A STUDY ON STREET FURNITURE DESIGN CRITERIA FOR BUS STOPS

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Design Criteria for Bus Stops

By
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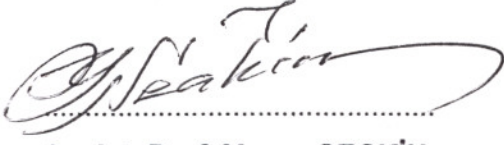**A Dissertation Submitted to the**
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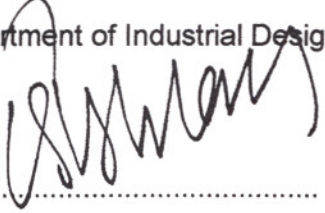
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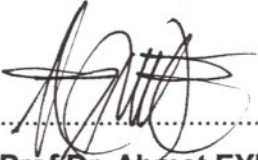
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ABSTRACT

People, in the effort to design the public spaces, began to constitute the elements that meet their simple demands in these spaces and so the first samples of street furniture began to form and increased in number.

Street furniture are systems that consist of products such as street lamps, signs, phone booths, seating, bus stops, which meet the user demands such as comfort, information, recreation and that are used commonly, located in urban spaces by institutions, and that help to form a healthy environment. In the beginning, they were produced one by one, but later mass production method began to be used according to the changing requirements. Today, the production and location of these industrialized elements carry importance with the design and location selection criteria.

So, the aim of this thesis, is to study the general design criteria about street furniture, that have importance in urban space and in special to study the criteria of elements used in bus stops which have an important place in the city with their location, classification, dimension and form.

As a result, design of a bus stop was realized in accordance with today's requirements and technologies and the design process and criteria were tried to be explained.

Key Words: Street Furniture, City Elements, Street Furniture Design Criteria, Bus Stops, Bus Stop Design

ÖZ

İnsanların, kamusal mekanları düzenleme çabası içerisinde, basit gereksinimlerini karşılayacak olan öğeleri, bu tür mekanlarda oluşturmalarıyla, kent mobilyalarının ilk örnekleri ortaya çıkmış ve zamanla sayıları artmaya başlamıştır.

Kent mobilyaları, kullanıcılarının konfor, bilgi, dinlenme, eğlenme gibi ihtiyaçlarına cevap verecek şekilde, kullanımı herkese açık, kamunun sorumluluğunda olan ve kentsel mekanlara yetkili kurumlarca yerleştirilmiş, kentsel çevrenin sağlıklı gelişmesine katkıda bulunan, sokak lambaları, işaret levhaları, telefon kulübeleri, oturma elemanları, otobüs durakları gibi çeşitli ürünlerden oluşan sistemlerdir. Başlangıçta tek olarak üretilen kent mobilyaları, zaman içerisinde ihtiyaçların gelişimine bağlı olarak, seri üretimle gerçekleştirilmeye başlanmıştır. Günümüzde endüstrileşen bu elemanların tasarımı ve yer seçimi ile ilgili kriterlerinin belirlenmesi doğrultusunda, üretimi ve konumlandırılması önem kazanmaktadır.

Bu nedenle bu tezin amacı, kentsel mekanda önemli bir yeri olan kent mobilyalarına ilişkin genel tasarım kriterlerinin incelenmesi, özelde toplu taşım sistemi içinde yer seçimi, sınıflandırılması, boyutları ve formu ile önemli bir yeri bulunan otobüs duraklarında kullanılan elemanların kriterlerinin verilmesi ve otobüs durağı tasarımında, dikkate alınması gereken noktaların açıklanmasıdır.

Sonuç olarak, bu tezde, bir kent mobilyası olan, günümüz ihtiyaç ve teknolojilerine uygun bir otobüs durağı tasarımı gerçekleştirilerek, bu ürünün tasarım süreci ve tasarım kriterleri açıklanmaya çalışılmıştır.

Anahtar Kelimeler: Sokak Mobilyaları, Kent Mobilyaları, Sokak Mobilyaları Tasarım Kriterleri, Otobüs Durakları, Otobüs Durağı Tasarımı,

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CHAPTER 1.

INTRODUCTION

Quality of urban space can be evaluated with the quality of life that will be realized in this space. Citizens wish to realize their activities in a public space in a well-planned and comfortable environment. Within these activities, in other words in activities such as transportation, shopping and recreation, many different needs come out with physiological, sociological and aesthetic basics. These needs that appear in public space can be met mostly with street furniture.

In an urban space every element that is presented to common usage of the society and that is stable, mobile or semi-mobile, and that is visual and functional is considered as street furniture. The term street furniture covers benches or other forms of seating, bollards and posts, kiosks, drinking fountains, planters, bus shelters, information signs, lighting fixtures, phone booths, etc.

Today, to see street furniture as a whole and intensify on this idea is becoming a design goal. However, practically, especially urban elements that have an industrial product identity, sometimes can not unit with each other and each of them is solved by itself. So, within the wholeness of a city, in the design of street furniture gaps can be detected in the mean of basic principles. The main goal of this thesis is to constitute these basic principles about the design and production of street furniture that can supplement each other and integrity.

The method of these thesis is first giving the definition of street furniture, then explaining by which user needs these furniture evolved and as the last step determining the general design criteria about street furniture. In the direction of these general structure, in the second section the definition of street furniture was made, its historical development was given and street furniture were grouped in order to bring a more comprehensive dimension to the subject.

In the third section, the stages, that starts from the appearance of a need to a certain furniture to the stage of its usage, were defined and subjects that should be properly considered in each stage were emphasized. In the second stage general design criteria about street furniture were examined. In the examination the criteria were grouped under the topics, as: physiological, psychological, technological and economic criteria. They were considered in a very board scope, from the design of a street furniture to the features of the city they will be located, and to the criteria that will be used at the production stage. In the same section, special criteria about street furniture that are especially used at bus stops were explained.

In the fourth section, bus stops as a street furniture were examined. Especially the importance and scope of bus stops were emphasized; then the location of bus stops within the systems of mass transportation and their categorization were studied. Classification of them, according to their usage frequency and to various place in the city, were made. Factors that determine the location, dimension and form of bus stops were defined. Then the users' needs and in order to meet these demands which criteria should be considered at bus stops were explained. Bus stops is a combination were many elements combine together. How these combination will be formed and its criteria were given in this section in detailed. As a last stage a design of bus stop was made in which all the above mentioned data were evaluated.

A bus stop is connection point of pedestrian and vehicle traffic. So, in the design process, its place and section of location, in other words environmental connections were taken into consideration. Production stages, materials, production methods, usage process will affect the cost and quality of the product. At each stage a comprehensive and different field surveys are needed, causing the process to have a very complicated property. So, in the study the design process and design criteria of a bus stop were tried to be explained in a systematic and detailed way.

CHAPTER 2

STREET FURNITURE

Before considering the street furniture as an industrial product with its design dimension, its place in human life, evolution, development and scope should be explained. Definitions of street furniture till today will be considered and classifications about its usage field and scope will be made. Meanwhile, its acceptance as an industrial product in the world, and its development will be explained.

2.1. Definition of Street Furniture

Through history, as urban settlements emerged, some elements were formed for the purpose of common usage of the public. In time, with efforts in increasing the urban life quality, development of urban settlements and also with the technological progresses, the number of street furniture and their variety increased, too, and are still increasing.

The term "street furniture" was defined in various ways with different concepts. "At public spaces within the artificial environment, street furniture were the elements that met the basic requirements of people. From the times when people first started to form the settlements, the first samples of street furniture began to be seen, also. The term "street furniture" was first used in 1950s in England.

Definitions of street furniture that were developed till our time are listed below.

"Street furniture are all elements that were placed at public spaces by authorities, that serve public, can be permanent or temporary, can be visual or functional, can be motional, semi-motional or stable." (Çubuk, et al. 1978, p.46)

"Elements that were designed at any landscape or public space in a way to meet the requirements of the users such as comfort, knowledge, circulation control, preservation and entertainment, can be named as "street furniture." (Y.T.Ü., 1992)

"These are the constructions and generally permanent service equipment, for various open air activities and with unknown users and that take place at urban space. Street furniture, is a system of products that was formed with the concept of city, through specific processes, and for meeting the requirements of users." (Hacıhasanoğlu, 1991)

"Street furniture includes all of the non, moving elements introduced into street and highway corridors as adjuncts to the basic surface paving and utility structures and enclosing buildings, fences or walls. These create the corridor, which then requires

furnishing with lights, signals, signs, newspaper/magazine kiosks, trash receptacles, seats, drinking fountains, public toilets, trees and other plantings and their containers, curbs, grates, and so on. Some of these elements cluster overhead in wire networks; others clutter the ground level in discordant uncoordinated mixtures; still more must be accessible through surface manholes or grills which complicate the ground surfaces." (Sato, 1992)

"Street furniture consists of the man-made elements of a streetscape located on the sidewalk, on a plaza, or in another type of pedestrian area. Street furniture elements are generally associated with amenities for pedestrians, and they may be free standing or fixed. Included are benches or other forms of seating, bollards or posts, kiosks, drinking fountains, planters, bus shelters, information signs, trash receptacles, bike racks, game tables, lighting fixtures, phone booths, and notice boards. Some authorities point to a distinction between street furniture and street hardware. The latter category refers to the utility and mechanical systems located within a street right, of-way and includes fire hydrants, manhole covers, traffic lights and signs, utility poles and lines, and parking meters. (Cartwright, 1982) (Fig. 2.1.)

Figure 2.1. Street Furniture of a Streetscape   (Sato, 1992, p.75)

"Street furniture, can change according to urban culture and can enrichen with the city's geography and climate. Whether the art objects such as clock towers, fountains and especially statues should be included in the system of street furniture or not is argued among many people. Besides this matter, some sculptors conclude that statues can be accepted as street furniture because they have visual function in the cities." (Yaylalı, 1998, p.67,68) (Fig. 2.2.)
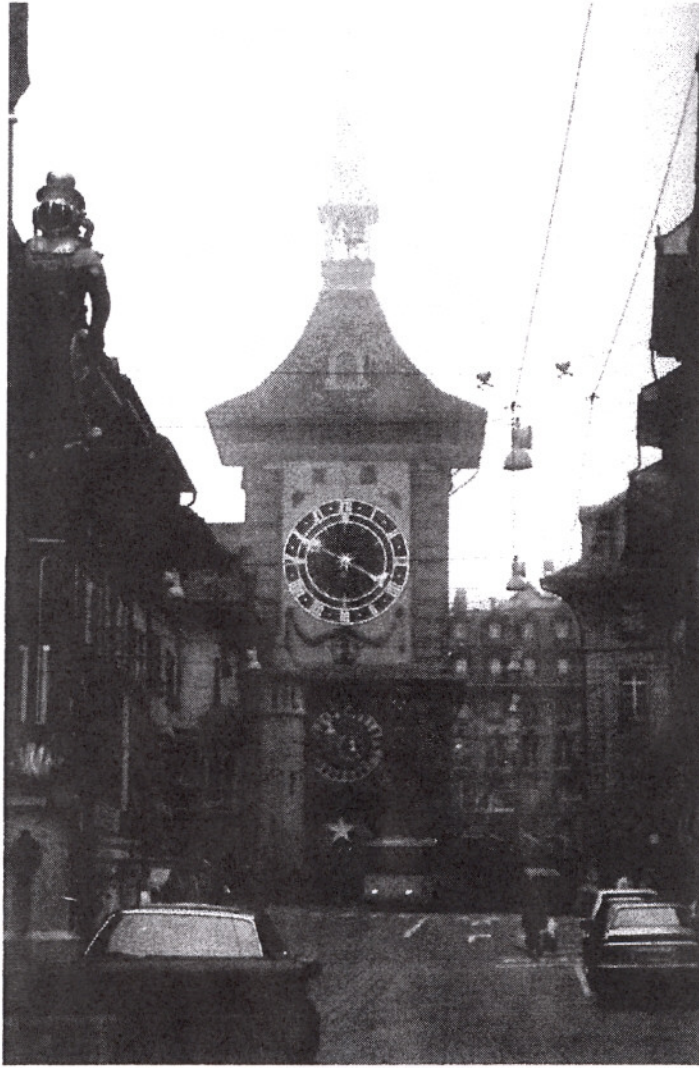
Figure 2.2. Some Sculptors Have Visual Function in the Cities   (Sato,   1992,
p.82)

The accented points of the above mentioned definitions are:
- the location of street furniture
- the reasons of its existence
- the movement ability of street furniture

The place that it was located explains its reason of existence, too. Because it is located at a public space it belongs to –everybody-.

In this sense, urban space not only includes open areas but also semi-close (passages) or close areas (metros, covered markets, etc.) that are opened to public usage. It is not important whether these urban spaces belong to public or to a person. Only, if it is a private space some limits can be put to public usage. In this framework street furniture, also, can belong to public or can be private. However, the important point is that it was offered for the common usage of public. An advertisement bulletin

board which takes place on the wall of a privately owned building is a street furniture, too, as well as the garden wall of a house or a school. (Fig.2.3.)

Its usage purpose is to meet the requirements of citizens at public space, to provide service for citizens. Visual and physical activities can be included in these needs. So, the utilities of these elements may differentiate. Consequently, monumental elements such as sculptures may also be included in street furniture.

Movement ability is another characteristic, that was emphasized in definitions. They are generally classified as moveable and unmovable furniture.

From time to time, trees also are included in the definition of street furniture. Although they have visual effects in urban environment, they are not man-made objects. Whether including trees into definition of street furniture or not is an undecided matter.

Figure 2.3. Some Advertisements Effects the Cities Appearances   (Sato, 1992, p.58)

After all of above mentioned definitions were examined in this thesis; street furniture was defined as: Within urban space every element that is, designed for the purpose of common usage; with a definite or indefinite usage period; immovable or movable or semi-movable; visual or functional can be included in the concept of street furniture.

2.2. Classification of Street Furniture:

In order to clarify the definition of street furniture, classifications of street furniture should be studied. With this classification which element belongs to which group is explained according to element's characteristics.

Street furniture includes different elements with different characteristics. (Fig.2.4.) Street furniture can be classified according to different view points as:

Classification according to their functions

1. Street furniture about activities:
   a) Street furniture aiming sports and entertainment activities- benches, pergolas, play equipment, sports equipment, sculptures, etc.
   b) Street furniture about service and shopping activities: bus-stops, boundaries, telephone booths, kiosks, clocks, toilets, parking automates, bicycle parking elements.
   c) About communication: traffic signs, advertisement and announcement bulletin boards and flag poles.
2. About infrastructure and landscape
   a) Street furniture about infrastructure: pavement coverings, illumination elements, trash receptacles, covers of infrastructure and sewer system.
   b) Street furniture about landscape: fountains, pools, tree bracelets, flower pots, park and green area protection. (Hacıhasanoğlu, 1991, p.5)

Classification according to their replacement in the urban space:

1. Aiming protection
2. Aiming information
3. Aiming direction
4. Aiming decoration
5. Aiming shelter
6. Aiming entertainment, play and
7. Aiming shopping. (Çubuk, 1989, p.17)

Classification according to their mounting:

1. Moveable street furniture: street furniture that can be carried to a nearby space easily.
2. Semi-moveable street furniture: furniture that cannot be carried but can be moved where they are.

3. Stable street furniture: street furniture that their location cannot ever be changed.

Classification of maintenance and responsible institutions:
1. Ones that were placed by local governments
2. Ones that were placed by traffic units.
3. Ones that were placed by mass transportation
4. Ones that were placed by private establishments.

According to their production:
1. Serial mass production: They are the street furniture that can be mass produced industrially.
2. Prototype production: They are the street furniture that have an artistic quality in the city at special occasions such as sculpture. (Yaylalı, 1998)

Classification in relation with the infrastructure:
1. Street furniture related with the infrastructure: squares illumination, street illumination, traffic lamps, illuminated traffic colons, telephone booths, clock towers, park-meters, ticket automates, sale units, bus stops, fountains, grates, lid of the infrastructure systems, illuminated colons.
2. Street furniture not related with infrastructure: pavement coverings, boundaries, pedestrian barriers, traffic barriers, impermanent barriers, cones, directionaries, locationaries, information boards, advertisements, posters, commercial signs, street signs, numbers, traffic signs, tents, playground equipment, bicycle parking equipment, flag poles, benches, flower pots, trash receptacles. (Doğan, et al., 1986, p.3)

Street furniture are taken up different classifications with various character as below. Classification of users needs, type of production and maintenance of responsible institutions are given ideas for the production and design of street furniture. The formation process and design criteria are researched in the following chapter detailed.

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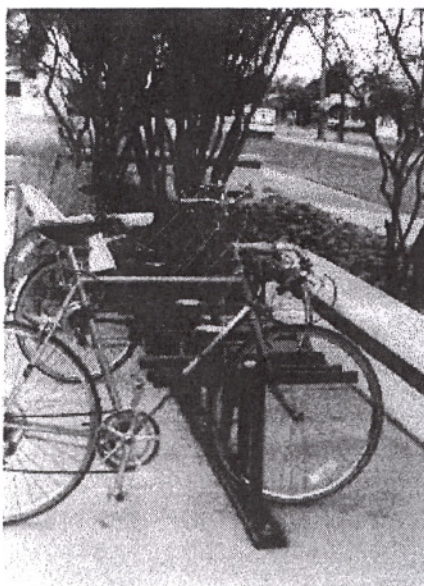
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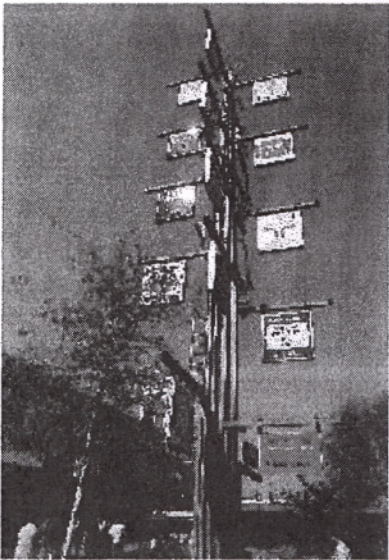
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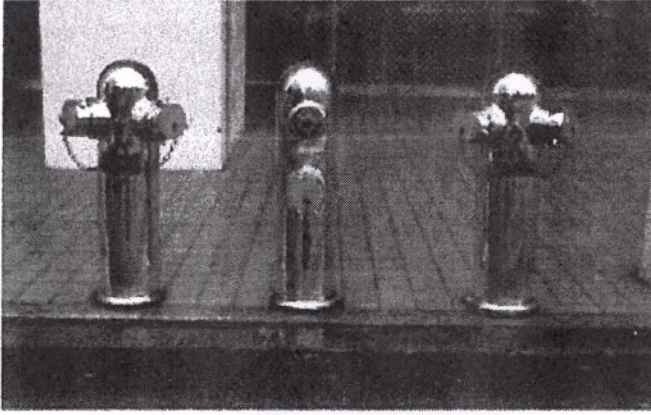
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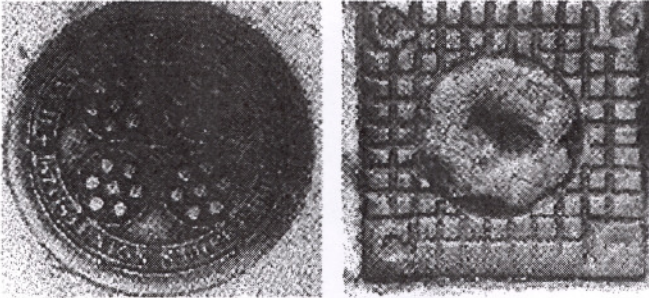
Figure 2.4. Examples of Some Street Furniture [Sato, 1992, p.115(1), Sato, 1992, p.68(2), Walker, 1992, p.423(3), Sato, 1992, p.134(4), Walker, 1992, p.400(5), Sato, 1992, p.136(6), Sato, 1992, p.121(7), Sato, 1992, p.135(8), Walker, 1992, p.395(9), Mukoda, 1990, p.34(10), Mukoda, 1990, p.43(11), Sato, 1992, p.123(12), Sato, 1992, p.115(13), http://members.mindinfo.com/maxsport/Visalia_Trolley-Info_Sign-s.jpg (14), Aaron, 1991, p.13(15)

2.3. History of Street Furniture

As people started to settle down and formed the first settlements, first samples of street furniture began to form, too. In other words, with the formation of cities, it is evident that the existence of the service elements used by the citizens is began to be seen. till Industrial Revolution, street furniture consisted of: street lambs, plaquattes on which the name of the street has written, fountains and classic benches. (Fig. 2.5.)

As the result of rapid urbanization after Industrial Revolution, urban public spaces gained importance and started to be used densely. Technological improvements of the period with developed transportation and communicational opportunities, many new service elements began to be seen as well as basic elements. In parallel with these developments "street furniture" concept began to take place and develop.

Widespread usage of street furniture began firstly in England, than in other European countries and in USA, becoming the most important element of urban architecture. First samples of street furniture within the concept of industrial product, are the gas lamps in England, used to illuminate the docks. (1790) These cast iron illumination elements, represent the classical line of the era with their gothic forms. These classic gas lamps continued to be used till 1880s and left their place to electric lamps as electricity got common. (Fig. 2.6.)

In between the years 1850-1900 when technological improvements increased and as motor vehicles were put into usage, new requirements emerged and, so, new elements were added to "street furniture" concept. Especially in urban environment, as the result of these developments, protecting and designing the life gained importance. Motor vehicles began to be used in the city uprevalently, transportation density increased rapidly and, so, the first semi-mechanical and semi-illuminated traffic light began to be used in London, in 1868. Besides, with the improvement of vehicles street covers differentiated and developed. (Fig. 2.7., 2.8.) When, in 1886, in London the first underground railway put into usage, concept of "street furniture" gained a new dimension. On the other hand, the first usage of long-distance telephone line began in 1884 in America and commonly used, causing the development and widespread of this concept. (Fig. 2.9.)

As communication opportunities increased, advertisement bulletin boards, telephones and information bulletin boards were improved as street furniture. As the streets and squares became traffic ways, pedestrian roads were formed at the central areas of the cities. These areas contain all the elements of urban services to users.

The first attempts in evaluating these developments started in 1920s, in England, and till today standardization of 3000 street furniture elements was realized.
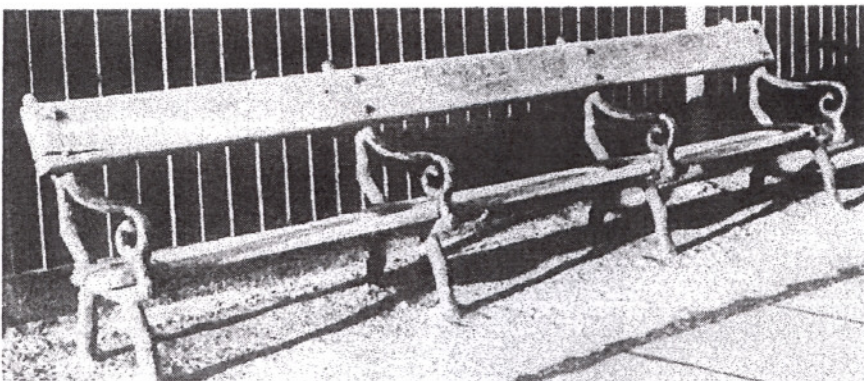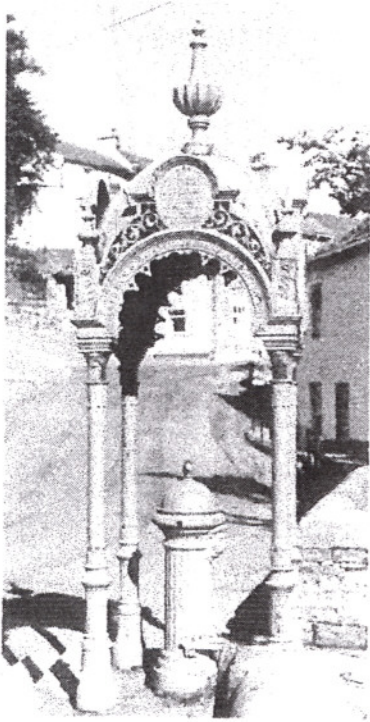
Figure 2.5. Some Street Furniture to be till Industrial Revolution   (Aaron, 1991, p.15)
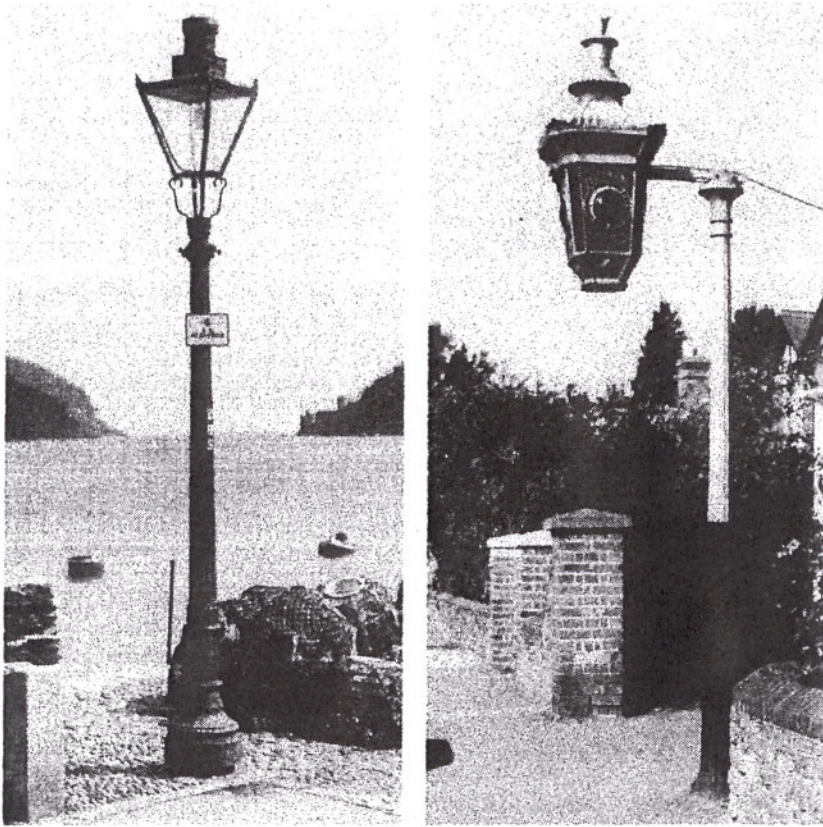
Figure 2.6. A Late Nineteenth- Century Gas Lamp in Darmouth, Devon, Discreetly Converted to Electricity   (Aaron, 1991, p.15)

Figure 2.7. Traffic Sign with Glass Reflectors   (Aaron, 1991, p.30)

Figure 2.8. Iron Passenger Shelter in Northampton   (Aaron, 1991, p.30)

Figure 2.9.The Telephone Boxes was Designed in 1927, 1930   (Aaron, 1991, p.30)

These attempts, are only a small part of the works done in choosing the street furniture, increasing their quality, in English cities.

Commissions formed about choosing and applying these products: Street Furniture Advisory Committee, Royal Town Planning Institute, British Design Council are the main ones. These committees assisted in the healthy development of the urban environment by, supervising all the processes from the product planning, evaluating to application. Also, they let the users contribute in the process of choosing and formation of the products, published publications about this subject and provided the healthy development of these processes.

Street furniture, is a subject related with urban planning, urban design, planning, architectural design and industrial design. The reason of the emerging of street furniture, like the reason of the emerging of every object and physical system, is related with the formation of requirements and its historical formation process related with the development of these requirements, in time. (Fig. 2.10.) While street furniture were produced by craftsmen one by one at first, it got industrialized due to rapid urbanization and because of increase in the need of production. Today, production of street furniture is done with mass production. (Zülfikar, 1998)
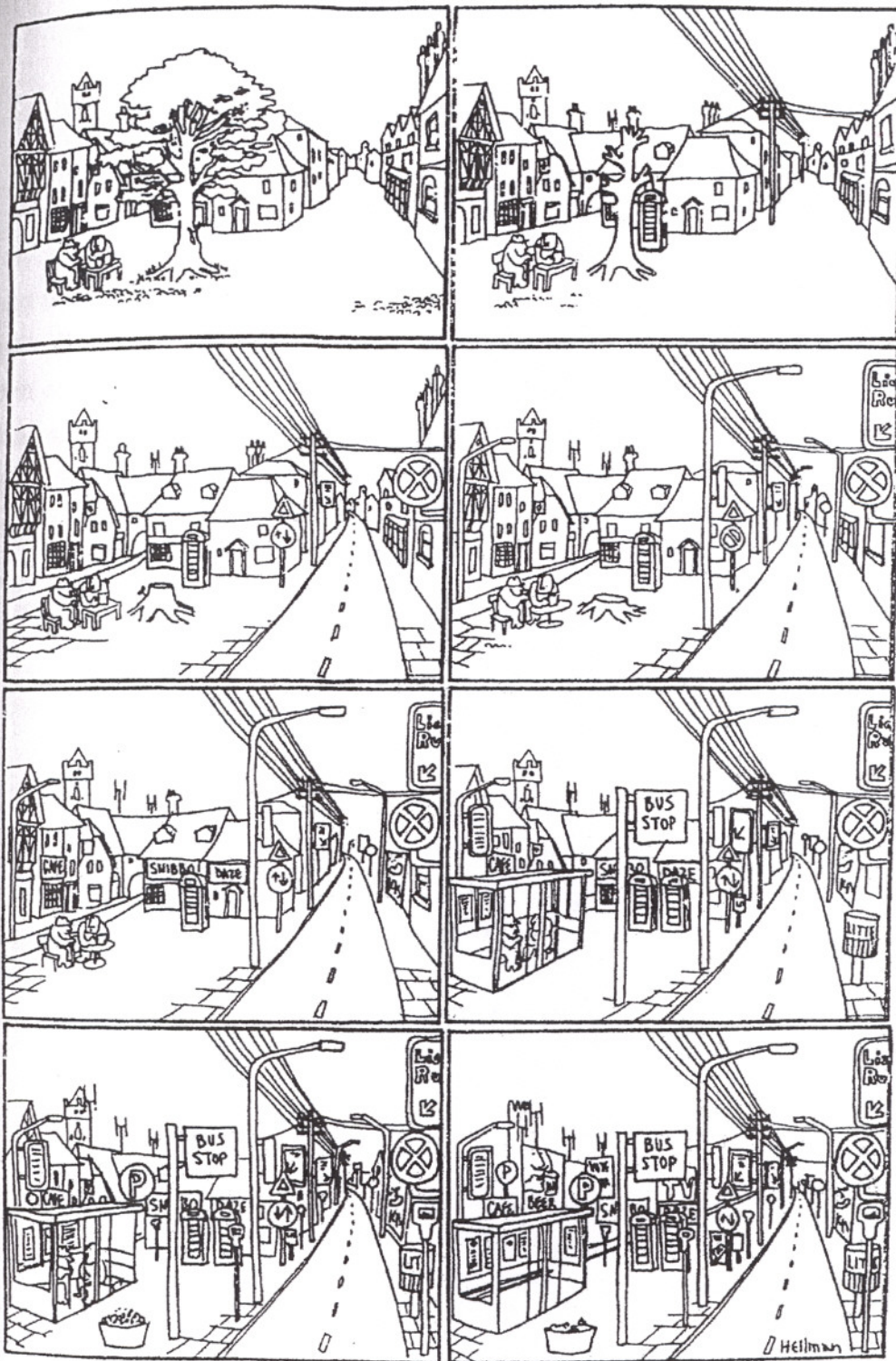
Figure 2.10. Developing of Urban Spaces (Doğan, et al., 1986, p.1)

CHAPTER 3

PROCESS OF FORMATION OF STREET FURNITURE AND DESIGN CRITERIA

Street furniture are industrial product type, that are integrated with urban space and used by public. As the products properties necessitate they should be integrated with other urban elements and urban relations that take place in urban space. So, it is part of a very complicated system. A very comprehensive work is needed, starting from the moment when a requirement of street furniture comes out to the time of usage. Both design and production and usage stages include many people and associations. In this section first the realization process of street furniture then street furniture design criteria will be studied.

3.1. Process of Formation of Street Furniture

Design and production process, are two important stages from the production decision of an industrial product to the usage stage. When a street furniture is considered other stages enter into the process like locating stage, usage stage and maintenance stage. (Yaylalı, 1998, p.101). Stages in the realization of street furniture is shown in Figure 3.1.
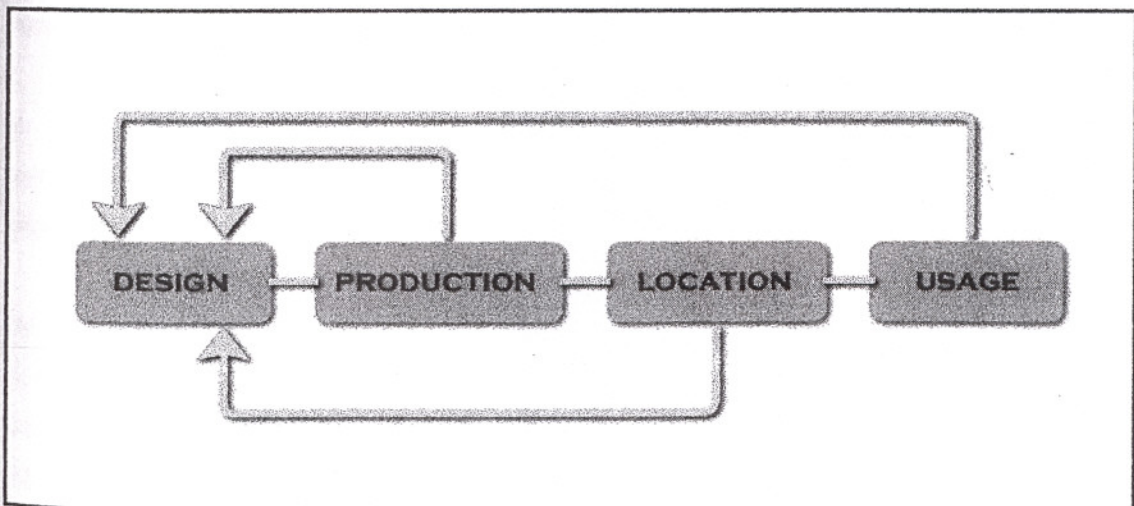
Figure 3.1. Process of Formation of Street Furniture   (Yaylalı, 1998, p.101)

3.1.1. Design Process

Design of industrial product is a very complicated fact in many different factors combine together. Besides, it is realized in a very complicated system where various people and groups involve in the formation of only one product. (Küçükerman, 1997, p.16).

In the design of street furniture an inter-disciplinary work gains importance. Each product that is involved in the street furniture is a different unit. And some of these furniture need different knowledge during their production and usage stages. For example, when illumination, signing and plastic elements are considered, knowledge from different disciplines and art fields should be evaluated about standards, laws and aesthetic values. Generally, in the design of a street furniture people from these careers should work together: industrial design, graphics, urban planning, architecture, landscape architecture, traffic design and sculpture.

"To determine a method that would guarantee the success of the end product in the design process of a new product is an important stage. Design method, surely will differ according to each industrial product group." (Küçükerman, 1997, p.16).

Design process, consists of these steps: observation, defining the problem, developing alternative proposals, comparison-evaluation, and selection. However, these steps are not always linear. In each step one may return back a step or maybe to the first step. Timing is also important in the determination of this process. To determine the time and people in the realization of each step is important because it is closely related with the economic usage of time and costs.

In the design of a product, firstly a requirement for that product should appear. In an urban space, the need for a certain furniture should turn into a demand or the need for it should be felt. These needs can be physiological, sociological or psychological.

As the demand appears, the need for a product should be defined in all ways. If this need is defined in very extent scope then the possible problems that can be seen in the next steps are eliminated. Defining the product can be made with the knowledge about; user determination, product location, usage frequency, management, production cost.

Analysis process, involves the collection and evaluation of data that will be used in design process. Analysis involves the definition of the product (in other words defining the needs) and also the technical aesthetic, production and economic data needed in the design of the product. In this context, the documents that will affect the design, the laws about the subject and market survey results are included.

In collecting data about a street furniture another method is finding out the idea of users. A detail that can be unimportant to the designer can be important to the user. Rather than the designer directing the users, users giving an idea to the designer is a more appropriate method in the formation of more efficient urban spaces. There are different methods in taking the viewpoints of users. Making a public survey is one of these methods. Questions about the product and its usage, about the place and time it will be used can be asked. However, survey cannot be an adequate method. Another, method is to observe the people's behavior in an urban space and to determine the need for a street furniture and its usage way. A very successful observation can give healthier results than a survey. Samples of a furniture, during observation stage, can be located in an urban space and people's reactions, usage ways and liking can be evaluated. Thus, design can be revised according to its negative and positive properties.

From time to time, alternatives about street furniture are put in an urban space and let citizens select among them. However, citizen's ideas are taken at the last stage of production. And citizens can only select among few products. Moreover, another problem occurs in at what degree the users are represented as the result taken from these kinds of votes.

With the analysis studies mentioned, above, design criteria about the product starts to be determined. It is possible to determine general criteria about the design of street furniture. For each product that takes place in an urban space, criteria such as: safety, integrity, accessibility, ergonomy, comfort, economy and durability can be used. These criteria can be grouped under four topics: functional criteria, psychological criteria, technological criteria, economic criteria.

Under these general criteria each element has different properties and values. A more detailed data about design criteria of street furniture is given under the topic "General Criteria in the Design of Street Furniture".

Next stage is alternative proposals. It is necessary to produce more than one alternative for a healthier result. By this way, an evaluation can be made among different alternatives and more arguments can be made about its details and properties. During this stage prototypes of the selected proposals are produced.

3.1.2. Production Stage

Production stage starts from the design stage to the products' marketing. Evaluation of data about the production during design stage will reduce the problems during production. In this stage some decisions should be given such as:

- material data
- production methods (casting, combining, etc.)
- production forms (serial production, prototype production)
- production standards and qualities. (Yaylalı, 1998)

3.1.3. Location Stage

Realization of street furniture do not end after production stage. Efficiency in usage is closely related with the furniture's location in city. Their location in an urban space, quantity, coordination between the units are important in this stage.

They should select location according to the needs in urban space. If a furniture is located in an urban space where there is no need, it is not functional and may create a visual pollution. During the design stage of the space, these elements' location should be determined, in another word, their location should be determined according to spatial relations. Another point in efficient usage of the furniture is its percevebility.

The quantity of street furniture in an urban space should meet the demand. For this, the users' quantity and density should be known. The important point here is that usage frequency may change during a day or during different days of the week (weekends or weekdays). So, the quantity should be determined according to the times or conditions when the urban space is used the most densely. Elements located in the urban space more than needed may create a chaos and also will increase the cost and labor-force unnecessarily.

Mounting the element during location stage is important, also. In an urban space, the mounting of unmovable or semi-moveable furniture should be very secure and ergonomic. There are some furniture that needs to be mounted according to antropometric dimensions: trash receptacles, coin boxes, benches, etc.

There are many furniture in an urban space. So, each of these can be located in different institutions. In order for them to constitute a harmonious relation with the urban space and among each other, the units (municipality, and infrastructure units about electricity, telephone, etc.) should decide on the location and quantity of the furniture. A coordination can be provided within the bodies of local governments. This way an integration, and harmony can be provided among elements.

3.1.4. Usage Stage and Maintaining Processes

After the location of street furniture the usage stage starts. Furniture should be used for a long time. So, it should be durable and long lasting.

There are many external factors that determine the life of street furniture. Rain, snow, wind, dust sun-light are some of the natural factors. They are directly exposed to these effects and their life is, thus, limited. In order to provide a long-lasting life, they should be controlled orderly and their maintenance should be done. Their material should be selected according to climatic factors.

Accidents within the city can also give damage to street furniture. To prevent hittings, blows, and damages at the places where there is a very dense pedestrian and vehicle traffic, a more durable material and from should be selected. Another important external factor is vandalism. Vandalism is a behavior, to give damages to furniture with violence. (Yaylalı, 1998)

Maintaining is important in order to extend the life of street furniture that worn-out physically and visually by exterior factors such as natural factors, accidents and vandalism. Mostly, maintaining is done by local governments and companies. In last years private sector also takes part in the maintaining of street furniture with special agreements. As applied in Izmir in last years: an advertisement company that organizes the advertisement facilities in the city by using the bill-boards at the bus-stops, also takes on the maintenance and cleaning of bus-stops.

3.1.4.1. Street Furniture and Vandalism

Urban space are places used publicly. Usage of the equipment at these places are elements that define and determine the urban space. They have two definitions; usage and destroy. Throwing garbage, writing on the walls, or taking the telephone directory from the booths are samples of destroy.

At this point, as a sub-topic, destroying aesthetic values, destruction of them, can put vandalism concept and problem on the agenda. Vandalism, in simplest definition, is destruction and bad usage of elements that take place at public spaces. Vandalism is danger to human lives, increasing fear of crime among the old and the unprivileged, loss of services and a general lowering of the quality of life in our communities.

The term "vandalism", maybe because it ends with "ism", is not used very much in every-day language. It is seen almost every day but most of the time is not or cannot perceived. Just like these advertisements, we do not pay any attention to street furniture that we pass everyday and most of the time accept destroyed elements very natural. However, being insensitive to their destruction, brings out the problem of not assimilating the place and equipment.

From air pollution to noise, from traffic problem to the facts of alienation and getting crowded, from alcoholism and drug addiction to burglary and vandalism, in a very wide range of spectrum form chain of problems of social breakdown. Even when we examine vandalism which is only one ring in the whole chain, we see various effect-reaction events; definition of vandalism varies in a very wide range of crime, from unimportant happenings to more serious ones like from graffiti is to arson.

Vandalism can threaten citizen's physical and psychological health. For example; (Geason and Wilson, 1990)

- a destroyed telephone booth may cause death indirectly by making it impossible to call to police or hospital.
- a destroyed slide in a playground may cause injures.
- a destroyed illumination element may create an atmosphere for thieves.

Statistics indicate the tragic signs of vandalism and are important in informing the public as well as the related foundation. Especially, in England, in the last 20 years many associations were founded in preventing vandalism as a governmental policy, because of increases in vandalism. The cost of these vandal events are determined by these vandal events are determined by these associations, and local governments each year determine the cost of repair and renewal of the furniture, writing reports about them. (Design Council, 1979, s.7)

About these subjects, no static or cost calculations were made in Turkey. Repair and renewal of all the destroyed elements is directly related with time and sources.

Vandalism marks at public spaces in cities; broken illumination lamps, broken glasses of bus stops, etc., demoralize public and can cause fear. Also, these kinds of views encourage the threatens and cause more happenings. (Fig. 3.2.)

Factors, Causing Vandalism:

Many factors play role at the formation of vandalism that is the subject to many disciplines like sociology, psychology, urban design, architecture and industrial design, architecture and industrial design. Some try to explain the reasons of vandalism with social and physical poverty, some others relate it with built environment, dimensions forms, types of the buildings and social control. Partially environmental (school, business, resting, entertainment, friendship, family and neighborhood atmosphere) partially emotional factors (distress, personal relations, dissatisfaction and feeling of uselessness) play role in vandalism (Türkoğlu, 1991 p.131).
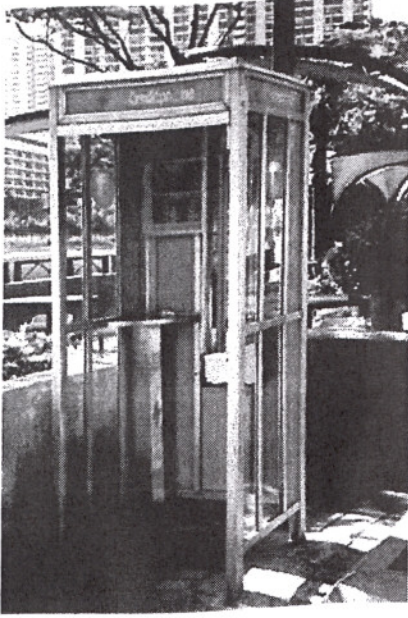
Figure 3.2. Vandalism Marks at Street Furniture in Cities
http://paoprj.lucksnet.or.jp/earth-c/html/9904apr/html/000066.html

Types of Vandalism:

Individuals, with the effects of the relation with the environment, perception and symbols, show their attitudes in two ways. In the first one they protect the place with an assimilation feeling or pretend not to see anything. In the second one, they express their behavior against the society, social order or space they choose, by their breaking behavior. Breaking actions can be grouped in 7 main groups:

In their investigation into graffiti and vandalism for the New South Wales State Rail Authority (1986), Paul Wilson and Patricia Healy used the following categorization of vandalism, adapted from Cohen (1972):

- Acquisitive vandalism - damage done in order to acquire money or property, for example damaging telephone boxes.
- Tactical Vandalism - damage done as a conscious tactic to achieve another end.
- Ideological vandalism - damage done to further a cause or communicate a message, for example slogans on buildings.
- Vindictive vandalism - damage done to get revenge, for example breaking school windows because of perceived unfairness by teachers.
- Play vandalism - damage inflicted incidentally or deliberately as part of a game or competition, for example seeing who can break the most windows.

- Malicious vandalism - damage as an expression of rage or frustration, for example scratching the paint work on expensive cars.
- Innocuous vandalism - damage done to property defined by youth as unimportant or of no value, for example slashing railway seats.

Wilson concluded that, though the motivation involved in tactical, ideological and vindictive vandalism is fairly obvious, the motivations for play, malicious and innocuous vandalism - most common to railway damage - are less obvious, and unfortunately, quite widespread.

Vandalism and graffiti on public transport have been reduced by a variety of strategies in several countries. These are:

- Quick repairs and fast removal of graffiti. As graffiti and vandalism seem to attract imitators, trains and railway stations should be kept as clean and attractive as possible - through the use of special graffiti squads, if necessary.
- The use of vandal-proof material wherever possible.
- Schools, police and the community should mount education programs to discourage children from becoming graffitists or vandals.
- Attacking the tools. Governments could ask private enterprise to develop paints which are easy to remove and better solvents for other types of graffiti. (Geason and Wilson, 1990)

Vandal-proof Materials:

Ideal targets for vandals are interior surfaces in places like public toilets and subways that are open to the public but private enough for vandals to go undetected.

- Their walls can be covered with tough, glazed ceramic tiles. Special vandal-proof tiles that look attractive but will not readily mark or scratch are available.
- Plastic laminates can be used as panels to protect surfaces.
- Special non-stick, non-mark paints and coatings based on polyurethane's such as fluorocarbonates are available for both internal and external surfaces.
- Special solvents for removing graffiti in any medium from paint to lipstick, felt tip to oil, and for both easy-to-clean and untreated surfaces can be purchased.

- Ribbed metal sheet, rough-textured bricks or roughcast surfaces can be used in buildings to resist damage. These are not easy to clean, however, and may act as a challenge to vandals.

Street furniture principles are- strong construction, good surfaces, non-corrodible materials and fixings, hidden fastenings, avoidance of projecting or easily removable parts, sensible siting, and regular maintenance. It should also be easy to repair.

- Damage to some items - street signs, for example - can be prevented by placing them out of reach.
- Vandal-resistant plastics can be used for glazing in items like bus shelters, illuminated bollards and traffic lights.
- Furniture which must be accessible - rubbish bins, seats, parking meters - should be sited so it does not provide ways of climbing walls or into buildings.
- In high-vandalism areas, replace conventional litter bins with those made in vandal-resistant materials and if necessary, attach to lamp-posts with extra strong steel bands.
- Ground-level furniture - seats, bins, pedestrian guard rails etc. - should be fixed in the ground at a reasonable depth, and the pavement or road surfacing around them should be properly finished off to discourage disturbance.
- Furniture that is not fixed should be too heavy to remove easily.
- Parking meters should have flush-fitting doors that allow no gap for levering open; the doors should have hidden internal hinges and tamper-proof lock; they should be in a strong material to resist attack.

In choosing a street furniture and about their endurance against vandalism six criteria are important; appropriateness, scale, material, care, location plan and connection details. A bench that is not comfortable, an illumination element that gives no light, an information board that cannot be read are functionally inappropriate. Materials should be durable as well as psychologically effective. A concrete bench have different effect on a person than a wooden bench. A street furniture exposed to vandalism is not repaired it may encourage vandalism. Multi, purpose usage of connection details and their adjustment provide modular and moveable units and reduce the number of elements. Strong connection details are important in vandalism.

Location of the street furniture and their appropriateness with human scale are important points, too. For example, people who live in an empty space are effected from vandalism, more.

A careful examination of strategies and programs tried in a number of countries to reduce vandalism and graffiti reveals a number of general principles: these are: planning and design, management policies and practices, building standards, maintenance and repairs, materials, education programs, community responsibility.

Effects Of Vandalism On Design Process

Actions of vandalism can be seen on all street furniture. There are some important points in struggling with vandalism; street furniture should be resistant to vandalism; should be produced according to design criteria which involve functionality, harmony with the space, identity and aesthetic values. Resistance and design criteria leave the designer in duality. Vandal-proof design comprehension can be seen as a normative approach against aggressiveness. Therefore, designer, should be able to meet these two concepts at a common point, according to the unit's function, location and design. While doing this, he should be able to reflect these principles on his product and examine the design that the user would assimilate and form a contact with it and do not give any harm. Material selection, connection details, form, color and texture may help him to form this connection and relation. (Türkoğlu, 1992, p.134)

Communicational and informational absences form due to the unorganized governments, not determining the true reasons of vandalism and not taking into account that people who constitute the society do not have a homogenize structure. Therefore, fighting with vandalism never succeeds. To create places that the society owns and defenses is an important factor in this struggle. A street furniture that becomes a strange thing, that does not meet the needs of the society and that has no identity cannot be owned. So, a good maintenance a good design will help to prevent these actions against street furniture. Street furniture produced with an adequate material by a designer who evaluates the collected from relevant disciplines and who protects the aesthetic values may reduce vandalism.

3.2. General Criteria in the Design of Street Furniture

For every type of street furniture general design criteria should be determined. These criteria can be grouped in 4 main groups.

1. Functional criteria
2. Psychological criteria

3. Technological criteria

4. Economical criteria

3.2.1. Functional Criteria

Every object is the result of a definite physical requirement. In the design process of a street furniture, functional dimension is considered in two scales. The first scale is the environment, in other words the relation between the furniture and the urban space. The second scale is the relation between the object and the user; this dimension rather includes physiological criteria.

3.2.1.1. Urban Environment Criteria

A street furniture should be thought as one of the elements that form the urban environment. Quality of urban space is one of the factors that influence the social life, at that space. Life within an urban space provides the formation of collective conscious, and citizens feeling of belonging. So, street furniture contribute in the realization of social life as a part of it, and in the formation of urban culture because they are part of the physical urban space. Absence or in harmony of these elements would also make the life at that place difficult or maybe to realize some life would be impossible.

After this explanation, the diversity of urban space that would provide important clues in determining the design criteria of street furniture and the needs of users of that place should be examined. Therefore, criteria determining the quality of an urban space should be considered.

Urban space, beyond just being a three dimensional physical fact, is sum of physical, social, economic relations where many interrelations take place. In this wholeness a very dynamic process takes place that changes every moment due to time and that is rearranged. In this dynamism, events that occur at the urban space and people who take place within these events change continuously. Also a change is seen at the structures that define the physical space in time, due to the requirements.

User of an urban space varies according to age, sex, social structure, and economic structure (profession, income level). Variety of users also brings various usages at the urban space. For example, requirements and movements of a 5 year old infant, 20 years old teenager or an elderly differentiate and due to these different requirements need would be met. Accordingly, each of them will have different perception of the same street. If these samples are increased it will be seen that as users' variety increase, usage ways and requirements increase too.

During the process of determining the criteria the interaction between the users and environment should be considered. "This interaction establishes the basis both for interventions in the environment and for user evaluation of the results"

"The environment is the actual geography that users experience. It is comprised of elements-the basic, discrete parts of the environment that constitute the physical substance of community design. These elements include masses (landforms, buildings, and structures), spaces (parks and other types of open areas), and paths (linear travelways). The essential physical constructs for each of these elements-which occur in both natural and built states-are their general form and detail". (Greene, 1992, p.180)

"Users are those who experience community design, who walk through cities and towns, who visit stores, and sit in parks. Their needs- physical, psychological and sociological-include:

- the need for sensory pleasures,
- the need to feel safe and secure; to be free from fear and chaos,
- the need to have personal space and group space-for recreation, learning, socializing and participating in groups,
- the need to be able to identify objects and places-to create mental images and cognitive maps for purposes of identification and orientation,
- the need for diversity, mobility, self-development, and surprise,
- the need for belonging, pride and self-esteem,
- the need, indeed the craving, for beauty and aesthetic pleasure." (Greene, 1992, p.180)

After studying the needs of users in an urban space, environmental factors, too should be examined. "Urban design encompasses all things perceived in the community. Perception refers to many components, including people, movement and circulation, time, mood, sound, light, color, though, taste and smell. Most of these are experienced whether driving, walking or riding through a community, down a street, in a shopping area etc. To achieve a cohesive satisfying environment all of the components of perception and sensitivity to the needs and goals of the community should be considered." (Eisner&Simon, 1993, p.570)

- Well-placed patterns of vehicular traffic meet the needs of destination and through traffic. Pedestrian **movement and circulation** should be major considerations of vehicular traffic patterns, for the speed of traffic determines the level of safety for pedestrians.

- When scale and character of nearby areas, structures, streets, landscaping, and open space are respected, the integrity of the design will promote a sense of **unity**.

- A **light**, bright area or community will appear safer for pedestrians and vehicles. In some areas natural landscaped screening is required for comfort and protection from the heat of the sun.

- **Harmony and contrast** can be formed through **color**. A subtle, soothing atmosphere can be achieved or busy activity promoted with color. A times when scale and character of structures has been disregarded, harmony can be felt through color when there is no structural harmony. Contrast in color helps to break up monotony; however, random meaningless contrast has a disrupting effect on the overall design. Color preference is extremely individual; thus it represents the identity of each and every individual city, town and community.

- **Taste and smell** are closely related. Pleasant odors can be overwhelmingly masked by vehicle exhaust and industry odors, adversely affecting air quality-in some cases to such an extent one never notices the aroma of the ocean pine trees, or other pleasant natural features.

- The **textures** of the ground, structures, street furniture, landscaping, and roads, all help to break the monotony of surroundings. Nature provides a wide array of textures to choose from when selecting construction and landscape materials. (Eisner & Simon, 1993, p.570, 571)

In the design process of an urban space, the design guidelines exist from urban planning to architectural design, to landscape design, to furniture design. In other words, from a general scene to the smallest element there are some common guidelines. Even though different tools are used at each level, the goal aimed at the end is the same.

"... the guidelines be made available to design professionals and that they are clear and positive so the users will not find themselves in conflict with their public due to vague or unusual language.

1. Purpose and basis for guidelines

2. Urban design goals and objectives

3. Design components

a. Site Planning: Setbacks, orientation, open space, circulation, grading, buffers, vistas, street scene, efficiency

b. Architecture: Height, bulk and area of buildings, style, color palette, roof type, scale, wall articulation, solid and void ratios.

c. Landscape architecture: Overall concept, plant materials palette, hard-scape palette, locations, size of landscape material, minimum coverage, lighting site furniture, solar orientation, color.

d. Parking Design: Locations, circulation, access, efficiency, entry character, landscape, lighting, screening

e. Signage/Advertising: Character, location, type, materials, size, color, illumination, orientation" (Eisner & Simon, 1993, p.571)

Among the physical environment criteria, especially the location of the furniture at the urban space is important. Users behaviors within the urban environment, their requirements and demands are the determinant factors in the determination of location of a street furniture are;

- **location of the furniture** in the city (park, street, square, underground, industrial area, etc.),
- **usage frequency** according to the location,
- user characteristics (children, teen-ager, elderly, handicapped, bicycle way or vehicle way, etc.),
- dimensions of the physical space in which the furniture takes place,
- Climate and other external factors of the place (pollution, vandalism, etc.).

Usage frequency will determine the material, dimension and number of the furniture. Also the land-use type of the place will determine the properties of the object. Properties of a trash receptacles can on a very busy street and properties of a trash can in a children's playground differ. Illumination of a busy street differs from the illumination of a less frequently used street.

Number of a street furniture, effect the organization of the space with its density and rhythm. Consequently, this will affect the level of meeting people's physiological demands and also the environmental perception on people. If the number of street furniture is more in number than needed, it will bring an economic burden and also have visual problems. It can be boring rather than be attractive. If the number is less than needed, that it will be insufficient in meeting the demands.

Accessibility is the most important factor influencing the usage of the object. A street furniture should be located so that a user can be able to reach whoever he wants to, and should be perceived easily. When a person is in need of something he wants to be able to reach that in a very short time and by spending very little energy. A

pedestrian with a trash in his hands cannot walk hundreds of meters in order to find a trash can and he cannot change his way. Or a person from out of city should easily find a telephone booth. Important point there is to form a performance standard for the accessibility for each street furniture.

As mentioned before, a street furniture is part of an urban space. So, it should have integrity with the environment. This integrity can be visual and also can be the harmony with the other activities taking place at the urban environment. Visual integrity is related with the proportion between the dimensions of the street furniture and the dimensions of the urban space it takes place. To design a very large pool on a very narrow street will affect the visual harmony and will also block the flow. To hang a very large advertisement board on the wall of a two-storey building is another sample to inharmonic. To locate one or two sitting benches on a very large square will be meaningless and will be inadequate in meeting the demands. Material should also be in harmony with the environment. In providing integrity general design criteria such as color, pattern, rhythm, contrast, simplicity are valid.

3.2.1.2.   Physiological Criteria

Human body is a wholeness with definite physical qualities. Every object designed for the usage of humans should be in relation with every piece of a whole under certain situations. This relation can be distant (visual, auditory, etc.) as well as face to face physical relation. During this relation, suitability of the physical properties of the object to the physical properties of people is realized with physiological criteria.

"Physical qualities of people are motor abilities of body, qualities of sizes, perception, information processing and storage, metabolism, structural qualities of bodies, etc. Each object should comply with the needs formed by these qualities." (Asatekin, 1976, p.248)

Each object has a basic function. Every sitting element (chair, armchair, bench, etc.) has this main function: providing a place to sit. Criteria that can provide a comfortable and healthy sitting is the physiological criteria of the chair. "Sub-usage factor changes are to the situation and the place it will be used. For objects that have various types these physiological criteria also varies. As from the view point of functionality there is no difference between a chair and armchair, however, their weight differs because an armchair does not need to be moveable. It can be fixed and heavier than an armchair." (Asatekin, 1976, p.249)

Among functional criteria; the dimensions of the object should be ergonomic, should meet the criteria such as comfort, variation, durability, safety.

Comfort: When a user needs an object, he wants to be able to reach that object in a very short time and wants to realize the activities in a very healthy way. In this situation users' comfort should be considered. User's age, sex and physical ability should be evaluated from the view point of anatomy, physiology and anthropomety material and texture should not negatively affect the user's comfort. Psychological comfort should be provided as well as physical comfort. (See, Psychological Criteria)

A criteria point here is that handicapped people are thought of in the designs. Objects that were designed according to normal adults' dimensions cannot meet the demands of visually, auditorly and walking handicapped people. Characteristics of elderlies and children are also far from the "normal" people's dimensions. Besides, an adult pushing a baby carriage or a market carriage can be considered as a handicapped person, too. When these user characteristics are considered, it is necessary to be very responsive. This responsibility will provide equal usage of urban space by citizens.

Also, in order to provide easy usage, elements that are closely related with each other should be placed side by side and in harmony with each other. A illumination element should be placed together with a bench and a trash receptacles.

Variation: In an urban space depending to time and place, to users' age and sex, different usage forms will come out in the direction of same goal; (such as illumination). A street furniture meeting a demand, should have different properties according to the place they exist. Variation should be met at the same place in order to meet different user requirements. Especially, adequate variation should be provided for furniture wide spreadly used, such as benches, illumination elements, etc. Variation, in this meaning is determined according to the physiological requirements. Besides, an aesthetic variation enriches the urban space and breaks the monotony.

Safety: Some predictions should be taken in order to prevent any accident during the usage of furniture. This is especially important at the playgrounds. Playground equipment are insured for any accidents. Firstly, furniture should be ergonomic in order to provide security. Misplacing the furniture may cause accidents. Like placing a street lamp in the middle of a bicycle path or placing a trash receptacles in middle of a pedestrian path. There can be accidents caused by mis, mounting or by wrong dimensions. A tall person can hit his head to an advertisement board or tents can hang down preventing any passage. Some other accidents may be caused by mis-production. To get worn out by mis-production or not using the adequate material may cause some accidents. This more often seen in the forces, broken benches or in the

unkempt play equipment. For safe usage of the furniture, their care and cleaning should be made orderly.

3.2.1.3. Communicational Criteria

Communicational criteria, aim to transmit the object itself to the user. Data can be about usage and/or about the basic existence of the object. So, communicational criteria can be grouped as functional and conceptual. (Asatekin, 1976, p.250)

Functional communication occurs when a user understands how the object will be used by just looking at it. A designer uses people's natural inclinations, daily conditionings and semiological symbols in order to provide this. (Asatekin, 1976, p.250).

"Natural inclinations are when certain forms remind us of certain functions, in other words without any conditioning. Like circular forms remind us of circular movements, or rough surfaces remind us of touch. Certainly it is impossible to discriminate them from the reminders resulting from the conditioning." (Asatekin, 1976, p.250)

Usage of semiological symbols for the object to transmit itself is an integrity within it. This kind of communication is used more in the transmission of complicated procedures, and starting from the usage of very simple color coding (like red buttons for emergency) may go to the usage of diagrams, pictograms and phonograms at different levels

"**Conceptual Communication** is related with the form-function connection of the object to the user's conscious. Every object developed for a certain function, reaches a formal wholeness, in time. New designers produced by a designer, mostly, are variations within this wholeness... This is the conceptual form when an object is talked of. As a design criteria it is necessary that the object should transmit itself conceptually." (Asatekin, 1976, p.251)

Urban elements should also conceptually inform itself. In an urban space user is range is very wide, so it is an important point. Every citizen could be able to perceive the object whenever he wants to. Distance and the approaching angles to the object vary too, so the object should be perceived from different angles and distance. In this sense, simplicity is also an important criteria.

3.2.2. Psychological Criteria

People, continuously evaluate everything that takes place in their lives and objects that from their environment. Natural requirements born from perception process that occur before evaluation period and from the evaluation fact can be grouped under "psychological criteria".

"Physical and formal qualities of an object also influence its perception and evaluations during the process of comprehension." Besides, because of personal experiences and factors, perception changes from one person to another, in other words, it is subjective. Therefore, perceptual criteria, in other words, design of an object is important because it should be perceived as it is and during the comprehension period no psychological deviations and lack of confidence should be seen. (Asatekin, 1976, p.253).

As it was mentioned under the topic "Urban Environment Criteria", we perceive our environment and objects through our organs. Objects' qualities in visual, tactual, auditorial, odoral, and kinesthetic senses are the basic elements. Visual perception comes first. Before starting to use objects, we construct a visual tie with the objects. Furthermore, visual perception may be the only data source in recognizing the environment.

Visual persuasiveness of an object increases as its visual form fits to its self structure. Besides persuasiveness, psychological assurance is important, too. If the object's form is not persuasive, if its visual balance is wrong, and if its visual structure is in adequate, a psychological insurance and discomfort are seen in the users. (Asatekin, 1976, p.253).

In order for objects to be easily perceived and not broken from the **environment, color, form** and **simplicity** are important factors. "Form can provide an urban element to bee seen and interpreted. Integration of color, form and material should be in harmony with the function of a street furniture. Color is affective in perceiving the object's width, volume and warmth. Concepts that will be reminded symbolically with the form, influence the aesthetic approval. If the element does not resemble other objects but only reminds us of its function it is a positive situation, because this way it can address various people." (Seyrek, 1992, p.122)

Under this topic social-cultural criteria can be studied, too. "A person's feelings of psychological-social security can only be when a person believes that he is accepted by the society. And while a person chooses the objects he would use, he also evaluates whether he will be in psycho-social security. So, in the design process of an

object, its appropriateness to the society's values should be considered, too." (Asatekin, 1976, p.254).

Psychological comfort is important in the usage of street furniture. Because, they are used by people who are totally strangers, at the same time. People have inclination toward leaving a certain distance with the people they do not know. (Every person has a privacy radius determined by his personality). Therefore, totally strange three people, do not share a bench without being forced. This and similar psychological factors affect the usage of street furniture. If these kinds of social-cultural and psychological factors were not thought of during design process; products cannot be used properly, strain between people can result or people can interfere to the objects. (Seyrek, 1992, p.121)

3.2.3. Technological Criteria

In order for a designed object to be produced and used, production situations and materials used in production provided by the existing technology should be considered. These criteria about material and production systems, will be discussed under the topic "technological criteria".

3.2.3.1. Material Criteria

Material affect production process in different ways. Chosen material should both be suitable in function and in usage situation and also be appropriate with the object's form.

When it is examined in functionally, basic function of the object and the physical and chemical conditions of the environment it will be used, necessitate the material to have certain structure. Physical qualities (density, toughness, melting qualities, etc.); chemical qualities (resistance to various chemical factors, burning qualities, etc.); structural qualities, surface qualities (process qualities, natural colors and tissues, toughness, etc.). All of these or some of these are limited by usage and function conditions. (Asatekin, 1976, p.258).

If the designed object is a street furniture; it is exposed to exterior factors (weather situation; moisture, rain, wind, sun, etc.), users continuously change (in other words belong to everyone and belong to no one at the same time) and so it is exposed to every interference. Exterior physical factors are more affective in determining the life of the object.

Every material has special treatment and shaping qualities. Formal possibilities provided by the chosen material should be appropriate with the formal characteristics of the designed object. If the qualities of the material are disregarded in the determination of the form, structural problems do come out. Such as: surface or deeper cracks, breaking, point relief or come out. Besides, if more than one material is used the structural characteristics of these materials should be in harmony. (Asatekin, 1976, p.259).

When above explanations are considered, and when existing technologies are thought of the important point in choosing the material for the design of street furniture is to be durable and permanent. Materials mostly are metal, wooden, plastic, concrete and natural stones. Sometimes glass and ceramic are also used for some parts of the furniture or when prototype will be produced. In choosing the material, the location of the furniture, users' characteristics, location and usage frequency are important determinants. Materials do have above mentioned properties:

Metal and alloys: These are the mostly used materials in street furniture production. They are heavy and very dense inorganic materials. They have very flexible production methods, so various products in various fields with various methods can be produced. Variety in their alloys also provides a wide range usage. They are preferred for their durability, in urban spaces. (Fig. 3.3.)

Figure 3.3. Metal Advertisement Poster in Japan   (http://www.corbis.com)

Wood: They are organic. They are durable if they are used in right way in right places. In urban spaces mostly they are used massively and should be treated orderly. They are very light materials. Wooden materials have warm and soft identity. (Fig. 3.4.)
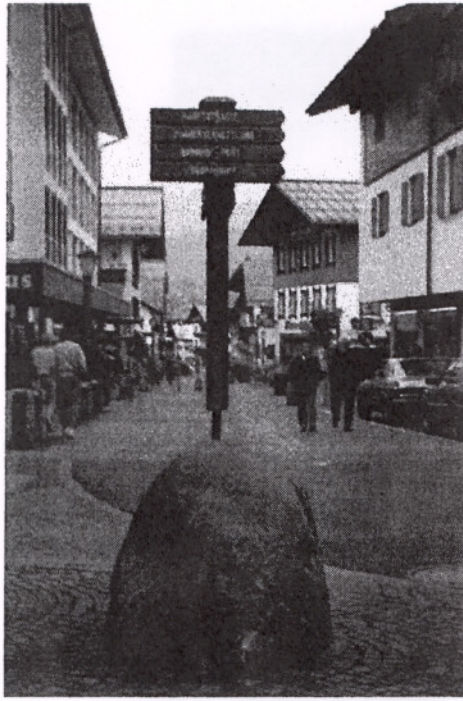
Figure 3.4. Wood Street Sign   (Sato, 1992, p. 67)

Concrete: This material can be easily produced and applied. With the changes in the proportion of the material in the mixture, the quality of the concrete changes, too. Concrete used in the production of street furniture molding system is used. Because they are easily produced their cost decrease, too. So it is widely used. (Fig. 3.5.)

Figure 3.5. Concrete Trash Receptacle   (Walker, 1992, p.404)

Plastics and Alloys: Plastic is a product from petroleum. Their hardness scale change in a wide range. So, can be used in various usage fields. Because they have electrical insulator they can be used safely in urban spaces.

Natural Stones: They are used as they are found in the nature. According to the structure of the stone they have different characteristics.

Glass: Glass can be defined as a silicate component with an a-morph structure and without permanent melting point. According to the raw materials put in and to the secondary processes applied during production glass' properties change, and way provide safe usage. Because of its transparent property they provide security. However, its durability is less toward vandalism. Especially if it has height as of a person it is frequently damaged. (Yaylalı, 1998, p.113, 114).(Fig. 3.6.)
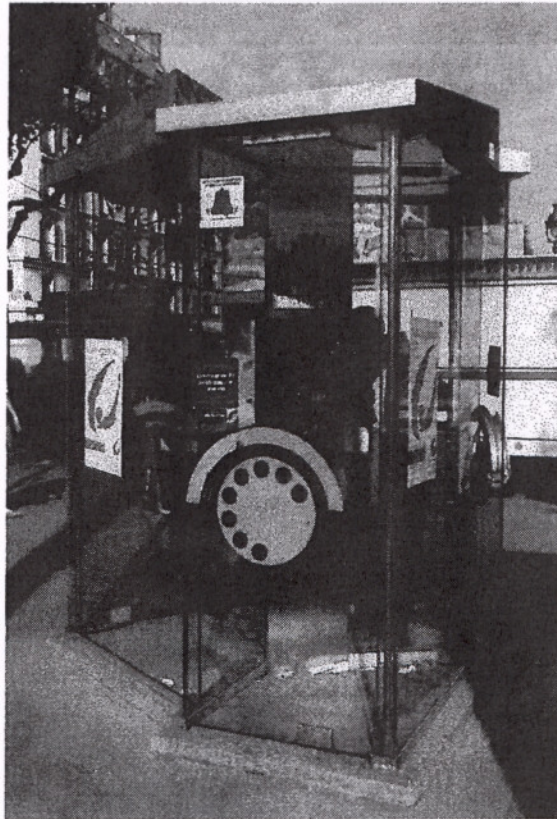
Figure 3.6. Glass Telephone Booths   (Mukoda, 1990, p.72)

Ceramic: It is made of compounds formed by inorganic materials (clay, kaolin, etc.). These compounds are shaped with different methods and later are fired till they get hardened and gained resistance. They are used for centuries. Today, they are produced with traditional methods or with high-tech methods. Ceramic form a huge class of material from the viewpoint of metallurgy and engineer sciences. It provides a

very rich form, pattern and color possibilities. However, it is not a common material for street furniture. Among all of these materials ceramic is the most argued and critical material used in the production of street furniture. Although they are very durable to exterior conditions their production price is very high. (Uludağ, 1993, p.131)

According to the studies, the most appropriate ceramic type used for street furniture is "Vitreous-Chine". It has basic properties of strong structure, very low water permeability and easy production. Its physical resistance, hardness and corrosion resistance to chemical effects and thermal shocks are very high, it is a very healthy material. So, ceramic can be chosen as the material and production methods for street furniture. Ceramic can be used in the whole of a street furniture or can be used as a complementary element in some of street furniture. (Uludağ, 1993, p.131,132). (Fig. 3.7.)
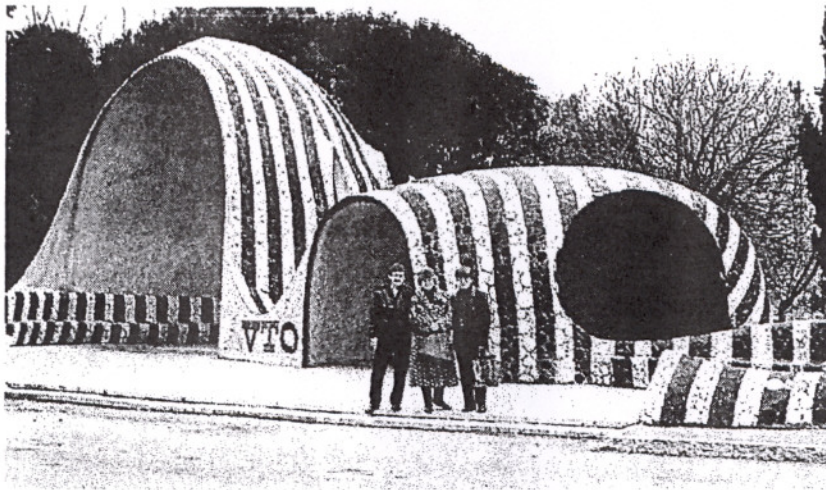
Figure 3.7. Ceramic Bus Stop in Georgia (Uludağ, 1993, p.131)

3.2.3.2. Production Method Criteria:

Harmony between the shape of the object and production method is an important criteria. Surely, there is a very close relation between the production process and the material. Type of the material, structural qualities and the final shape determine the production method. Hardness of the surface, interior stresses, molecular structure and similar factors are affected from the production methods. However, from time to time, production method can enter the design process from the beginning. So, type of the material, structural qualities expected from the material, the physical situation of the raw material and formal qualities of the object are described according to the

requirements and data of the production method that will be used. (Asatekin, 1976, p.259).

Different production methods are used in the production of street furniture. The most commonly used are casting, cold shaping and combining techniques.

Casting, is one of the most commonly used methods in street furniture. It is a method appropriate for serial production and also a very economic method. It is basically, taking the shape of a model and making multiple models by copying this model. Products can be made by this method from the materials glass, metals, plastic and ceramic. Copying models differentiate according to the material.

Cold shaping is used in giving shape to delicate pieces of metal sheet iron. By using different tools, material can take the shape of whatever wanted. Some of these methods are: shaping by bending, shaping by passing through press or shaping by using models.

Combining techniques are producing street furniture by using more than one material. Different techniques can be used for combination. Techniques such as welding, rivet, solder are **permanent combination** techniques. Screw, nut, bolt are used for **temporary combination.** It is easier to interfere to the production by this method. It makes it easier to change the worn-out pieces of the furniture and provide a flexible design. In the **moveable combinations**, even though pieces are fixed together, they can also move.

Besides production methods, another important criteria is the **production way**. Production way can be examined in two groups: serial production and prototype production.

The number of each element that takes place in the system of street furniture changes according to quality, usage type and usage frequency. Multi-production of a product necessitates **serial production**. Because of its cost, most of the street furniture were produced by this method, starting from industrial revolution. Another advantage is a furniture can be modular by this system. They combine in different forms, providing variety. Besides, the broken or damaged pieces can be changed easily. This provides easy maintaining and repair. Its being modular, makes the furniture to be in harmony with the urban spaces that have different location and dimension. (Yaylalı, 1998, p.115-117).

Prototype production is used only when the furniture will be produced for once and for certain places and if it has an artistic value. In this method the furniture can be produced in another place and later put at its real location or can be produced where it will take place. Even though it may cost high, the meaning it will add to the place is important. Prototype production is mostly seen for sculptures, ceramic panels.

However, some functional street furniture can be prototype, too. They have a monumental value, also.

3.2.4. Economic Criteria

Production process and the usage process are realized in a certain economic atmosphere. It is possible to gather every economic fact formed during production and usage period under the technological criteria. In order to be able to analyze these criteria, they should be evaluated according to factors that take place in different situations around the furniture.

One of the most important factors is users. Because production rationality of the product is to meet certain requirements of the users. User accepts that by buying the object he would meet his needs. This change of value should be optimal for the consumer. The financial equivalent of an object is a very complex fact. The job of a designer, in this respect is to transfer the object, to the consumer in a very cheap price. The formal qualities of the designed object, number of pieces, materials and production methods, etc. affect the cost of the product. These decisions are under the responsibility of the designer.

Users of street furniture (citizens) are not the customer of them. Usually, municipalities are the buyers of street furniture in the name of citizens. However, financial source is still citizens. Therefore, indirectly, street furniture's users (consumers) are also the buyers.

From the viewpoint of producers, the aim of the producers is people and associations who have economic expectations in the direction of their economic possibilities. During design process producers' production possibilities (production methods, marketing, labor force and time) should be considered.

Product brings certain load to the producer and user and it also has effect at macro level. Especially, from the product that was designed for serial production, maybe thousands will be produced, when necessary. It means consuming raw material, labor force, energy and natural resources in large amounts. A mistake in design decision would cause waste of these resources. Therefore, designer should design "proper" objects in order to use the resources of all humans correctly. Designer's design with this conscious he can then use these resources more efficiently and positively. (Asatekin, 1976, p.260).

3.3. Design Criteria of Certain Street Furniture

According to the general design criteria mentioned above, design criteria about each street furniture will be examined. In this section, especially elements that are related to bus stop are examined. They are; seating, lighting, sign and symbols, trash receptacles, phone and booths.

3.3.1. Seating

Sitting is one of the basic movements of human body, like walking and sleeping. Sitting is not only related with relaxing but also a psychological and social-cultural activity. A person sits down when he gets tired, it is meeting the need of getting rid of tiredness. A person when he gets tired, chooses and uses the best element among many in order to renew his energy. (Seyrek,1992, p.120)

"In order for sitting to be done in healthiest way, in the design of the furniture, users' comfort, in other words, comfort of skeleton, muscles and blood circulation should be provided." (Seyrek,1992, p.120)

In order to provide harmony between the dimension of the seating element and the user, designs according to human anatomy should be made, by which physiological anatomic and antropometric sizes are recognized. (Zülfikar, 1998, p.50) (Fig. 3.8.)
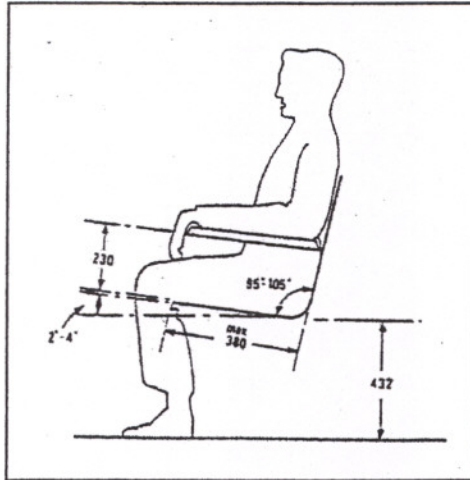

Figure 3.8. Dimensional Properties of a Sitting Elements   (Purdy, 1990)

Sitting elements should be located together with other activities. For example: at the pedestrian ways at the shopping centers, sitting furniture should be placed so that

they should not block the way. In recreational areas it should be located to show direction and so that it should not block pedestrians. (Hacıhasanoğlu, 1991)

Benches are street furniture, designed for sitting action but also used for chatting, waiting or just for killing time. A sitting element usually consists of surfaces that we sit on and lean our backs and of legs. There are two basic types of benches; with back and backless. (Manchanda, 1998, p.4)

Design of Sitting Elements:

Natural effects such as wind, rain, noise should be considered when they are installed. For example, benches should be located so that they should be protected from mud and water. Besides benches should be oriented so that people can benefit from winter sun and protect from summer sun.

Psychological comfort should be provided, as well as physical comfort. Distance between strangers is reflected on the sitting position and consequently on the sitting element. This condition affect relation between people. So, in recreational areas such as parks and gardens, designs should be made so that benches were blocked with natural elements leaving people alone. On the contrary in cultural and social activity areas designs should be made so that it should provide relation among people. (Seyrek, 1992, p.121)

Sitting elements that are used for shorter time should be close together while the elements at the places where people prefer to be lonely and used for longer time should not be very close. Sitting elements should be located so that they would help people to develop their social relations. For example, more than three people may not wish to share a linear sitting element but sitting elements located circularly, in order to provide social. (Zülfikar, 1998, p.52) (Fig. 3.9.)

Figure 3.9. Providing Social Relations with the Location of Sitting Elements (Sato, 1992, p.129)

Sitting elements should be located on a ground without having any drainage problem, dry, secure land, in a way to provide safety and together with lighting elements.

Material and Production Techniques:

Materials of benches can be concrete, steel, wood, fiber, etc. All of these materials should be resistant to exterior conditions.

During the usage of these elements, most of human body is in contact with the sitting and leaning part of the element. From the viewpoint of cleanliness, form and surface of the element should be so that it can be cleaned with rain and wind. "Another subject about the material and surface patterns is that the sitting part should not be very hot or cold or damp. Climatic factors of the environment play role on this subject, too." (Seyrek,1992, p.120)

"For this reason, wooden and hard plastic materials should be chosen because they reduce the cold. However, wooden material should be protected from decaying and its material and work should be qualified." (Zülfikar,1998, p.54) (Fig. 3.10.)

Figure 3.10. Timber Sitting Elements

Today, plastic and metal material covered with pvc materials are getting prevalent. Sitting elements produced by these materials should be durable. Metal materials used in benches should be resistant to rust. Metal material, cast iron, especially classical cast iron and aluminum are used in benches very much.

(Fig.3.11.)Ceramic objects can be used in benches too as an auxiliary element. (Fig.3.12.)

Figure 3.11. Concrete, Metal, Stone and Cast Iron Sitting Elements
(http://members.mindinfo.com/maxsport/Santa_Rosa_Concrete_Bench-s.jpg,
Sato, 1992, p.128, Sato, 1992, p.28)
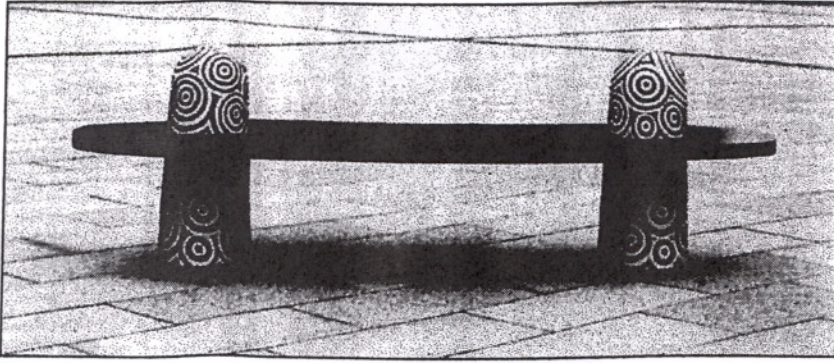
Figure 3.12. Ceramic Sitting Elements   (Uludağ, 1993, p.132)

Fixing elements used in benches (screw, button, etc.) should be rustproof, should not be dismantled easily, should not be uncomfortable and should be protected from vandalistic activities. (Türkoğlu,1990)

3.3.2. Lighting Elements

The lighting of streets has attained marked progress during the last several years. The development of lighting fixtures and study on lighting which goes with the scenery is illuminated for the producing of stage effects. Lighting in cities helps prolong night time activities, and is also essential for the prevention of crimes and protection of public security lighting gives a symbolic significance to open space also highlights are the characteristics of cities. (Sato, 1992, p. 116)

Lighting elements are the most evident members in an urban space that affect the characteristic of that space. In cities, different urban spaces have different lighting ways and lighting elements. They are:

Lighting of highways:

For a safe drive at traffic roads, the lighting should be made so that the driver could see the surrounding objects from a safe distance and stop in time. There are some point that should be considered in the lighting of a road: plan of the road, cross section, boundaries, geometric shape, close environment and their relation, traffic conditions today and in the future, quantity of light and distribution.

For the lighting of a road armatures on concrete or metal poles are used. These elements' structure, shape, sections, dimensions, lighting levels differ according to the form of the road, traffic density and crossing points. (Fig. 3.13.)
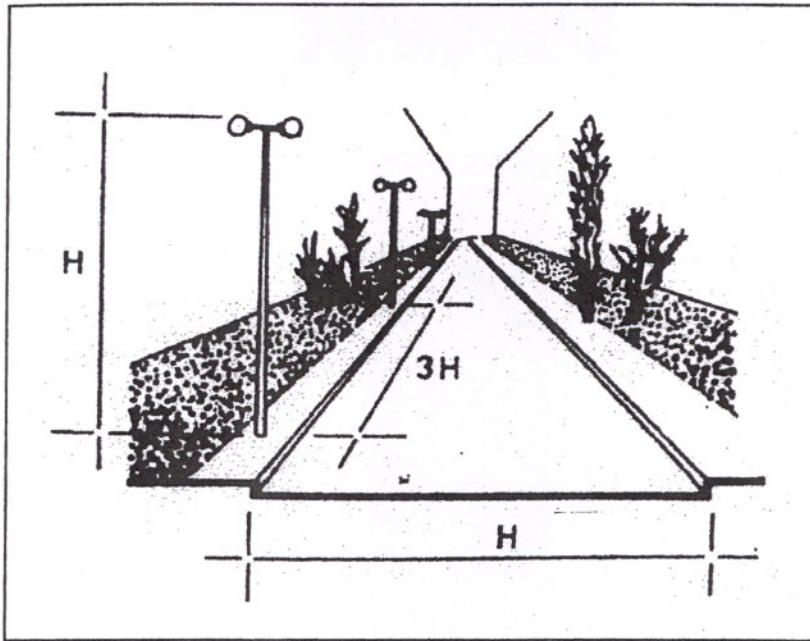
Figure 3.13. Height of Lighting Elements Differ According to the Form of the Road.Elements   (Doğan, et al, 1980, p.1)

Choice of the light source and problem of glare are directly related to the mounting height and spacing. Therefore as below points are taken into consideration while lighting elements are designed

- Lighting system must provide between 0.6 to 0.8 maintained foot candles, which suggests that higher lumen output fixture might conceivably go to higher mounting heights and wider spacing, resulting in fewer poles and lesser overall cost.
- Uniformity of lighting on road ways is directly proportional to mounting height of the luminaries.
- The minimum limit of the mounting height depends upon the type of vehicle the road has to take. (Manchanda, 1998, p.31)

Lighting of pedestrian ways:

The main purpose of such lighting is to provide enough visual information for pedestrians to use the city at night with safety. In the neighborhood the pedestrian requires light to illuminate his path and high-light obstacles, but his needs are primarily psychological. A sense of security is all important. In general pedestrian spaces should give an impression of warmth, variety and brightness.

Pedestrian lighting can be further categorized into the kind of light a certain fixture emits:

- Downward concentrating: Here the fixture directs the light onto the ground surface, and there is no horizontal or upward component of light. It gives a general impression of comparatively low brightness with points of high intensity. These are usually low level lights.
- Downward distributing: These fixtures spread or diffuse the light with the help of various reflectors of translucent surfaces. It helps reduce concentration of bright spots and thus achieve a more uniform lighting. These are most efficiently used on pedestrian paths along vehicular roads.
- Multidirectional distributing: There are light fixtures which do not use any reflectors but let light travel in all directions. They have the light source (bulb) exposed or covered with transparent/translucent plastic or glass. These fixtures have a relatively efficient utilization of light and are most commonly used in pedestrian areas. (Manchanda, 1998, p.31)

In the lighting of pedestrian ways and squares there are some standards: the height of illuminators can be less in height at about eye level of human (about 0.7 meter), or can be higher than eye level (about 3-4 meter). They should be resistant to environmental factors. Also, should be resistant to blows, hitting and stealing. Their shape, location and details should be in harmony with their environment.

Lighting of parks, gardens and green areas: With a proper lighting these areas may look safer and things that do not drive attention during daylight may seem very attractive.

In these areas; lighting elements that are close to ground level, or on the wall or at the sides of walls should be used at ramps, stairs and walking ways. (Hacıhasanoğlu, 1991)

Briefly, in the selection of lighting elements the ones that are appropriate to the place and purpose should be chosen. Besides, the distance between the illuminators and lighting types should be considered.

Design of Lighting Elements:
- Lighting elements, because they are lighted and therefore are perceived very easily, are very attractive and important elements. Therefore, should be designed according to the architectural, artistic and aesthetic properties of the roads, squares, green areas, building areas they are placed and according to the properties such as shape, detail, material, etc. For example, an lighting element with contemporary style should not be used at a historical building.

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- Lamps should be in harmony with the poles they are mounted on. (Fig. 3.14.)
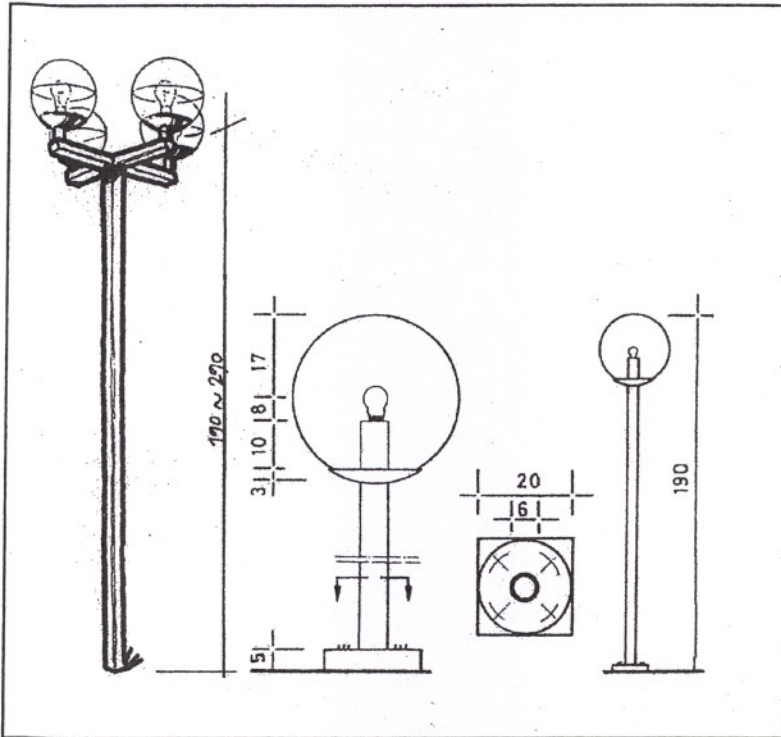
Figure 3. 14. Dimensions of Lighting Elements   (Doğan, et al, 1980, p.3)

- Briefly, lighting elements should be designed and located, as a part of an urban space, according to their function and in harmony with the existing environmental atmosphere.
- Lighting elements are one of the street furniture that are destroyed and face vandalism. Mostly, breaking, giving damages and problems at electrical connections are seen. So, materials should be endurable and their maintenance should be made orderly. (Zülfikar,1998, p.23)

Material and Production Techniques

Lighting elements protect the lamps from the external factors by providing electrical connection of the lamps. So, they should be made of materials that are resistant to exterior environmental conditions, and that are rustproof. In the production of them, iron, cast iron, metals, concrete, wood and plastics can be used, and various designs can be made. (Fig. 3.15.)
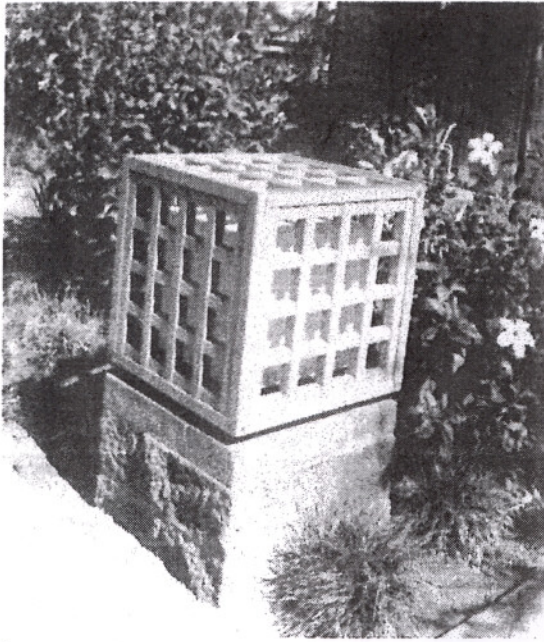
Figure 3.15. Examples of Lighting Elements   [Walker,1992,p.494(1),
http://www.orbis.com(2, 3), Sato, 1992, p.117(4)]

In the selection of the most appropriate and economic lamps, there are some
important points that should be considered:

- For economic usage of electricity lamps with high efficiency should be used.
- Some lamps, because of their technical properties can only give light at
  certain positions (for example only at horizontal position). So, selected
  lamps should be positioned according to their properties.

- For easy maintenance lamps with long durability and without need of many supplementary pieces should be selected.

- At places with vibration, lamps that fit to these vibrations should be used (Zülfikar, 1998, p.23).

3.3.3. Sign And Symbols

A person, perceives environmental stimulation with his sense organs within certain limits, and reflects his ideas and behaviors to his life style and to physical and social environment. (Özaydın, 1991, p.64) So, in urban spaces, the elements that help us to understand our environment to use objects in the direction of our wishes, and to organize our social relations, are information and utility sign. They are used for communicational, transportational, technological, productional, consuming and educational purposes.

Today, increase in the social and inter-social relations, the data transferring, population increases, rapid transportation caused communication to reach to its highest point. (Fig. 3.16.) Billboards and posters can be given as an example to this fact. (Zülfikar, 1998, p.25)

Figure 3.16. Billboards Increase Social Relations
(http://www.adshel.com/solutions/furniture-design/products/index.asp)

Any letter, pictorial presentation, symbol, emblem, lighting or animated device displayed in any manner whatsoever, which directs the attention of a person can be termed as a sign. Signs not only convey information and provide vitality to the urban environment but if well designed also improve the character and flavor of the area. However they can often be confusing or fail to deliver their messages. In the clutter of our cities the informational messages are unnecessarily long which can be more simply and graphically presented. The opposite of this is the over polite uniformity of signs where every thing is controlled, in good taste and completely uninteresting. There is a point where good taste can become extremely dull.

In the location of billboards maximum visually and openness are the most important points. In each country, local governments put laws and regulations about the location of these billboards on pedestrian and traffic ways. In these regulations principles about the most appropriate locations, and the dimensions of bill boards are given.

With the developing technology, advertisements, cultural, social and political activities can be announced at the urban spaces where people gather. These kinds screens should be located at the squares where they can be easily watched and at squares with appropriate and adequate sizes. (Özaydın, 1991, p.65)

Outdoor information can be grouped into four categories:

1. Directional
2. Location
3. Identification
4. Display

The information should be formatted and placed within easy view of either the pedestrian or motorist. The primary mode of transportation, whether pedestrian or vehicular, will determine the optimum location and size of signs. (Harris and Dines, 1988, p. 5.10-16)

Signs and symbols are categorized as below;

Mandatory/Regulatory Signs

These inform the road users of laws and regulations, they have to abide by. Violation of these signs is a legal offence. They are generally circular in shape with few exceptions; speed signs, breaking signs, stop, no entry, give way, turning signs, lane usage control, curb usage control. (Manchanda, 1998, p.23) (Fig. 3.17.)

Figure 3.17. Regulatory Signs   (Sato, 1992, p. 67)

Cautionary/Warning Signs

These signs warn road users of the existence of certain hazardous conditions, activities, movement and are essentially meant to help in averting occurrence of an accident. They are triangular in shape to attract immediate attention. Since they are anticipatory in nature, they consist of prominent red color border with specific message inside.

Traffic Signals

They provide organization of pedestrian and vehicle traffic, help the pedestrians and drivers to be directed and to get information. Pictograms and phonograms are used for this purpose. Diagrams and pictograms are mostly used because their language is universal. Information units directors and maps give information about parking areas, underground passages and bus stops. (Rubenstein, 1987, p.67) (Fig. 3.18.)

Such signs are the most effective traffic control devises, which are usually well understood and generally obeyed.
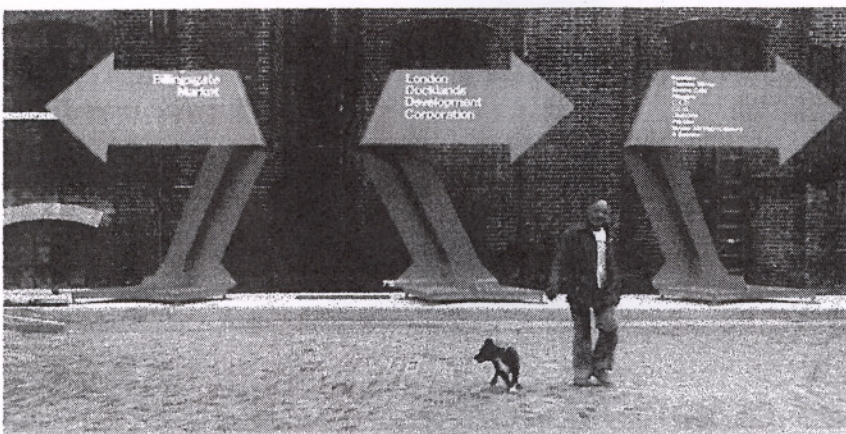
Figure 3.18. Diagrams And Pictograms Are Mostly Used in Signs
(Sims, 1991, p.162; http://paoprj.lucksnet.or.jp/earth-c/24exp/indexexp.html;
Sato, 1992, p.68; Sims, 1991, p.140)

<u>Informatory Signs</u>

These signs provide information and guidance to the road users. They are sometimes in "worded messages" which are not immediately comprehended by many people. Therefore, today's trends is to denote them by symbols as far as possible. Such signs are classified as:

- City / Area Maps: These signs fall in pedestrian information system. They are located at road intersection or T- junctions from where the traffic begins to distribute in the area for which it is meant. The mounting height should be at eye level for easy readability, and the map highlighted with colors to help in quick identification or various areas.(Fig. 3.19.)

Figure 3.19. City Map in Tokyo   (Sato, 1992, p.79)

- Street / Place Names: These are provided at entry points of roads for their easy identification and usually consist of concrete slabs fixed vertically with single or double directional profile as per requirements. Sometimes metal name plates are fixed to light poles or even independent pipe frames with metal plate boards are provided. The size, height, type of letters and proper lighting at night are important considerations for these elements. (Fig. 3.20.)
- Public Information/Utility signs: These are most important and useful signs which act as actual guides to the public, both pedestrian and vehicular, in reaching certain activity areas. They carry information .pa relating to numerous activities and can be sub-divided as health signs, Public

utility/facility signs, recreational/Sports activity signs, place signs etc. etc.
(Manchanda, 1998, p.24)(Fig. 3.21.)

Figure 3.20. Place Names Sign   (Sims, 1991, p.48)
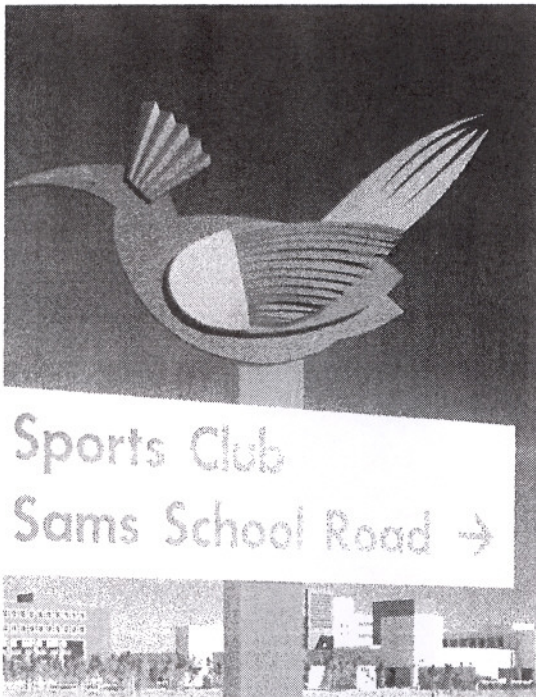

Figure 3.21. Public Information Sign   (Sims, 1991, p. 95)

Unlike other signs/symbols, these signs and sometimes provided by various developers or institutions to local authorities and traffic police etc. These signs help in bringing about clarity, both for pedestrian and vehicular movement, and thus reduce chaos on the city streets.

Advertising

"Advertising is part of everyday living and in cities may take the forms of posters, neon lights, shop window stickers or printed paper bag and carriers." (Mukoda, 1990, p.258) Advertisement not only serve as massage conveyors but also provide a useful means of screening unsightly areas and unoccupied sites from view. 'bulletin boards are ideal for this purpose. The advertisement is painted directly onto the panels in the display artists studio and, after assembly and erection on site, the entire board is given a finishing treatment. Usually, advertisement boards of this nature are illuminated. A summary of posters and bulletin board sizes and their uses is given in Figure 3.22

General Principles And Design Considerations of Signs

In order to perform its function, a sign must be capable of transmitting its message clearly and at the right time to people travelling at normal speed. To achieve this a sign must meet the following requirements:

- Environmental conditions: The sign must be designed for foreseeable traffic conditions and speed on the roads on which they are to be used.
- Appropriate target value: They should be conspicuous so that they will attract the attention of people at a sufficient distance and should be easily recognizable from there.
- Simplicity of content and layout: They should contain only essential information and their significance should be clear at a glance so that the drivers attention is not diverted from the task of driving.
- Correct visibility distance: They should be visible from sufficiently far away to be read without diverting his attention.
- Their perception is related with the factors like the color, spelling character, dimension, etc., that are used. If the color of the background is dark and writing is light then the information can be easily perceived.
- Location: They should be placed so that they are obscured as little as possible by vehicles and other objects.

- Placement: They should be designed and sited so that after reading the signs, the driver is left with sufficient time to take necessary action with safety.
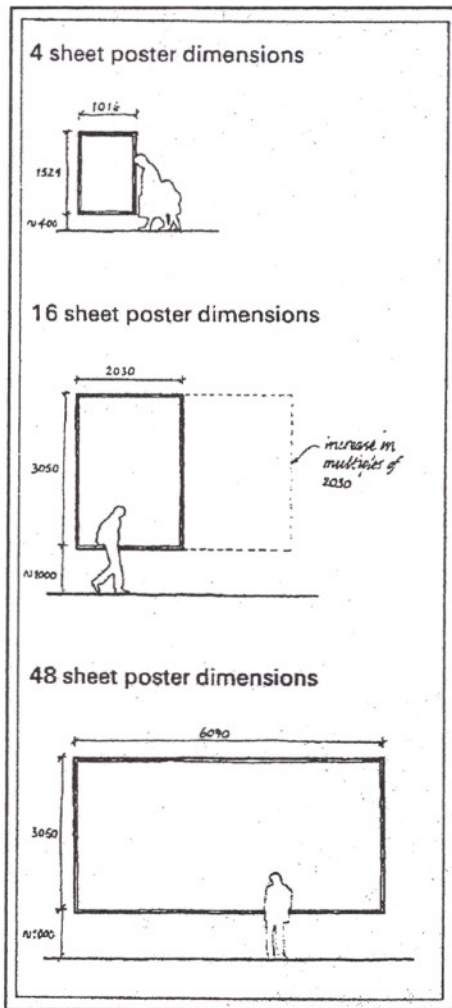
Figure 3.22. Bulletin Board and Posters Sizes   (Cartwright, 1980, p.104)

- Night effectiveness: They should be effective both by night and day (Effective lighting or reflectarization).
- Economics: Signs must be adequate in design and construction without being extravagantly expensive.
- The relative brightness and contrast of sign-to- background and legend-to-sign are of primary importance for easy visibility, identification and attention value.
- Information regarding requirements of different type of actions should be conveyed differently

- The system should prepare the driver in advance for indicated conditions, decisions or other eventualities.
- Cooler, shape, message from, and location should be consistent for sign, signal and marking conveying similar type of information.
- Human factors effect the physical characteristics of sign installations. This is even more critical since the eye level of man changes with each activity.
- A normal sitting person has an eye level of 1250 mm to 1300 mm.
- An average standing person's eye level is 1600 mm.
- A driver in a car or scooter has an eye level of 1450 mm. (Manchanda, 1998, p. 25)
- These elements that are used in urban space, should be in harmony with the other elements with their materials, design and maintenance. If this kind of harmony cannot be maintained, then they may cause a visual chaos and the message they give may lessen. (Zülfikar, 1998, p. 27)
- Billboards should also be perceived by visually handicapped people. For this purpose relief calligraphy should be used.
- The height of billboards should be appropriate with each other. For pedestrians their height should be at the eye level of a standing person. (Zülfikar, 1998, p.26).

Material And Production Techniques for Sign Elements

These street furniture can be produced with wood, metal, fiberglass and natural rocks. They can be lighted or not. The bill boards are widespread and for the perception of the lighted ones there is an extra cost and it should be compared with the income they bring. For example, in last years, in Japan, sun-energy began to be used in lighted bill-boards instead of electric energy.

- Traffic lights should be perceived openly. So, simple graphics should be preferred.
- Information units should have the effect, color and size to be noticed from a distance.
- Also they should be in harmony with the urban space they take place, from the viewpoint of style, form and shape. (Yaylalı, 1998, p.87) (Fig. 3.23.)
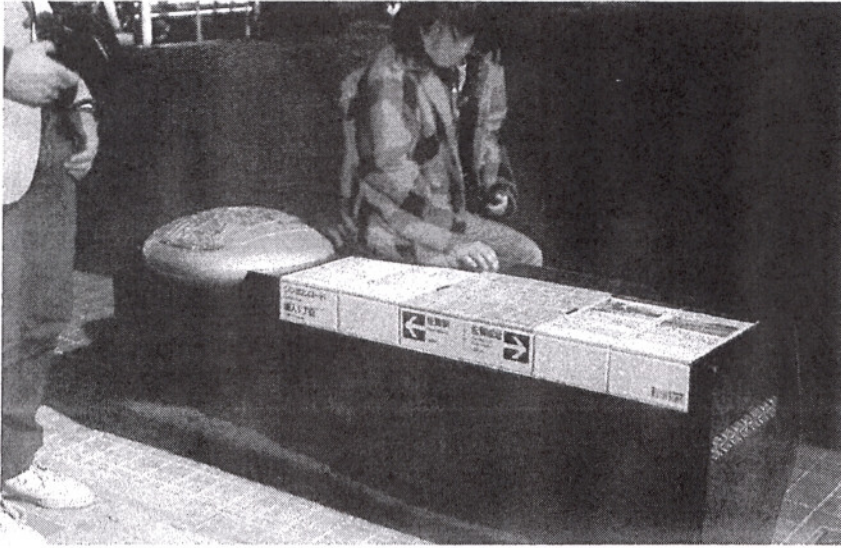
Figure 3.23. Different Type of Informatory Sign   (Sato, 1992, p. 107)

Below materials used for designing signs. The following are typical materials:

- **Stone** has been used since old times as a material for buildings and sculptures. The processing of massive and heavy stone has seen great progress due to the development of processing machines and techniques. Stone was mostly used in the past by using simple techniques, engraving letters on its surface, etc. (Fig. 3.24.)

Figure 3.24. Stone Informatory Sign   (Sato, 1992, p.15)

- **Wood;** The natural touch of wood is appealing. It is now noted as an attractive material which goes with natural scenery, especially when it has become weathered.

- **Cast Metals;** Iron and aluminum are cast metals which can be comparatively freely modeled. The production of a limited number of works is possible. Although their structural strength and precision degree leave something to be desired, they do not undergo changes for many years. They have a quiet atmosphere and viewers will feel closeness toward these materials. Considerably many colors can be used for them, but colors should be used within the limit of not spoiling their quality as cast metals.

- **Aluminum Press Type;** Aluminum can be pressed freely and varieties of section forms are obtained. It is possible to stress originality in designs. Costs can be reduced by mass production When a small amount is produced, costs will become higher.

- **Steel Tube;** Several kinds of steel tube are available. Including stainless steel and general steel tube. This comparatively light-weight and handy-to-use material has been widely used for signs. It is generally used for ball-type signs. Stainless steel as a material is somewhat monotonous, and therefore, ingenuity should be displayed in designs. When iron is used, which easily gets rusty, its structure should be designed, while taking into account how to carry out a check.

- **Steel Materials;** Stainless steel and aluminum are often used when signs are placed in a place where they are exposed to rain and wind for a long period of time. Anti-corrosive treatment is necessary for ordinary steel materials. A new light-weight steel material which is sandwiched in between resin coating is also available. Steel materials generally give an artificial and cool impression, but on the other hand, there is an urban and refined atmosphere about them.
(Fig. 3.25.)

- **Glass-Tempered Cement;** This is a material which is something like being in between concrete and resin, and is often used for small-size signs put up on the street. When this material is used, it is possible to make more minute designs than when concrete is used. This material is also strong. It seems, however, that with the pass of time its surface becomes easily breakable.

- **Concrete;** The supply of concrete is stable and it can be obtained comparably at low prices. This is why it has so far been used very extensively. It can be freely molded into any forms. Artistic molds have also been developed.

However, it is default to prevent it from becoming stained and its colors becoming faded. As a task for the future, it is necessary to study what designs are suitable for this material.
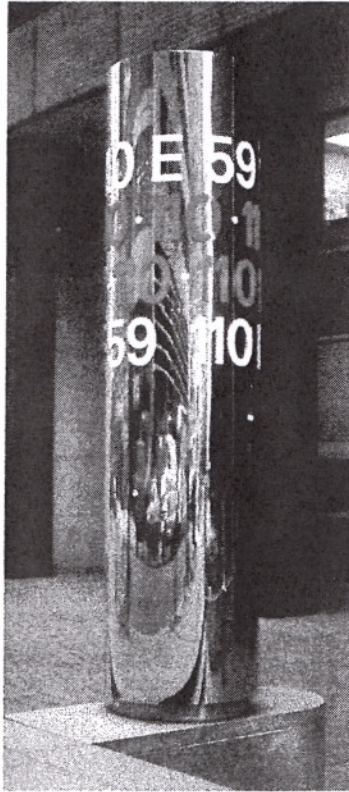
Figure 3.25. Stainless Steel Identificational Pillar in Manhattan   (Sims,   1991, p.143)

- **Glass** gives the impression that it easily gets cracked. However, if its edge is processed properly, its intensity will increase. At some bus stops in Paris, glass panels are set up facing sidewalks. This gives a sense of openness. Glass is used to protect symbols on signs. It is scarcely used by itself. When sandblast or etching is used for designing glass, that will create an artistic feeling special to glass. Stained glass will probably by used more frequently than before. It is expected that it will become an attractive material from now on.
- **Resin** is widely used because its prices are low and it can be processed easily. However, its surface is not so strong and with the progress of time, it cracks easily. If designs are made utilizing this material's unique feeling which is quite different from glass, resin can be used in many ways recently polycarbonate with strong intensity has been developed. Resin is being used on increasingly many occasions.

- **Ceramic Tiles;** They are now widely used as a building exterior material. They seldom sustain changes, even used for many years, and have a feeling which is special only to a natural materials. Ceramic tiles are good, in that accurate designing becomes possible when they are used and that any colors can be freely used, in case these tiles are used for outdoor flooring, it is necessary to use contrivances for the prevention of slip.

- **Sheet Materials;** The highly shinning reflection sheet is used as signs to help automobile drivers. It reflects at automobile headlights, and helps drivers read clearly what is written. Generally, the sheet is pressed with heat on aluminum plates. General sheet materials, such as cutting sheet, are mostly used for store signboards, and interior displays. They are now increasingly used in place of colorful painting because a large number of colors can be used for sheet materials, and also they can be processed easily. (Sato, 1992, p.99)

Signs are a symbol which transmits various kinds of information signs are not merely things which are put up public attracting the public attention, such as signboards, but they are also symbols shown in a variety of forms, like gestures and signals which transmit intentions and meanings.

Public signs put up by local authorities and they show the locations of public facility, space areas and buildings. One function of signs is to transmit unmistakable information, by standardizing the contents of information and by giving it authenticity and trustworthiness.

3.3.4. Trash Receptacles

The Trash receptacles as a street furniture are used: to collect the garbages in the urban spaces and protect them till they are collected by large vehicles.

Production of trash receptacles can be in two ways: First one is the ones that were produced by people who do activities like shopping, recreation, sport at urban spaces like streets and parks. They are collected in different types of cars placed at shopping centers, parks, streets. Secondly, garbage is collected in houses, offices, factories, hotels, etc. They should be placed at locations where they can be easily noticed and reached, because of their functions. (Bus stops, buffets, etc.) In order not to attract attention, they should be grouped with lamps or benches or mounted to the walls, poles or railings. (Zülfikar, 1998, p.57)

They can be classified in three groups for their usage properties:

1. Uncovered,
2. Semi covered,
3. Cover with hinge.

Types of trash receptacles are as below:

1. Fixed basket type: These consist of an outer shell or basket of metal frame with wooden battens or weldmesh infill and an inner container of fiberglass/sheet metal which can be taken out for periodic cleaning. The basket is either fixed to the ground or hung to a vertical support. Such an arrangement is quite satisfactory except that the container is liable to be damaged/misplaced or even stolen specially from areas which are not well guarded. (Fig. 3.26.)

2. Hinged basket type: In this type the metal container is a part of the outer shell and is hinged to a vertical support at a convenient height. The arrangement help to clean the bin by moving it upside down, as well as provides safety from vandalism.

3. Fixed pill box type: These are generally larger bins, drum shaped, and of concrete construction fixed to the ground. They are mostly provided in shopping centers requiring larger volume for waste collection.

4. Movable basket type: Generally consist of fiberglass basket of large size and provided with disposable bags. Such types are mostly provided by commercial enterprises. (Manchanda, 1998, p.10)
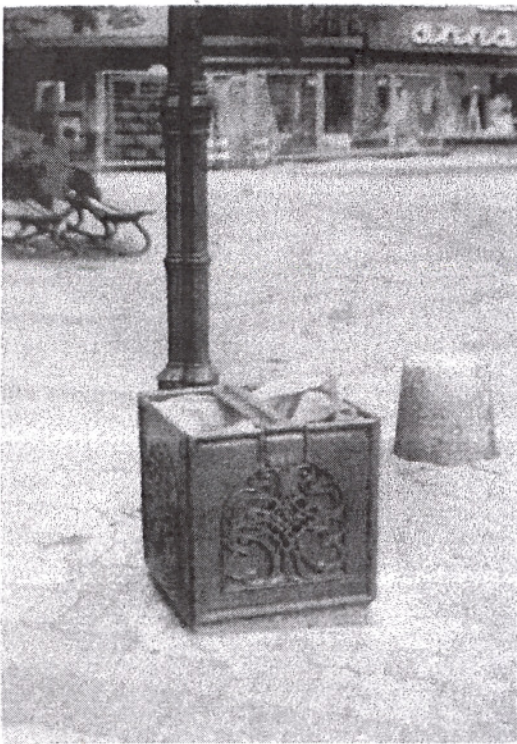
Figure 3.26. Fixed Basket Type of Trash Receptacles   (Sato, 1992, p.129,130)

General Principles And Design Considerations

In the design of trash receptacles, it is important to known at what frequency they will be emptied. Because, dimensions of them is related with this frequency. Besides, this is important in determining the type of the trash receptacles. (Fig. 3.27.) For example, if they will be emptied daily, they can be without a cover. If they will be emptied seldom, the ones with a cover resistible to exterior factors and with hinges should be selected.

They should also fit to the environment dimensionally as well as shape and material. Because if the garbage can is larger than it should be, it seeing will be very bothering. However, if garbage density is very high on a place, and if their number cannot be increased and if a large container will be very inharmonious with the environment, then a secret garbage container method can be used. (Zülfikar, 1998, p.60)
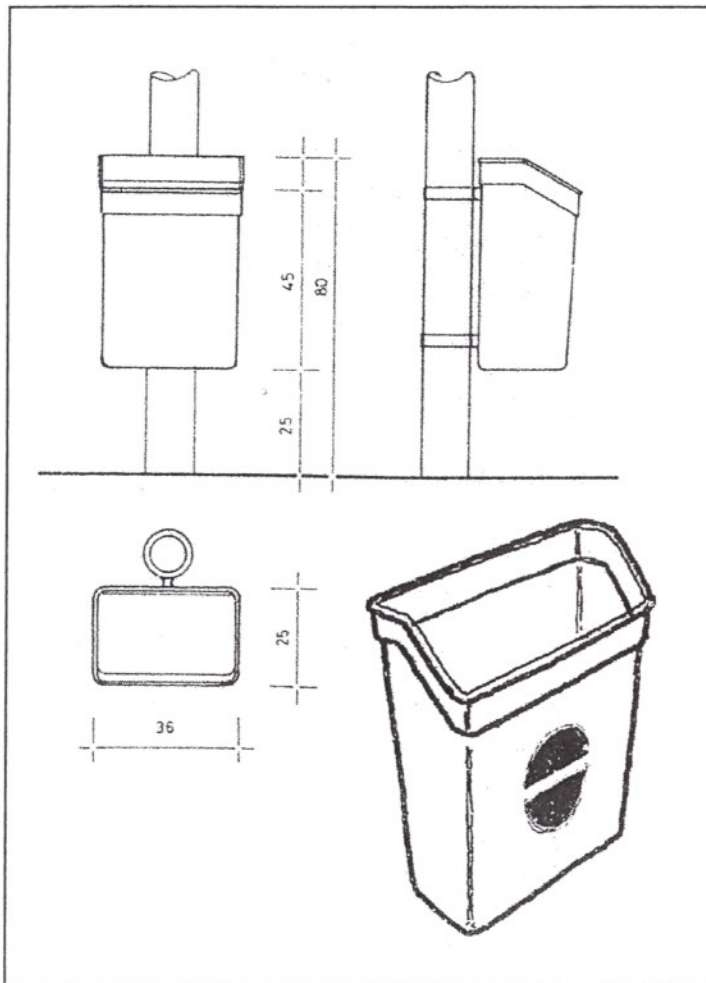
Figure 3.27. Dimensions of Movable Basket Type of Trash Receptacles (Doğan, et al, 1980, p.117)

Trash receptacles should be appropriate with the human ergonomy, too. For example, it should be have proper height both for adults and children, and should be easily emptied. Their mouth should not be very larger than necessary. Otherwise, they cannot do their function, because other garbage from houses and offices will be emptied. (Zülfikar, 1998, p.61)

Today, most of trash receptacles consist of two main parts: An outer section and an inner, moveable, rust proof part with precautions for stealing. (Fig. 3.28)
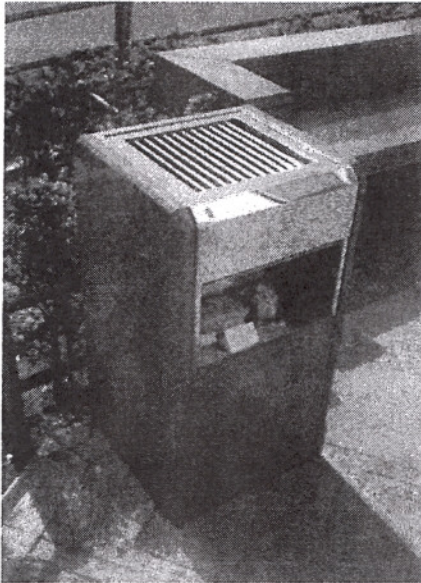

Figure 3.28. Two Parts of Trash Receptacles   (Sato, 1992, p.129)

Ash trays should be set up in waiting rooms and others places where many people gather. Some ash trays are combined with trash receptacle and the two functions are not clearly separated. This type is not recommended. (Sato ,1992, p.127)

Their color should be visually noticed. So, bright colors can be noticed easily, but are not rustproof and as durable as dark and natural color. (Zülfikar, 1998, p.62)

Trash receptacles should be designed, while taking into account what types of cans will be suitable for areas where they will be placed. When durable materials are used for trash receptacle, and when they have small openings (about 15 cm) and round shoulders, it will be easy to collect trash inside cans. Also, there should be some space between the bottom of cans and the ground.

Material And Production Techniques

They should be very well-built in order to resist damages and vandalism. Therefore, material selection is important both for production period and for the later

maintenance and repair period. Metal, wood, fiberglass and concrete are the mostly used materials. (Çokar, 1994) (Fig. 3.29.)
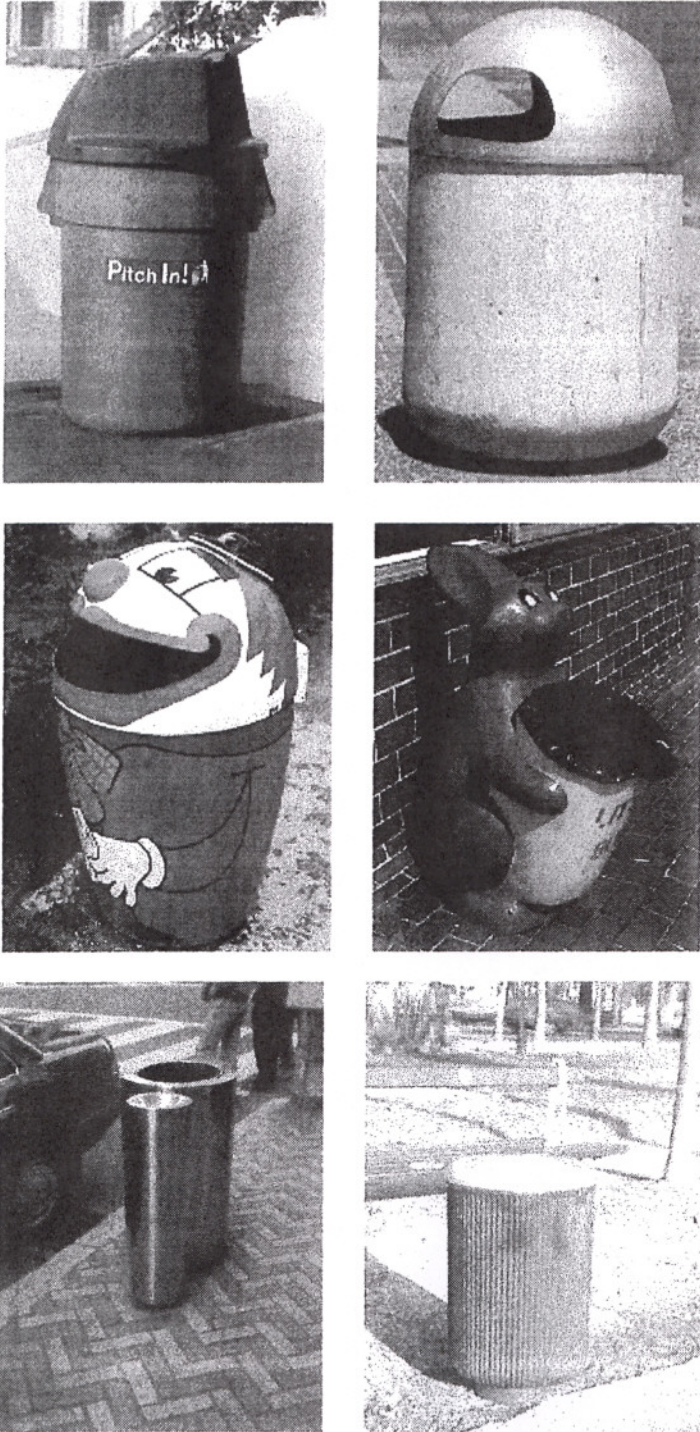
Figure 3.29. Fiberglass, Concrete, Metal, and Wood Trash Receptacles
(Mukoda, 1990, p.38,40; Sato, 1992, p. 130)

In an arrangement, in order to select the most proper one an evaluation of its cost, permanency, and harmony with the environment should be made. For example, in

recreational areas, it is not proper to use cast concrete trash cans. These types are more suitable for urban spaces with concrete flooring rather than recreational areas.

The cost of a product that was produced by resistible material and with an advanced technology maybe high at the beginning. However, when compared with a disqualified product it does not cost much, because other one will need more maintenance and renewal in the future. (Çokar, 1994)

3.3.5. Phone Booths

They are the units to meet the communicational needs of citizens. Starting from the times when telephone was first invented and used prevalently, phone booths were accepted as street furniture, too. Today, against the intensive usage of mobile telephones, they still have great importance.

Phone booths have 3 main forms: (Yaylalı, 1998, p.83).

1. placed on a supporter
2. mounted to a wall
3. in a booth

The telephone booth has already of street furniture that can legitimately stand out from its background. For example its color and shape make its instantly recognizable for its purpose and make it an affectionately regarded emblem of British scene. (Sato, 1992) (Fig. 3.30.)

Figure 3.30. Telephone Booth in London   (Sato, 1992, p.133)

Traditionally, the telephone booth has already provided a prime example of color acting as a key usage and meaning: certain types of direction signs are blue, others are green, and yellow has been used to denote a warning. (Mukoda, 1990, p.16)

General Principles And Design Considerations:

Provision of phone booths on the street/public places could be a great asset to the person on the move. (Manchanda, 1998, p.15)

- Mostly they are grouped together
- Can be closed or open booths
- It should provide privacy and person should not be affected from street noises.
- Coin booths in phone booths should be vandal proof (Yaylalı, 1988, p.83)
- Phone booths at noisy places should be closed booths.
- Inside the booths, there should be a shelf and a phone-book for the users.
- They should be illuminated to provide safety and easy usage. The ones with a supporter beam can be illuminated with the lighting elements within the same system. For telephone booths, however, it would be inadequate. So, in the booths, a system that lights on and off when a person enters to the booth or exists, should be provided. (Zülfikar, 1998, p.31)

The internal space requirements of a phone booth are 900 mm x 1100 mm x 2400 mm high. The height of telephone instrument should be at 1100 mm. Some dimensions are given in Figure 3. 31.
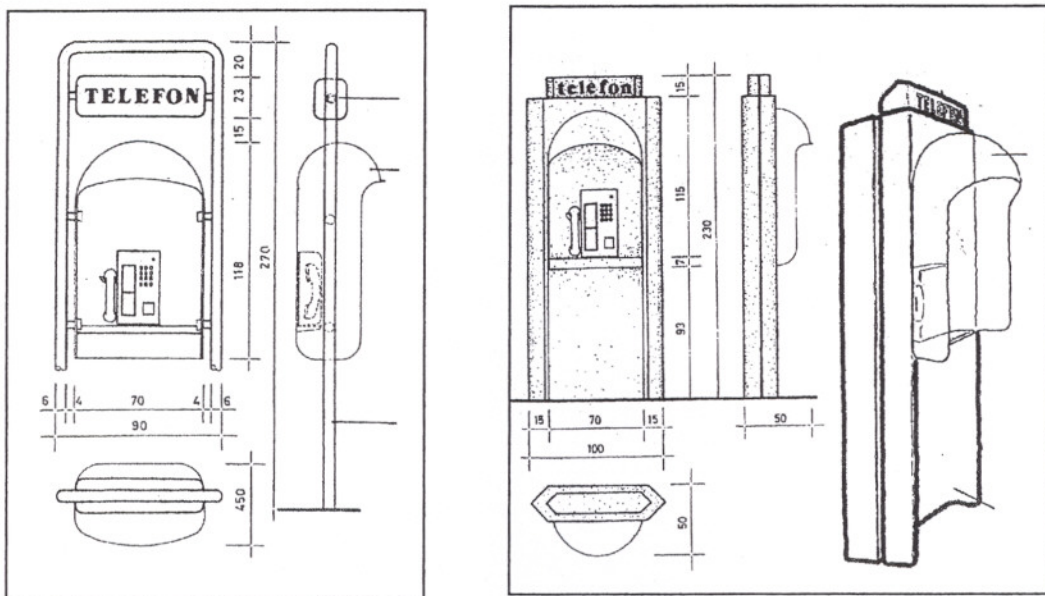
Figure 3.31. Dimensions of Telephone Booths (Doğan, et al., 1980, p.18.19)

In the last years human dimensions are used more efficiently in the designs and so phone booths began to be designed especially for children and handicapped. For example, the production of booths with wider and shorter dimensions became prevalent for people who use wheel-chairs. In phone booths designed for this purpose, the height of the phones is 150 centimeter. (Mukoda, 1990)

Material And Production Techniques

A telephone booth has to be transparent at least on one side so that it is possible to see if the booth is engaged or not. The internal surfaces of the booth are required to be sound absorbed, whereas external surfaces should be sound reflecting so as to maintain proper acoustics. (Fig. 3.32.) (Manchanda, 1998, p.15) The first samples of phone booths were made of wood or cast iron. Today, they are mostly made of aluminum, steel or glass. Their transparency provide a security for vandalism and bad usage

Figure 3.32. Examples of Telephone Boots in Australia and Ireland
(http://paoprj.lucksnet.or.jp/earth-c/html/9904apr/html/000094.html, Mukoda, 1990, p,48)

Due to the importance of this facility in the urban space it is necessary that its presence should be too obvious on the street. They should, therefore, be located in pedestrian zones, especially commercial areas where need for instant communication is important.

Telephone booths are placed in groups and in large numbers at places, where pedestrian circulation is dense, such as: pedestrian roads, bus stops, underground and train stations, airports, shopping centers, passages, and squares. (Fig. 3.33.) At the places, like recreational areas, parks, playgrounds, sport areas, where density is rather small, they should be located at points where they are mostly needed.

Figure 3.33. A group of Transparent Telephone Booths   (Sato, 1992, p. 133)

On streets, various kinds of equipment are installed for the facilitation of control over traffic and city functions. In various cities , projects for arranging these installations carefully and improving the scenery of cities are being carried out. The concept on giving precedence to pedestrians and protecting their comfort has started to take root, superseding the concept on giving precedence to automobiles. Therefore an increasing number of cities are using street furniture are for creating harmony with the environment and image of the city.

In this chapter, general design and some street furniture criteria are given with related to their size, material and location. These criteria are assist to formation of bus stop design in the following chapter.

CHAPTER 4

BUS STOP DESIGN CRITERIA

General criteria that should be considered in the design of street furniture were explained in Chapter 3 as physiological, psychological, technological and economic criteria. These criteria comprise all street furniture. In this chapter, explanations about bus stops and design and location guidelines about the elements that take place in a bus stop will be given. Afterwards, a bus stop will be designed according to these criteria.

4.1. Definition and Sizing of Bus Stops

The bus stop is the first point of contact between the passenger and the bus service. The spacing, location, and design of bus stops significantly influence transit system performance and customer satisfaction. This is the point of entry to the bus system, the interface with the city. It has both to afford access to the vehicle and also to provide bus route identification and an information and waiting point. The difficulties in setting it out stem from sharing territory with the pedestrian-movement area (Dejeammes, 1998, p.3).

The function of bus stops is generally determined by operations and their location/situation. That is, the nature of bus operations themselves (service frequency, schedules, route network, interchange etc) will assign roles and classifications to bus stops consistent with the structure of the bus routes serving them. The situation that the bus stop is in, in terms of the traffic environment, land use and activity levels, or other factors, will also influence its role and its design requirements.

The purpose of a discussion of determinants of function is to provide a consistent and functional basis for the identification of design elements required at bus stops in different circumstances. In the development of a hierarchy of stops, the key consideration is the link between bus stop facilities (such as shelters, transport information, bus zone delineation) and the location/situation and operational determinants relating to the stop.

These aspects are related to the operation of bus services in a network sense (frequency of service, stopping patterns etc). Bus stops have an operational function and relationship between stops, which is indicative of a hierarchical structure (State Transit Authority, 1999, p. 31).

Stops can be grouped in the following way:

Terminus – stops at the beginning or end of a route where terminal functions (meal breaks, change of destination information, layover) might take place. Bus dwell times may be longer at the terminus than at some other stops. Passenger numbers (both alighting and joining) may be higher at a terminus;

Interchange Stop – both bus-bus interchange passengers may transfer between bus routes or between buses and other modes. Dwell times may be longer to ensure modal connections are made, and the stop is generally more prominent in a network sense. Intermodal interchanges (bus-rail, bus-ferry) often have a higher standard of design and are often off-street;

Limited/Express Stops – some bus operational patterns establish skip-stop operations, with particular stops designated stopping places for express or limited stops (skip-stop) services. These stops are often situated at important activities (shopping centers and the like) and so serve passenger origins and destinations;

Standard Stop – provides for passenger pick up and set down for most bus services, but may be skipped by limited stops or express services;

Part-Time Stops – part-time stops only operate during certain periods of the day, for example, school stops operate during the morning and afternoon school peaks, and only on school days. It is important that part-time bus stops be clearly marked as such;

Set-Down Only Stop – a stop, usually towards the end of a bus route, where passengers are dropped off, but not picked up (State Transit Authority, 1999, p. 31,32).

4.2. Location of Bus Stops

These principles does not focus in detail on the determination of stop location – rather, it concentrates on the placement and design of bus stops in the surrounding environment, and the design and use of the stop elements and facilities under different circumstances.

However, the general principles of stop placement and location encompass the following issues:

- traffic safety for vehicles and passengers;
- accessibility (particularly for mobility-impaired passengers);
- proximity to attractions and pedestrian facilities;
- gradients and surfaces of roadways and footpaths;
- legibility, stop spacing and relationship to other bus stops;
- personal safety and security (particularly lighting);
- capacity requirements for buses, passengers, and passing pedestrians; and traffic and parking impacts (State Transit Authority, 1999, p.29).

The function or classification of a bus stop will also be influenced by its surrounding land use, traffic environment etc. Stops can be grouped within the following environments.

Town Centres/CBDs – these situations tend to have concentrations of passenger activity (picking up and setting down), convergence of bus routes, and potential for conflicts between buses, pedestrians, traffic and parking. More attention needs to be paid to the quality of passenger facilities in CBDs and town centers, the protection of bus zones from illegal use, and interaction between the transit operation and the operation of nearby retail and commercial activities. Bus services in CBDs and town centers need to be efficient, and there is usually competition for kerb space allocation and vehicle access.

Regional Shopping Centers – important passenger origins and destinations, but usually found in different environments to CBDs and town centers (often in residential areas or on the fringes of CBDs or town centers). Access to regional shopping centers is usually car-oriented, with large supplies of car parking, major road connections and multiple car park accesses. Regional shopping centers can operate late at night (cinemas and late shopping), but a lack of adjacent complementary commercial and retail activities, and often inactive street frontages, present particular challenges for bus services and stop requirements. Regional shopping centers are often the focus of extensive bus feeder networks.

Neighborhood Shopping Centers – important local destinations, but usually with a lower level of intensity and competition for kerbspace than town centers or regional

shopping centers. Neighborhood shopping centers may have less intense levels of bus activity. Limited night-time activity.

Residential Areas – issues relevant in residential areas include impacts on adjacent residential amenity, night-time safety, personal security, and all-weather access to the stop. Waiting times at stops in residential areas may be longer than at higher-order stops.

Rural, Semi-Rural – situations will present particular challenges including lower street and road standards, discontinuous footpaths and absence of kerbs, lower levels of activity, street lighting and surveillance, higher traffic speeds and possibly less frequent buses and more widely spaced stops.

Other location/situation issues include traffic, both volume and speed. Bus stops in a high speed traffic environment (>60 km/h) or on motorways or arterial roads will have different requirements to those in lower speed environments, and hence a different class of facilities might be required. (State Transit Authority, 1999, p.32).

4.3. Bus Stop Design

There are important determinants that should be considered in the design of bus stops which are important in mass transportation system. In order to determine these criteria there are some points that need to be considered: how bus stops are integrated in the transportation system, pedestrian and vehicle relations, activities that take place around the bus stops, human behaviors. In this context, first of all user needs should be determined.

4.3.1. User Needs for Bus Stops

The first requirement is that no two stops should be too far apart, as the elderly often have difficulty in walking more than 200 meters. There are two aspects to making it easier for passengers to wait: improving physical comfort and raising psychological ease. Features which make it easier for passengers (especially people of reduced mobility) to wait there but to feel safe are: protection from the weather, lighting, seats at the right height, clear view of the oncoming bus and, possibly, additional items like telephone, litter bin, newspaper stand or other services nearby (Dejeammes, 1998, p.6).

Issues relevant to bus stops vary in three broad functional ways:

- the passengers for whom the stops are access points for bus transit;
- the efficient operation of the bus services themselves; and
- outside influences and other users (such as traffic, passers-by, adjacent land uses and the like).

Passengers

Passengers expect the following things from bus stops:

- comfort while waiting for the bus, including weather protection, and cleanliness ;
- recognisability and consistency – bus stops provide system information and enhance network legibility. A consistent design approach through different areas can enhance market presence and passenger perceptions of the network;
- safety and security – the stop should be a safe place to approach, wait, and leave;
- information – passengers expect to find information on bus frequency, routes and relevant maps, at the stop;
- accessibility (special needs) – the stop should relate to its surroundings, connect with footpaths, pedestrian crossings and the like, have regular surfaces, and provide for access by the mobility impaired; and allow waiting passengers a clear view of oncoming buses so that they can anticipate and signal drivers to stop.

Operational

Bus operators are usually not responsible for the provision of stops and bus stop infrastructure. However, bus stops and the facilities provided with them can have significant implications for a bus operator – both in terms of day to day bus operations, and capital and recurrent budgets. Bus stops are a key element of a bus service's image and can impact on the perception of the service by users and non-users alike.
For an operator of bus services, bus stops:

- should be conspicuous, because they provide simple information on the existence of a bus route for users and non-users (i.e. system legibility),
- allow the bus to stop close to and parallel with kerb and with minimum delay,
- have sufficient capacity for passengers and buses,

- should not be blocked by illegal parking but be kept clear for buses, and not disrupted by road and utility maintenance activity,

- should be readily accessible without complicated maneuvers,

- can indicate to drivers where exactly to stop the bus,

- should allow for standardization (such as user information, identification signs, route destinations, and section numbers), and

- should provide for other operational requirements, such as ticket selling, and the requirements of other operational staff (such as inspectors etc), where appropriate. (State Transit Authority, 1999, p.29)

Non-Users

The way in which a bus service presents itself to the broader community is affected by the form, quality and condition of its bus stops. Well-designed and maintained bus stops and related facilities can enhance the perception and attractiveness of a bus service, even to current non-users. Issues of relevance to non-users can include:

- pedestrians – incorrectly located bus stops with waiting passengers can act as a barrier to pedestrian through-movement and disrupt access to adjacent land uses and activities,

- care should be taken to ensure road safety and personal safety is enhanced and not diminished by the siting of a bus stop and shelter,

- other road users – for safety, potential conflicts (such as with driveways, turning lanes, etc) should be minimized, and bus stopping and waiting passengers should not conflict with adjacent land uses (State Transit Authority, 1999, p.30).

4.3.2. Bus Stops Design Guides

In the design of a bus stop, first of all the basic needs of users should be met. Besides the needs and behaviors of bus operators, activities around the bus stops should be considered, too. The location of bus stop, the location, dimensions, forms and materials of elements should be determined.

In order to assist the decision making process a number of objectives are highlighted, which together with the cost estimate for each option, form a set of criteria which could assist in selecting the most suitable option. These objectives are:

- To provide physical shelter from the prevailing wind and rain to bus passengers using the stop as soon as possible;
- To maximize user safety and security,
- To provide weatherproof mounting for bus passenger information such as timetables and route maps which are readable at all times from within the shelter,
- To provide robust seating for the convenience of several passengers,
- To provide sufficient lighting for the convenience of users during darkness,
- To ensure that it is constructed of material which is sufficiently robust to minimize vandalism and graffiti,
- To minimize the costs for ongoing repairs, maintenance and cleaning,
- To have an aesthetically acceptable form which blends in with the immediate environment,
- To be clearly identifiable as a bus shelter. (Sikiotis, 1998, p.1,2)

Passenger security is a major issue in bus stop design and location, because the design and location of the bus stop can positively or negatively influence a bus passengers' perception of that bus stop. From the perspective of security, landscaping, walls, advertising panels, and solid structures can restrict sight lines and provide spaces to hide. Each of these items can be an integral part of the bus stop, either by design or by proximity of existing land uses. Therefore, the transit agency should carefully review which amenities are to be included at a bus stop and consider any factors that may influence security.

Some guidelines regarding security at bus stops are as follows:
- Bus stop shelters should be constructed of materials that allow clear, unobstructed visibility of and to passengers waiting inside.
- Bus stops should be at highly visible sites that permit approaching bus drivers and passing vehicular traffic to see the bus stop clearly.
- Landscaping elements that grow to heights that would reduce visibility into and out of the bus stop should be avoided. Low-growing shrubbery and ground cover and deciduous shade trees are preferred at bus stops. Evergreen trees provide a visual barrier and should be avoided.
- Bus stops, whenever possible, should be coordinated with existing street lighting to improve visibility.

- Bus stops should be next to existing land uses, such as stores and businesses, to enhance surveillance of the site (Texas Transportation Institute, 1996, p.85).
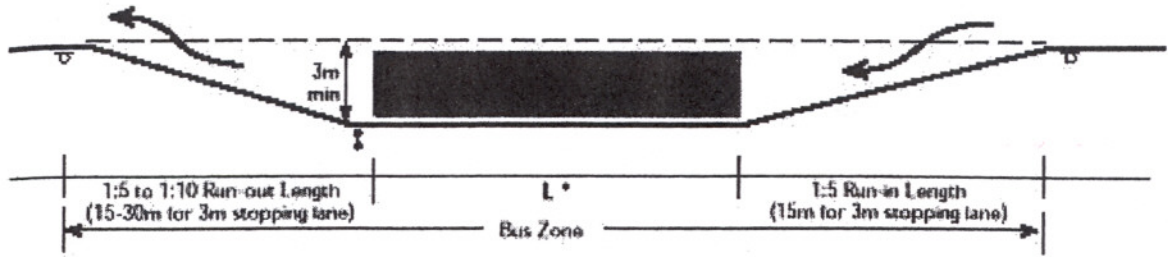
4.3.3. Bus Stop Design Elements

A bus stop consists of various street furniture such as seating, lighting, transport in formation sign, telephone, shelter, etc. At different bus stops the number and integration of these elements may vary. Each element's dimensions are thought besides their location, integration and material.

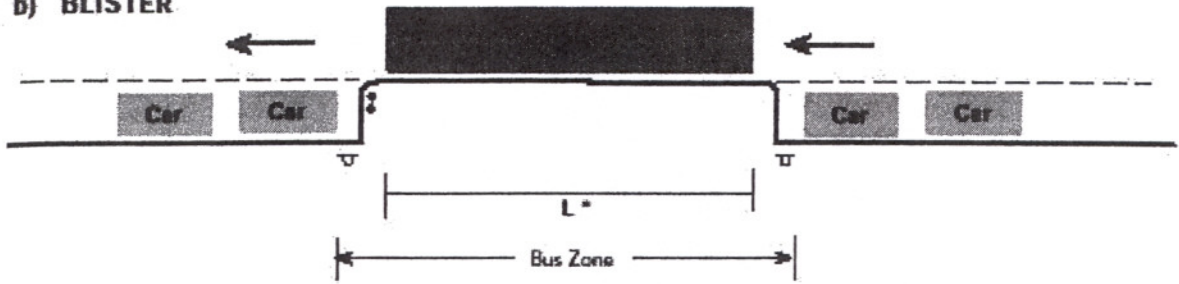The sorts of bus stop facilities which need to respond to stop function therefore are:

- bus zone – from kerb side provision to bus bays, (Fig. 4.1.)
- pavement – in more intense operations concrete pavement may be desirable to avoid deformation of or damage to conventional flexible pavements,
- bus stop identification signs,
- bus zone delineation – from "bus zone" roadside signs to markings on the road; (Fig. 4.2.)
- shelters,
- seating,
- transport information – from simple timetables and route maps to network maps, locality maps, chronological displays and real-time information, and
- public telephones. (Fig. 4.3., Fig. 4.4.)

The design requirements are based on existing standards and guidelines related to bus stop and traffic facilities, modified to reflect STA (The State Transit Authority in USA) operations. Table 4.1. summarizes design elements for bus stops. The table identifies the elements, its function, options for its provision, comments on application or special circumstances, and specific design requirements.

a) BUS BAY

| 3m min |

1:5 to 1:10 Run-out Length
(15-30m for 3m stopping lane)

L *

1:5 Run-in Length
(15m for 3m stopping lane)

Bus Zone

b) BLISTER

Car   Car

Car   Car

L *

Bus Zone

c) KERBSIDE

Car   Car

Car   Car

Draw-out *

L *

Draw-in *

Bus Zone

d) OPEN BUS BAY

Left Turn Only
Buses Excepted

Draw-out *

L *

No Stopping
Zone
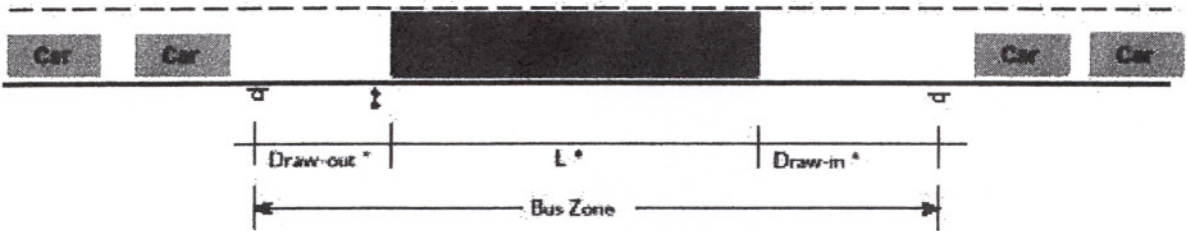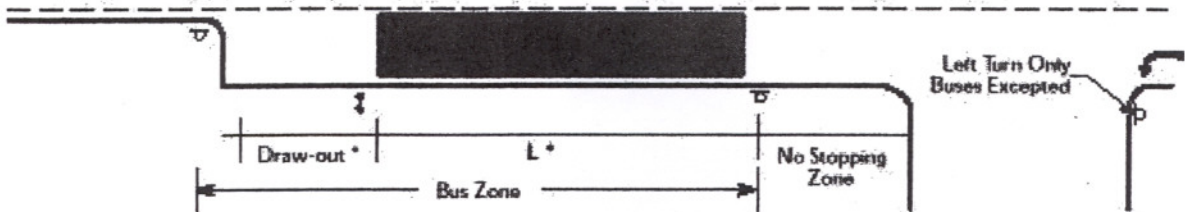
Bus Zone

* Note: See table in Figure 4.2.
         L = Bus length

Figure 4.1. Bus Zone Types   (State Transit Authority , 1999, p.18)
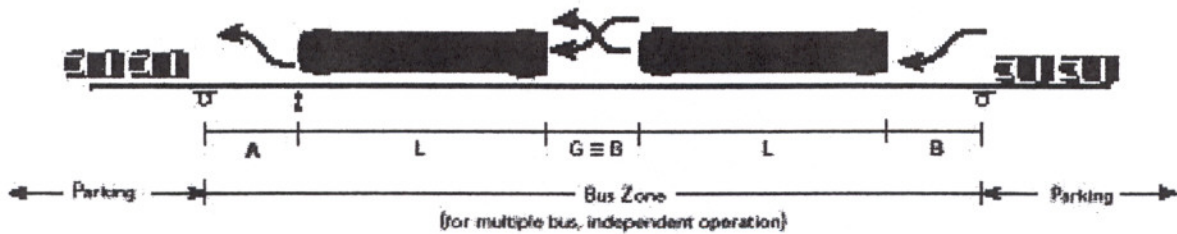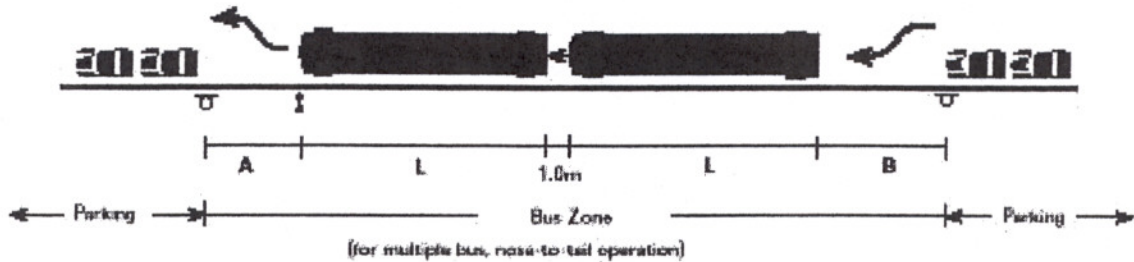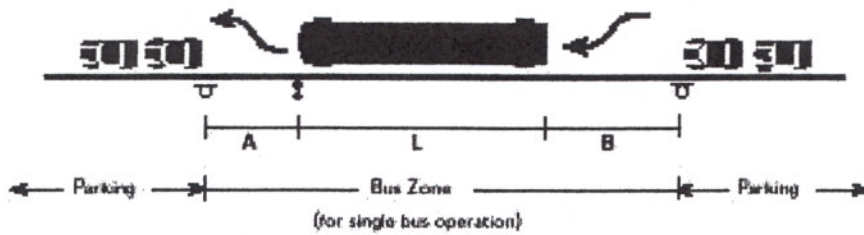
Bay Dimensions (m)	Midi	Design Bus	Long	Articulated
L = length of bus	9.0	12.5	14.5	17.5
A = minimum draw out length *	3.0	4.0	4.0	4.0
B = minimum draw in length	6.0	6.0	8.0	10.0
G = minimum gap for independent operation	6.0	6.0	8.0	10.0

Note: * When located on-street close to an intersection, the statutory no-standing distances may be substituted for dimensions A or B for bus stops on the immediate approach and departure side of the intersection respectively.

Design for Midi buses only in exceptional circumstances. In general, Design Bus should be used.

Figure 4.2. Bus Zone Dimensions for Various Bus Operations   (State Transit Authority, 1999, p.19)

Kerb ramps

Light post

For bus stops near a corner, the corner should also be well-illuminated

Direction of traffic

Property line

"BUS ZONE" sign

Where plantings are provided, use only ground cover or low shrubs. Trees for shade should be long-trunked with minimum branch height of 4.5 metres. Plantings should not obstruct line of sight between approaching bus and waiting passengers.

BUS STOP

15m

6-10m*

Light post
Telephone
(if not included in shelter)

Bus Zone

L (minimum 12.5 m)

Rear door location (depends on type of bus)

400 min | 1500 typ | 1500 min

Bus shelter with seating
(walls shown as bold line; awning shown as broken line)

1200 min

Front door 1200 wide, typical

Space for wheelchair/pram

1200 min

15m street light spacing in vicinity of bus zone

400 min

Bus stop identification sign with timetable and route map case

3-4m*

BUS STOP

Rubbish bin

Light post with "BUS ZONE" sign attached

Painted linemarking and "BUS STOP" text to show bus zone
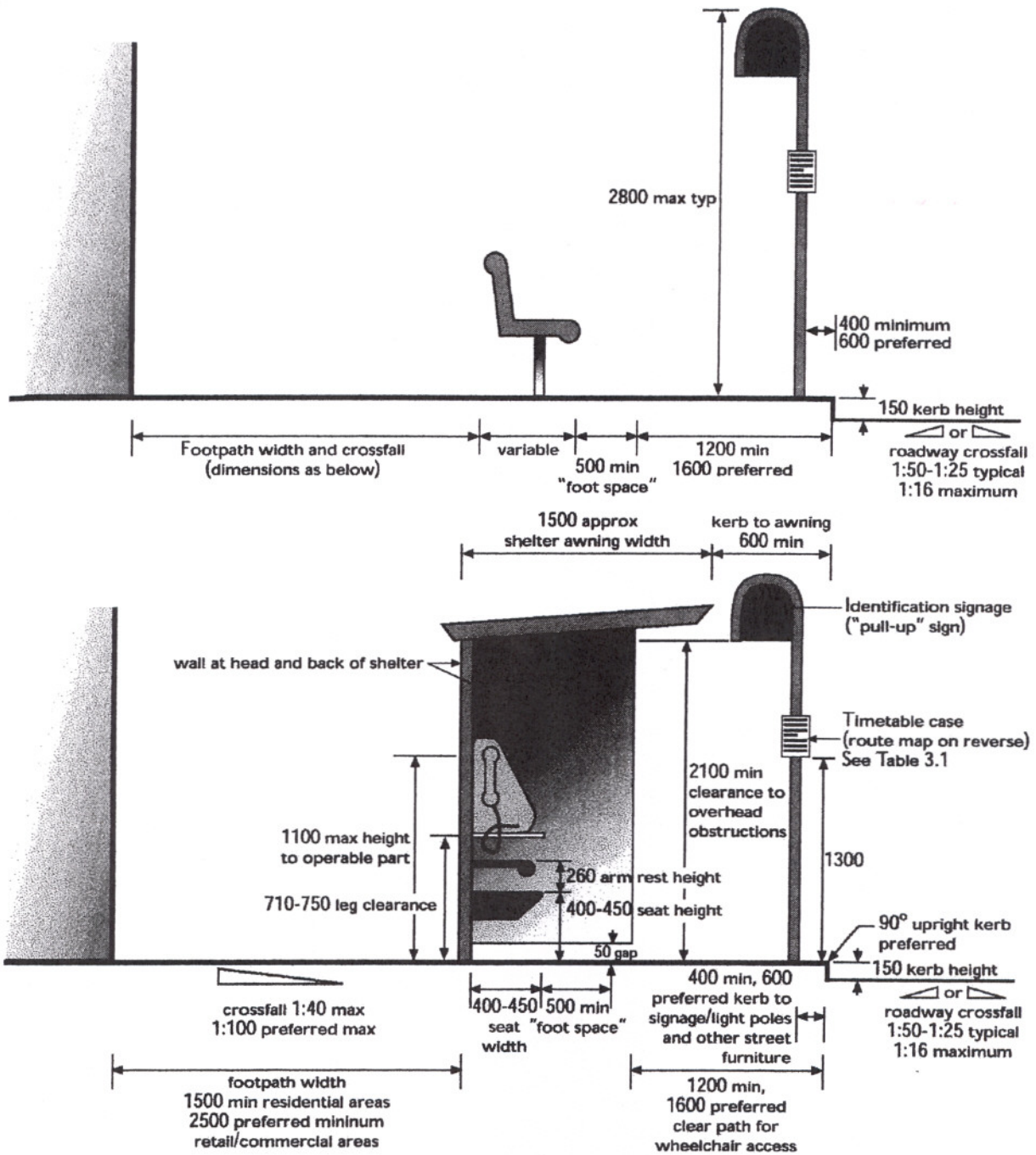
Notes: * depends on "L"
"L" = bus length (see table in Figure 4.2)

Figure 4.3. Bus Stop Example Design (Plan)   (State Transit Authority, 1999, p.20)

2800 max typ

400 minimum
600 preferred

150 kerb height

or
roadway crossfall
1:50-1:25 typical
1:16 maximum

Footpath width and crossfall
(dimensions as below)

variable

500 min
"foot space"

1200 min
1600 preferred

1500 approx
shelter awning width

kerb to awning
600 min

wall at head and back of shelter

Identification signage
("pull-up" sign)

Timetable case
(route map on reverse)
See Table 3.1

2100 min
clearance to
overhead
obstructions

1300

1100 max height
to operable part

710-750 leg clearance

260 arm rest height

400-450 seat height

50 gap

90° upright kerb
preferred

150 kerb height

or
roadway crossfall
1:50-1:25 typical
1:16 maximum

crossfall 1:40 max
1:100 preferred max

400-450
seat
width

500 min
"foot space"

400 min, 600
preferred kerb to
signage/light poles
and other street
furniture

footpath width
1500 min residential areas
2500 preferred minimum
retail/commercial areas

1200 min,
1600 preferred
clear path for
wheelchair access

Notes: All measurements in millimetres.
         Boarding and alighting zones should be free of street furniture.

Figure 4.4. Bus Stop Example Design (Section)   (State Transit Authority, 1999,
p.22)

Table 4.1. Design Elements

Element	Function	Options	Comments	Design Requirements
Bus Zone	Clear area in which only buses may stop to load and unload passengers	Kerbside Bus Zone	Most common passenger facility	Sufficient space for bus numbers and lengths, incorporating approach and departure distance. See **Figures 4.1, 4.2** Generally located on departure side of intersection or pedestrian crossing, but should relate to passenger destinations and pedestrian facilities. Where stop must be located on approach side of signalised intersection with pedestrian crossing, then bus zone should be located 9 m clear of the crossing or stop line.
		Indented Bus Bay	Used in high speed traffic environments, (>60 km/h), or where high occupancy lanes in operation (bus lanes or transit lanes), more than 10 buses and 40 passenger boardings per hour. Should not be used where traffic in adjacent lane delays buses leaving stop.	Bus to be fully out of traffic stream. Dimensions in **Figure 4.1** In high speed traffic environments, acceleration and deceleration tapers are required. They are calculated on the basis of the adjacent road's speed limit.
		Open Bus Bay	Variant of indented bus bay. Used at intersections – allows bus to drive straight into, or out of, bay. Can be used as part of bus priority measures (such as a queue jump).	See **Figure 4.1**
		Bus Stop Blister	Kerb extension for length of bus stop. Used in areas with extensive kerbside parking. Does not require draw in and draw out length, but stopped bus blocks travelling lane. Reduces delay for buses using stop. Should be used where bus numbers are high and where loss of kerbside parking needs to be minimised. Can provide for turning traffic clear of bus lanes. Can be used as a traffic calming device (unless delay is onerous to other buses and general traffic). Suitable for CBD applications in association with bus lanes.	See **Figure 4.1**
Kerb	To allow for loading and unloading of bus passengers.	Standard kerb, kerb only	Buses are designed to use a kerb at bus stops. A standard kerb should be used. Roll top kerb must not be used. Kerb height must allow for standard bus with 300 mm step height to sweep across kerb.	See **Figure 4.4** At a bus stop, kerbs should be straight, not curved, to allow buses to pull-up parallel to the kerb and thereby minimise the gap between the bus and kerb, for both doors.

Element	Function	Options	Comments	Design Requirements
Footpath	Provide access to and from stop, and allow for pedestrian movement around waiting and loading bus passengers.	Any all-weather non-slip hardstand surface	Minimise gradients and crossfalls; sealed path from bus stop to nearest existing path as a minimum design requirement; provide for waiting passengers and passing pedestrians. Consider also the need for kerb ramps at nearby intersections.	See Figure 4.4 Desirable minimum widths: Residential areas – 1200mm; 1500mm in retail/commercial areas (preferred minimum 2500mm). Crossfall: maximum 1:40, preferred 1:100. Gradient: maximum 1:12, preferred 1:20. A hardstand surface should be used to ensure that wheelchair users and pram users are able to manoeuvre easily to and from the stop and from the waiting area to the bus.
Bus Zone Signs	Dimension bus zone for bus operations and enforcement	Bus Zone signs; road markings	Use in circumstances where standard signage is not effective in keeping bus stop clear of illegal use – particularly city centre and town centre stops.	
Stop Identification Sign	Identifies bus stop and bus stopping location for driver; identifies bus stop for passengers; provides information on all relevant route numbers, service types, and popular destinations.	Tombstone plate in combination with inverted J or inverted U pole. Plate can be mounted on shelter in special circumstances (such as to reduce number of poles in footpath).	Important system identification for passengers and drivers: tells our customers where to find our service. Stop identification signs should be used at all bus stops. Black lettering on yellow field for all services except special services (Airport Express, Explorer, Nightrider). The inverted J-pole is used for standard, part-time, and setdown only stops, so it is the most commonly used type of pole. The inverted U-pole is recommended where a variety of passenger information is explained, such as at interchanges, special service stops, and termini.	Tombstone plate should have reflective yellow field, with black lettering featuring bus and passenger logo. Route numbers and section numbers, and destination for some routes, can share pole. Located min 4 metres from head of bus zone where departure clearance space is required. Min 400mm from kerbface. Where sign is to be incorporated into a shelter, the shelter should be located such that the head of the shelter coincides with the proposed location of the stop identification sign. Maximum height of pole: 2800mm. Minimum clear height under bottom of plate: 2100mm. Inverted J pole to be used at all stops but higher order stops. Inverted U pole to be used at higher order stops (terminus, CBD stops, transfer stops). Inverted U pole should have block or bar joining legs at ground level to warn visually impaired people.
Bus Shelter	Protect waiting passengers from rain, wind, and sun, while allowing them to see approaching bus	Many types of shelters may be used, as long as they satisfy the design requirements and serve their necessary function.	Use at stops where more than 25 passengers board per day, or where passengers transfer between buses, or where bus are frequent. Bus shelters are the most visible permanent indicators of the presence of a bus service. Located to provide effective shelter, enhance perceptions of personal safety and allow occupants to see approaching bus. Shelter should incorporate seating, space for wheelchair/ pram, lighting, and transport information, on a hardstand ground surface.	See Figures 4.3 & 4.4 for dimensions and design requirements. Minimum 1500mm wide. Minimum height under awning 2100mm. Desirable maximum height for standalone shelters 2400mm to provide effective shelter. Location min 1200mm on approach side of bus stop identification sign. Where identification sign is to be incorporated into the shelter, see "Stop Identification sign" above. Minimum set-back from kerb – 600mm to edge of awning, but should be increased where there are steep approach and departure angles to the stop. Standard alignment – front of shelter to street. Consider reversing shelter where west-facing (for sun protection) or south-east facing (wind and rain), but ensure maximum visibility of approaching buses, and passive security.

Element	Function	Options	Comments	Design Requirements
Bus Shelter (cont'd)			Should be constructed of vandal-resistant materials and consist of roof, back and at least one side panel. Glazed panels are preferred to mesh for its superior shelter and transparent qualities. Side and rear panels should not extend to ground (see **Figure 4.5**), to allow for cleaning. Should be connected to a pedestrian footpath to provide an accessible path of travel.	Design requirements should be secondary to function in shelter design. Extend awning when located in unprotected north-facing aspect. Where advertising panel is used for wall element, this should be located on departure side of shelter. When constructed on an island in a traffic situation, protection of the rear of the shelter is required by barrier and set-back. The design of continuous shelters for interchanges and terminals should be subject to a specific design and review process.
Seating	Place to sit, for waiting passengers	Seats may be incorporated into shelters, or stand alone; Bench or individual; made of timber, metal, plastics.	Seats are generally required at pick-up stops, as close as possible to head of bus stop (bus stop identification sign). Number of seats in response to demand and waiting times. Bench seat preferred for versatility of use. Avoid sharp edges and mesh surfaces. Non-flammable material (metal) preferred to timber. Seating material should be strong, easy to clean, quick drying (in exposed positions), and not get too hot/cold under adverse weather conditions.	Seating in shelters should be located at rear of shelter. Seat dimensions shown in **Figure 4. 4** An area under shelter but free of seating needs to be provided for wheelchairs and prams.
Lighting	Illuminate bus stop to identify stop and provide security for waiting passengers.	Mains or solar powered.	Avoid strong variations in lighting so as to avoid shadows. Illuminate to allow people to see the way to and from stop, and to allow passenger at stop to identify approaching person at sufficient distance to allow evasive action. Allow passenger at stop to read transport information. Lighting should also be provided within a shelter also.	Illumination area at stops shown in **Figure 4.3** Illuminate to 300 lux in shelters or at transport information points. Streetside illumination to 200 lux.
Telephone	Ancillary facility to improve security and convenience for waiting passengers	At stop, or near stop.	Telephone should be located near higher-order stops in most circumstances. Phone can be incorporated into shelter design at major stops.	See **Figure 4. 4** for design guideline for a telephone installed within a bus shelter.
Other Street Furniture			Location of street furniture should allow for clear access to loading and unloading points, and access routes to bus stop.	Locate away from shelter to maintain clear space at loading and unloading points and accesses (see **Figure 4.3**).
Transport Information	Provide passenger information on bus route, present location, bus departure times and route network. Reassurance for waiting passengers.	Bus stop timetable	A3 or A4 case(s) attached to inverted J or inverted U pole. Shows bus stopping times at that particular stop. Should include route map on reverse. Not required at "set-down only" stops. If mounted in shelter, transport information displays should not be located over seating.	A3 case used at multiple route stops. Attach to inverted J/U pole at 1350mm from ground. Can be attached to shelter if bus stop sign not on pole. If mounted in shelter, then timetable and route map should be on same side of display case (ie A3 case). At a minimum, the timetable should be illuminated by street lighting.

Element	Function	Options	Comments	Design Requirements
Transport Information (cont'd)		Destination Guide	A3 size sheets showing all significant destinations served by the routes serving that stop. Should be provided at all multiple route stops.	
		STA Route map	A4 or A3. Should be provided at all pick up stops. Should show bus route, including section numbers and identify cross-streets and important destinations. At multiple-route stops, this information should be incorporated into the Destination Guide.	See "Bus stop timetable" above. Title of map to include route number, route description, and region name. Map can be in black and white or in colour. Do not overlay route onto street directory map, because for long routes the scale may be too large for street names to be legible.
		Network Map	A1 format STA network map (840x610mm) to fit A1 metal and perspex case.	Provide at higher-order stops, transfer stops and in CBD where shelter is provided. Mount inside shelter on back or side panel, but not above seating.
		Chronological Display	Use at terminal stops or ranks with number of different bus routes serving it. Display should list scheduled bus departures in chronological order and be combined with a system map.	Provided in free-standing case A1 or larger, or on wall-space in central location in long bus zone. Very frequent services can refer to standard gap, rather than list all departure times.
		Locality Map	To provide "you are here" information relating to stops and nearby destinations in major centres. At locations with large populations having English as second language, consider using pictograms, symbols and landmarks, or a language in addition to English (except where there are multiple languages).	Can be incorporated into A4 or A3 timetable case at stop, or into shelter where appropriate. Translation to be provided by local authority. Visual appearance to be consistent.
Temporary Information	Display of information for a short period of time	Laminated posters, confoam boards, etc.	Temporary information should replace permanent information, and be displayed in the relevant display cases.	Design of temporary information should follow specifications for permanent information, except printed material which can be shown in black and white.
		Temporary bus stop identification sign	In the case of a bus stop requiring a new temporary position (for example, due to roadworks), a temporary bus stop identification sign should be located at the new position.	An inverted J-pole or inverted U-pole, mounted on a solid circular concrete block may be used. Should ensure that it is not easily tipped over. Yellow or white paint should be used around the outer edge of the block and on its sides to alert visually-impaired people.
				Design of temporary information should follow specifications for permanent information, except printed material which can be shown in black and white.
		Bus stop Not in Use	If the identification has not been removed, the normal tombstone should be replaced with a "Bus Stop not in use" tombstone.	"Bus Stop not in use" tombstone should be white with black text reading "Bus Stop not in use". Information directing passengers to an alternative stop should be put in a display case attached to the sign pole.
General Information Format	Font type and size		The font style used should provide easy readability for all customers, and should be consistent. Do not use font with serifs. Recommended font is Helvetica Condensed.	The minimum letter height for each information element on bus stop identifiers should be as follows: Section number – 75mm, Service type – 50mm, Route numbers and description – 20mm. For other information such as timetables and maps – 2.5mm.

4.3.3.1. Shelter Inclusion and Sizing

A bus shelter provides protection from the elements and seating while waiting for a bus. Standardized shelters exist that accommodate various site demands and different passenger volumes. Typically, a shelter is constructed of clear side-panels for clear visibility.

Ideally, the final location of a bus stop shelter should enhance the circulation patterns of passengers, reduce the amount of pedestrian congestion at a bus stop, and reduce conflict with nearby pedestrian activities. The location of the curb and sidewalk and the amount of available right-of-way can be determining factors for locating a bus stop shelter. The size of the shelter include availability of right-of-way width, existing street furniture, utility pole locations, landscaping, existing structures, and maintaining proper circulation distances around existing site features. The following placement guidelines should be used when placing a bus stop shelter on a site: (Fig. 4.5.)

- Bus stop shelters should not be placed in the 150 by-240 centimeter-wheelchair landing pad.
- Locating shelters directly on the sidewalk or overhanging a nearby sidewalk should be avoided because this may block or restrict general pedestrian traffic. A clearance of 90 centimeter should be maintained around the shelter and an adjacent sidewalk (more is preferred).
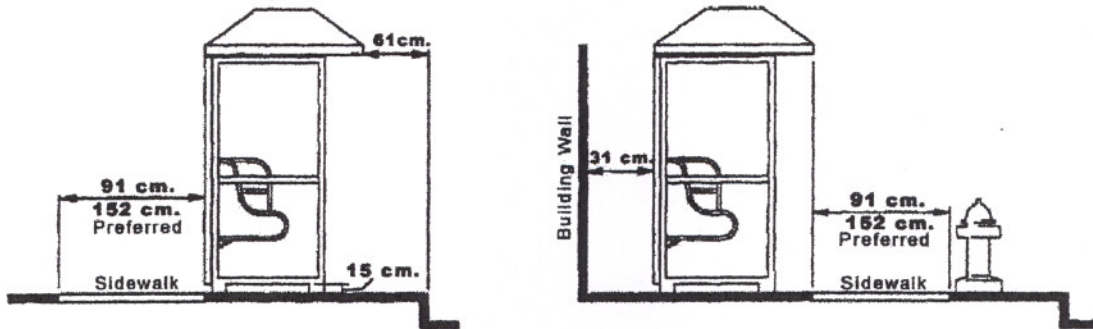
Figure 4.5. Shelter Clearance Guidelines (Texas Transportation Institute, 1996, p.67)

- Greater distances are preferred to separate waiting passengers from nearby vehicular traffic.
- Locating bus stop shelters in front of store windows should be avoided when possible so as not to interfere with advertisements and displays.

- When shelters are directly adjacent to a building, a 30 centimeter clear space should be preserved to permit trash removal or cleaning of the shelter. (Texas Transportation Institute, 1996, p.66)

In orienting and configuring bus shelters, personnel should consider the environmental characteristics of each site, because placement and design can positively or negatively influence passenger comfort. For example, in very hot climates, particularly in areas with few tall trees, bus shelters may be uncomfortable if they face directly east or west. However, this orientation may be appropriate in cooler climates during the winter months. When shelter interiors are uncomfortable, passengers will seek relief from the elements outside the shelter, appropriating walls or window ledges of nearby private property for their use.

Different bus shelter configurations can be used to reflect site or regional characteristics (Fig. 4.6.). Shelters can be completely open to permit unlimited movement of air, or panels can be erected to keep the interior of the bus shelter warm. For southern climates, perforated panels can be used to reduce the glare while permitting ventilation. Alternatively, shelters can be fully enclosed by solid panels and the back of the shelter may be rotated to face the street to protect waiting passengers from splashing water or snow build-up. To enhance ventilation and to reduce the clutter that can accumulate inside a shelter, a 6-inch clearance between the ground and the bottom of the panels is standard in fully enclosed shelters. In any case, shelters should be coordinated with landscaping to provide maximum protection from the elements and to enhance the visual quality of the bus stop. Shade trees reduce heat at a site and provide additional shade for passengers waiting outside the shelter. (Texas Transportation Institute, 1996, p.68)

Panel placement and type is the most common treatment used to make the bus shelter as comfortable as possible. In southern climates with mild winter temperatures and extreme summer temperatures, shelters can be designed to be completely open to air circulation from all four sides. At sites with wind, rain, or glare problems, standardized shelters can be retrofitted with panels to provide protection and shade. The panels can be solid pieces of glass, metal, or plastic. The panels observed in southern climates typically have openings to permit air movement through the shelter. On some occasions, panels are properly placed to diffuse direct sunlight and glare.
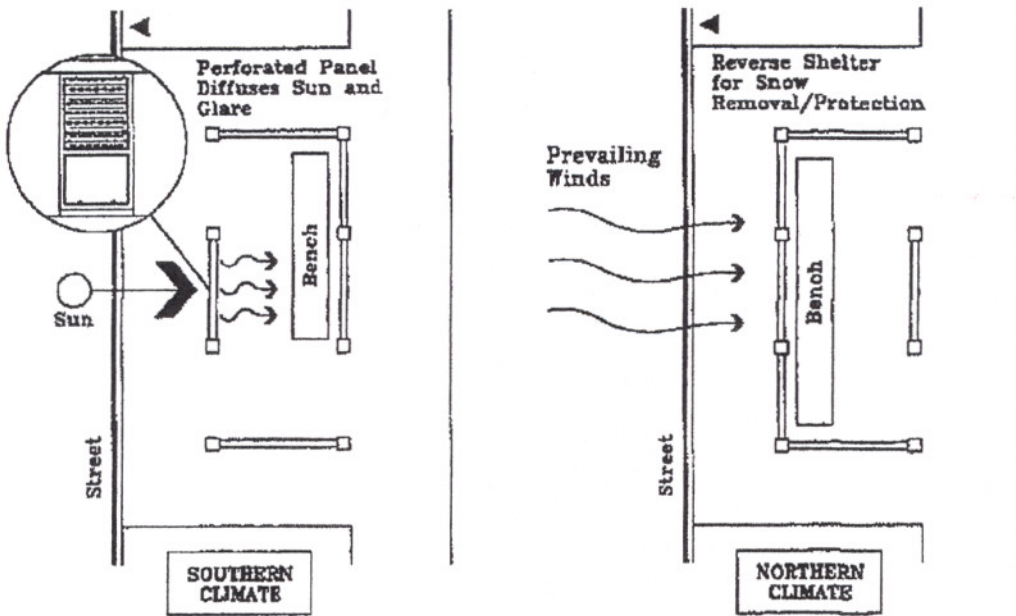
Figure 4.6. Examples of Orientation and Panel Placement to Improve Interior Comfort   (Texas Transportation Institute, 1996, p.68).

In northern climates, four-sided shelters with solid paneling is common. The panels help reduce exposure to wind and precipitation. Four-sided shelters usually have two openings for entry and exiting. (Fig. 4.7.) One opening for entry and exiting is avoided because of safety concerns rather than enhancing ventilation conditions. (Texas Transportation Institute, 1996, p.E-20)

Figure 4.7. Shelter in Northern Climate with Two Openings for Entering and Exiting   (Texas Transportation Institute, 1996, p. Appendix E-20)

4.3.3.2. Route or Passenger Information

Route information, such as system maps and schedules, is an elements that is quite valuable to transit customers. The actual displays mounted on the sign can include the transit agency logo, route numbers available at the stop, type of route (local or express), and destination for a limited number of routes. Most bus stops visited have the mechanism for including route schedules and maps. Mechanisms include panels specifically designed to hold this type of information, frames inside the shelter, and panels on signposts. (Fig. 4.8.)

Interior panels of shelters also can be used for posting route and schedule information. Side panels may be large enough to display the entire system map and can include back-lighting for display at night. Shelters that lack side panels can display route and schedule information on the interior roof of the shelter.

Figure 4.8. Panel on Post   (Texas Transportation Institute, 1996, p. Appendix E-43)

Some recommendations for route or passenger information display are as follows:

- Provide updated information when changes are made to routes and schedules.

- Consider the quality and appearance of information displays. A visually poor route map conveys a negative impression of the system.
- Make information displays permanent. Temporary methods for displaying information (such as tape-mounting) create a cluttered, unsophisticated appearance at the bus stop (Texas Transportation Institute, 1996, p.76).

4.3.3.3. Benches

Two factors that greatly influence the use of benches are crowding at a site and the environment at a site. Crowding limits passengers choices about sitting and waiting and forces passengers to wait around, rather than in, the bus stop. Uncomfortable bus stop environmental conditions, such as heat and sun, can also discourage use of the bench.

Preserving minimum circulation guidelines, coordinating with existing landscaping, and providing additional waiting areas can improve bench and site utilization. The following bench placement guidelines are recommended:

- Avoid locating benches in completely exposed locations. Coordinate bench locations with existing shade trees if possible. Otherwise, install landscaping to provide protection from the wind and other elements.
- Coordinate bench locations with existing street lights to increase visibility and enhance security at a stop.
- Locate benches on a non-slip, properly drained, concrete pad. Avoid locating benches in undeveloped areas of the right-of-way.
- Locate benches away from driveways to enhance passenger safety and comfort.
- Maintain a minimum separation of 61 cm. (preferably 122 cm.) between the bench and the back-face of the curb. As the traffic speed of the adjacent road increases, the distance from the bench to the curb should be increased to ensure passenger safety and comfort.
- Do not install the bench on the 153 cm. by 244 wheelchair landing pad.
- At bench-only stops, additional waiting room near the bench should be provided
- (preferably protected by landscaping) to encourage bus passengers to wait at the bus stop.

Figure 4.9. provides an example of the circulation requirements at a bench-only bus stop with additional seating provided.

Benches at bus stops can be a stand-alone amenity inside a bus shelter or additional seating outside a bus shelter. (Fig. 4.10.)

Interior Seating. Interior seating is standard among many manufactured shelter designs. The seats or benches are typically linear and are parallel and adjacent with the rear of the shelter. In some instances, the bench did not extend along the entire length of the shelter. The additional space may accommodate standing passengers inside the bus shelter or passengers in wheelchairs.

Exterior Seating with Shelter. Additional seating outside a shelter is necessary at sites with large passenger volumes or to accommodate increased demand during peak periods. Typically, the additional seating is placed to either side of the shelter and may vary in length, depending upon space availability, demand, or system policy. Crowding, environmental conditions, and claims to personal space affect utilization of benches and surrounding features. (Texas Transportation Institute, 1996, p.E- 22)
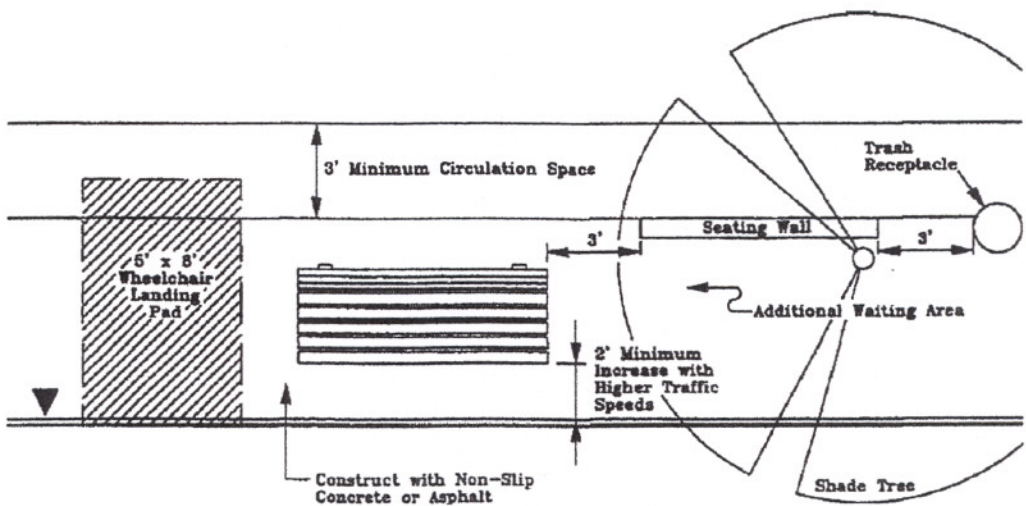
Figure 4.9. Conceptual Bench and Waiting Pad Design   (Texas Transportation Institute, 1996, p. 75)

Figure 4.10. Benches inside a bus shelter or additional seating outside a bus shelter

(http://members.mindinfo.com/maxsport/American_Canyon_Transit_Flosden_a
nd_Canyon_Creek-s.jpg)

4.3.3.4. Trash Receptacles

Trash receptacles can improve the appearance of a bus stop by providing a place to dispose of trash. The installation of trash receptacles is typically a system wide decision and the size, shape, and color reflect transit agency policy. Not all bus stops have trash receptacles. Low passenger volumes may not justify the inclusion of this amenity at a bus stop; however, litter at a site may warrant the inclusion of a trash receptacle at an otherwise low-volume location. (Fig. 4.11.)

Problems can arise when the receptacles are not regularly maintained or when the bus stop is next to a land use that generates considerable trash such as convenience stores and fast food restaurants. In such cases, transit agencies should work with these establishments to define maintenance responsibilities for the bus stop and the area around the businesses.

Figure 4.11. Providing a Place to Trash Receptacles in a Bus Stop. (http://members.mindinfo.com/maxsport/FTHL-Shelter_at_Claremont_TC-s.jpg

Recommendations regarding installing a trash receptacle at a bus stop are as follows:

- Anchor the receptacle securely to the ground to reduce unauthorized movement.
- Locate the receptacle at least 60 centimeter from the back of the curb.
- Ensure that the receptacle, when adjacent to the roadway, does not visually obstruct nearby driveways or land uses.
- Avoid locating the receptacle in direct sunlight. The heat may encourage foul odors to develop (Texas Transportation Institute, 1996, p.80).

Figure 4.12. shows the minimum circulation and separation requirements for trash receptacles at bus stops.

4.3.3.5. Phones

Phones at bus stops offer many potential benefits for bus passengers. Passengers can make personal and emergency calls while waiting for the bus.

Transit agencies should review the potential consequences of installing a phone at a bus stop prior to installation. When locating a phone at a bus stop, the place of phone should not obstruct other pedestrians' passing and separate the phone and the bus stop waiting area by distance when possible.

Figure 4.13. shows a phone at a bus stop.

WITHOUT BUS SHELTER
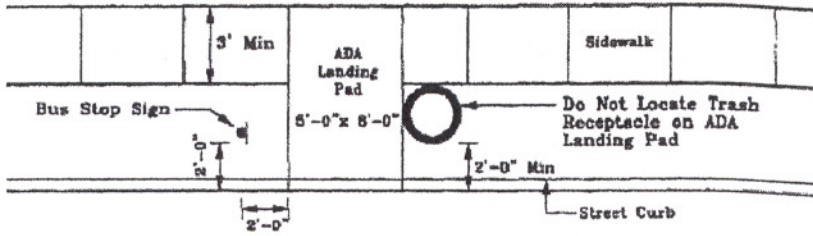
WITH BUS SHELTER
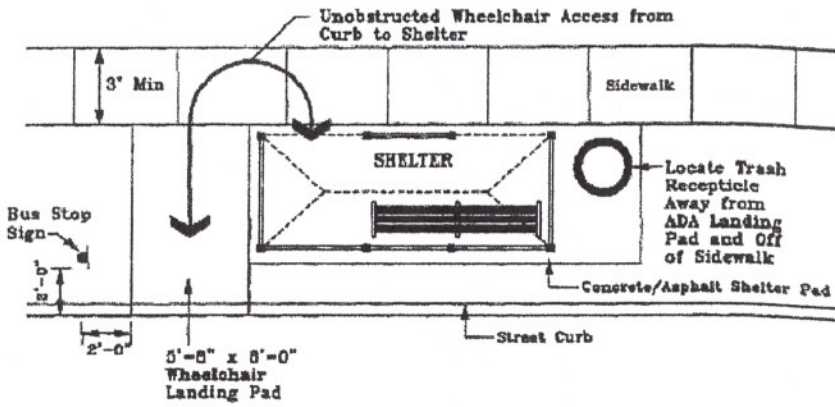
Figure 4.12. Trash Receptacle Placement Guidelines   (Texas
Transportation Institute, 1996, p. 81)

Figure 4.13. Example of a Phone at a Bus Stop
(http://members.mindinfo.com/maxsport/

4.3.3.6. Lighting

Lighting is an important amenity at bus stops, in particular during the winter when daylight is limited Lighting affects bus passengers' perception of safety and security at a bus stop, as well as the use of the site by non-bus passengers. Good lighting can enhance a waiting passenger's sense of comfort and security; poor lighting may encourage unintended use of the facility by non-bus passengers, especially after hours.

Cost and availability of power influence the decision to install direct lighting at a bus stop. Direct lighting is expensive and difficult to achieve at remote locations. When installing direct lighting at a bus stop, the fixtures should be vandal proof but easily maintained. For example, avoid using exposed bulbs or elements that can be easily tampered with or destroyed.

A cost-effective approach to providing indirect lighting at a site is to locate bus stops near existing street lights. When coordinating bus shelter or bench locations with existing street lights, the minimum clearance guidelines for the wheelchairs should be followed (Texas Transportation Institute, 1996, p.84).

4.3.3.7. Advertising

Many transit agencies have paid advertising in bus shelters to supplement funding and to provide other benefits. An advertising-in-shelters program provides the opportunity to install bus shelters at bus stops that otherwise would not receive one. As part of the contract, the advertising company installs the shelter or kiosk. Other benefits of this program include regular maintenance of the bus stop shelters and facilities, including trash removal and installation of interior lighting at selected sites, by the advertising agency. The advertisements are placed on panels attached to the bus shelter to take advantage of the visibility that the bus stop receives from passing traffic. Back-lighting is sometimes used to display the images at night. Advertisements do not necessarily have to be attached to the shelter. (Fig. 4.14.)

Issues associated with advertisements placed on shelters and kiosks include compatibility with local land uses, ordinances, and safety. The signs can conflict with color schemes or limit views of adjacent store fronts. Advertising at bus stops must also comply with local sign ordinances, which may hinder installation in some communities (Texas Transportation Institute, 1996, p.704).
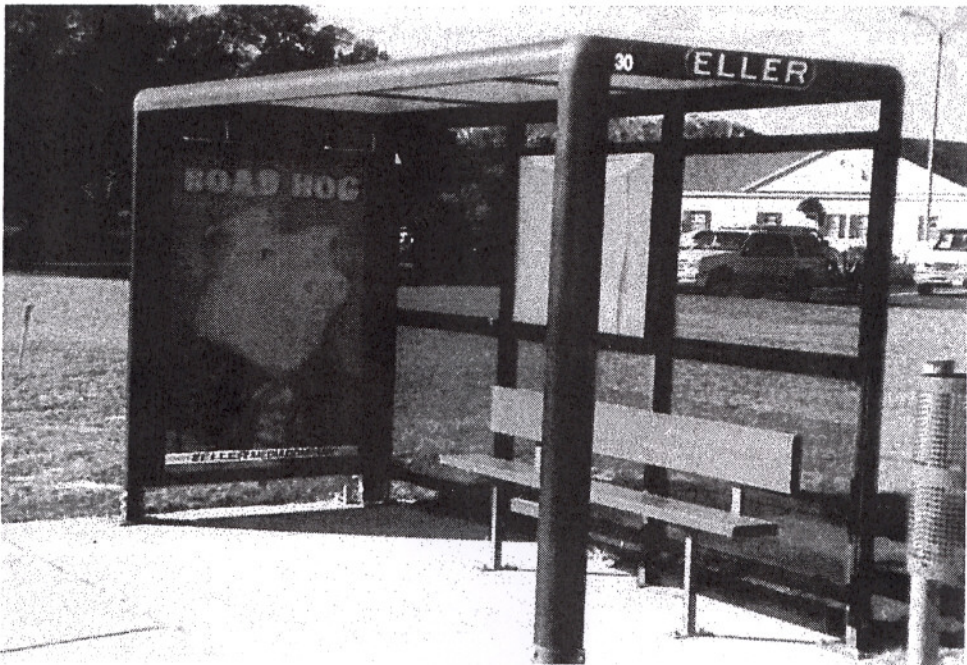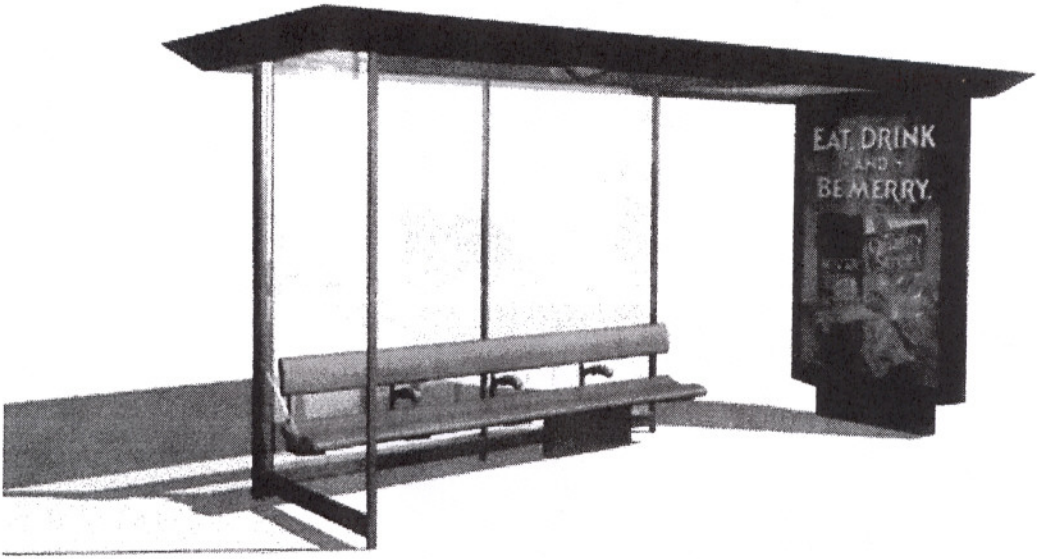
Figure 4.14. Advertising at Bus Stop (http://www.adshel.com,
http://www.scenicflorida.org/photos/busroadhog.jpg)

Passenger and pedestrian safety and security are of greater concern at shelters with advertising. The advertising panels may limit views in and around a bus stop, making it difficult for bus drivers to see passengers. The panels can also reduce incidental surveillance from passing traffic. To prevent restricted sight lines, advertising panels and kiosks should be placed downstream of the traffic flow. An approaching bus driver should be able to view the interior of the shelter easily. Indirect surveillance from passing traffic should be preserved through proper placement of the panels (Fig. 4.15.).
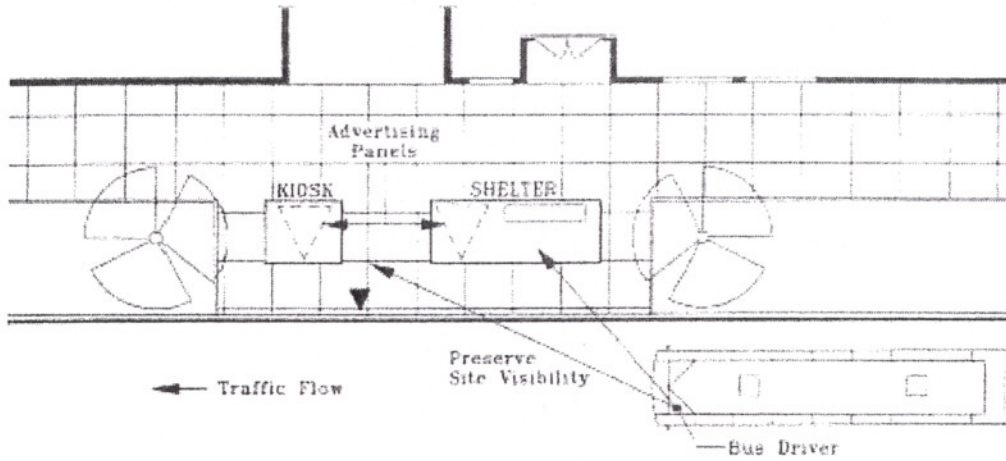
Figure 4.15. Placement Recommendations for Advertising Panels and Kiosks (Texas Transportation Institute, 1996, p. 71)

4.3.4. Materials of Bus Stop Elements

Various materials can be used to construct a bus stop. The best materials are those that are weather-resistant, can withstand continual use, and can be easily maintained. The ease with which a particular material can be vandalized can reduce its desirability; easy-to-clean materials are desirable. Primarily, wood, metal, concrete, glass, and plastics are used at bus stops.

Wood, sometimes used for benches, is rarely used to construct other elements because it is easily vandalized and weathers badly. (Fig. 4.16.)
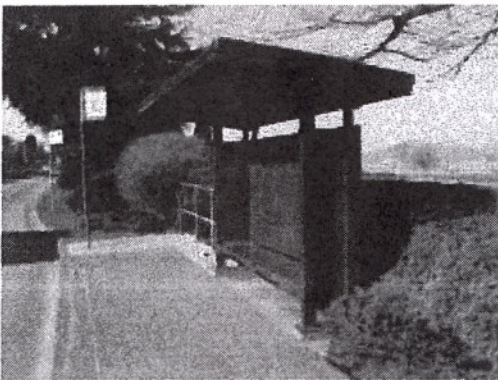
Figure 4.16. Wood Bus Stops
(http://www.cityvancouver.bc.ca/engsvcs/streets/furniture/bus.htm)

Metal is frequently used to construct shelters, benches, bike racks, and trash receptacles. Aluminum, although fairly inexpensive and easy to work with, is soft and easily scratched. Its high recyclability makes it a target for theft by unscrupulous recyclers. As with any item or material, objects should be properly affixed to prevent/discourage unauthorized removal. Metal, in combination with a plastic coating, is a good material for benches, especially when a wire mesh design is used. The design resists everyday wear and tear and graffiti. (Fig. 4.17.)

Figure 4.17. Metal Bus Stops
(http://www.cityvancouver.bc.ca/engsvcs/streets/furniture/bus.htm)

Concrete, an excellent non-slip surface, can be easily poured on site to construct sidewalks, waiting pads, and connections between the stop and the curb. Concrete is too heavy and cumbersome to use in other elements at a bus stop. The best use of concrete at bus stops is in the paving. (Fig. 4.18.)

Figure 4.18. Concrete Bus Stop
(http://www.brama.com/travel/pics/bstop5.jpg)

Plastic is used for paneling and roofing on shelters. The material is lightweight and can be installed with minimal effort. Clear plastic permits the interior of the shelter to be visible from a distance, which enhances security. Depending on the desired effect, plastic can be frosted to reduce the amount of sun entering the shelter or left clear to permit sun exposure. A major disadvantage of plastic is that it is easily damaged or destroyed by vandalism—the material can be scratched or kicked out from its holdings. Plastic declines over time by becoming translucent and scratched, and harsh chemical cleaners can expedite the decline (Texas Transportation Institute, 1996, p.88). (Fig. 4.19.)

Polycarbonate plastic is readily available, can be cut to size, and is almost impossible to break. It also offers the highest degree of vandal-resistance in terms of breakage. Disadvantages include that it is the most easily scratched, it requires deeper than normal framing because of its flexibility, and is most easily damaged by graffiti. It is also more expensive.

Figure 4.19. Plastic Roof at bus stop in Cape Town
http://www.hd.org/Damon/photos/places-and-sights/-more2000/-
more02/SouthAfrica

Mar resistant polycarbonate has all the attributes of regular polycarbonate but adds increased resistance to abrasion. It has some degree of ultraviolet stabilizers, and is also the most expensive. (Tolliver, 1993, p.3)

Tempered glass is primarily used for side panels on shelters. Visually, the material is more pleasing than plastic and withstands environmental demands better than plastic. Unlike plastic, the material is not damaged by repeated cleaning; broken glass, however, can create a hazard for waiting passengers (Texas Transportation Institute, 1996, p.88). Wire glass or laminated resistant glass. (Fig. 4.20.)

Acrylic is that tends to be inexpensive, is easily available, can be cut to size, and is somewhat resistant to breakage. Disadvantages include that it can be scratched and, over long periods of time, may deteriorate as a result of exposure to ultraviolet radiation. Care must also be exercised in cleaning to prevent damage (Tolliver, 1993, p.3). (Fig. 4.21.)

Figure 4.20. Tempered Glass is Primarily Used for Side Panels On Shelters.
(http://www.vitruvio.ch/arc/masters/foster.htm)

Figure 4.21. Acrylic is Used for Roof on Shelters
(http://www.sieger-design.de)

It is given advantages and disadvantages of materials for bus stop elements on Table 4.2.

Material	Advantages	Disadvantages
Wood	• Is used to construct benches • Is repaired or replaced easily	• Weathers easily • Can be vandalized easily
Metal (Aluminum)	• Resists weathering • Can be used to construct multiple elements at a bus stop • Can be inexpensive	• Can be scratched easily (vandalism problem)
Concrete	• Can be installed as a non-slip paving surface	• Is too heavy and cumbersome for use other than paving
Plastic	• Is lightweight • Allows unobstructed view into and out of shelter • Can be formed into different shapes	• Declines with exposure to sun and repeated cleaning • Can be scratched easily
Glass (Tempered)	• Withstands environmental demands better than plastic • Can be cleaned easily • Can be perceived as more attractive than plastic • Allows unobstructed view into and out of shelter	• Can be broken, which can present a safety hazard to patrons

Table 4.2. Advantages and Disadvantages of Materials   (Texas   Transportation Institute, 1996, p.89)

4.4. A Case Study of Bus Stop Design

General criteria about the design of the street furniture were determined and studies about the function, location, dimension and materials of the bus stops were done. a design of a bus stop, on which all these data were tested, was brought up as a final product. The reason for re-considering the bus stop design is beyond producing a version of the existing bus stops that contain exactly the same functions, but designing a new bus stop that can meet the new requirements of today's cities including services of changing and developing technologies. Surely, functions, production and mounting problems of the existing ones were considered and tried to be solved, too. However, technological possibilities and how they can be used by public in common places were determined as a primary problem.

In the design of this bus stop they were certain points that were considered; it should be recognized easily in urban space; should be very resistable to environmental factors because they will be used by many people; should be flexible because it will be used in various densities and should provide different combinations; and its cost is important because it will be used by public.

4.4.1. Characteristics of the Elements Used in the Bus Stop Design

As mentioned before, a bus stop should involve certain elements, such as: shelter formed by roof ad window panels; information signs, route signs, sitting elements, lighting elements and trash receptacles. Besides these elements, telephone, electronic ticket boots, information machine, etc. will take place, when information machine, etc. will take place, when needed.

Before determining how and at which bus stop these elements take place and how they will be integrated into the bus stop, each element is considered separately and information about function dimension and materials of these are examined.

The basic element of the bus stop is Main unit. Main unit is both basic structural element of the shelter and also the bus stop. In other words, even if no other elements exists, column can represents the bus stop by itself. Main unit is formed by two steel parts. (reinforced by fiberglass) covered by polyester and at the front and back galvanized sheet iron was used. Main structural steel elements will be anchored to the ground by metal plaque. Main unit will carry the shelter's roof window panels and seats. (At type A bus stops secondary structural elements will be used, too.) Rainwater that gathers on top of the shelter will be discharged by an installation system placed within the main unit. Besides these all the cable connections of telephones , lighting and

electronic machines will be placed within the main unit, too. So, main unit also will have the function of installation shaft. On to the main unit, according to the needs of the location, of the bus stop, telephone, information machine, electronic ticket boots will be mounted. At the sheet iron panels at the front and back of the main unit, the places of these machines were determined.

Shelter forms from a roof and window panels. This structure that forms the protection panels at the sides and above is produced of aluminium profiles. Semi-transparent acrylic panel profiles are mounted to the roof. At the sides "security glass" with 12 mm will be used. These panels will be mounted to the bus stop according to the wind. In this sense the bus stop has a very flexible plan.

One of the side panels was planned as an advertisement panel. This advertisement panel was dimensioned according to standard advertisement posters, formed of aluminium profile frame and lighted from within. This panel is carried by primary and secondary structural elements. U frame opens very simply and makes it possible to change the advertisement posters.

Route information sign is also one of the basic elements of the bus stop. It takes place at each type of bus stop. Route sign will be placed 2.30 m high, at the direction of buses and minimum 1.20 m away from the bus shelter. On the route sign the name of the bus stop, the logo of bus operators and the names of bus routes at the eye level (about 1.50m high) take place. Route sign is made of aluminium profiles and aluminium panels. Aluminium panels on which the names of the bus stops were written can be changed when necessary. The times of buses can be seen on a digital screen mounted on the main unit.

Trash receptacles is also placed at the bottom of the route sign. This may the smell and dust stay away from the shelter. Trash receptacles is resistable to sun light, is made of high density polyethylene, can be opened and closed with only one hand, and has about 30lt capacity.

Seat, in minimalist approach, is mounted at the back of the seat that is profiled shaped. This structure is connected to the main unit which is the main element of the shelter. The sitting element can be made of wood or aluminium panels. Here easy mounting was considered as an important point.

For evening lighting, a lighting element is mounted on the main beam. Besides, main unit and advertisement panel will be lighted from within. So, the bus stop will be lighted, sufficiently.

4.4.2. Combination of Bus Stop Elements

One of the most important point in the design process is easy mounting. During the mounting of the shelter an attention was given not to interfere the floor, too much. Since, there will be hundreds of bus stops in a city, to decrease laborship as much as it can be is an important fact. Therefore, as mentioned before, the whole structure is carried by main unit. However, being considered that the environmental factors can put constrain at some bus stop types secondary structural element were jointed.

As emphasized at the beginning of this study, one of the aims of this design is to bring together various urban services at a bus stop. However, it cannot be expected that all of these services take place at each bus stop located with a distance 200-500 meters. So, forming the right combination and deciding on the places of each service, becomes an important subject

Three main combination were formed. The main determinants of these combinations are; whether there is a shelter at the bus stop or not, the size of the shelter, and number of elements at the bus stop. These main types defined as type A, type B, and type C may from sub-combinations according to the combination of various elements and whether certain elements take place or not. After this information, the characteristics of each main bus stop type and how they will take place within mass transportation system is studied.

Type A Bus Stops:

At these types every elements that was explained above, takes place. The main unit takes place on the longest edge of the shelter and at the middle. The places of main units, beams, and advertisement panels are permanent at sub-combinations.(A1, A2, A3, A4) It is possible to increase or decrease the number of seats. Side window panels can be reorganized according to prevailing wind and according to the connections with the pedestrian roads and other pedestrian areas. Type A bus stops will be located at the main terminals, interchange stops and at the places where pedestrian, commerce and office users are in high density. If necessary many type A bus stops can be used together. At a more secondary accesses, type A can only be used at places where waiting time for a bus is very long.

Type B Bus Stops:

It will be used at standard bus stops and at places where user number and waiting time is less than terminal and interchange bus stops. The size of the shelter is smaller and the main unit takes place at the corner of the shelter. At the sub-

combinations (B1, B2, B3) the location of the main unit, window panel and advertisement panel are permanent. If there is no pedestrian passage at the back of the shelter, then window panel may not take place. At the bus stops that take place at the main accesses where waiting time is no longer than a few minutes seats may not take place. Another reason for choosing this type is that it does not cover too much place on the narrow pavements where pedestrian access is very dense. Telephone, information machine, electronic ticket booth will not take place at each type of B bus stops. According to the location of the bus stop and according to the needs and demands, which services will take place where and at what frequency will be determined and added or removed.

Type C Bus Stops:

These are the bus stops where shelter does not exist. Here only the main element of the bus stop, the main unit takes place. They will be used at standard bus stops, like type B. Type C's will especially chosen at the places where the width of the pavement makes it impossible to locate a shelter. Besides, they can only be used at the line-ends, where no passenger is taken. At type C's, electronic service machines will take place according to the needs.

Production, management, maintenance costs and organizations of bus stops, which are one of the commonly used street furniture, reach to extreme ends. Especially usage of new technologies at the bus stops also increases these costs. In the last years, some applications were developed to cover production and management costs. The most prevalent application is; the usage of advertisement panels at the bus stops are preferred by advertisement firms. These advertisement agency take on the production and maintenance costs. With the agreements done with the municipalities, the sizes, dimensions and qualities of the bus stops are decided upon.

The advertisement agency commits that they will do all the production and maintenance services. Firms that give other information services at the bus stops may also contribute to the production and management costs.

Before design process, criteria that should be considered about the location of a bus stop in urban space and production of it as an industrial product are studied. Leading from all of these data a design that can be applied was tried to be done

In this context, the final product's legibility, durability, flexibility (variability according to the conditions of its locations) and its feasibility are determined as main criteria.

CHAPTER 5

CONCLUSION

Above everything, street furniture has a role of simplifying the city life. They have an important role in providing communication in urban space. Both with their own physical presence and by directing human behavior, they gain importance in the formation of urban space. Street furniture that vary each day, can be defined as elements that were presented to common usage, that can be stable, mobile or semi-mobile, that are visual and functional.

They are classified according to their functions, production, integration to the urban system and management. With this classification, the variety of street furniture, and their purposes can be seen in detail, and so the positions they take within the city can be understood better.

The formation process of a street furniture, like in other industrial products, has three main steps; determining the need, design process and production process. However, in the formation of a street furniture usage process can be included, also, as an important step. Formation process being considered in a large perspective also necessitates coordination among different disciplines.

There are many determinants in the design process of a street furniture. It is possible to group them under the titles functional, psychological, technological and economic criteria. Factors that provide integration of street furniture with urban environment are; physical appropriateness, its perception, social and psychological factors in its usage, production methods, materials and economic data. Here, the critical subject is, the user number of a street furniture, when compared with many other industrial products has a wider scale. Within this user scale, people with different ages, sexes and social-cultural structure, disabled people may take place. Besides the variety of users, the street furniture are subjected to usage by many different users. In other words, a street furniture is an element of the social life. Therefore, the cultural and physiological aspects are basic influence points for the design. In a design of a sitting element, when the medium and the dimensions are identified, the specs of the social relations and unique social understanding of intimacy and habits must be carefully examined.

The second critical subject is that street furniture belongs to public. So, usage, maintenance and management steps should be considered, too. Therefore, economic dimension comes out as an important determinant. If the determinant parameters are

large in number, it becomes harder to find an optimum balance between criteria, during design process.

In this study, design of a bus stop was examined in detail. However, it should be taken into consideration that concept of "bus stop" and "bus shelter" are two different concepts. Bus stop defines a place where passengers wait and where the bus parks to take on passenger. In a bus stop activities and elements such as seats, lighting, shelter, information sign, telephone, etc. On the other hand, bus shelter is a structure to protect the passengers from water, rain and wind.

Considering the bus stop design, it is aimed to design a bus stop, in a certain region of the city where specifically it will be present. It's also aimed to design a bus stop model that will be mass produced and that will be easily used all around the city in mass transportation. Therefore, the special characteristic of some region did not possibly determine the design's characteristics. Instead of having personal tendencies, in the design the function and the production cost identified the designs outstanding characteristics. In the design esthetical aims are perceptible in the details and at the conjunctions. In this manner the criterion that needs to be paid attention:

- To provide physical shelter from the prevailing wind and rain to bus passengers using the stop as soon as possible;
- To maximize user safety and security,
- To provide weatherproof mounting for bus passenger information such as timetables and route maps which are readable at all times from within the shelter,
- To provide robust seating for the convenience of several passengers,
- To provide sufficient lighting for the convenience of users during darkness,
- To ensure that it is constructed of material which is sufficiently robust to minimize vandalism and graffiti,
- To minimize the costs for ongoing repairs, maintenance and cleaning,
- To have an aesthetically acceptable form which blends in with the immediate environment,
- To be clearly identifiable as a bus shelter.

Along with the developing technology, life habits and so requirements change. Therefore the form, frequency and quality of services change, too. It is current for street furniture like in other industrial products. With the developing technology, people, in public spaces, may meet their requirements without being face to face with other people, with the help of electronic and mechanical tools. This factor increases the number of street furniture in urban space.

This study is based upon this fact, that a new bus stop design is needed in order to meet the changing needs in accordance with the developing technology. With these changes, bus stops that provide various services by the usage of more than one street furniture are thought as urban service point beyond being just a shelter. In this context besides seating, lighting, shelter elements, electronic ticket desks, boards that shows bus routes, and times, information elements such as advertisements and announcements and communication services such as telephones take place. With the bus stops, that can be accepted as collected service units, service can be provided even at the most remote urban places. When frequent bus stops and the location of bus stops are considered it is not possible that every bus stop can involve all of these services. The dimensions of physical space do not make it possible and also the production and management costs will be affected. Therefore, flexibility has an important place in the bus stop design. The important point here is that while bus stops should have the same language in the whole city, at different points of the city, according to the requirements, should also be able to bring together different elements.

In the design of bus stop, the coordination of these elements was taken as an important parameter. In this study, in the design of a bus stop, the subjects that need to be considered in design process were determined.

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APPENDIX A

THE BUS STOPS PROJECT IN HANNOVER

Andreas Brandoli, Frank .O.Gehry, Massimo Iosa Ghini, Wolfgang Laubersheimer, Allessandro Mendini, Jasper Morrison, Heike Mühlhaus, Ettore Sottsaa and Oscar Tusquets Blanca have designed nine bus and tram stops for Hannover. Beginning in April 1994, the EXPO 2000 city has a collection of architectural products unequaled around the world.

Hannover's "Art in the Public Sphere" project began with a retrospective exhibition of outdoor sculpture from the 'old' Federal Republic of Germany. Called "Up to Now", it targeted the fact that many specific considerations had already been made to art in the public sphere by the development of outdoor sculpture in the past. The BUSSTOPS project, which are attracted international attention even in its early stages, is a step in the latter direction. It is at the same time a step forward for art in the public sphere, not just in respect to the aesthetic discussion about the disappearing boundaries between art, architecture and design, but in respect to a new dimension of art-its usefulness and, at the same time, the unique artistic language and highly individual interpretation of the "bus stop" theme. (Romain, 1994, p. 7, 8)

"In the case of BUSSTOPS, this clearly and simply means experiencing the time you wait for bus or tram not just as wasted time, but as a short break at a special place, as a bid to your senses. This may not improve the whole world, but it makes it more pleasant and more personal for that moment when the passenger can feel he is being looked after and taken seriously, being valued in the best sense of the world. " (Romain, 1994, p. 8)

There is nothing like Hannover's BUSSTOPS anywhere in the world. They are a pioneering step taken by the artists who designed them, opening up new areas to art. Retrospective references to basic questions about the aesthetics of daily usage and art as a sign and a service. The BUSSTOPS suggest a path for art in the public sphere which might just run parallel to that of the autonomous work of art. The one can not replace the other, but they can complement each other. The BUSSTOPS are not only an aesthetic but also an instrumental intervention in the environment. As with all bus stops , their functions makes sense to everyone. Their construction, like that of all other works of art in the public sphere, remains an aesthetic challenge. The BUSSTOPS articulate possible differences in the use of potentially similar things and, in their own way, resist the tendency to urban synonymy and indifference.

The nine designers have all made one or more visits to Hannover to chose their sites from among the pre-selected list of bus stops. Because of their inspections and

discussions, an awareness have arisen of places on streets and plazas which have seldom been the object of local attention. (Romain, 1994, p. 9)

B.J. Archer is said that about Brandoli' bus stop "So here we are in Hannover, waiting under the canopy of this most enchanting bus stop, which looks like some friendly armadillo stopped in its tracks to wait for humans to gather under its woven skin. How like Frank to break the code of the urban waiting room and make it seem like a canopy one might find in a rain forest."

For his BUSSTOP at the university, Andreas Brandolini carefully considered the special situation there. It can be hoped that this glance back at the development of Brandolini's work is sufficient proof of his persistence in hanging on to "knocked knees" for his BUSSTOP.

An important contribution to this BUSSTOP, which is unusual in both its form and its content, is made by Mother Nature herself. The bushy top of flourishing vegetation not only presents the first floor neighbors with a front yard, but also wiggles the sign of the times, the designer's green thumb, at all of people.

http://www.uestra.de/busstops/art/ brandolini10.jpg

FRANK O. GEHRY

"Frank. O. Gehry's design shatters all common nations about the urban vocabulary. One could imagine the framework for the roof being made out of bamboo poles. And yet it is precisely this exotic illusionism that Gehry not aiming for, but instead at the distinction from the customary, at the distinction between organic form and surrounding architecture which is so striking in the urban context, without making direct reference to nature." (Romain, 1994, p. 67) While Los Angeles is home to some of Frank Gehry's largest works, Hannover is home to one of his smallest constructions: his BUSSTOP at Braunschweiger Platz. The Italian craftsmen who created the bus stop respectfully called it "Frank's Dino".

Sheet iron and light are the components of Gehry's BUSSTOP. Just as Bellini brought light to the canvas, he captures it in his architecture. On the one hand, by means of a brilliant inclusion of daylight in parts of the construction where light is not expected. On the other hand, Gehry has the sun and the sky play on specially created surfaces, such as at the Frederick R. Weisman Museum in Minneapolis.

http://www.uestra.de/busstops/art/ gehry10.jpg

In the middle of the night Gehry's BUSSTOP arrived in Hannover on a flatbed trailer, the roof - "lizard-like", "armadillo-ish" and however all the other attempts to describe it sound - made of stainless steel sheets which had been edged several times, spherically formed and plated then mounted on a construction made of nickel-plated steel. Gehry's roof had presented overwhelming views of the alpine sky. The way it captures the sky, more a dome than a roof, can now be seen in Hannover. (http://www.uestra.de/busstops/gehry.jpg)

JASPER MORRİSON

"Design is not done with rules, but with intuition. Intuition never lies."— *Jasper Morrison*

Morrison's "simplicity" is usually the exact opposite. The designer's very special, almost artificial standards require very special solutions. Morrison's design presented the construction engineers with one puzzle after another concerning the precision and the proportions it demanded. (http://www.uestra.de/busstops/morrison.jpg)

http://www.uestra.de/busstops/art/morrison10.jpg

For example, the posters which go into the showcases on bus stops are standard-sized. This dictates the size of the showcases. And of course Morrison had provided for this format in his design. However, the walls of his BUSSTOP were not to be as thick as necessary for the installation of a standard showcase. So the construction engineers had to come up with a completely new thin showcase which bordered on the impossible in terms of construction technology.

Morrison's stainless steel shell reminds one from distance of the forms of a bus which has been cut off at one end: an object with no frills, the stringency of which hints

at the design formulated in the Bauhaus and expanded in Ulm. The bus stop can present itself as a purely useful form, because no playful elements distract from it, and the intrinsic value of the form is not suppressed. The stringency and the fascinating simplicity of this development are clarified in Morrison's stark sketches. (Romain, 1994, p.68)

MASSIMO IOSA GHINI

Massimo Iosa Ghini's BUSSTOP. For the waiting passenger, the shrill green top, asymmetrically modeled of synthetic material, is a roof. For the birds who use the wooden birdhouse at the bowsprit as a diving board, it is an outdoor pool. Even though very little water collects up on the roof, the rain is drained by a pipe through the concrete wall to the flower-bed which it waters. Behind the waiting passenger and to the rear of the palace, the nice concrete wall is soon to be covered with ivy.

He used three whole sheets to formulate his design for Hannover, and his work was complete from the very beginning. It looks fast, and streamlined, and that is exactly how it seems to have been conceived.

In 1986, Iosa Ghini joined 14 other architects in Bologna to initiate "Bolidism", a new artistic philosophy that reflects new ways of using time and space and stresses mobility in a "fluid city". At this BUSSTOP, the Bolidist passenger waits for his modern day spaceship to arrive. (http://www.uestra.de/busstops/ghini.jpg)

http://www.uestra.de/busstops/art/ghini10.jpg
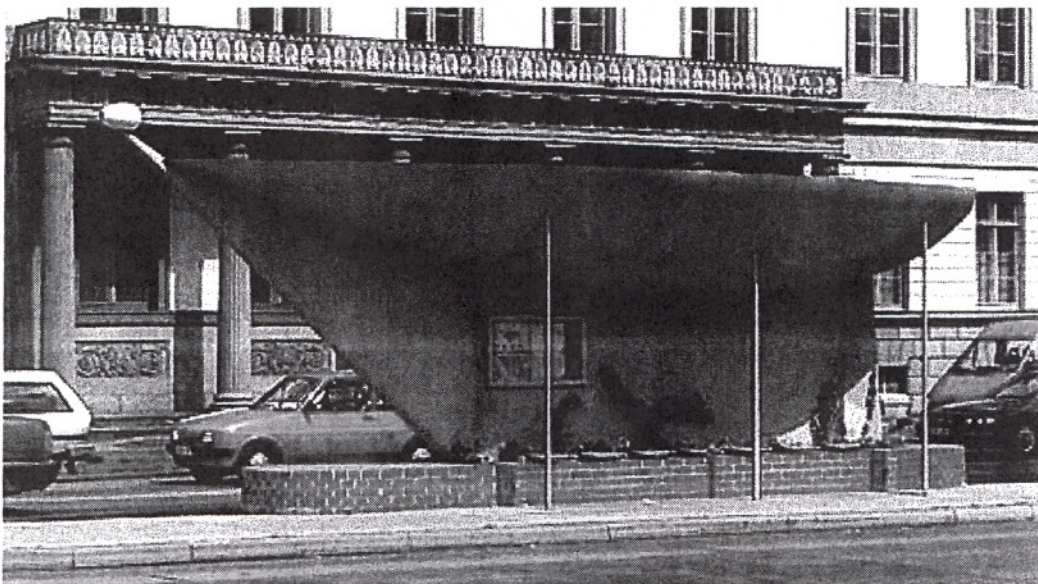
Massimo Iosa Ghini integrates nature by having ivy grow up behind the seats around the supporting center of the waiting room- a place for nature, but only a tenacious weed that clings to things, with very little floral popularity at the moment. The style of his bus stop with its boat-lile, asymetrical hollow basin as a roof formulates not only the pure expansion, but also the dynamics of the city, an island which doesn't dam up the currents of urban life but slows them down for a moment, making them visible, by means of its aerodynamic lines, as the immaterial reality of the channels of communication. Waiting at Iosa Ghini's bus stop, people are protected from weather, but not from the city. (Romain, 1994, p.68)

WOLFGANG LAUBERSHEIMER

Whether or not waiting rooms are called "weather protection roofs" (as they are referred to in official German) or BUSSTOPS, you wait. As waiting is stigmatized as boring or utterly superfluous, Wolfgang Laubersheimer concentrated on inventing appropriate waiting room entertainment. What is striking about his approach is that the idea meant more to him than formal considerations.

http://www.uestra.de/busstops/art/Lauber10.jpg
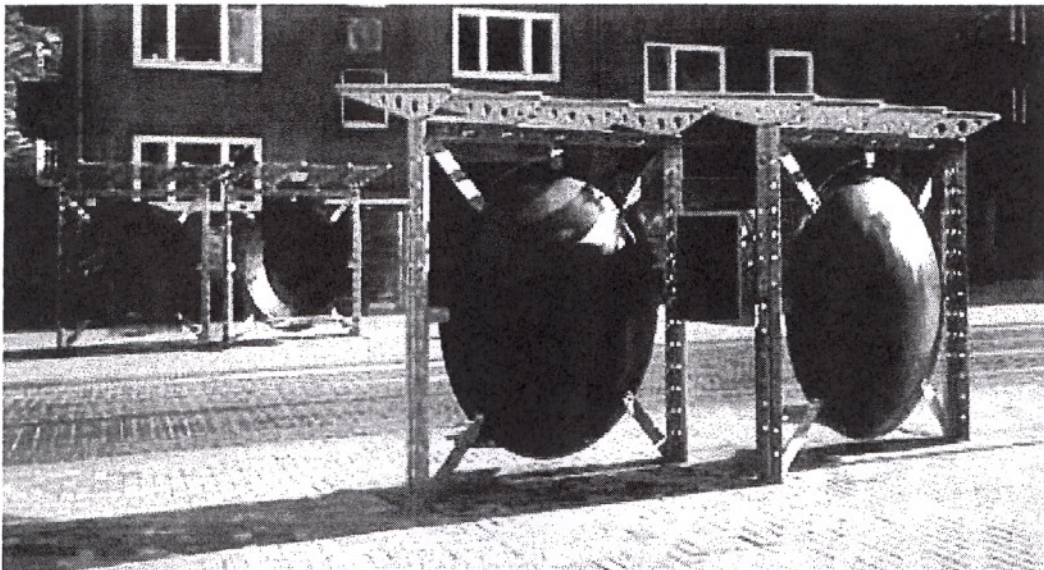
Laubersheimer developed the form of his BUSSTOP around the communications principle of a whispering gallery, a domed room in which the words whispered at one place can be heard at a place a particular distance away, transported by reflection. At his BUSSTOP, using spherical segments placed opposite to one

another, it is possible for people to talk to each other while sitting yards apart from each other waiting for different trains.

For the construction of the membrane-like surface of the parabola, Laubersheimer made use of the most advanced laser technology. By choosing the tram stop on Nieschlagstraße, a peaceful residential area with a playground around the corner, he picked the ideal location.

His seats are installed in front of great round steel shell which are suspended in wide steel frames like the membrane of a loudspeaker. And in fact, Laubersheimer is fascinated by graphic form and by the amplifier effect which makes communication possible without shouting across the tracts to the identical boxes on the other side. Boxes refers here to the simple form of the transparent protective wall; nobody is jammed in here, people are protected in the best possible way from their weather. (Romain, 1994, p68) (http://www.uestra.de/busstops/lauber.html)

HEIKE MUHLAUS

A giant wing protects waiting passengers at Heike Mühlhaus' BUSSTOP across from the Maschsee, an artificial lake near the Sprengel Museum. Mühlhaus designed this roof with an organic form connected to ideas of buoyancy, wings, and protection. And she stuck this "wing" on a sky-blue slanted tower on a triangular foundation. At the very last minute, it turned out that the geography of the site made it necessary to drive in 18-foot pilings to safely support the construction.

Mühlhaus' winged BUSSTOP has origins which go far back into her oeuvre. It began with the purchase of a stuffed partridge some time at the end of the 1980s, goes on with a winged amphora called Hermes, a winged lamp which she presented as a prototype in Herbert Jakob Weinand's Berlin Design Gallery at Christmas 1989, right up to "Birds", a light fixture which has become the most publicized best-seller in the Swiss "Belux" lamp collection.

By stressing aspects of traditional sculpture, she opens up different levels of interpretation than might arise in a work based primarily on architectural criteria. It is therefore necessary to consider the sculptural qualities of her BUSSTOP. As so often in her work, Mühlhaus has created a vast panorama of associations. The daytime sky presents basically friendly and buoyant associations in the glass tower and in the silver-grey "wing". At night, on the other hand, the blue of the sky glows like the depths of the sea and opens up other spaces to our imagination.
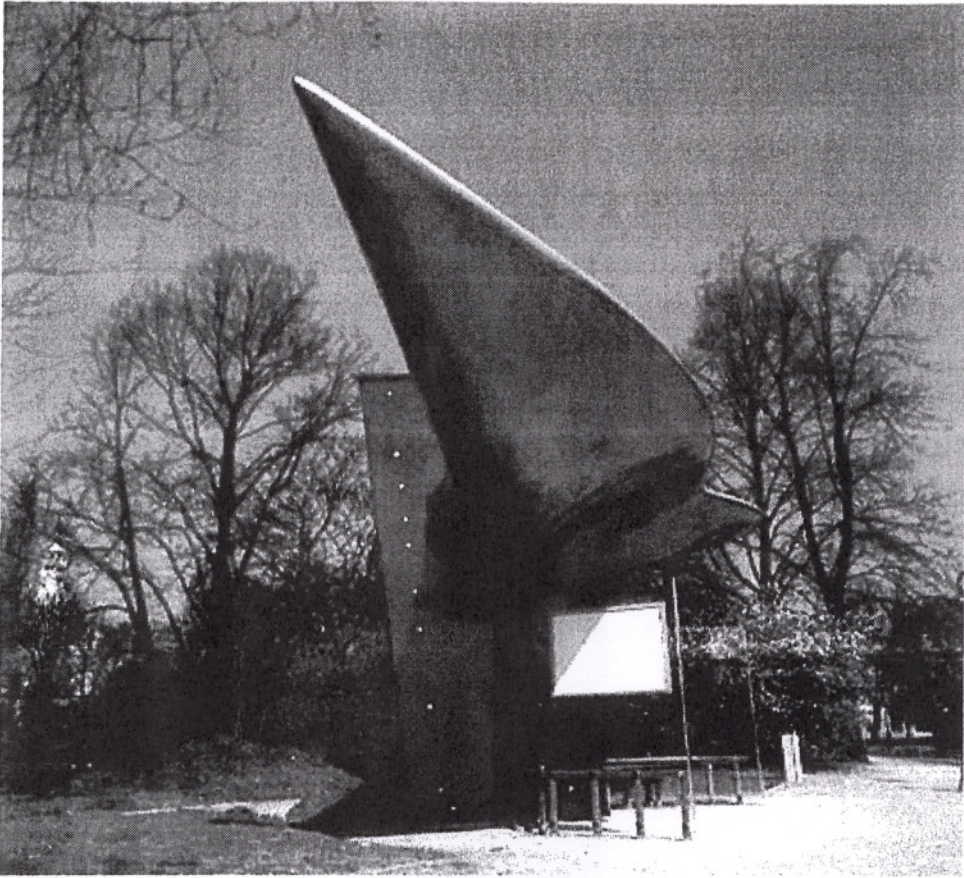
Heike Mühlhaus's bus stop with its glowing glass tower, supporting a silver trajectory in the form of an airplane wing which has been liberated from its physical limitations and forms a roof for the shelter, testifies, it must be said, to a different presence of such dynamics. Motion is stressed by the sweep of the tranperant protecting wall around the seats. It is like flying and ice-dancing, like decoration and imaginary stage settings, but not with the distant flair of a film screen as a banal setting for everybody. (Romain, 1994, p68)

(http://www.uestra.de/busstops/muhlhaus.html)

ETTORE SOOTTSAAS

At Königsworther Square, a typical non-place which the residents of the city have sacrificed to automobility, Ettore Sottsass achieves the impossible with his bus stop atrium and its epithatic XX. Century profile in yellow steel mounted on a black and white console of artificial stone. The symbolic clarity, the complexity of its volume and

the bright colors in a very gray place have given focus to a non-place. It adds to the Königsworther traffic lane a goal worth reaching on foot.

Sottsass was not content just to put a new waiting room in front of the Kestner Museum. He designed the entire plaza. Unfortunately, the re-routing of the bus line put a stop to his plans for the plaza. Three models emerged from his pencil drawings, two of which eventually merged into the design for the BUSSTOP. If you compare Sottsass' drawings to the model which was developed from them, the plain sketches prove to be remarkably accurate in terms of the final proportions and other formal aspects.

A secure haven for the pedestrian, open 24 hours a day. At night, it's like being under Edward Hopper's ice-cold neon light. In the daytime it's is apparent how comfortable people can feel under the roof of a bus stop. Free and tall and taken seriously. Could it be that Sottsass' perception of things grants us more square feet than we might have granted ourselves? (http://www.uestra.de/busstops/sottsass.html)

http://www.uestra.de/busstops/art/Sottsass10.jpg
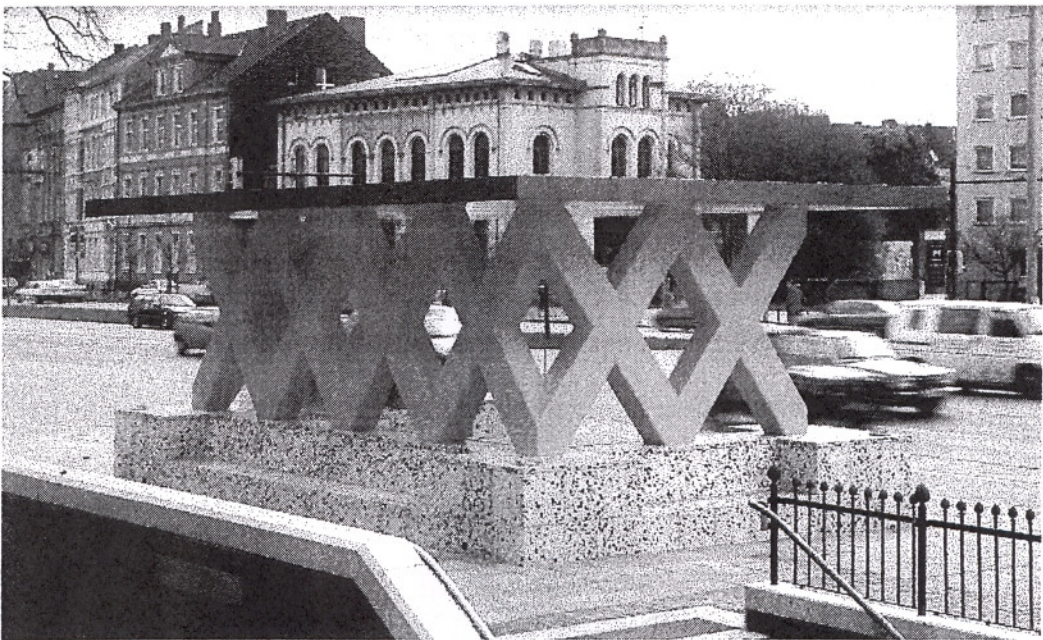
Between the two side walls behind the seats there is glass: protection which does not dide inside from outside. An urban junction for a short stop and passage, a real one and one like the pictures of surroundings which pass trough the glass and are reflected in it at the same time. The pointed towers also proclaim a delight in celebration, but not in stiff formality.

The surroundings of the stop, which Sottsass kept in mind in the design, are taken into consideration in the size and proportions. It can be said without blushing that Sottsass's bus stop lends unobtrusive dignity-to the site on which it is to be installed, to the people who are to experience it as an atrium, not pushing them around but protecting them. Sottsass has created a waiting room for himself. He would get on, but he would not stay there. It was a classical moment of repose- just as it should be! (Romain, 1994,67)

OSCAR TUSQUETS BLANCA

In contrast to Alessandro Mendini, who was not at all bothered by having to plan for one of the ugliest urban corners in Hannover, Oscar Tusquets Blanca was on the lookout for a "pretty", aesthetic site from the very beginning. He immediately liked the atmosphere around the Stadthalle at Theodor Heuss Platz with its symmetrical setting, bordered on both sides by a lane of trees, leading up to the great copper dome of the city center. Unfortunately, the stark symmetry of the park had been blemished by an oversized green ÜSTRA waiting room and the removal of five trees during the 1970s. Tusquets clearly stated his intention to do away with this blemish.

Not only did Tusquets spontaneously decide on this site; he also knew at the moment of the first visit there what the general contours of the design should look like. He insisted that the trees be replaced, at least at the end of the walk, to reinstate the symmetry which had been lost. His design was to fit carefully into this restored symmetry.

http://www.uestra.de/busstops/art/Tusquets10.jpg
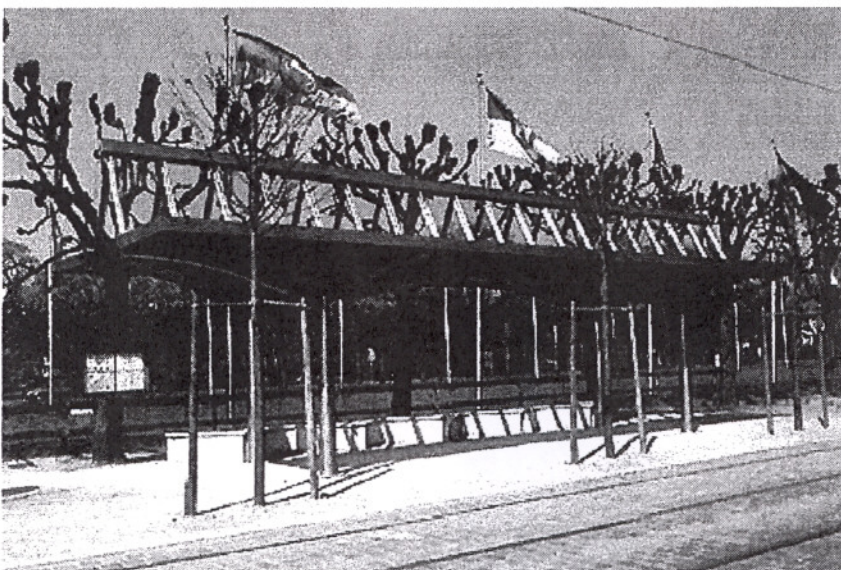
Resting on four conic stainless-steel columns, a long roof stretches out along the avenue. Due to the pointed roof and the light it lets in through, the true size of it tends to fade into the background. The people who use the BUSSTOP generally experience the roof as illuminated gables which guide your eyes to the sky and the crown of linden trees on the avenue. In a self-supporting construction, the gables connect the longer sides of the steel and paneled construction whose graceful wave-like curves strengthen the impression of transparent levity. A design of classic beauty and elegance. (http://www.uestra.de/busstops/tusquets.html)

ALESSANDRO MENDINI

With the tenacity of a warrior, Alessandro Mendini tackled what might be considered the most difficult challenge: a waiting room for the street-car stop at Steintor/Kurt Schumacher Straße. It is so difficult for two reasons. In the first place, this area has two extremely narrow, 50-yard-long boarding areas. Secondly, the surroundings can modestly be referred to as a catastrophe of urban planning.

Alessandro and his brother Francesco created four concrete proposals for the construction, and we had to choose one. In all four designs, the street-car is raised to train level. A street-car stop is turned into a street-car station. Originally, Mendini had indicated various possibilities for colors in the sketches, but in the end he turned to yellow and black, the combination Germans know about from the "Universal Museum", his project for the documenta 8, which today belongs to the Groningen Museum.

When we now look at Mendini's BUSSTOP, which for some unknown reason people have come to call "Defiance Castle", we experience a clear and cheery structure. But not all the response has been positive, and special attention should be paid to the constant reference that this BUSSTOP "doesn't fit in with the surroundings". Mendini figured he would get reactions like that. Perhaps the mumbling and muttering are but an expression of fleeting irritation about a suspiciously kitschy and perfect design and its elegant craftsmanship by first-class enamelers. (http://www.uestra.de/busstops/mendini10.html

The bus stop models demonstrate this in varios approaches to and interests in urbanity.

http://www.uestra.de/busstops/art/mendini10.html
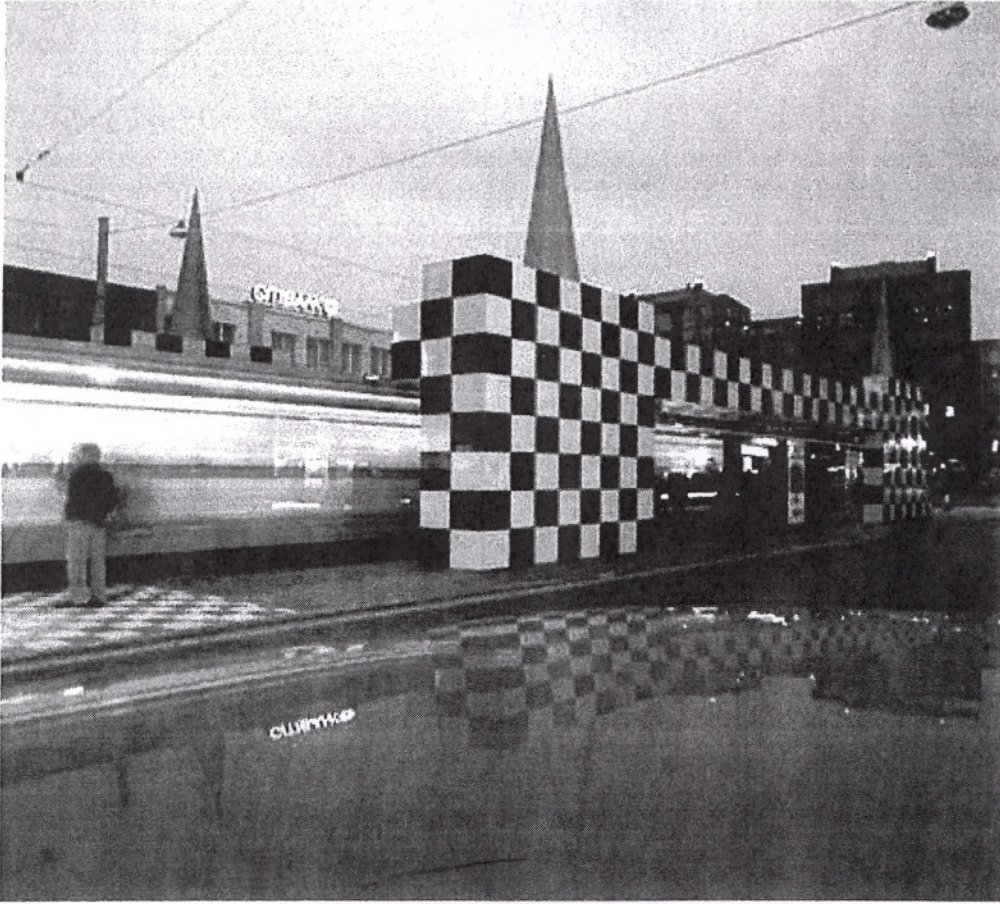
APPENDIX B

EXAMPLES OF BUS STOPS IN DIFFERENT COUNTRIES

1. Australia

http://www.arkitekturmuseet.se/bus/kur/kur4.html

http://www.adshel.com/adshel.asp

2. Canada

http://www.city.vancouver.bc.ca

3. China

http://www.adshel.com/adshel.asp

http://www.corbis.com

4. Denmark

http://www.adshel.com/adshel.asp

http://www.euroweb.net/jüpiter/busstops.htm

5. Egypt

http://www.corbis.com
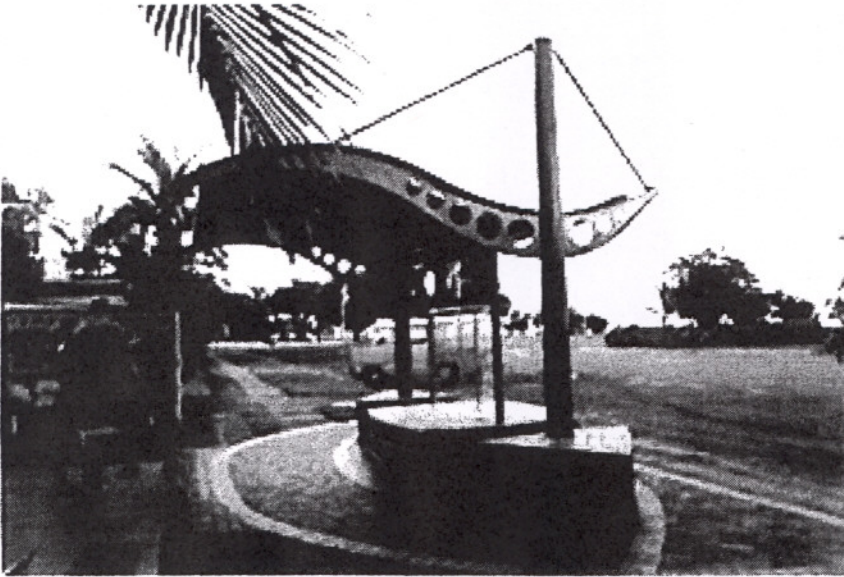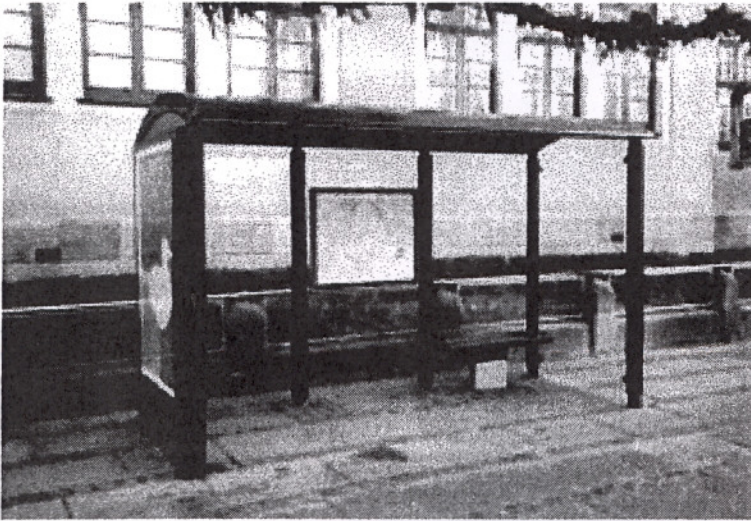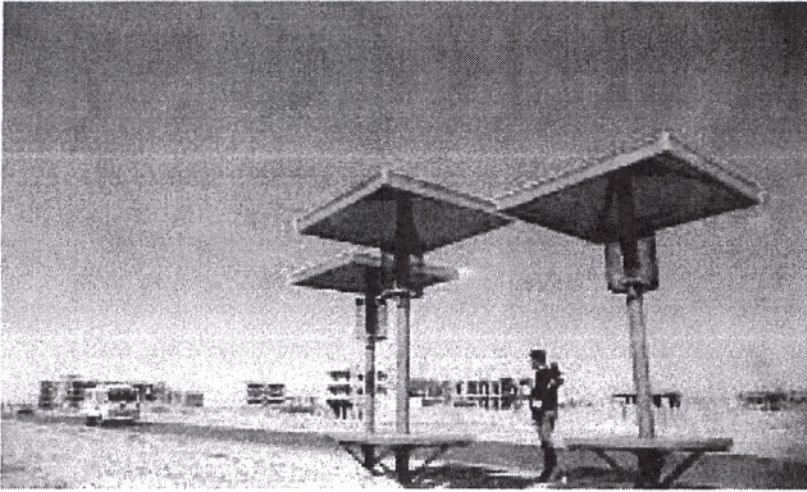
6. Ecuador

Galapagos Ecuador

http://www.arkitekturmuseet.se/bus/kur/kur4.html

7. France

http://www.vitruvio.ch/arc/masters/foster.htm

http://www.vitruvio.ch/arc/masters/foster.htm

http://www.adshel.com/adshel.asp

8. Germany

9. Holland

http://zwarts.jansma.nl/Projects-e/002/

10. Indian

http://www.arkitekturmuseet.se/bus/kur/kur3.html

11. Ireland

http://www.adshel.com/adshel.asp

12. Israel

http://www.corbis.com

http://www.community.webshots.com/photo/13256479/13256876DBxnPSixgF
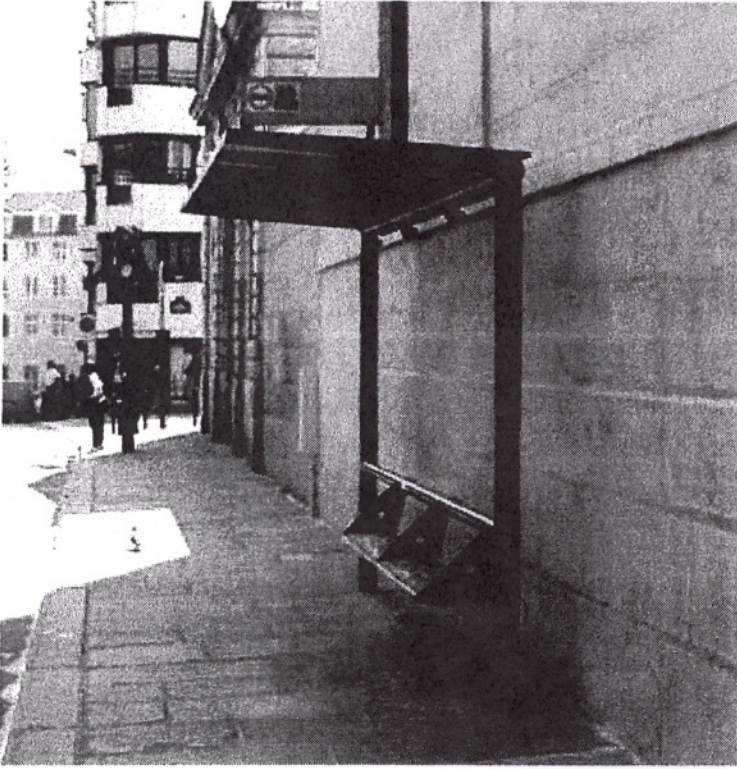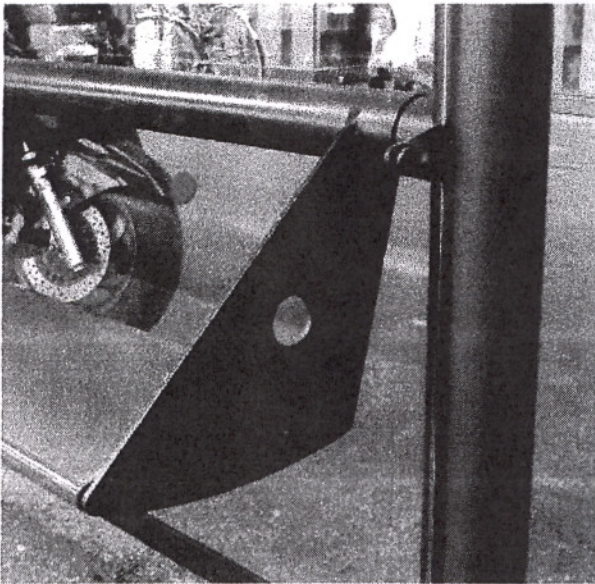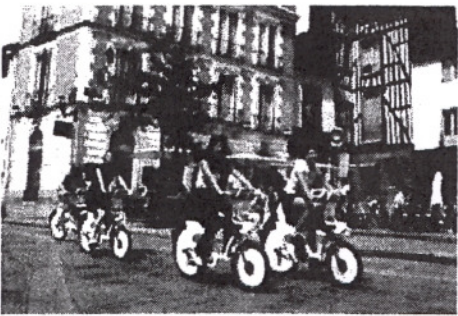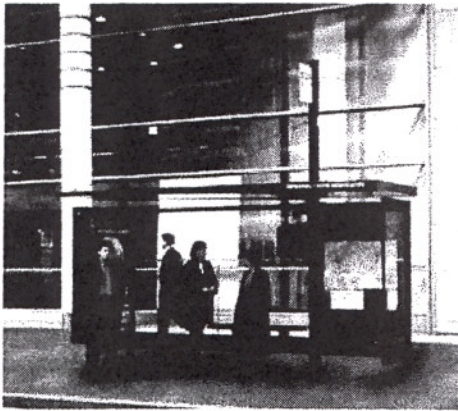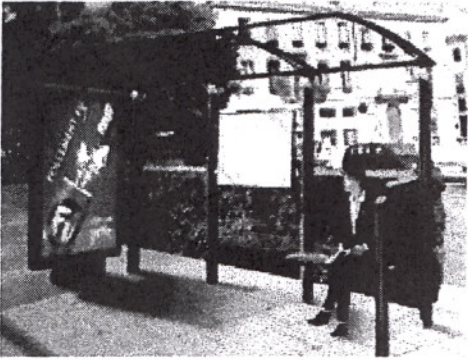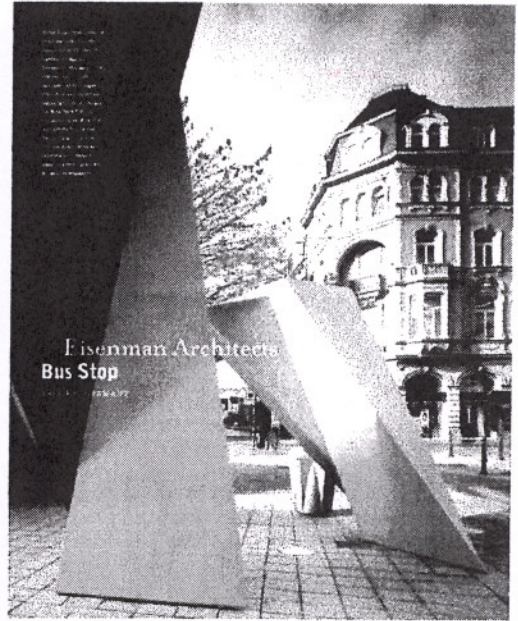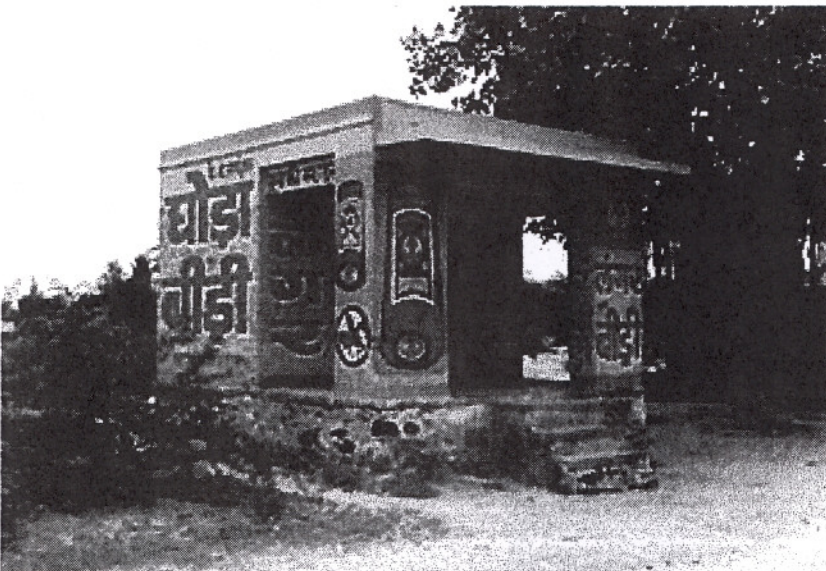
13. Japan

http://www.we-love-oita.or.jp/english/enewwin_gururin/05okubungo/etotoro.htm

14. Kirghizistan

http://www.brama.com

15.Libya

http://sofien.freeserves.com/pages

16. Mexico

http://www.mexconnect.com

17. New Zealand

http://www.arkitekturmuseet.se/bus/kur/Default.html

http://www.adshel.com/adshel.asp

18. Norway

http://www.adshel.com/adshel.asp

19. Peru

http://www.arkitekturmuseet.se/bus/kur/kur2.html
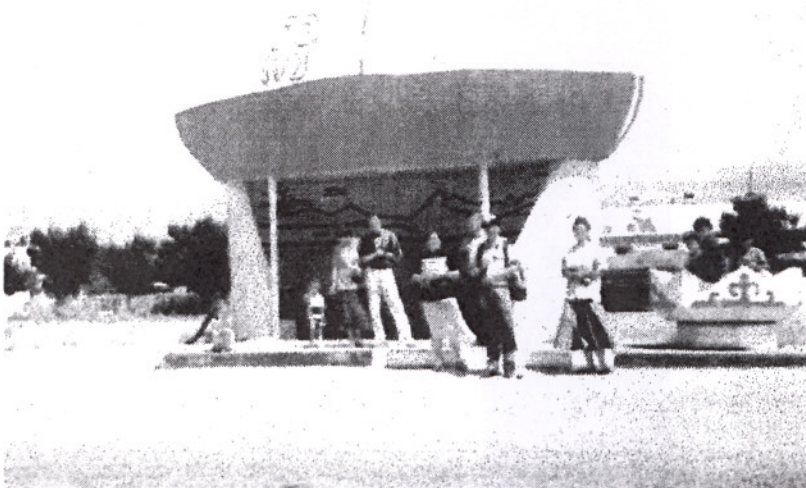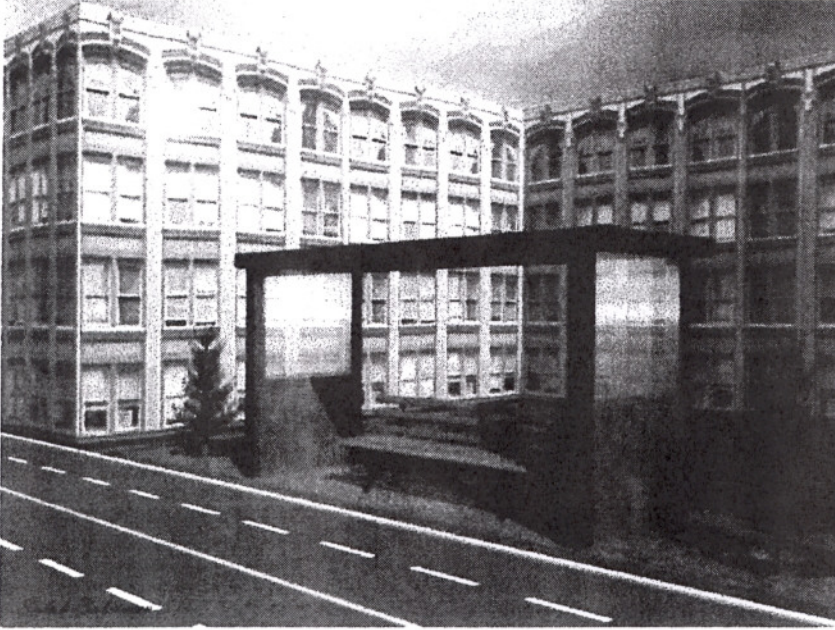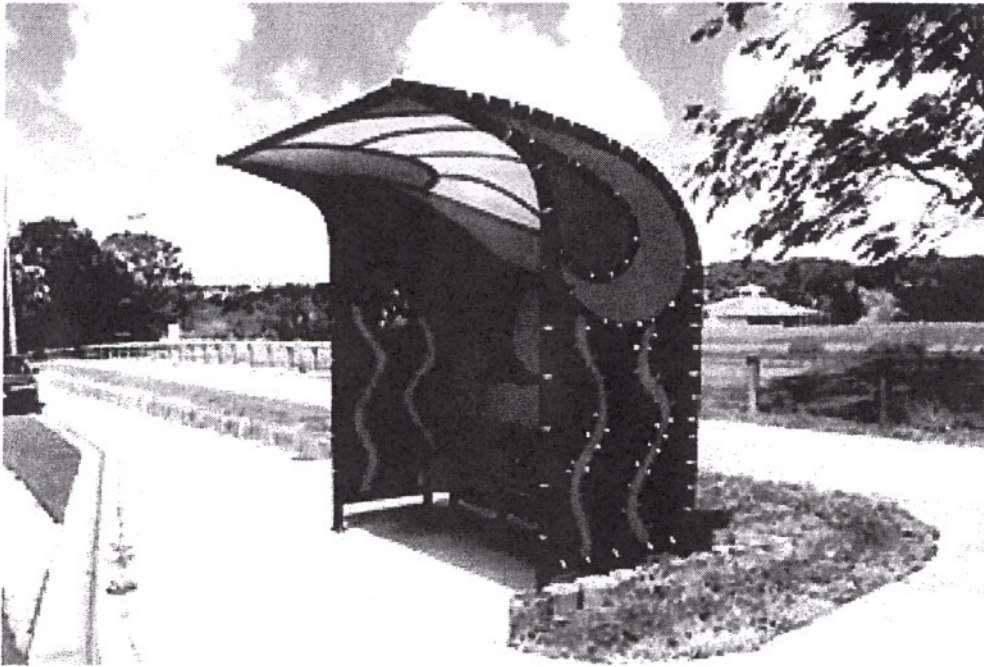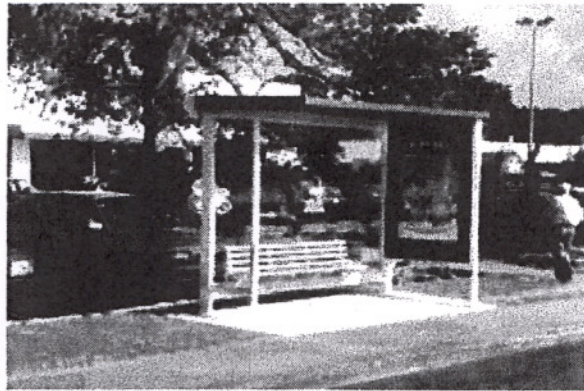
20. Rarotonga Cook Island

http://www.arkitekturmuseet.se/bus/kur/kur5.html

21. Sweden

http://www.corbis.com

22. Singapore

http://www.adshel.com/adshel.asp

23. Thailand

http://www.arkitekturmuseet.se/bus/kur/kur3.html

http://www.adshel.com/adshel.asp

24. Taiwan

http://www.adshel.com/adshel.asp

25. Ukraine

http://www.brama.com/travel/pics/bstop2.jpg

http://www.brama.com/travel/pics/bstop3.jpg

26. United Kingdom

http://www.adshel.com/adshel.asp

http://www.corbis.com

27. U.S.A.

http://www.mtholyoke.edu/~dalbino/shelter.html

http://www.adshel.com/adshel.asp

http://community.webshots.com/photo/3108237/4379846CTnmbpnzJF
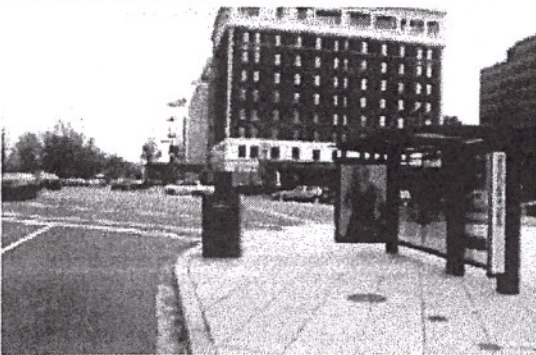

http://community.webshots.com/photo/13052313/13052688ylHoltoDBup

http://community.webshots.com/photo/479868/479886

http://members.mindinfo.com/maxsport/pictures.html

BUS STOP DESIGN   EROL KAYA ID 002

SIDE VIEW

NIGHT VIEW

FRONT VIEW

PERSPECTIVE

BACK VIEW

18.06.2009 13:41

FRONT VIEW

BACK VIEW

TOP VIEW

SIDE VIEW

BLOW-UP

18.06.2009 13:41

DETAILS

1 — SHELTER
THE ADVERTISEMENT PANEL

2 — LIGHTING ELEMENTS
THE TELEPHONE UTILITY

3 — JOINT
MAIN UNIT AND THE SITTING ELEMENT

4 — ROUTE SIGN
SITTING ELEMENT

POLIGON

18.06.2009 13:42

A   B   C

LOCAL
STRUCTURAL
MODIFICATIONS

BEAM

ADVERTISEMENT

SITTING
ELEMENTS

WINDOW PANELS

THE MAIN UNIT

18.06.2009 13:42