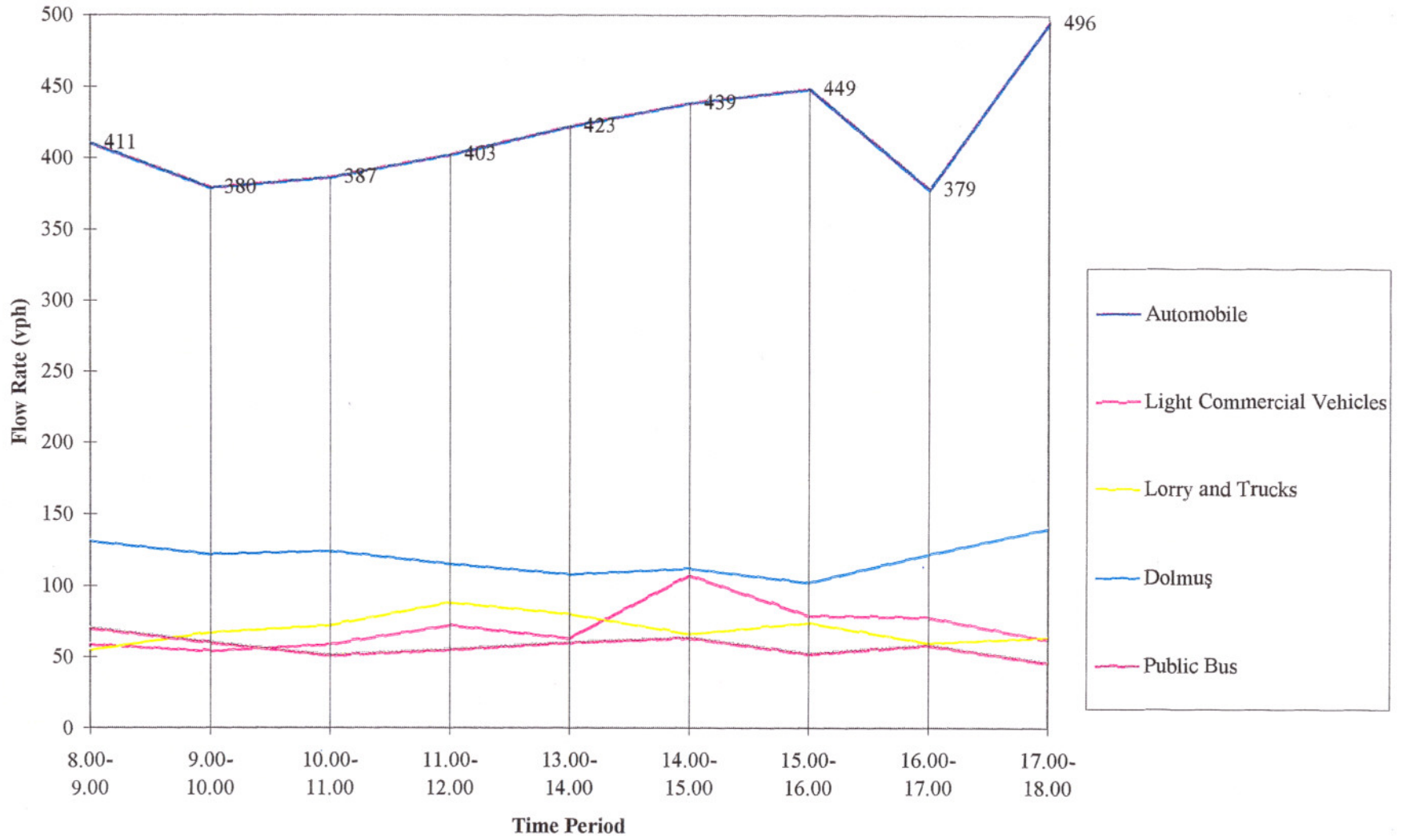
Fig. A.2. Traffic Flow Diagram of Fevzipaşa Street

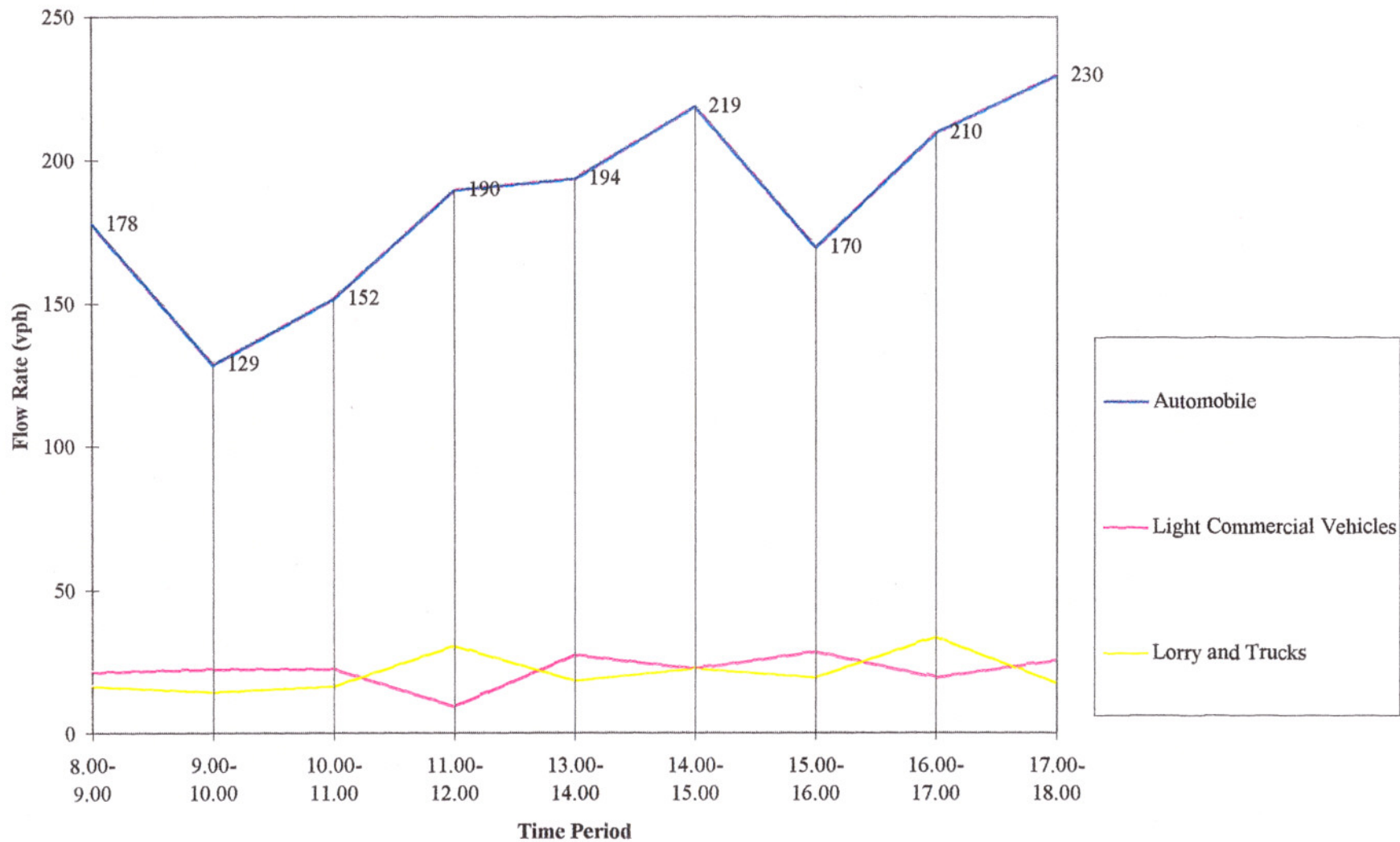Fig. A.3. Traffic Flow Diagram of Süvari Street

Table A.4. Traffic Flow of 159 Street

| VehicleTypes/ Hours | Automobile | Light Commercial Vehicles | Lorry and Trucks | TOTAL |
|---|---|---|---|---|
| 8.00-9.00 | 135 | 33 | 20 | 188 |
| 9.00-10.00 | 168 | 31 | 33 | 232 |
| 10.00-11.00 | 179 | 23 | 27 | 229 |
| 11.00-12.00 | 189 | 27 | 39 | 255 |
| 13.00-14.00 | 208 | 29 | 49 | 286 |
| 14.00-15.00 | 251 | 32 | 37 | 320 |
| 15.00-16.00 | 252 | 32 | 36 | 320 |
| 16.00-17.00 | 242 | 21 | 11 | 274 |
| 17.00-18.00 | 304 | 43 | 33 | 380 |
| TOTAL | 1928 | 271 | 285 | 2484 |

## A.3. Local Streets

The traffic flow of the seven local roads (Fig. A.5), was given in the table A.5. Local roads, Number 2, 9, and 10, are not through traffic routes. Therefore, traffic flow rates of these street were not calculated.

Table A.5. Traffic flows of local roads

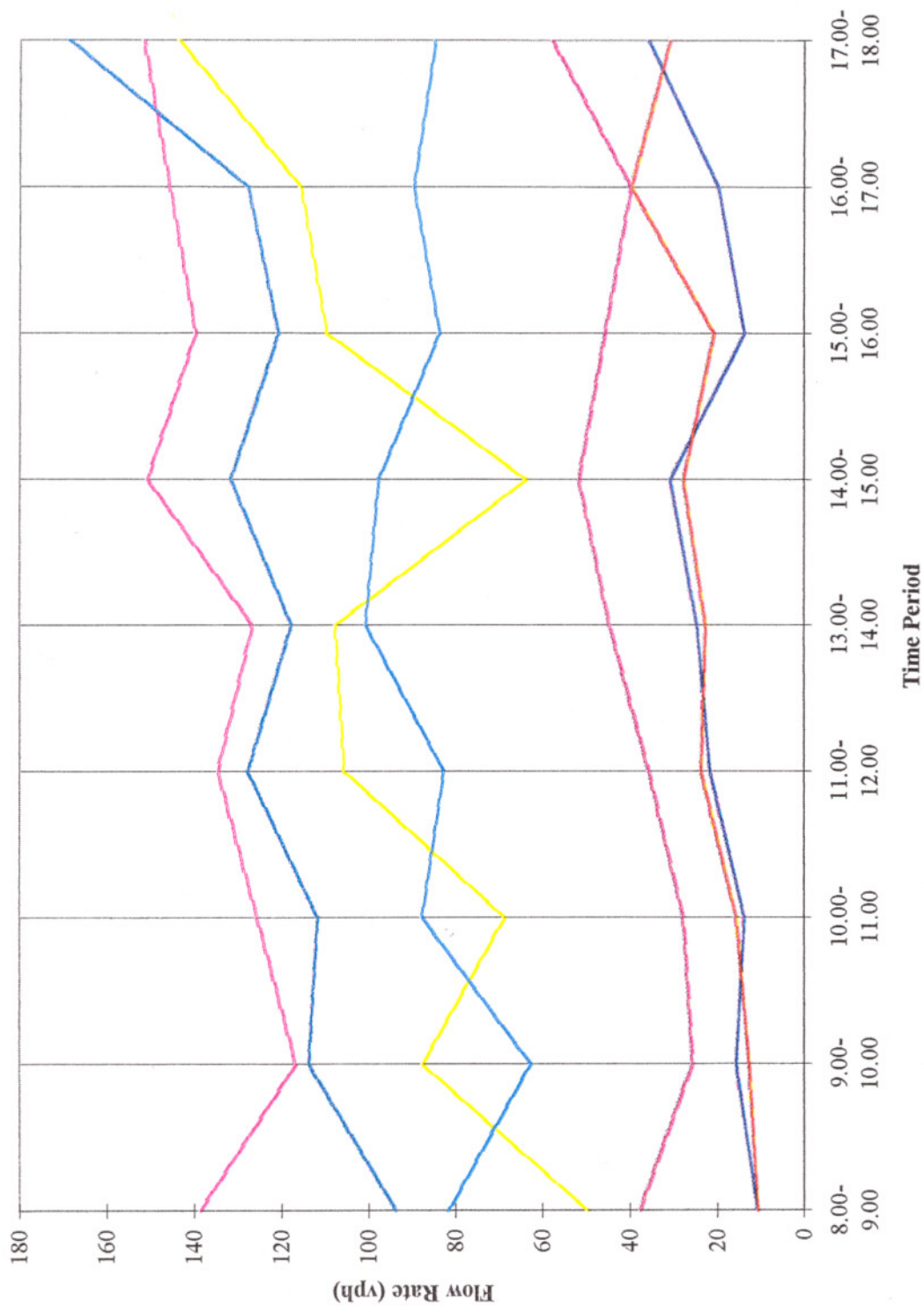| Local Roads (vph) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Street No/ Hours | 1 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8.00-9.00 | 11 | 139 | 50 | 82 | 38 | 11 | 94 |
| 9.00-10.00 | 16 | 117 | 88 | 63 | 26 | 13 | 114 |
| 10.00-11.00 | 14 | 126 | 69 | 88 | 28 | 16 | 112 |
| 11.00-12.00 | 22 | 135 | 106 | 83 | 36 | 24 | 128 |
| 13.00-14.00 | 25 | 127 | 108 | 101 | 45 | 23 | 118 |
| 14.00-15.00 | 31 | 151 | 64 | 98 | 52 | 28 | 132 |
| 15.00-16.00 | 14 | 140 | 110 | 84 | 46 | 21 | 121 |
| 16.00-17.00 | 20 | 146 | 116 | 90 | 40 | 40 | 128 |
| 17.00-18.00 | 36 | 152 | 144 | 85 | 58 | 31 | 169 |
| TOTAL | 189 | 1233 | 855 | 774 | 369 | 207 | 1116 |

Fig. A.4. Traffic Flow Diagram of 159 Street
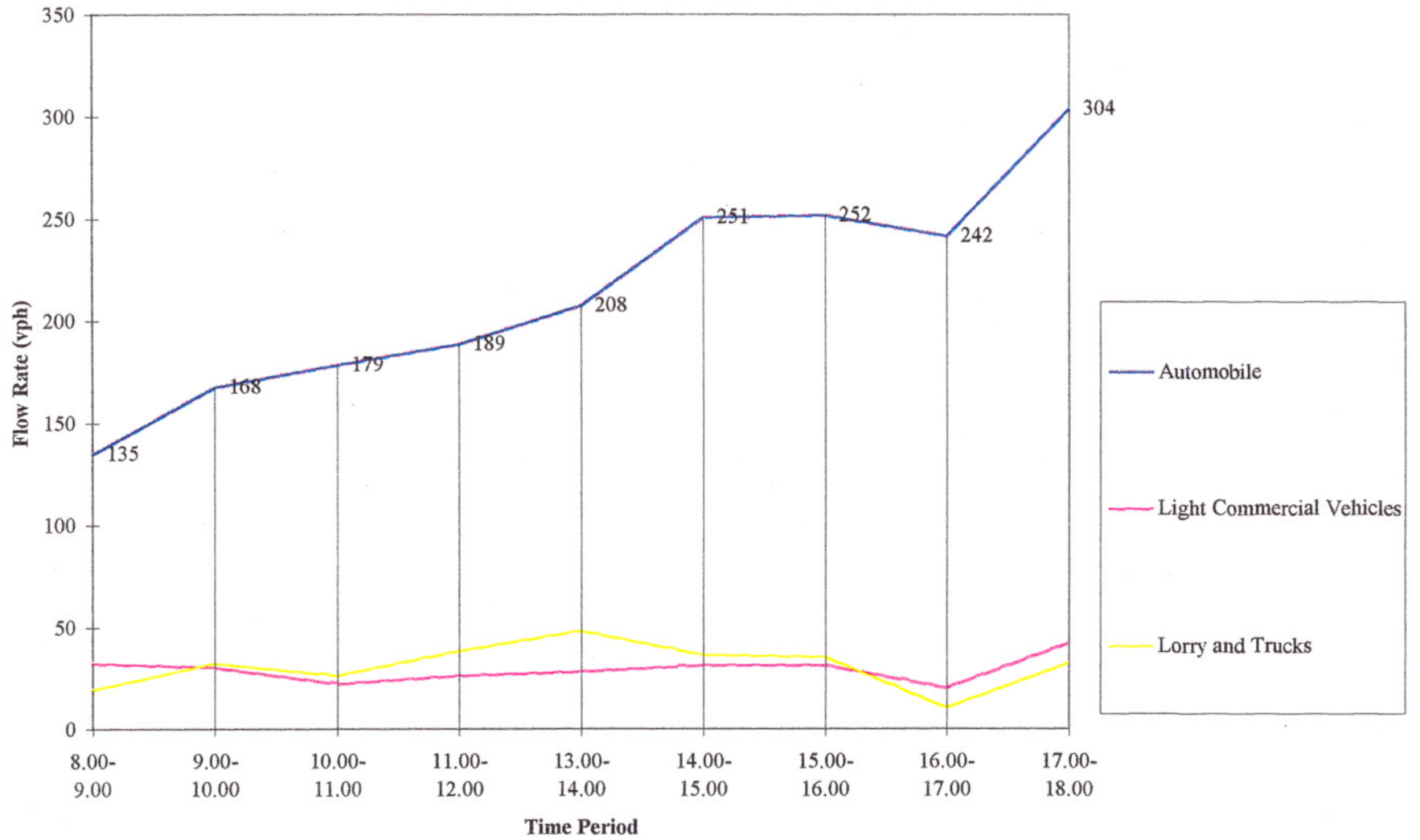
Fig. A.5. Traffic Flow Diagram of Local Roads

A8

# B. GLOSSARY OF TERMS

Traffic calming and pedestrian priority street design is a fresh idea for our cities and towns. Therefore, in this section meaning of some new terms that were mentioned in the thesis will be given with their Turkish suggestions. It is compiled from the various sources: Shaping up: Queensland Department of Transport, Devon County Council Traffic Calming Guidelines, Clark County Road Standards and TRL Guide.

- **Busway** (Otobüs Yolu): System of bus stations connected by dedicated rights-of-way for buses only.

- **Carriageway** (Taşıt İzi): That portion of the road devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes.

- **Central Island**- Median- (Orta Refüj): The area separating the opposing traffic lanes of a divided roadway.

- **Chicanes** (Kavisli Yol Değişimleri): That are a form of pinch point implemented on alternating sides of the carriageway.

- **Cycleway** (Bisiklet yolu): That portion of road, street or public path set aside for exclusive use by cyclists.

- **Cushion** (Yol Minderi): Raised portion of carriageway with flat top, extending over part of the carriageway width only to alllow exemption for certain emergency vehicles, other large vehicles, and two-wheelers.

- **Design Speed** (Tasarımla öngörülen Hız): A speed fixed for the design and correlation of those geometric features of a carriageway that influence vehicle operation. Design speed should not be less than 85th percentile speed (the speed at which 85 percent of vehicles travel)

- **Design Volume** (Tasarımla öngörülen Trafik Hacmi): (a) The number of vehicles expected to use the transport route adopted for the purposes of design, normally expressed as of vehicles per hour. (b) The number of vehicles per hour for which the road is designed.

- **Integrated Transportation** (Entegre Ulaşım): Considering all modes, land use patterns and social, environmental and economic impacts.

- **Lateral Shifts in the Carriageway** (Taşıt Yolundaki Yanal Değişiklikler): Lateral shifts are the techniques that are created by building alternate sidewalk extensions or islands on the carriageway and include pavement extensions central islands and chicanes.

- **Light Rail Transport** (Hafif Raylı Sistem): A modern electric train systme capable of on-street running, but segregated from the road traffic as much as possible.

- **Occasional Strips** (Düzensiz Şeritler): That are set out adjacent to and at the same level as the main carriageway. Occasional strips occur either side of the carriageway and are used to divide the carriageway with a different texture or colour.

- **Optical Width** (Görsel Genişlik): That is a technique to reduce the traffic speed with the use of vertical elements between the width of the street.

- **Parking Lane** (Park Şeridi): An auxiliary lane primarily for the parking of vehicles.

- **Pinch Points** (Daraltılmış Yol Kesimleri): A technique that can be used to slow traffic down at key locations, define parking bays and provide opportunities for environmental improvements such as tree planting.

- **Plateau** (Plato): A section of carriageway (from kerb to kerb) raised via ramps to sidewalk height covering the whole of a junction.

- **Raised Crosswalk** (Yükseltilmiş Yaya geçidi): A section of the roadway used as traditional pedestrian crossing areas that are purposely raised to afford greater visual enhancement to crossing locations. It is used a combination of speed hump, sidewalk extensions, and crosswalk striping.

- **Road Hump** (Yol tümseği): A raised portion of carriageway laid at right angles to the direction of traffic. Usually built from kerb to kerb, or tapered to retain drainage via existing channel.

- **Shared Surfaces** (Paylaşımlı Yüzeyler): That are spaces where the demarcation between sidewalk and carriageway is removed and where vehicles are slowed to a walking pace.

- **Streetscape** (Sokak Düzenlemesi): The design and character of a street, often with regard to the aesthetic design of features such as landscaping, lighting, pedstrian facilities, signage and street furniture.

- **Traffic Calming** (Trafik Sakinleştirme): In a narrower sense, traffic management techniques aimed at reducing the impact of traffic especially on local streets. In a wider sense, it may be defined as an overall transport policy concept, which includes, apart from a reduction of the average motor vehicle speed in built-up areas, a strong promotion of the pedestrian, public and bicycle transport and traffic demand management techniques.

- **Transit Oriented Development(TOD)** (Ulaşım Oryantasyonlu Gelişme):Urban development comprising of mixed residential and commercial uses within a comfortable walking distance of public transport and the core commercial area.

- **Travel Demand Management (TDM)** ( Yolculuk Talebi Yönetimi): Measures to influence the demand for travel, and how and when this travel is undertaken, leading to an overall reduction in traffic congestion, energy and pollution costs.

- **Vertical Shifts in the Carriageway** (Taşıt Yolundaki Dikey Değişiklikler):That are most effective speed reduction techniques that are used to slow the traffic down with the installation of road humps, cushions and plateaux.

## C. LAND USES THAT SUPPORT PUBLIC TRANSPORT

The type of land use has a significant impact on the whether public transport can be provided at a reasonable cost to meet the required standard of service in terms of frequency, reliability and comfort.

The table A.6. indicates the overall level of public transport orientation for a variety of land uses. This level of public transport orientation is classified as high, medium or poor according to whether the land use is likely to support a satisfactory level of service. This table is adapted from Queensland Department of Transport: Shaping Up.

Table A.6. Land Uses That Support Public Transport

| LAND USES | LEVEL OF PUBLIC TRANSPORTATION | | |
| --- | --- | --- | --- |
| | HIGH | MEDIUM | LOW |
| Apartment buildings/ Attached houses/ town houses | ■ | | |
| Duplexes | ■ | | |
| Detached houses on > 700 m$^2$ blocks | | ■ | |
| Car Parks | | ■ | |
| Clubs | ■ | | |
| Cultural/ community centres, public halls, etc... | ■ | | |
| Child care | ■ | | |
| Government Offices | ■ | | |
| Military Zones | | | ■ |
| Libraries | ■ | | |
| Urban Parks | | ■ | |
| Post Office | | ■ | |
| Recreation Facilities | | ■ | |
| Schools/ Colleges/Universities | ■ | | |
| Showgrounds | | ■ | |
| Youth Centres | ■ | | |

(cont. next page)

| LAND USES | LEVEL OF PUBLIC TRANSPORTATION | | |
|---|---|---|---|
| | HIGH | MEDIUM | LOW |
| Banks | ■ | | |
| Cafes | ■ | | |
| Cinemas | ■ | | |
| General Stores | | ■ | |
| Junk Yards | | | ■ |
| Motor Vehicle Storage Yards | | | ■ |
| Pharmacies | ■ | | |
| Restaurants | ■ | | |
| Service Stations, car repair etc. | | | ■ |
| Shops | | ■ | |
| Showrooms | | ■ | |
| Snack bars, fast food kiosks etc. | ■ | | |
| Medical Centres | ■ | | |
| Anchor Stores (department stores, supermarkets, etc.) | | ■ | |

(Source: Queensland Department of Transport, 1997, pp:69-72)