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16. Abstract

This report represents the first of two documents examining strategies to encourage and enhance transit use in Texas and throughout the country. The second report entitled *Examination of Policies and Programs Supporting Transit Use in Texas*, identifies general approaches and implementation techniques to encourage greater use of all types of transit services. This report documents the results of a study examining design treatments that can enhance the comfort, convenience, and safety of transit facilities, and to improve pedestrian and transit interaction. The study identifies the human and environmental elements that should be considered in transit facility designs and provides examples of design features that can be incorporated into different types of transit facilities. The major focus is on transit facilities appropriate in small communities and rural areas in Texas. These include bus stops, passenger shelters, and bus stations and centers. Other facilities such as light rail transit (LRT) and commuter rail stations, park-and-ride lots, and intermodal facilities are briefly discussed. A six step process for planning and designing transit facilities is presented. The report also outlines other supporting policies and programs that can enhance the design of all types of transit facilities.

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# DESIGN GUIDELINES TO ENHANCE PEDESTRIAN AND TRANSIT INTERACTION

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Research Report 1975-1
Research Study Number 7-1975
Research Study Title: Examination of Policies and Programs Supporting Transit Use in Texas

Sponsored by the
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November 1994

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# IMPLEMENTATION STATEMENT

Public transportation services are currently provided in major metropolitan areas, small- and medium-sized communities, and rural areas in Texas. These transit systems have many purposes—from providing alternatives to single-occupant vehicle travel in congested travel corridors to providing basic levels of mobility for individuals who do not have alternative forms of transportation available. Exploring ways to make transit services more accessible to all groups and encouraging greater use of public transportation has become a priority in many areas. Ensuring that all elements of a transit system employ user-friendly designs, are easily accessible, and are integrated with adjacent land uses and developments can enhance their use.

This study examines design treatments that can be used to enhance the convenience, comfort, and safety of transit facilities, and to improve pedestrian and transit interaction. It examines the human and environmental factors that should be considered in transit facility designs and provides examples of good design treatments. It also outlines a six-step process for planning and designing transit facilities. This report should be of benefit to transit agencies, the Texas Department of Transportation (TxDOT), city staff, private developers, federal agencies, national organizations, and other groups interested in enhancing the design of transit facilities. It should be of particular benefit to transit systems in small communities and rural areas with limited staff and financial resources.

# DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation.

# ACKNOWLEDGEMENTS

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# SUMMARY

Exploring ways to encourage greater use of all forms of public transit has become a priority in large metropolitan areas, small and medium-sized communities, and rural areas throughout Texas and the nation. This interest is based on concerns of increasing levels of traffic congestion and air pollution, as well as the desire to enhance mobility and accessibility for residents and visitors. Many of these efforts are focused on improving the convenience, comfort, and safety of buses, paratransit, and rail services. Ensuring that all elements of these systems employ user-friendly designs, are easily accessible, and are integrated with adjacent land uses and developments can help enhance their use.

This research study was undertaken to examine the issues associated with enhancing pedestrian and transit interaction and to identify approaches to improve the design of transit facilities to accommodate these factors. This report represents the first of two documents examining strategies to encourage and enhance transit use in Texas and throughout the country. The second report, entitled *Examination of Policies and Programs Supporting Transit Use in Texas*, identified general approaches and implementation techniques to encourage greater use of all types of transit services.

The report presented here provides an overview of the general factors often considered in planning and designing different types of transit passenger facilities and illustrates examples of good design treatments to enhance pedestrian interaction. Finally, the report outlines a six step process that can be used in planning and designing different types of transit facilities.

Researchers conducted a number of activities in order to accomplish the objectives of this study. First, they undertook a comprehensive literature review to identify available information on transit facility design concepts and guidelines. This included an examination of journal articles, national reports, and documents available from individual transit agencies. The results of this review were used to identify current state-of-the-practice design techniques, as well as examples of good design features to enhance pedestrian and transit interaction. Information on all types of facilities—from bus stops and shelters to more complex stations and intermodal terminals—was examined. In addition, the requirements of the Americans with Disabilities Act (ADA) and other regulations were reviewed to identify specific design considerations for improving access for disabled individuals. Further, information on pedestrian design issues and transit-friendly developments were examined.

The information from these different sources was used to identify examples of good transit design considerations and elements that enhance passenger comfort, convenience, and safety. Concepts for different types of transit facilities were reviewed and assessed. The results of these analyses were used to develop a six step process to provide guidance in planning and designing user-friendly transit facilities. Additional policies and activities that can be used to support good transit design features were also identified.

# CHAPTER ONE

## INTRODUCTION

Many agencies in Texas provide a wide range of public transportation services. These services, which are operated in major metropolitan areas, small and medium-sized communities, and rural areas serve a variety of roles. In large metropolitan areas, transit systems provide high levels of park-and-ride, express bus, and local fixed route services, as well as specialized transportation for elderly and disabled individuals. In addition, a light rail transit (LRT) system is being constructed in the Dallas area, and rail service is being considered in other areas. Smaller communities and rural areas provide fixed route and demand-responsive services. All of these systems provide transit alternatives for commuters as well as basic levels of mobility for individuals who may not have alternate forms of transportation available.

Exploring ways to encourage greater use of all forms of public transit and high-occupancy vehicles (HOVs) has become a priority in large metropolitan areas, small and medium-sized communities, and rural areas throughout Texas and the nation. This interest is based on concerns over increasing levels of traffic congestion and air pollution, as well as the desire to enhance mobility and accessibility for residents and visitors. Many of these efforts are focused on improving the convenience, comfort, and safety of buses, LRT, heavy rail, commuter rail, and other HOV modes. Ensuring that all elements of these systems employ user-friendly designs, are easily accessible, and are integrated with adjacent land uses and developments can enhance their use.

Designing, implementing, and operating transit facilities that meet these objectives is not an easy process, however. Numerous factors relating to costs, local ordinances, and coordination with businesses, developers, and neighborhood groups must be considered and addressed. Examining the issues associated with enhancing pedestrian and transit interaction and developing approaches to improve the design of transit facilities to accommodate these factors was identified as a priority research need in the *Texas Transit Research Agenda* (1). To address these needs, this research study was undertaken by the Texas Transportation Institute (TTI), a part of The Texas A&M University System, for the Texas Department of Transportation (TxDOT). This report represents a part of a larger study examining policies and programs to enhance the use of transit in Texas. The second report, *Examination of Policies and Programs to Support Transit Use in Texas* (2), explores strategies relating to land use and zoning, parking pricing and supply, trip reduction, growth management, and transit service enhancements.

This report provides an overview of the general factors often considered in planning and designing all types of transit passenger facilities. A major focus is on transit facilities used in small communities and rural areas in Texas. These include bus stops, passenger shelters, and transit stations and centers. Facilities associated with other modes, such as LRT and commuter rail, and intermodal centers are also explored. Design considerations related to passenger needs or human factor issues and the environment are examined. This report further provides

examples of good design treatments to enhance pedestrian interaction, and outlines a six step process that can be used in planning and designing different types of transit facilities.

## Study Objectives

This study was undertaken to meet several objectives. The first was to identify the human elements related to transit facility design. Researchers identified factors influencing greater pedestrian and transit interaction and examined design techniques to enhance passenger comfort, convenience, and safety. Based on this information, examples of design treatments to improve pedestrian and transit interaction were identified. Finally, a six step process was outlined to provide guidance on planning and designing pedestrian-friendly transit facilities.

This report can be of use to transit agency and TxDOT personnel, city staff, private developers, architects, and other groups interested in enhancing the convenience, comfort, and safety of transit facilities. The document may be of particular benefit to small and medium-sized transit systems and communities in Texas with limited financial and staff resources. Further, it may be of value to elected officials and other decision makers interested in transit-supportive policies and programs. Finally, the Federal Transit Administration (FTA), the American Public Transit Association (APTA), regional and state transit associations, and transit systems throughout the country may find this report beneficial for enhancing the design of transit facilities.

## Research Approach

A number of activities were conducted in order to accomplish the objectives of this study. First, a comprehensive literature review was undertaken to identify available information on transit facility design concepts and guidelines. This included an examination of journal articles, national reports, and documents available from individual transit agencies. The results of this review were used to identify current state-of-the-practice design techniques, as well as examples of good design features to enhance pedestrian and transit interaction. Information on all types of facilities—from bus stops and shelters to more complex stations and intermodal terminals—was examined. In addition, the requirements of the Americans with Disabilities Act (ADA) and other regulations were reviewed to identify specific design considerations for improving access for disabled individuals. Further, information on pedestrian design issues and transit-friendly developments were examined.

The information from these sources was used to identify examples of good transit design considerations and elements that may enhance passenger comfort, convenience, and safety. Concepts for different types of transit facilities were reviewed and assessed. The results of this analysis were used to develop a six step process to provide guidance in planning and designing user-friendly transit facilities. Additional policies and activities that can be used to support good transit design features were also examined.

## Report Organization

The remainder of this report is divided into four chapters. Chapter Two discusses general design considerations for enhancing pedestrian and transit interaction. This includes an examination of the human elements and the environmental factors influencing the design of transit facilities. Chapter Three provides examples of good design treatments for different types of transit facilities. This is followed by a discussion of a six step process that can be followed by agencies and groups interested in planning and designing transit facilities. The report concludes with a summary of the major points addressed in the research study and the identification of other supporting policies and activities that may be appropriate for further consideration by transit agencies, local communities, and other groups interested in enhancing the design and operation of all types of transit facilities.

# CHAPTER TWO

## GENERAL DESIGN CONSIDERATIONS

There are a number of general factors that should be considered in planning and designing different types of transit facilities. Giving adequate consideration to the needs of passengers—or the human factors associated with design—represents one important area. In addition, the type of setting or the environment within which the facility will be located will also influence design considerations. This chapter summarizes the major elements associated with each of these factors.

### Human Elements in Transit Facility Design

John J. Fruin identified convenience, comfort, and safety as three important factors that influence the use of public transportation (3). Individuals who feel that transit systems are not convenient, comfortable, or safe are unlikely to use the service. As a result, consideration should be given to design treatments which can enhance the convenience, comfort, and safety of transit facilities. The characteristics associated with each of these factors are summarized below.

**Convenience**—Transit facilities should be convenient for passengers to access and to use. From the perspective of a rider, convenience usually relates to the time and effort involved in using transit (3). This is especially true of commuters, who may drive their automobile if the transit service is not viewed as being convenient. To help ensure that transit is convenient, facilities should be located at main access points, so that individuals do not have to go out of their way or backtrack to reach them. Providing information and directional signs so that people can easily understand how to use the facility and the system is also important. Further, for many individuals, convenience relates to the ability to do errands or conduct other business on the way to and from work. Locating transit facilities close to other services or integrating transit into joint use developments can enhance riders' access to desired services.

**Comfort**—The comfort of passengers can be influenced by the environment of a transit facility. Factors such as temperature, lighting, seating, shelters, and cleanliness may all influence the comfort levels associated with a specific facility. Ensuring that a facility provides a comfortable environment can help encourage transit use. Thus, consideration should be given in the design phase to the different elements associated with making a transit facility comfortable.

**Safety**—Transit facilities should be safe for passengers to use. The perception that a facility is not safe or secure can negatively impact ridership. Designing transit facilities to maximize the safety and security of riders, while at the same time providing a comfortable environment, may not always be easy. Design issues related to safety

include walking surfaces, adequate lighting, railings and grade changes, warning signs and markings, and other elements. On-site personnel and surveillance cameras may be used at high volume transit facilities to enhance safety and to reduce the potential for incidents or accidents. Designing facilities to avoid recesses or dark spaces where passengers may be isolated, can help address safety concerns. Further, circulation routes and waiting areas should not be blocked by walls or landscaping. Adequate lighting and emergency telephones can also be used to help increase the safety and security of a facility.

Designing transit facilities that are convenient, comfortable, and safe is not easy. Tradeoffs may sometimes need to be made between these elements. For example, concerns over safety may take precedent over features that would make a facility more comfortable. In addition, construction and maintenance costs are important considerations in the design of a transit facility. Although tradeoffs may need to be made, the design should maximize the convenience, comfort, and safety of a facility.

**Environmental Elements in Transit Facility Design**

The design of a transit facility will be influenced by the area, setting, and environment within which it is located. Rural, suburban, and urban settings all provide different issues and opportunities associated with locating and designing transit facilities. Land availability, compatibility with adjacent uses, and safety concerns represent just a few of the issues to be examined in the planning and design process. The general elements that may need to be considered within each of these areas are described next.

**Rural Settings**—In most cases, obtaining the land needed for transit facilities should be less of a problem in rural areas than in suburban and urban settings. The amount of land needed and the location will depend on the type of transit facility being developed. A park-and-ride or a park-and-pool lot will have different requirements than a bus or paratransit stop. All types of rural transit facilities share many of the same characteristics, however. Given the remote nature of many facilities, safety and security are often major concerns. These issues can be overcome by locating the facility close to existing land uses, and incorporating adequate lighting and other safety features into the design.

**Suburban Settings**—Suburban areas present numerous challenges to planning and designing pedestrian-friendly transit facilities. In many cases, suburban land use patterns—both residential and commercial—are not conducive to transit services or the development of transit facilities. Low density residential areas, which are often designed around cul-de-sac streets, are difficult to serve with regular routes. Further, most suburban developments have been designed for automobile access, with little or no thought given to transit. Shopping centers and business parks are often surrounded by parking lots, making them difficult to access by transit. The major issues in planning and designing suburban transit facilities include land availability, compatibility with

adjacent land uses, integration with automobile oriented developments, comfort, convenience, and safety. In order to address these issues, some transit agencies are taking a more proactive approach in working with developers early in the process to design transit facilities into the project from the start.

**Urban Settings**—Urban settings include densely developed residential areas, central business districts (CBDs), and other major activity centers. In most cases, these are the areas that have traditionally been well served by transit. These settings are usually characterized by limited available land, high land values, congestion, and greater potential for vandalism and crime. Land availability and cost, pedestrian access, and safety represent major issues to be addressed in the design of transit facilities in urban settings.

Although this classification system is useful for identifying issues and opportunities, it is important to remember that differences exist within each of these three general types of environments. For example, historical districts or special use areas may exist within each of the three settings. The unique or special features of an area, such as the one illustrated in Figure 1, should be considered in planning and designing transit facilities.

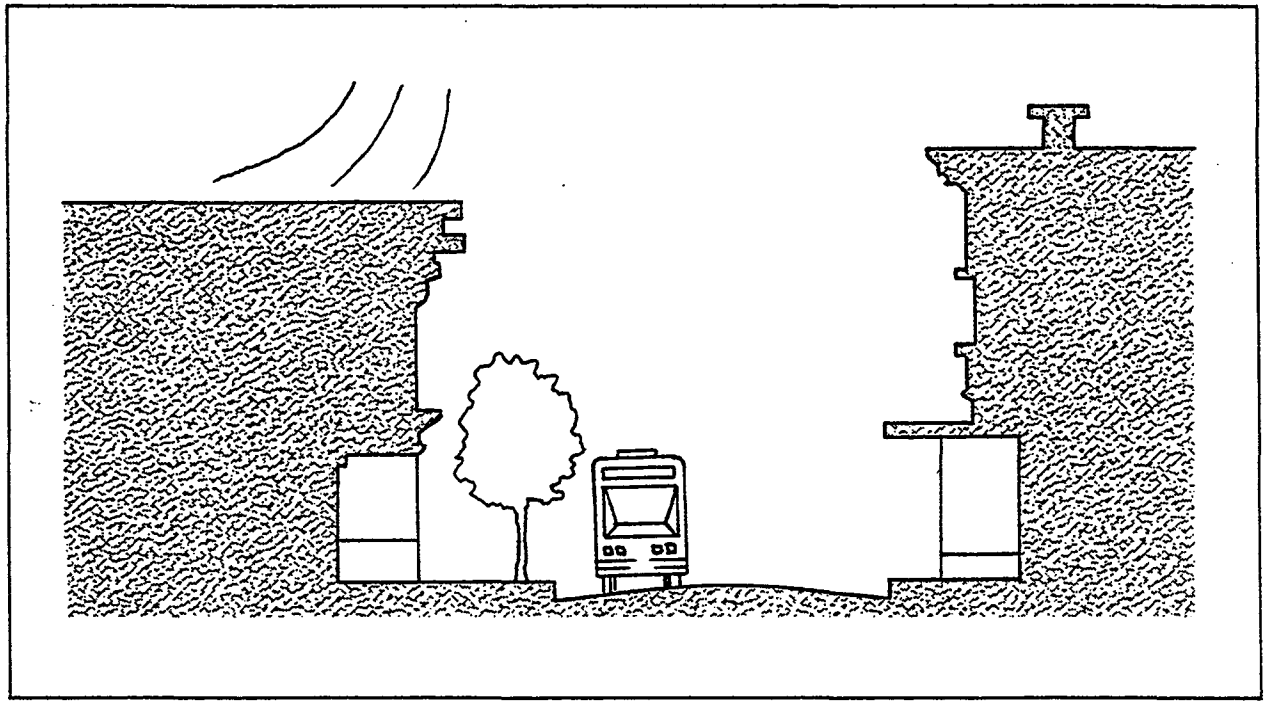

Figure 1. Example of Historical District

Historical districts, or other special use areas, are typically identified by a unique architectural style or a common building design. Transit facilities located in these settings should blend in and match the unique characteristics of the area rather than conflicting with the surrounding neighborhood. Design treatments related to form, color, exterior finish, and location can all enhance the integration of the transit facility into the surrounding area. Figure 2

provides an example of a transit stop that conflicts with the architectural style of the neighborhood, while Figure 3 provides an example of a transit stop that has been designed to reflect the characteristics of the area. Incorporating the unique features of an area into the design of a transit facility can help promote greater community support and a positive image of the transit system.

Figure 2. Example of Transit Stop that Conflicts with Neighborhood Architectural Style

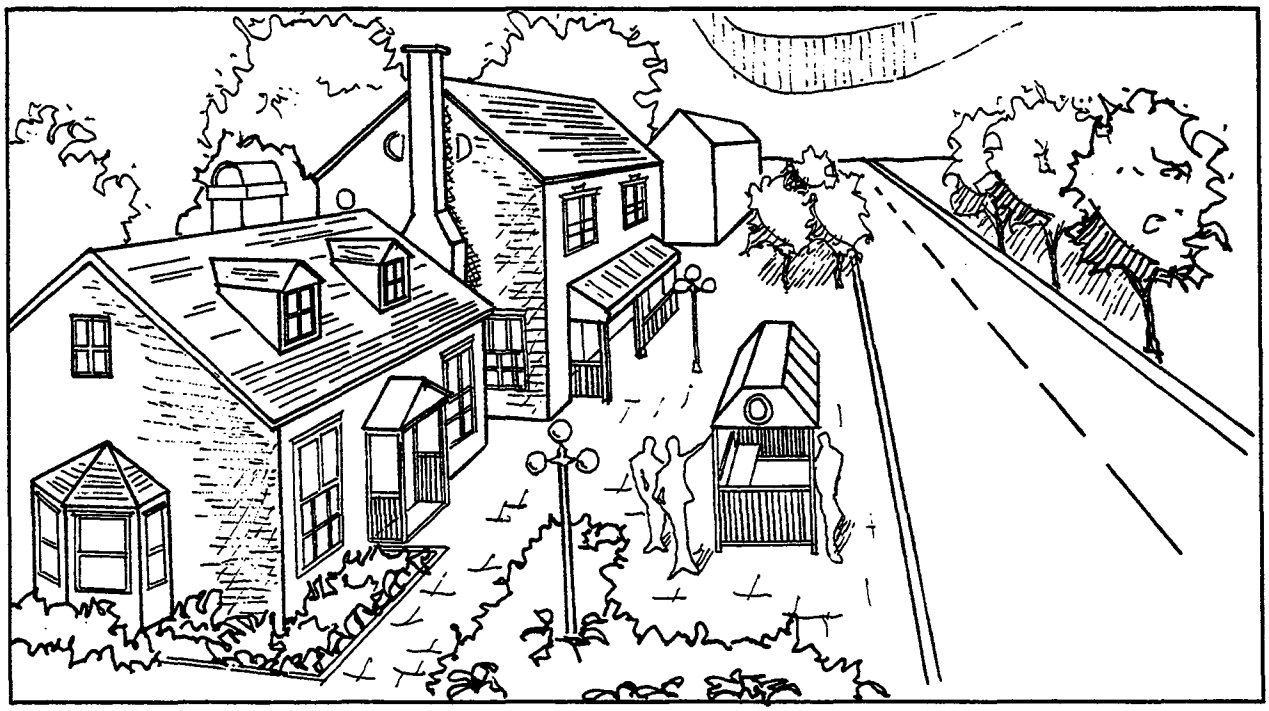

Figure 3. Example of Transit Stop Compatible with Neighborhood Architectural Style

Environmental factors will also influence the design of a transit facility. These include the weather and climatic conditions of an area, and the specific characteristics of a site. The design of a transit facility should consider seasonal variations in temperature, humidity, rain, and snow in an area. It should also consider the specific characteristics of the site related to sun, wind, and other elements. Design treatments can then be developed to address the specific needs of an area. For example, a transit facility in Northwestern Texas would need to be designed for colder temperatures and the possibility of snow, while a facility along the Texas/Mexico border would not. The decision to heat or cool a facility will be related to conditions in the area, agency policies, and cost factors. In addition to these general weather considerations, two other important factors—the sun and wind—should be addressed in the design process.

The amount of sun at a transit facility plays an important role in the comfort level of waiting passengers. In the winter, the sun can provide needed warmth, enhancing passenger comfort. In the summer, however, the sun may be a source of discomfort to passengers. The amount of sun and shade at a specific site should be examined during the planning and design of a facility. The final design should maximize the benefits of both during different seasons. For example, the placement of shelters should be sensitive to the angle of the sun at different times of the day and year. Figure 4 illustrates how the movement of the sun can be analyzed to determine the impact on a possible shelter location (4). Figures 5 through 7 provide examples of how the placement of trees and other landscaping, as well as the design of shelters, can provide passengers with shade and protection from the sun, wind, and rain.

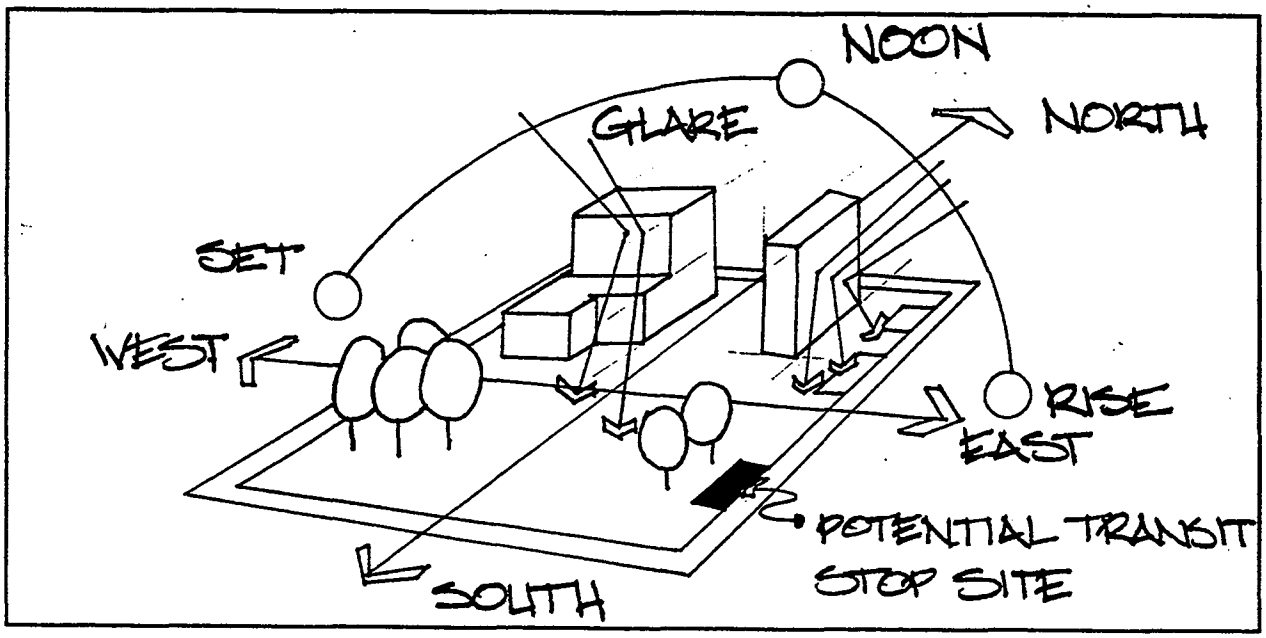


Figure 4. Analysis of Solar Conditions

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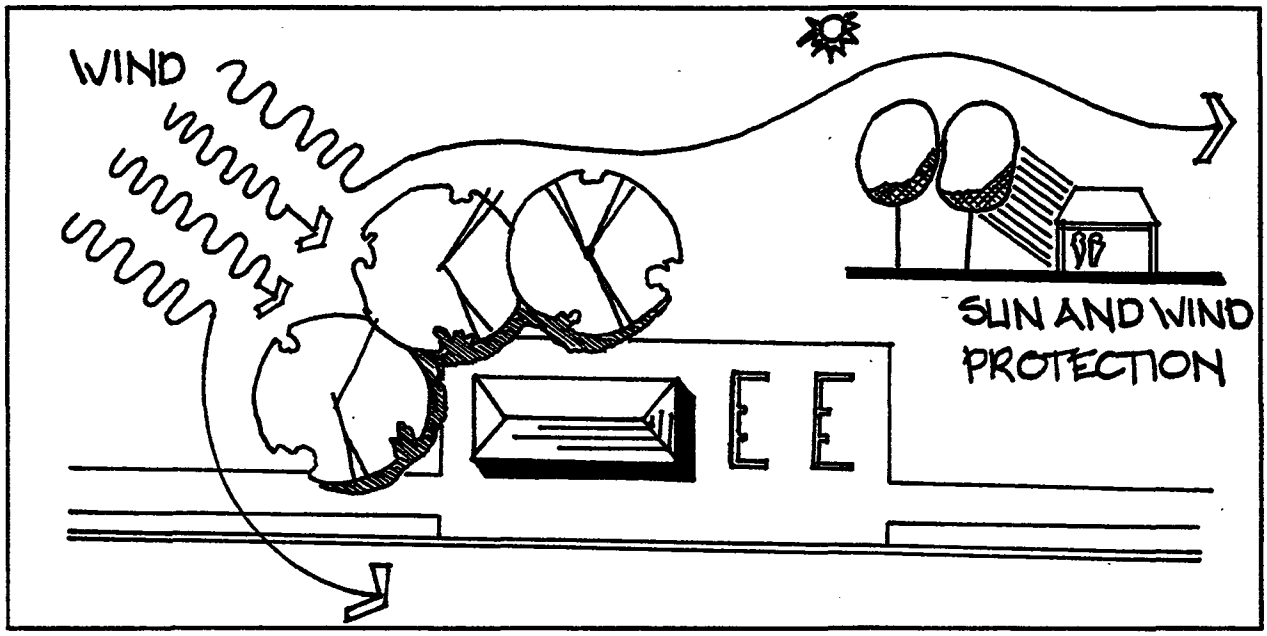


Figure 5. Using Trees and Landscaping to Provide Shelter from the Sun and Wind

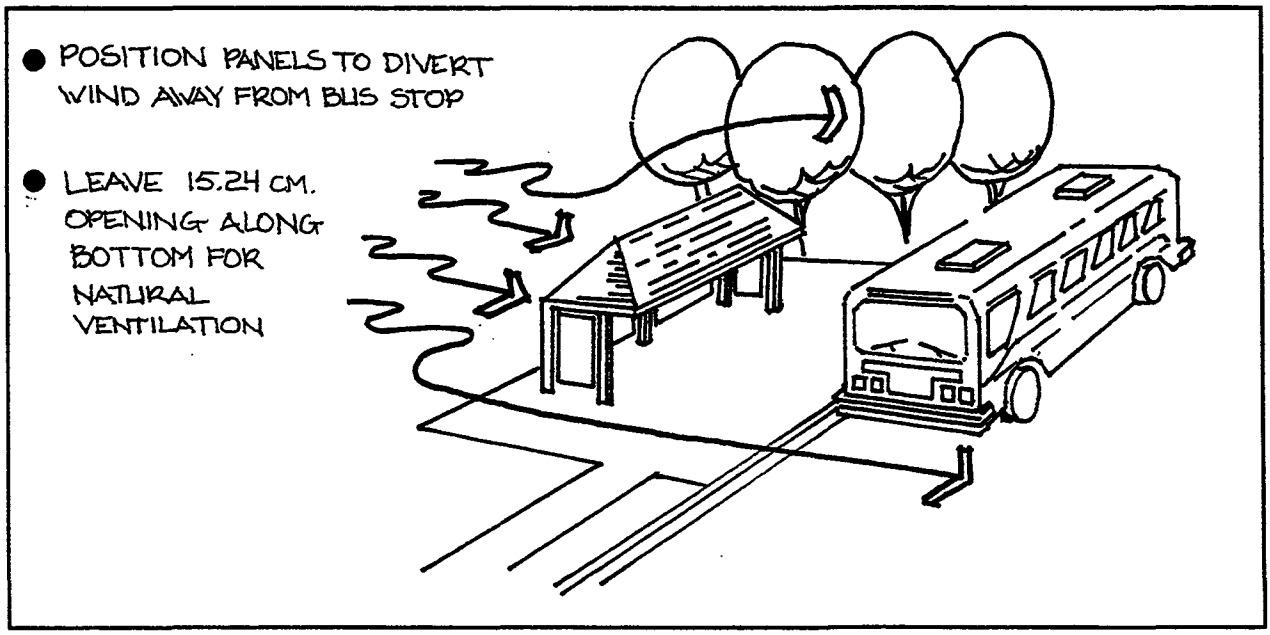


Figure 6. Shelter Design and Landscaping for Wind Protection

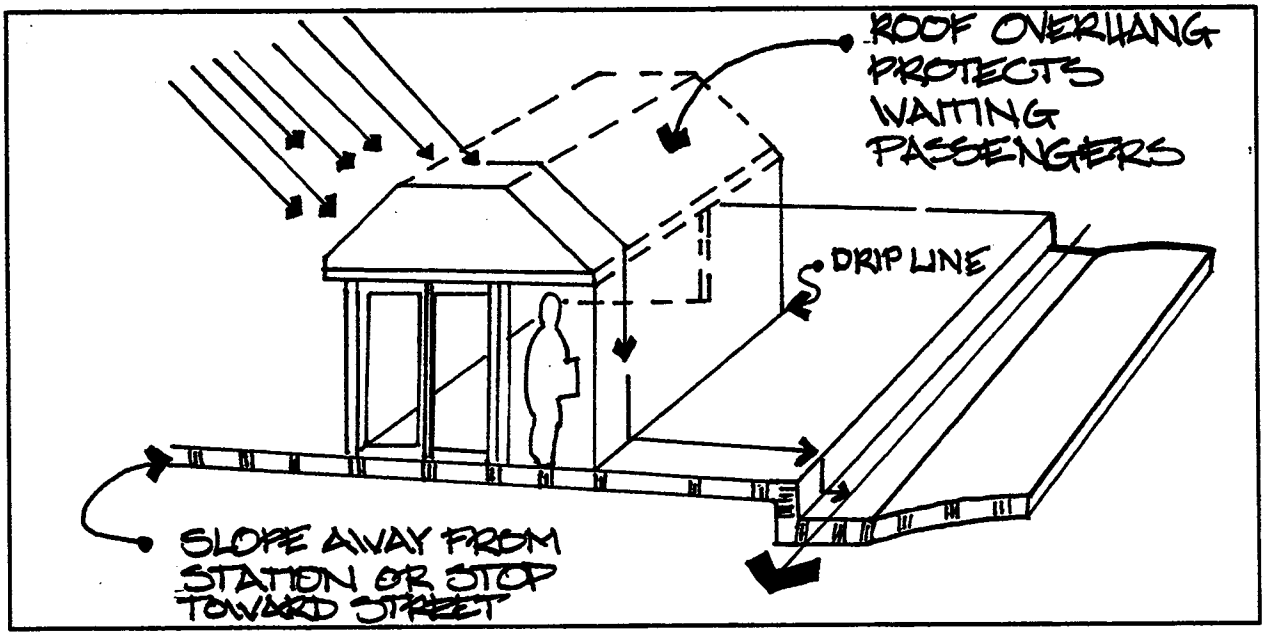


Figure 7. Shelter Design for Rain Protection

# CHAPTER THREE

## EXAMPLES OF GOOD TRANSIT DESIGN TREATMENTS

In addition to the human elements and the environmental factors discussed in the previous chapter, the type of transit facility being considered will influence the design features and the complexity of the design process. The development of a bus stop or a bus shelter will involve fewer design considerations and should require fewer resources than planning and developing a major transit center or intermodal facility. Although transit facilities differ greatly in scale, scope, and complexity, they share many of the same basic elements and design features. It is critical that the designs for all types of transit facilities provide a positive image for the system, communicate basic information about how to use the service, and provide a convenient, comfortable, and safe environment for passengers (3).

This chapter provides examples of how these elements and the human and environmental factors summarized in Chapter Two can be incorporated into the design of different types of transit facilities. The examples are oriented primarily toward the types of transit facilities that would be utilized in small communities and rural areas in Texas. The chapter also provides examples of facilities related to the larger metropolitan areas in the state. Reports and other documents which examine specific elements of the design process in more detail are also noted.

### Transit Stops

A bus stop is a designated curbside area reserved for the loading and unloading of passengers. Bus stops may vary in length, size, and layout depending on the number of transit vehicles serving the site and passenger volumes. Stops are commonly identified by paint striping along the curb and a bus stop sign. Bus stops may be more complex, however, including information kiosks, benches, shelters, and other amenities.

On-street stops may be located on the near-side of an intersection, on the far-side, or mid-block. Further, stops may be located in off-street facilities, such as shopping center parking lots. Each of these locations has advantages and disadvantages. The following factors should be considered in determining the best location for a transit stop:

- Curbside space,
- Ability to remove parking to create loading areas,
- Location of other parking spaces,
- Road widths,
- Sidewalk widths,
- Intersection geometry,
- Intersection vehicle volumes,
- Existing traffic control devices,
- Frequency of transit services,

- Location of other transit stops,
- Location of other transit routes,
- Patronage levels, and
- Pedestrian access to site.

The removal of on-street parking spaces for transit stops often causes concerns among businesses located adjacent to the stops. Identifying other parking areas and allowing other vehicles to use the stops during off-peak periods are strategies which may be used to address these issues. Ensuring that conflicts do not arise between transit and other vehicles is critical. The major characteristics, advantages, and disadvantages associated with the three main stop locations are briefly summarized next, along with examples of each (5).

**Near-Side Stops**—As shown in Figure 8, near-side stops are located immediately before an intersection. Near-side stops are often used when transit operations are more critical than traffic flow and on-street parking. Advantages of near-side stops include a lower potential for bus-automobile conflicts from cars turning from the side street and the provision of convenient access to crosswalks for passengers. In addition, if some type of signal priority is provided, buses may pull back into traffic before other vehicles after the light has changed. Disadvantages include potential conflicts with vehicles making right turns, buses blocking sight lines for drivers of other vehicles and pedestrians, and buses being delayed by traffic signals if priority treatments are not provided.

**Mid-Block Stops**—Mid-block stops are located in the middle of a block, about equidistant from both intersections. Figure 9 provides an example of this type of stop. Mid-block stops may be used in conjunction with the entrance to a major activity center, a transit facility, or a skywalk. Mid-block stops remove possible bus and vehicle conflicts from intersections and can provide more space for transit vehicles and passengers. Passengers have to walk further to crosswalks, however, and mid-block locations may require the removal of more on-street parking spaces than other options.

**Far-Side Stops**—Far-side stops are located immediately after an intersection. Figure 10 is an example of the layout and design of a far-side stop. In general, far-side stops are preferred by most transit agencies for a number of reasons. First, buses can maneuver into and out of traffic easier as a result of the gaps created by signalized intersections. There is also less potential conflict for transit vehicles turning left at the next intersection. Shorter deceleration and acceleration lengths are needed for transit vehicles, as the intersection can be used to start the approach to the stop. Passengers have easy access to crosswalks and pedestrians and passengers can cross behind the vehicles. Far-side stops do have disadvantages, however. Among these is the potential for buses to queue up back into the intersections, blocking cross traffic. The transit vehicles may also obstruct the views of drivers turning right from cross streets.

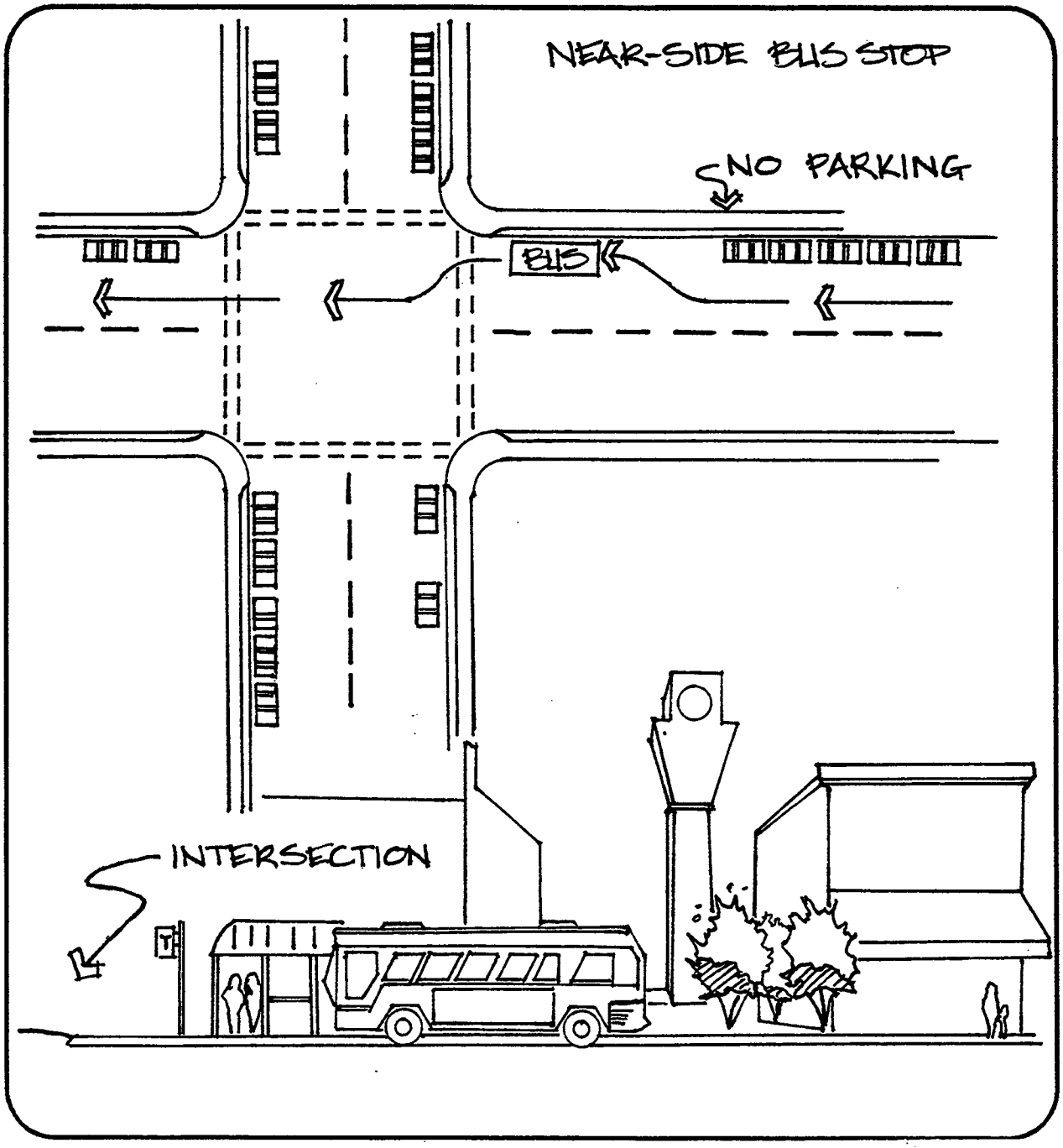


Figure 8. Near-Side Transit Stop Design

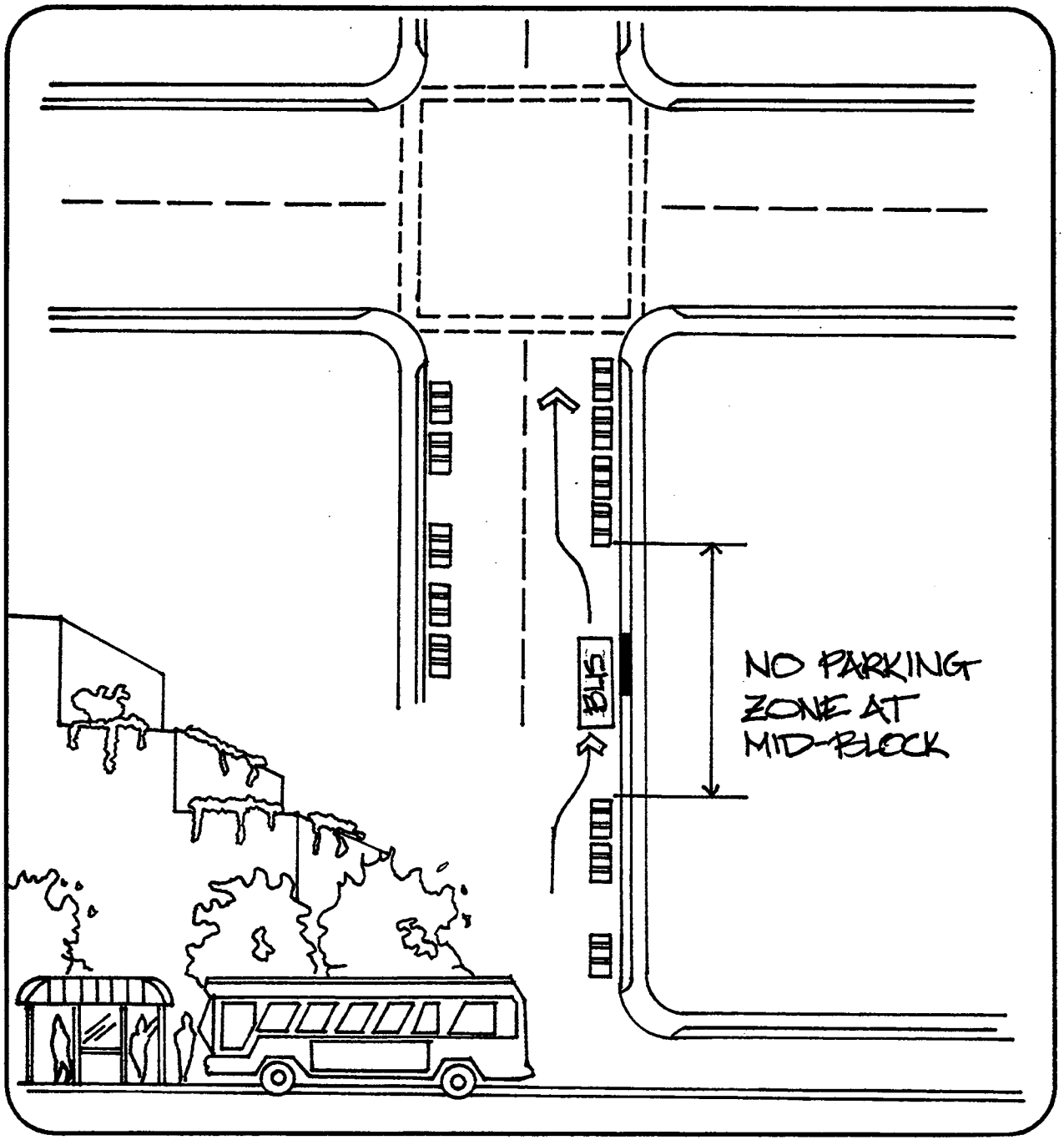


Figure 9. Mid-Block Transit Stop Design

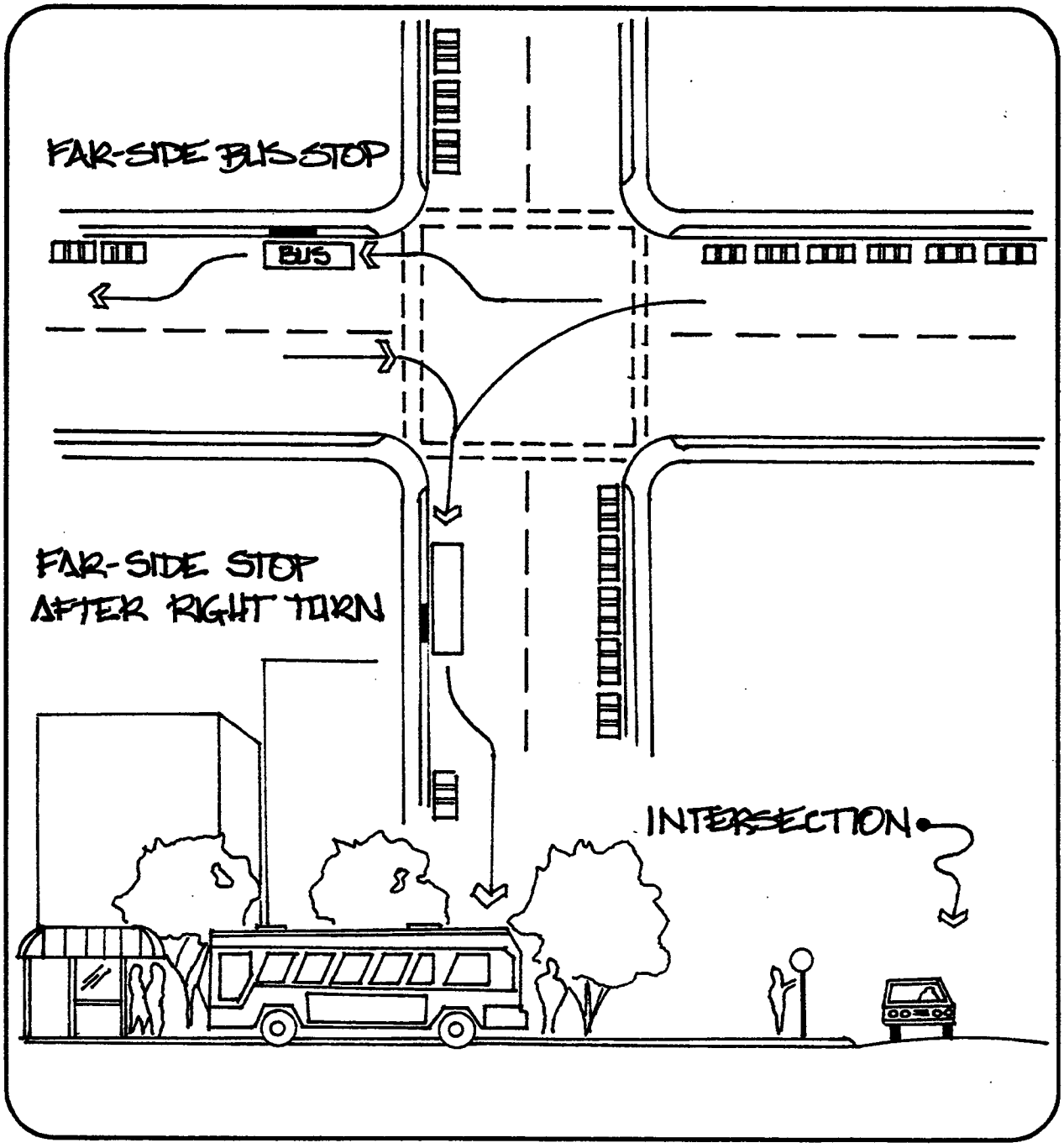


Figure 10. Far-Side Transit Stop Design

Other factors are important for locating transit stops. These include taking advantage of mandatory stops for traffic signals, locating stops as close as possible to major trip generators, and clearly delineating transit vehicle and passenger waiting areas (6,7). In addition, the distance between stops should be determined based on consideration of both pedestrian access needs and transit operating efficiencies (8). Providing a uniform pattern to stops in an area is important, although some differences may exist in response to specific issues, opportunities, and demand levels. Many transit agencies have developed specific policies governing the location and spacing of stops.

**Transit Signs**

Transit signs can provide a variety of information and can serve multiple functions. Signs should help orient passengers and potential customers to the location of a transit stop, and should provide information on routes, schedules, and fares. More detailed route and system maps may also be available at some stops. Transit signs should utilize the logo and colors of the transit system or provide some other common unifying theme. Signs should be easily recognizable for both existing riders and possible new users.

Transit signs can take a number of forms, ranging from a simple flag sign to information kiosks. The following elements should be considered in the design and location of transit signs and information kiosks (9,10,11):

- Locate signs away from obstructions such as trees and buildings to ensure visibility;
- Locate signs away from other traffic operations signs to avoid confusion and to accentuate the area as a transit stop;
- Locate signs or information aids away from a curb;
- Locate signs at the front of the stop or loading area and away from areas where passengers board and exit from transit vehicles;
- Make supporting elements or materials weather and vandal resistant and easily maintained;
- Make the size and shape of the signs consistent throughout the system;
- Make colors, patterns, logos, fonts, and letter sizes consistent throughout the system and recognizable at all times of the day; and
- Make other information displays or signs that are placed on or near the shelter level and readable with the typical height of a human being. Information should also be accessible to disabled individuals and school age children.

Figures 11 through 13 provide examples of different design treatments for transit signs, information kiosks, and information centers. Many transit agencies use simple signs at low volume stops, but provide more extensive information at high volume stops. In most cases, this information is provided in a read-only form rather than interactive. Some systems provide racks for schedules or other information that passengers can take with them. In addition, some systems are developing electronic information systems. These may contain both static and real-time information on the status of transit vehicles, as well as other route, schedule, and fare information, and the current status of traffic conditions, weather, and news.

**Passenger Benches and Seating Areas**

Benches and seating areas can provide convenience and enhance comfort for waiting passengers. Benches may be incorporated into shelters, adjacent buildings, or they may be free standing. A number of factors should be considered in the design and placement of benches and seating areas. These relate to providing a comfortable and safe facility, while minimizing the potential for vandalism, abuse, and use by vagrants. The following identify the major factors for consideration in designing and locating transit benches and seating areas (6,10,11):

- Locate benches facing the street or transit loading area a minimum distance of approximately 1 meter from the curb to provide necessary safety clearance for waiting passengers and to allow for pedestrian movement around the bench;
- Provide the necessary width and clearance on the side and the rear of a bench for pedestrian movement and disabled access. Minimum widths of approximately 1 to 2 meters are recommended;
- Locate benches a minimum distance of approximately 2 meters and a maximum distance of approximately 4 meters from the beginning or forward zone of the bus stop to prevent conflicts between loading and alighting passengers;
- Locate benches on a non-slip concrete or paving pad that is sloped toward the street to prevent collection of rain runoff and the creation of mud and ice on the pad;
- Locate benches in such a way that there is adequate width and room for adjacent pedestrians and waiting passengers to stand in a comfortable environment.

Benches and seating areas should be designed to be compatible with adjacent land uses and developments. Figures 14 through 16 provide examples of transit benches and seating areas in different environments. These include free standing facilities, as well as the use of existing elements, and coordinating benches with adjacent developments.

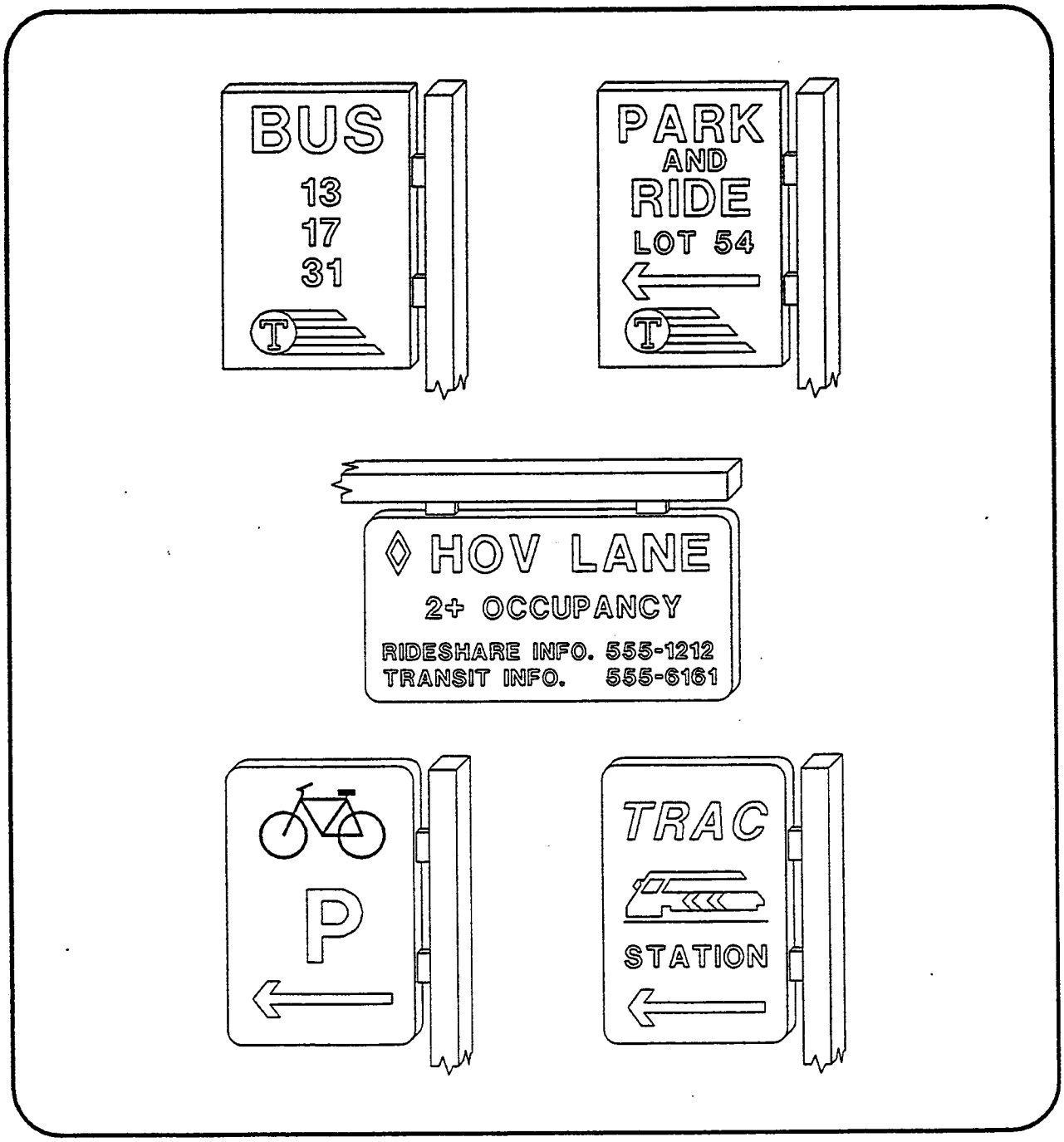


Figure 11. Examples of Transit Signs

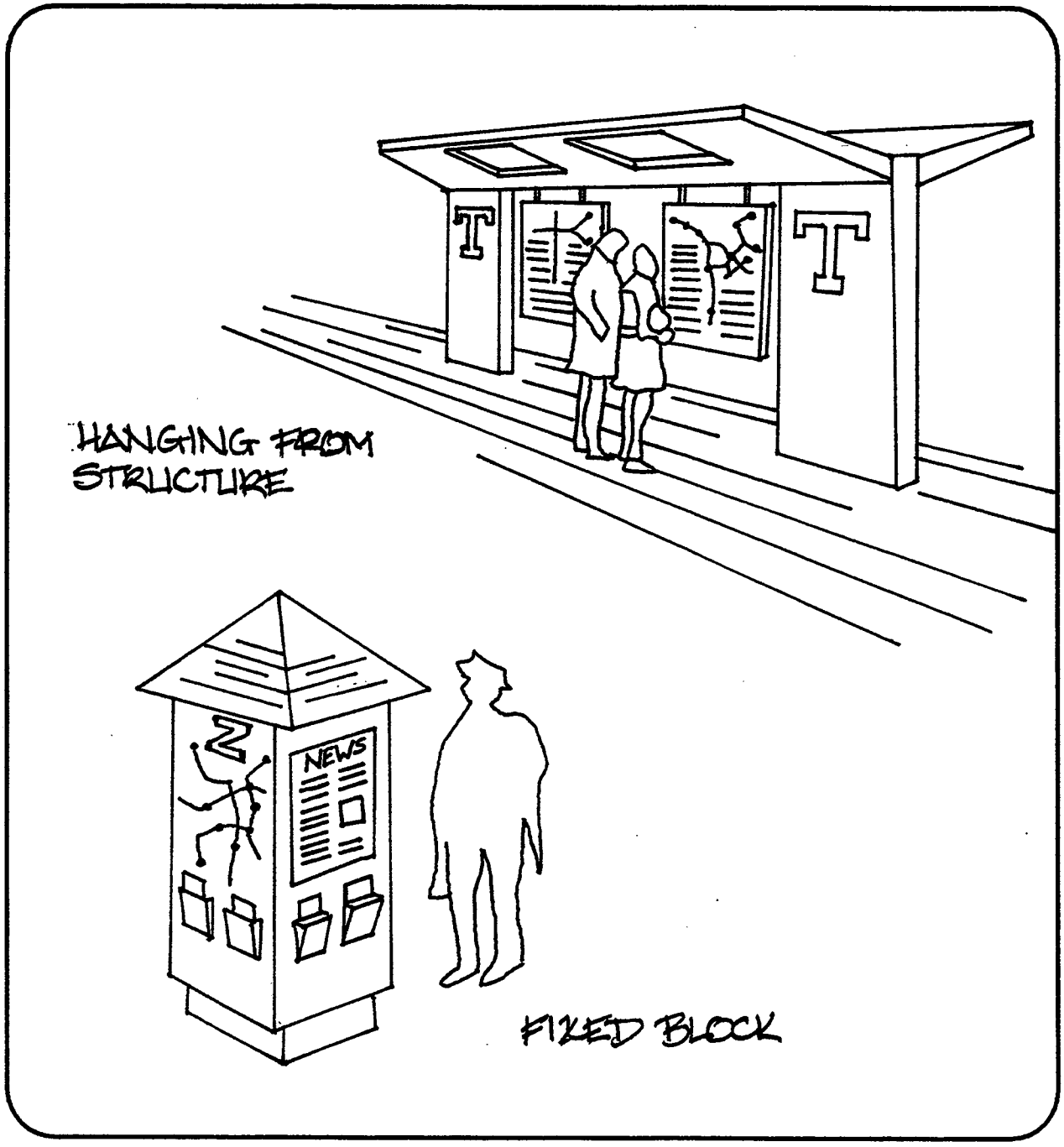


Figure 12. Examples of Transit Information Kiosks

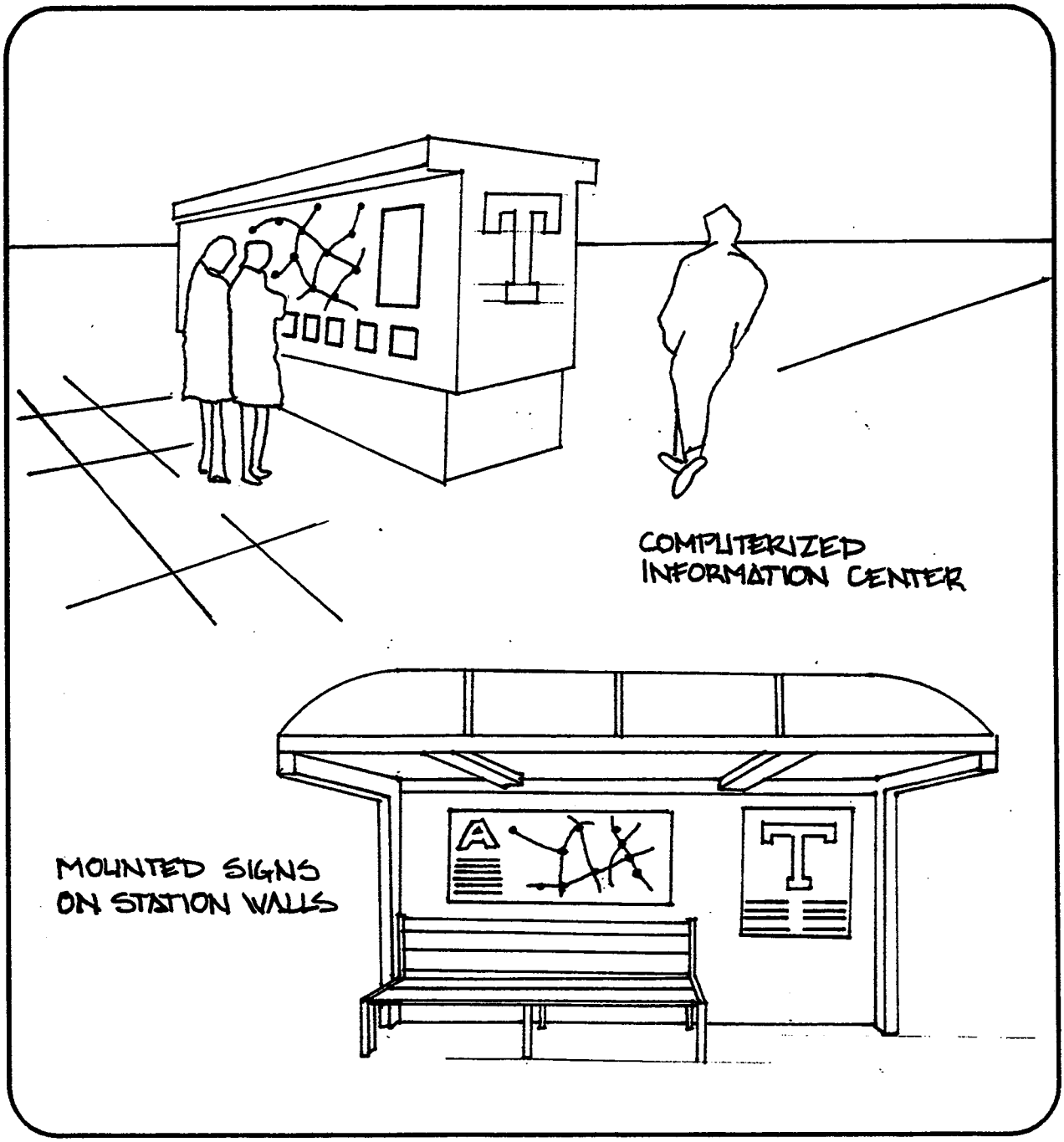


Figure 13. Examples of Transit Information Centers

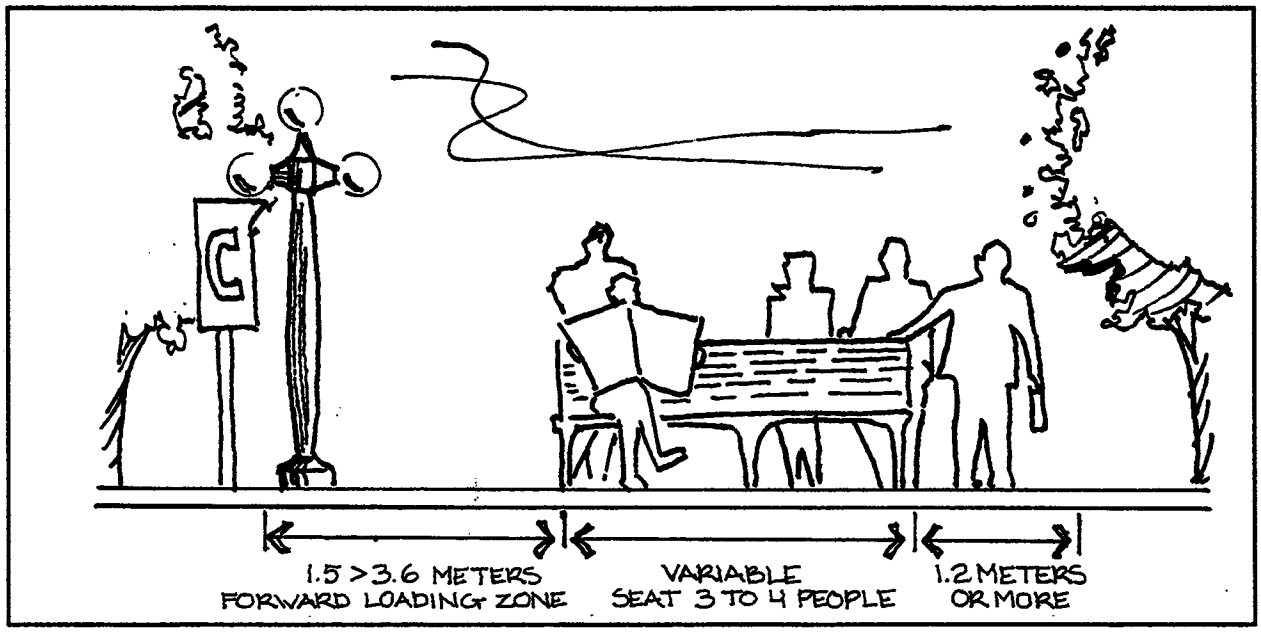


Figure 14. Bench Placement at Unprotected Transit Stop

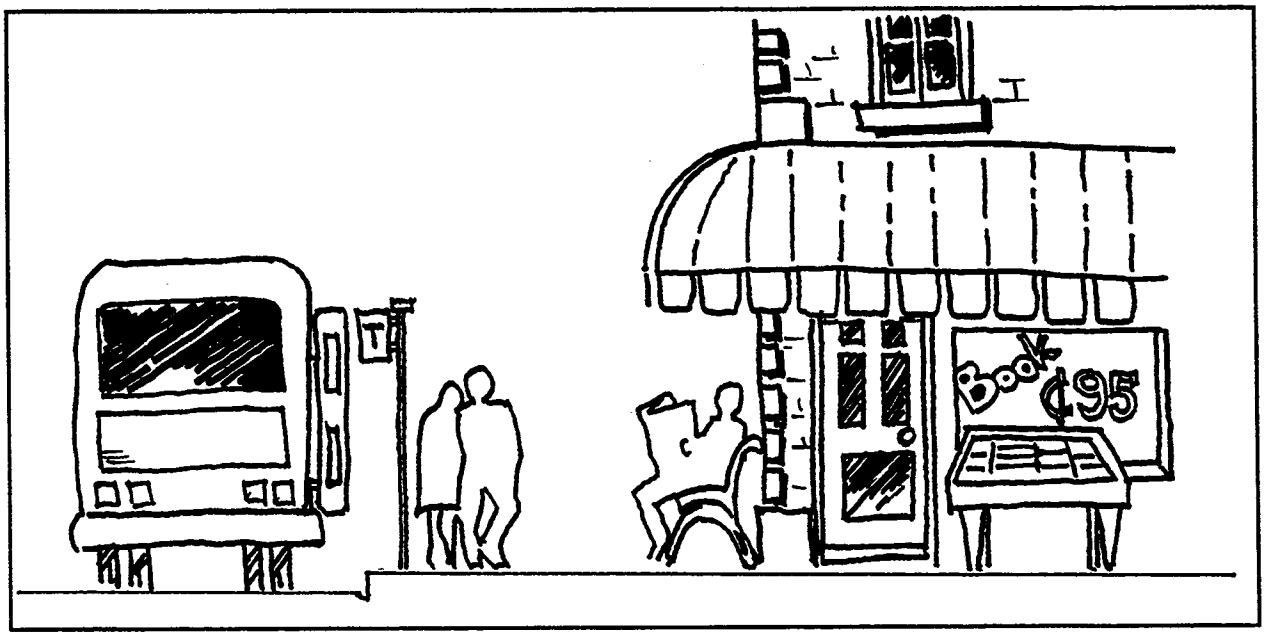


Figure 15. Incorporating Transit Bench into Adjacent Development

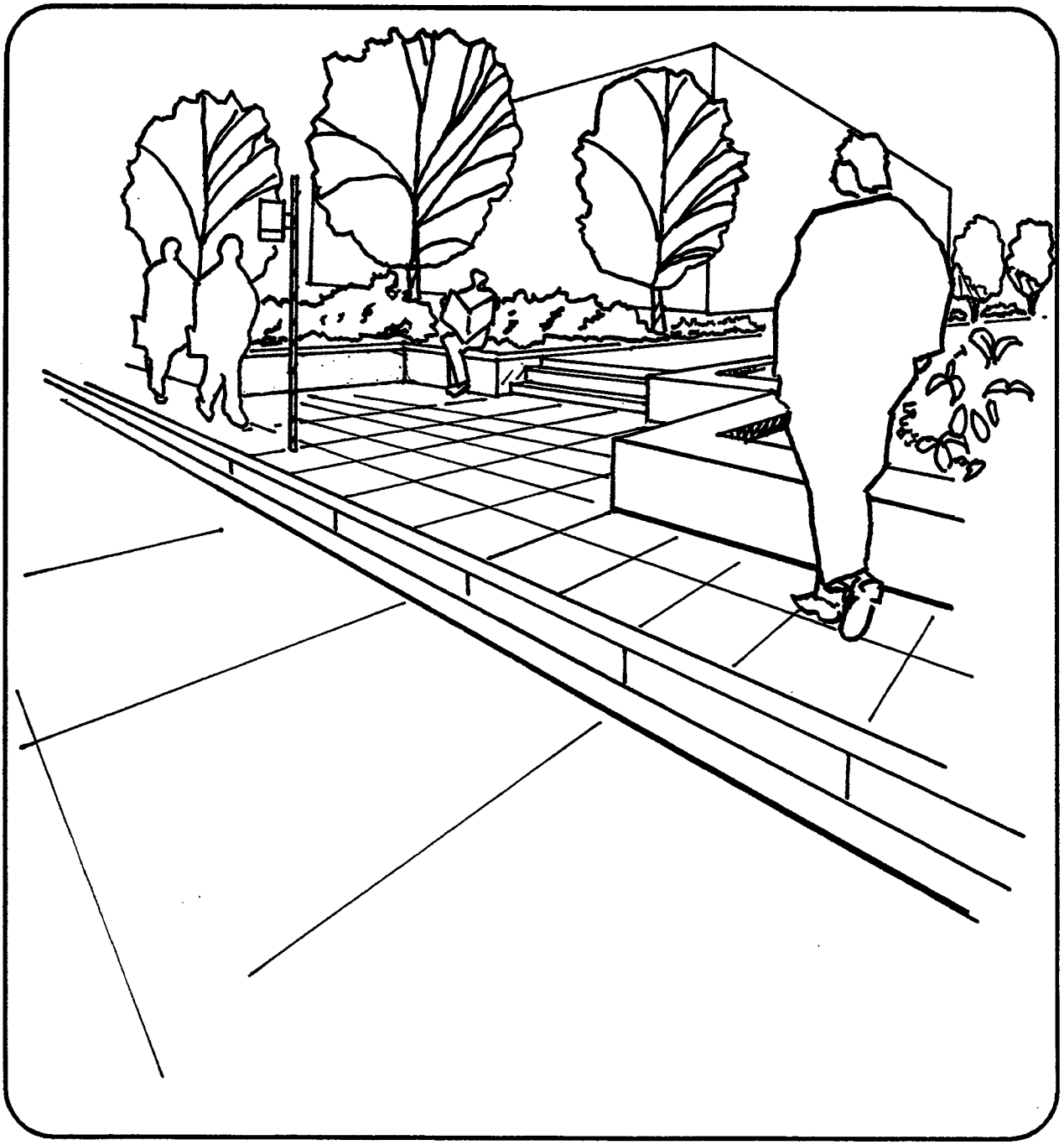

Figure 16. Transit Stop Using Existing Urban Features for Seating

## Transit Shelters

Transit shelters provide enclosed or semi-enclosed waiting areas for passengers. Shelters may be very simple in design or they may be more complex structures. Shelters may be heated or cooled, or they may be semi-open facilities providing protection from rain or snow. Some transit agencies use pre-fabricated shelters, while others design each shelter to fit into the specific location. One common approach is to use a mix of pre-fabricated or shelters of similar design in most areas, with specially designed shelters in specific areas such as downtown, in historic districts, and in other major activity centers.

One must consider a number of factors in the design of passenger shelters or waiting areas. First, waiting passengers must have a clear view of approaching transit vehicles. Many transit shelters use clear sides to allow passengers to see out. In addition, clear sides can also help reduce possible vandalism and crime by providing an unobstructed view of the waiting passengers to others. Although some transit agencies allow advertising on the sides of shelters, others do not over concerns related to vandalism and safety. Second, shelters should also be located and designed to provide adequate lighting levels. Shelters may be located near existing street lights or other lit areas or additional lighting may be incorporated in the shelter design. Figure 17 provides an example of a shelter design using both exterior and interior lighting. Ensuring that shelters are adequately lit is a critical element for passenger safety and comfort.

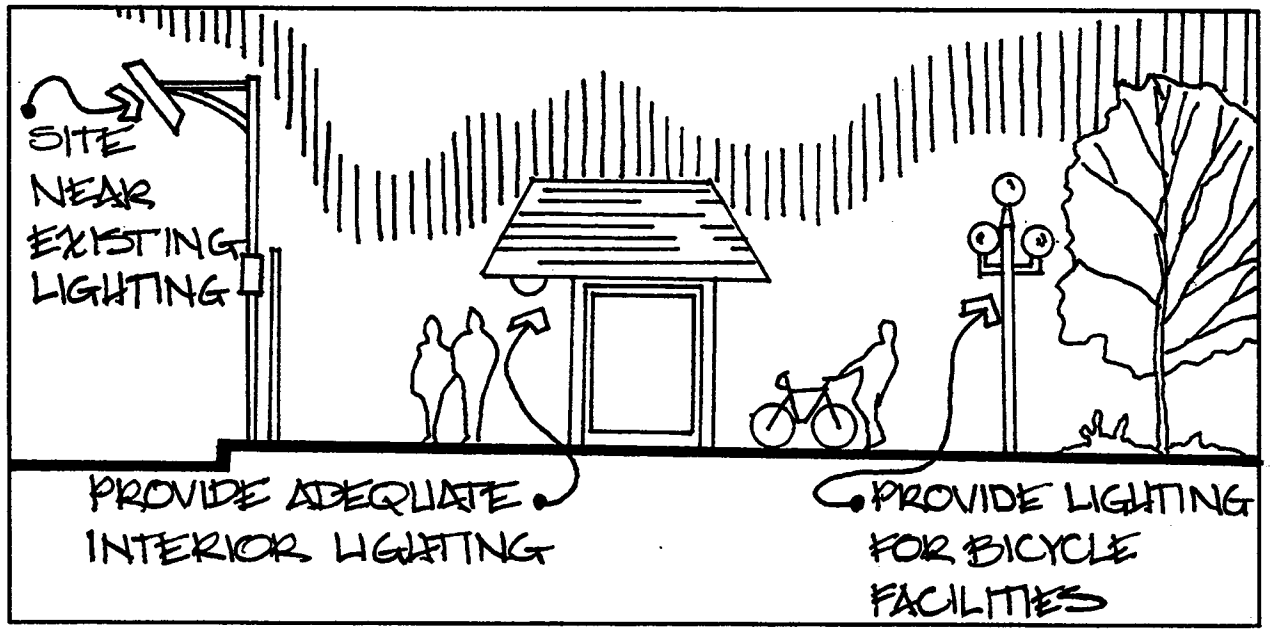


Figure 17. Shelter Using Exterior and Interior Lighting

Figure 18 provides examples of amenities that may be considered in the design of transit shelters and stops. These include elements such as landscaping, trash receptacles, and transit information signs or kiosks. Shelters should also have adequate seating and standing space for the number of passengers anticipated to be using the facility. Thus, larger shelters and waiting areas will be needed at higher volume stops. Figure 19 provides an example of shelter seating and passenger movement requirements.

**Bicycle Storage Facilities**

Access to a transit stop or facility is typically made by walking, driving to a park-and-ride facility, or being dropped off. Riding a bicycle is another alternative, however, and there are several strategies that can be used to increase the convenience of using a bicycle to access transit. First, pathways that access the stop or facility should accommodate bicycles. Exclusive bicycle lanes may be provided, or bicycle/pedestrian paths may be used. Storage facilities should be provided at the site so that cyclists can leave their bikes and transfer to the transit mode. Both racks and lockers can be used to store bicycles. One of the key concerns of cyclists is that the storage facilities provide a secure area for their bicycles. Lockers provide more secure facilities for bicycles, but they are more expensive to purchase and maintain than simple racks. The convenience of using bicycles with transit is further enhanced when showers and changing rooms are provided at work.

One should examine a number of factors when determining the appropriate type of bicycle storage facility for a specific transit facility. Elements to be considered include the weather and climate of an area, the anticipated number of cyclists using the facility, available space, and cost. Accommodations for bicyclists should be considered at transit stops that are located near high activity centers, such as schools, parks, hospitals, and shopping centers (12). Furthermore, to avoid damage to the shelter from improperly stored bicycles, adequate amounts of space for bicycles should be provided at transit stops. This will also help reduce the potential for conflicts between pedestrians and bicyclists (12). The following elements should be considered in the design and location of bicycling storage areas:

- Locate bicycle storage facilities near the transit station or stop to take advantage of surveillance from waiting passengers;
- The bicycle route to the transit stop should be as direct as possible (13,14);
- Locate bicycle storage facilities in areas that have unobstructed views from surrounding activities and land uses;
- Locate bicycle storage facilities in well lit areas;
- Use non-slip paving or concrete material in construction to avoid problems created from rain and mud;
- Make storage areas wide enough to accommodate maneuvering movements without damaging stored bicycles;
- Clearly mark bicycle storage areas with signs and information on use; and
- Storage areas should provide the bicycle user with the capability to secure the frame and both wheels (12).

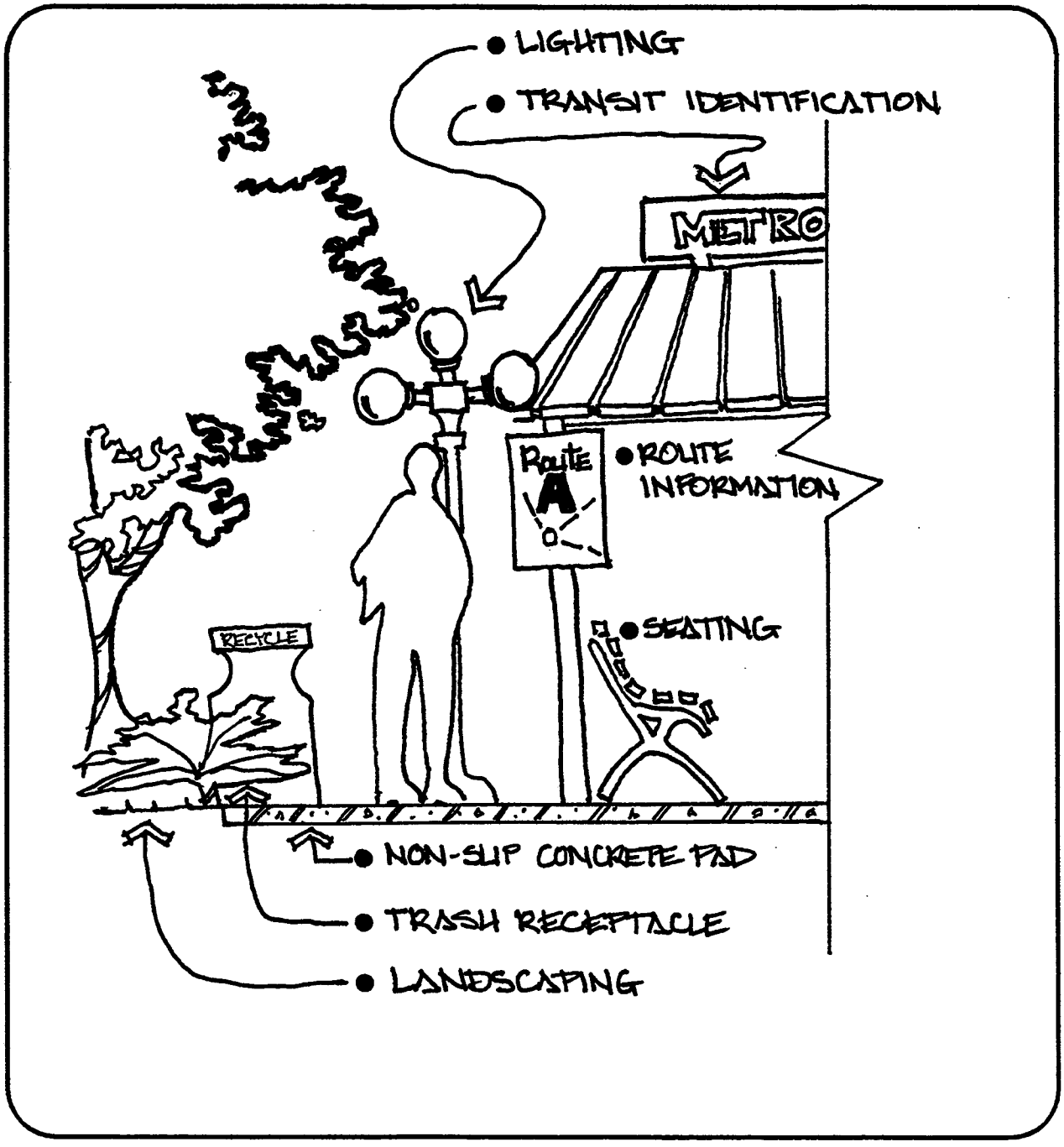


Figure 18. Shelter and Stop Amenities

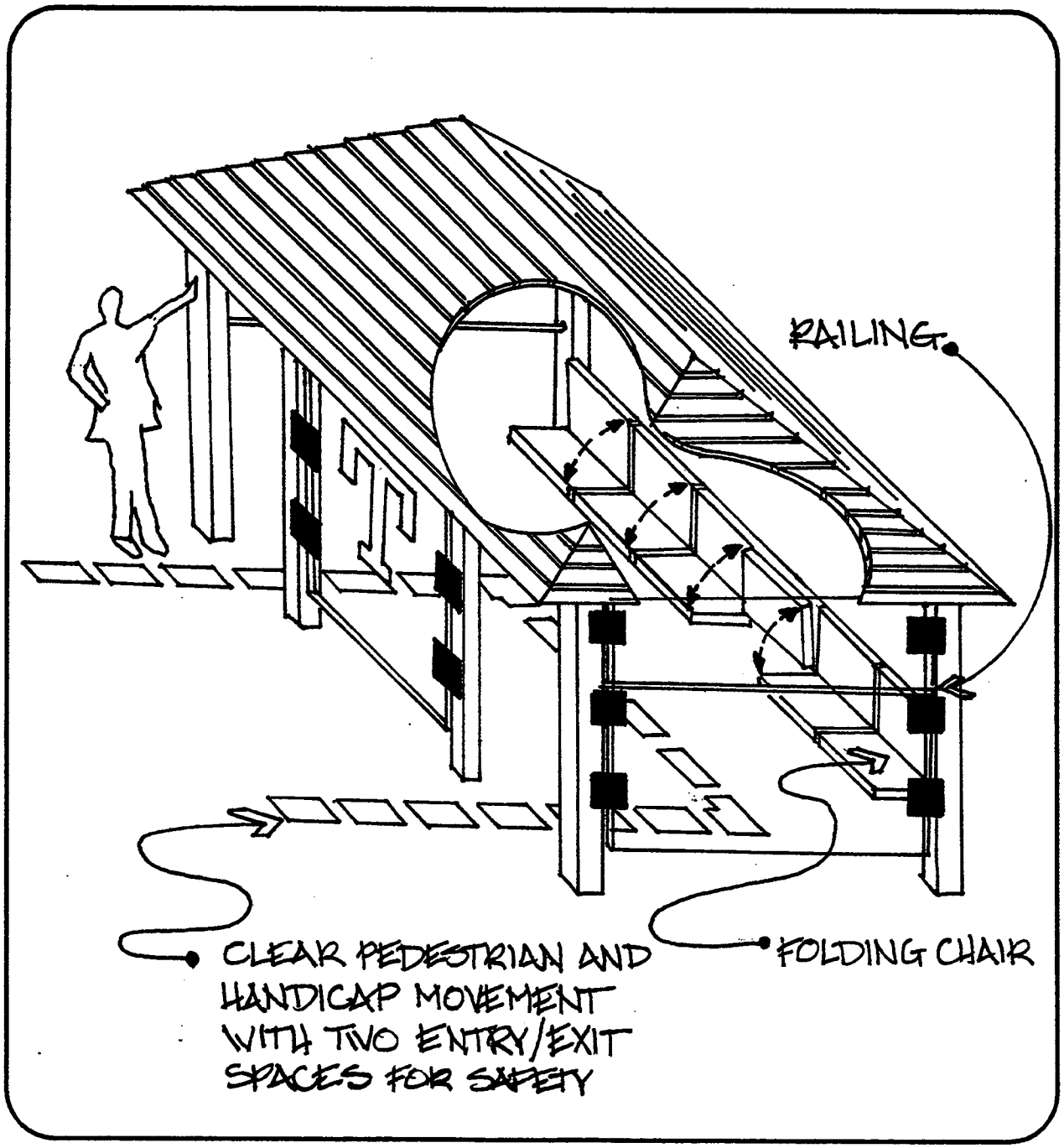


Figure 19. Shelter Seating and Passenger Movement Requirements

A number of standard bicycle storage racks are currently on the market. The most common is a galvanized steel bike rack that allows for storage on both sides. A drawback to bicycle racks is that bicycles are exposed to the elements at all times and are more susceptible to vandalism. With a little creativity, however, bicycle racks can be located to provide protection from the elements and visibility to reduce the potential of vandalism. Storage lockers are more expensive than racks, but provide advantages in protecting bicycles from bad weather and deterring vandalism. Figures 20 through 22 provide examples of bicycle storage treatments for different types of transit facilities.

**Design Considerations for Disabled and Elderly Individuals**

Transit facilities should be accessible to all individuals. The Americans with Disabilities Act (ADA) of 1991 and subsequent rules issued by the Architectural and Transportation Barriers Compliance Board and FTA outline specific design requirements for wheelchair lifts on transit vehicles and for ensuring that all transit facilities are accessible to disabled individuals. The most common concerns in ensuring that transit facilities are accessible to all individuals relate to mobility, maneuverability, ease of understanding or way finding, and access to information.

A few of the major concerns and the design treatments that can be used to address these are described next. Agencies should consult the specific accessibility requirements of the ADA and other regulations to be sure all issues are adequately addressed. The FTA *Accessibility Handbook for Transit Facilities* (15) is one of the best sources of information on the requirements and on design treatments for transit facilities.

A major design concern is to ensure that adequate space is provided for individuals in wheelchairs or with other disabilities to maneuver. The design of entry and exit points, benches, bathrooms, and loading and unloading areas should accommodate these needs. In addition, pathways should be free of obstacles, and spaces should be large enough for wheelchairs to move among other passengers. Figure 23 provides a few examples of obstacles and obstructions that disabled individuals may encounter. In addition, the loading and unloading areas at bus stops should allow for the extension of lifts from transit vehicles. This usually requires an extra 1 to 2 meters (6,15).

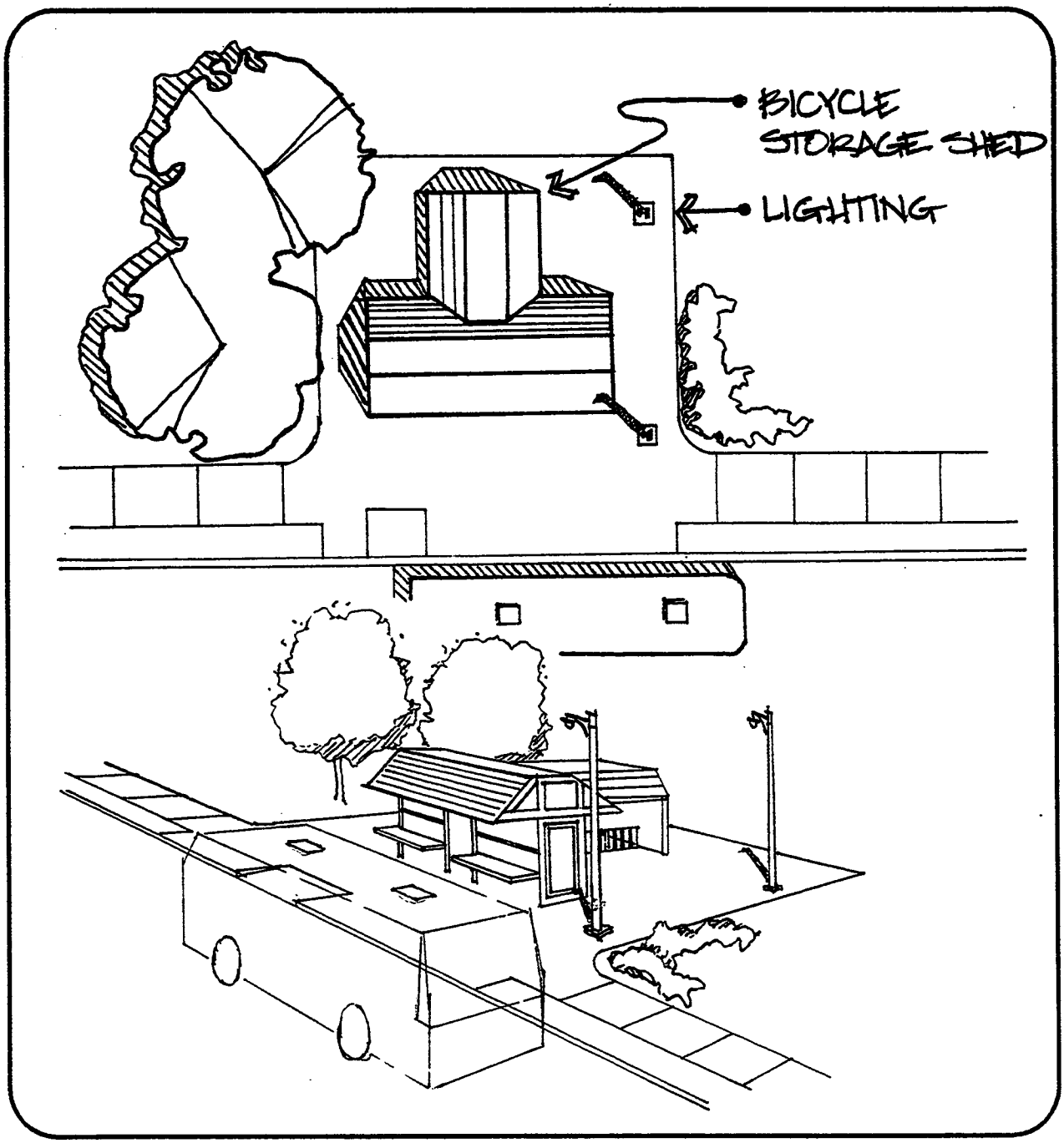


Figure 20. Bicycle Storage Facilities at Transit Shelter

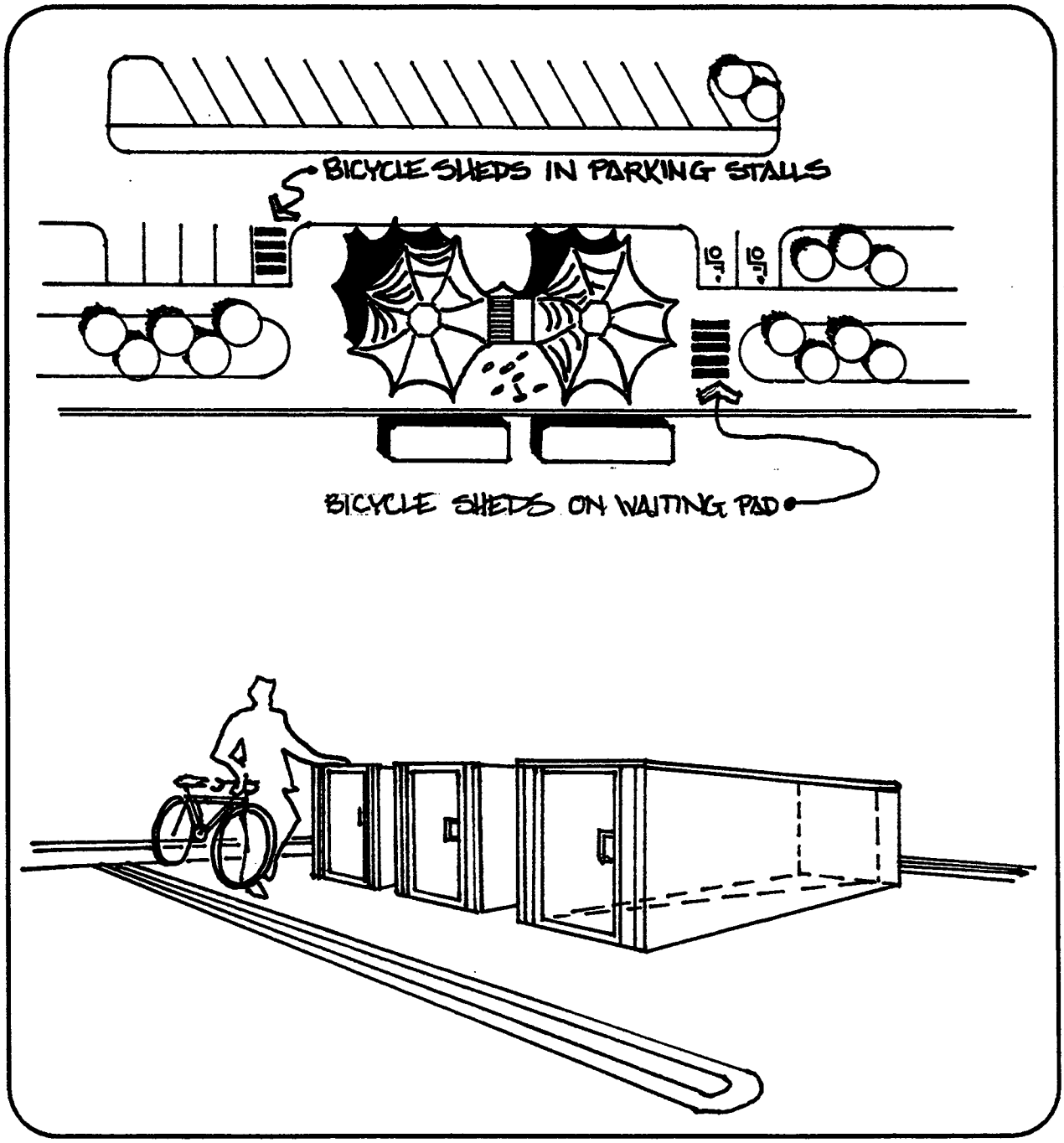


Figure 21. Bicycle Storage Lockers

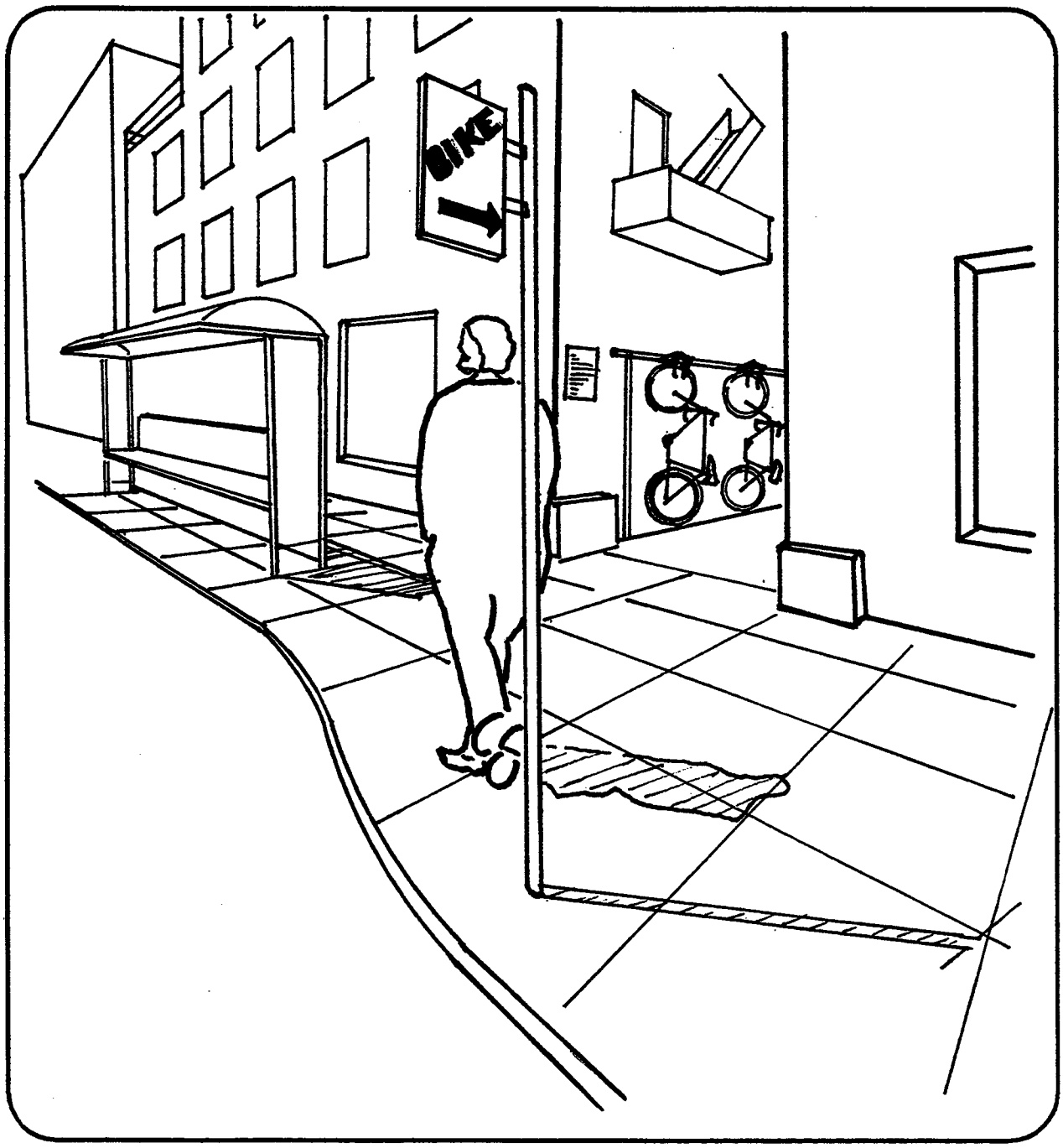


Figure 22. Vehicle Bicycle Storage Facility in Urban Area

Adopted from Richard K. Untermann, "Pedestrian Circulation." From *Handbook of Landscape Architectural Construction*, 1976.

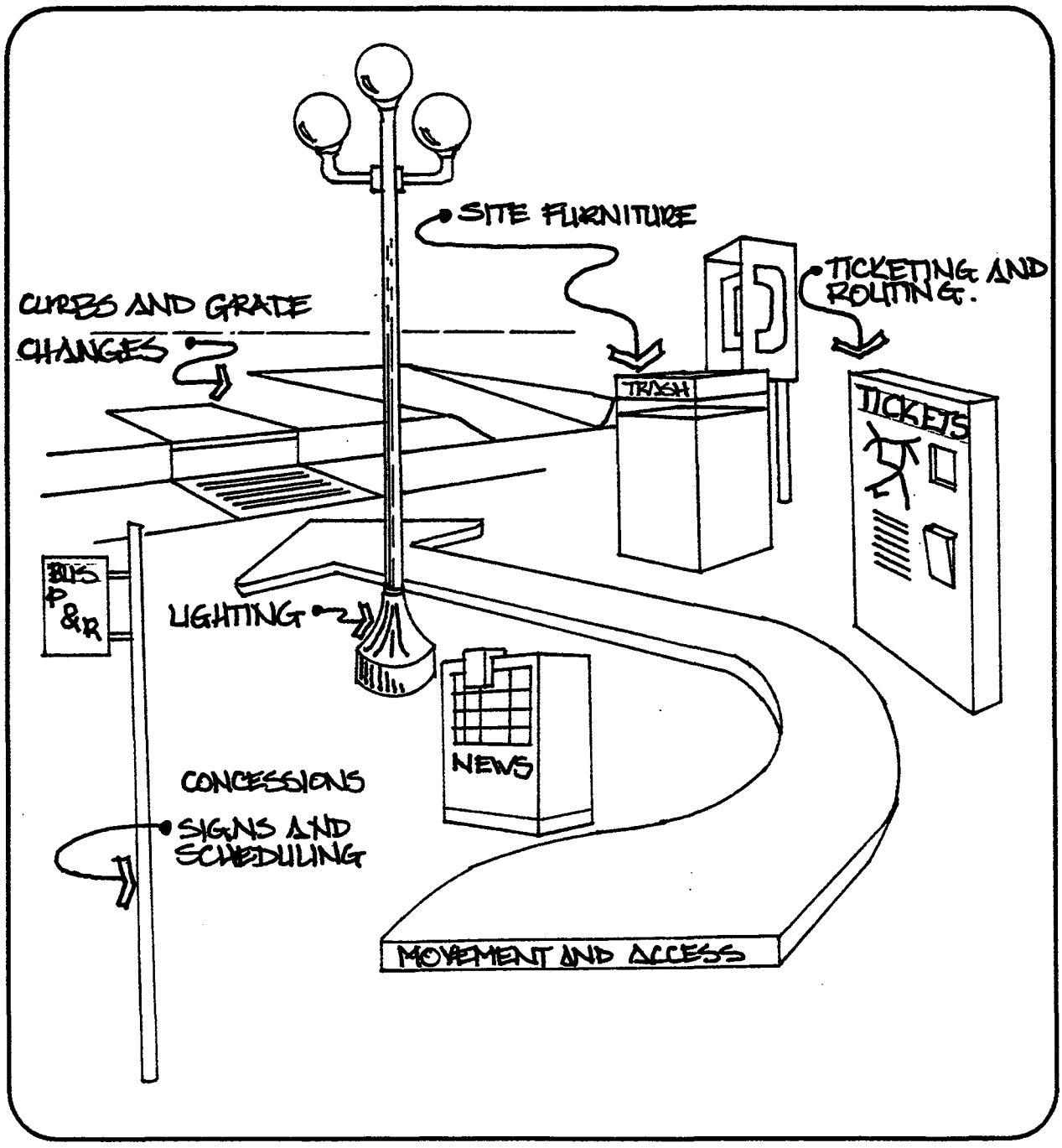


Figure 23. Potential Obstructions for Disabled and Elderly Individuals

Access to the transit facility should also be clear and unobstructed. Crowded platform spaces, stairs, escalators, drainage grates, and curbs may all present impediments to disabled and elderly individuals. Curb cuts and ramps should have slopes of no more than 1:12 in areas with significant grade changes. Lifts can also be provided in spaces that are too small to accommodate ramps. Stair railings should be constructed at heights to provide necessary support. Railings can also be extended at the tops and bottoms of stairs to provide extra support for individuals (6,15). Figures 24 and 25 provide examples of these basic design treatments.

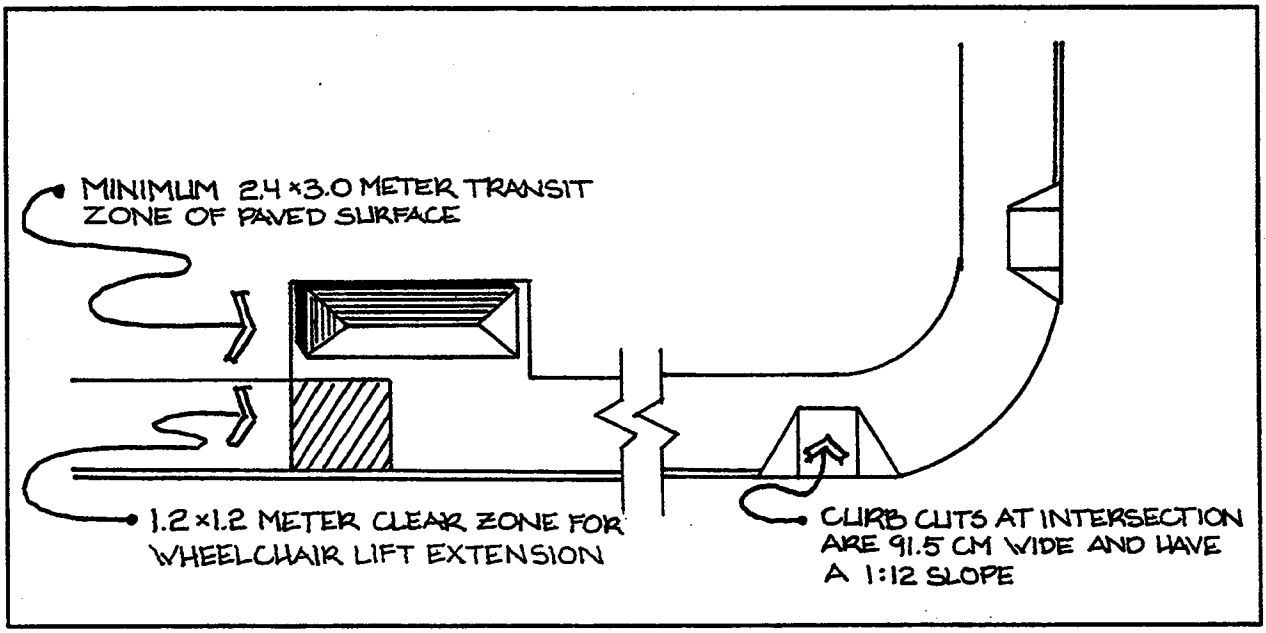


Figure 24. Wheelchair Access at Transit Stations

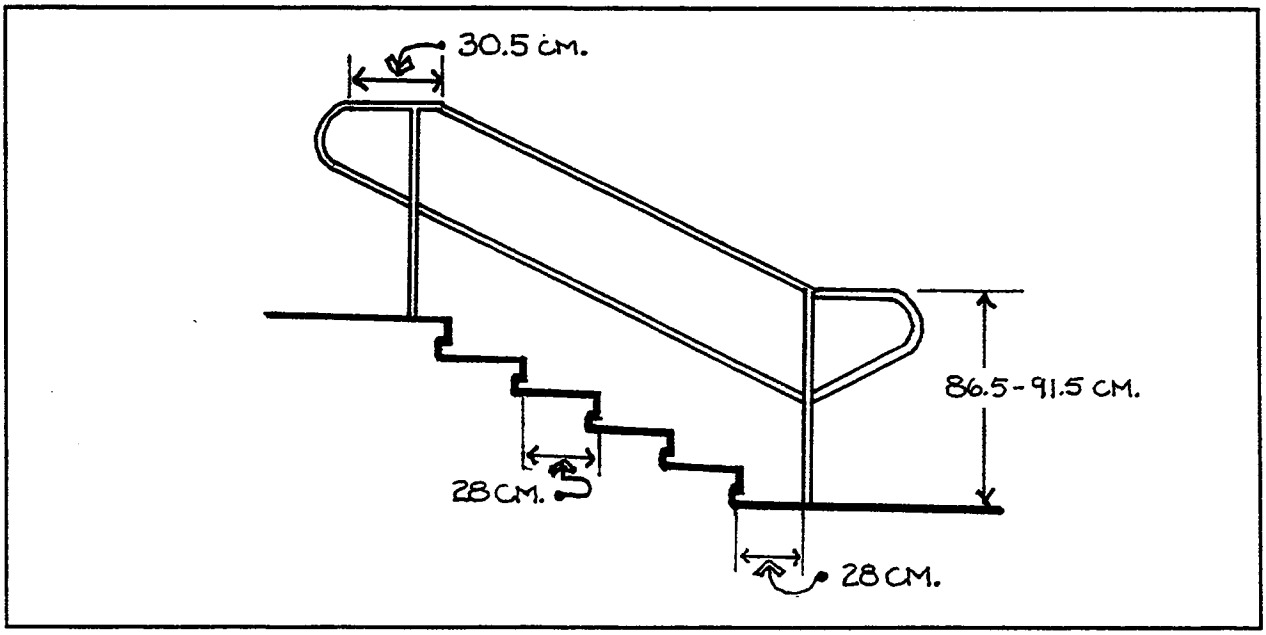


Figure 25. Accessible Stairs with Extended Handrail

One must also consider locating signs to ensure that disabled individuals have access to needed information. Directional signs for those in wheelchairs should be provided at eye level height, and letters and information should be sized according to viewing distance, with proper contrast between the letters and the background. Place signs in areas that are free and clear of obstructions and construct them of non-glare materials. Make emergency signs clearly visible to everyone, including disabled and elderly individuals. Information should also be available to blind or visually impaired individuals. Braille signs or stop annunciator systems can be used to provide needed information to these individuals.

## Other Transit Facilities

The basic design principles described in this chapter are appropriate for other types of transit facilities. These include larger facilities such as light rail transit (LRT) or commuter rail stations, park-and-ride lots, transit centers, and intermodal stations. Although planning and designing these facilities is more complex due to their size and access by multiple vehicles, the same basic concepts relating to passenger convenience, comfort, and safety are relevant. As summarized next, a number of reports provide additional guidance for designing these types of facilities.

**Park-and-Ride Facilities.** Park-and-ride and park-and-pool facilities provide a common location for individuals to transfer from a low-occupancy travel mode to a high-occupancy travel mode. In most cases, this means transferring from an automobile to a bus or a rail system. In areas where regular transit service is not available, park-and-pool lots may be provided to encourage the formation of carpools and vanpools. Access may also be accomplished by walking or bicycling. Park-and-ride facilities have been used extensively throughout Texas and the U.S. A number of guides to planning and designing park-and-ride lots have been developed by TTI (16,17), federal agencies (18), national organizations (19), states (20), and transit agencies (6,21,22). Figure 26 is an example of a park-and-ride lot at a commuter rail station.

**LRT, Heavy Rail, and Commuter Rail Facilities.** Dallas Area Rapid Transit (DART) is constructing an LRT system, and other metropolitan areas in Texas are considering LRT and commuter rail projects. A number of reports are available on planning and designing stops and stations associated with different rail systems. These include reports from national organizations (23,24) and transit agencies (10,25). Figure 27 is an example of a light rail station in a metropolitan area.

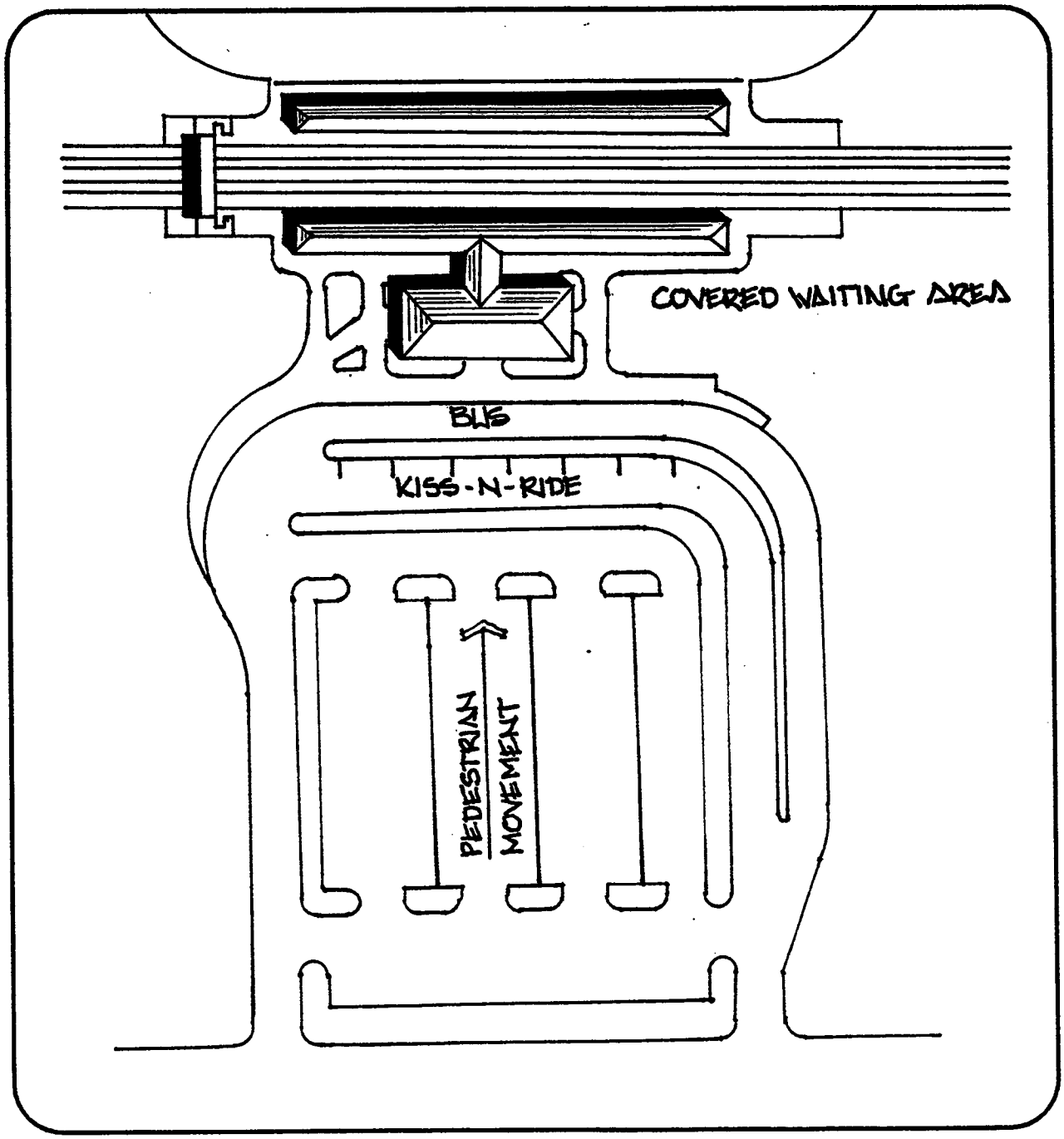


Figure 26. Park-and-Ride Lot at a Commuter Rail Station

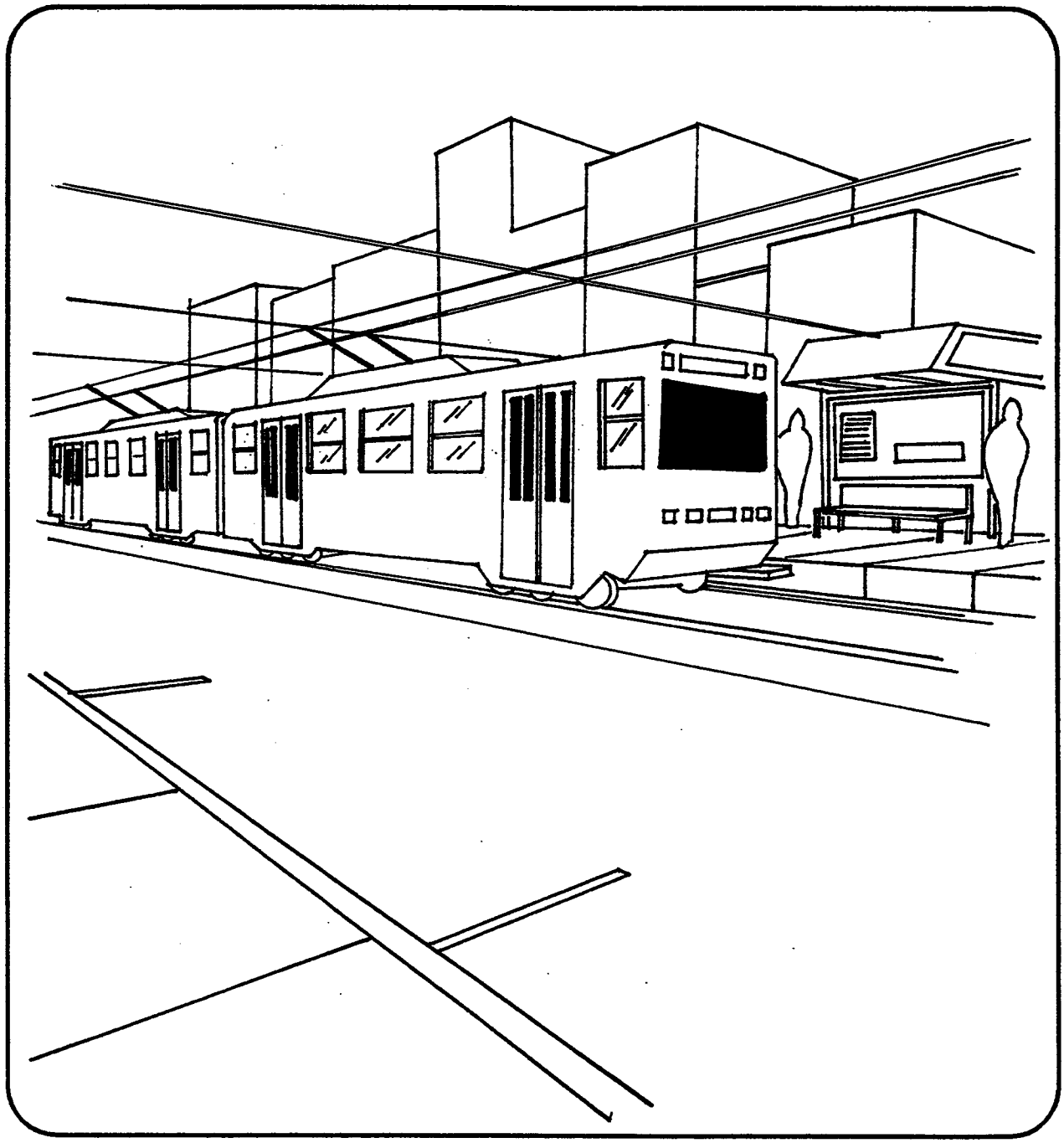

Figure 27. Light Rail Station

# CHAPTER FOUR

## SIX STEP PROCESS FOR PLANNING AND DESIGNING TRANSIT FACILITIES

The complexity and level of detail involved in the planning and design process will vary greatly depending on the type of transit facility and the characteristics of the area. Locating a bus stop or a small bus shelter is easier, requiring fewer resources than designing a major rail station. The same basic process can be used for all types of transit facilities, however.

This chapter presents a basic six step process that can be used by all groups interested in planning and designing transit facilities. This process can be used by transit agencies, service providers, TxDOT, local communities, private sector businesses, and other groups interested in planning and designing different types of transit facilities. Although the level of analysis will vary among projects, the information provided in this chapter can be used as a general guide for all kinds of facilities. Further, these steps outlined help to focus the planning and design process on the key elements that should be considered in the decision making process.

### Six Step Design Process

The basic six step design process is illustrated in Figure 28. The six steps are: examining the need for a facility, identifying and inventorying potential sites, analyzing the characteristics of the sites, developing design alternatives, evaluating the design alternatives, and selecting the most appropriate site and design. The major elements of each step are summarized below.

**Step 1—Examine Need for Facility.** Developing any type of transit facility is not an end or objective in and of itself. Rather, the development and operation of a specific facility represents one means of achieving a goal or an objective. In the case of transit, fixed facilities are used to provide access to services for users, to enhance passenger comfort and convenience, and to provide necessary connections between different types of services and modes. Thus, before the design process is initiated, the need for the facility itself must be established.

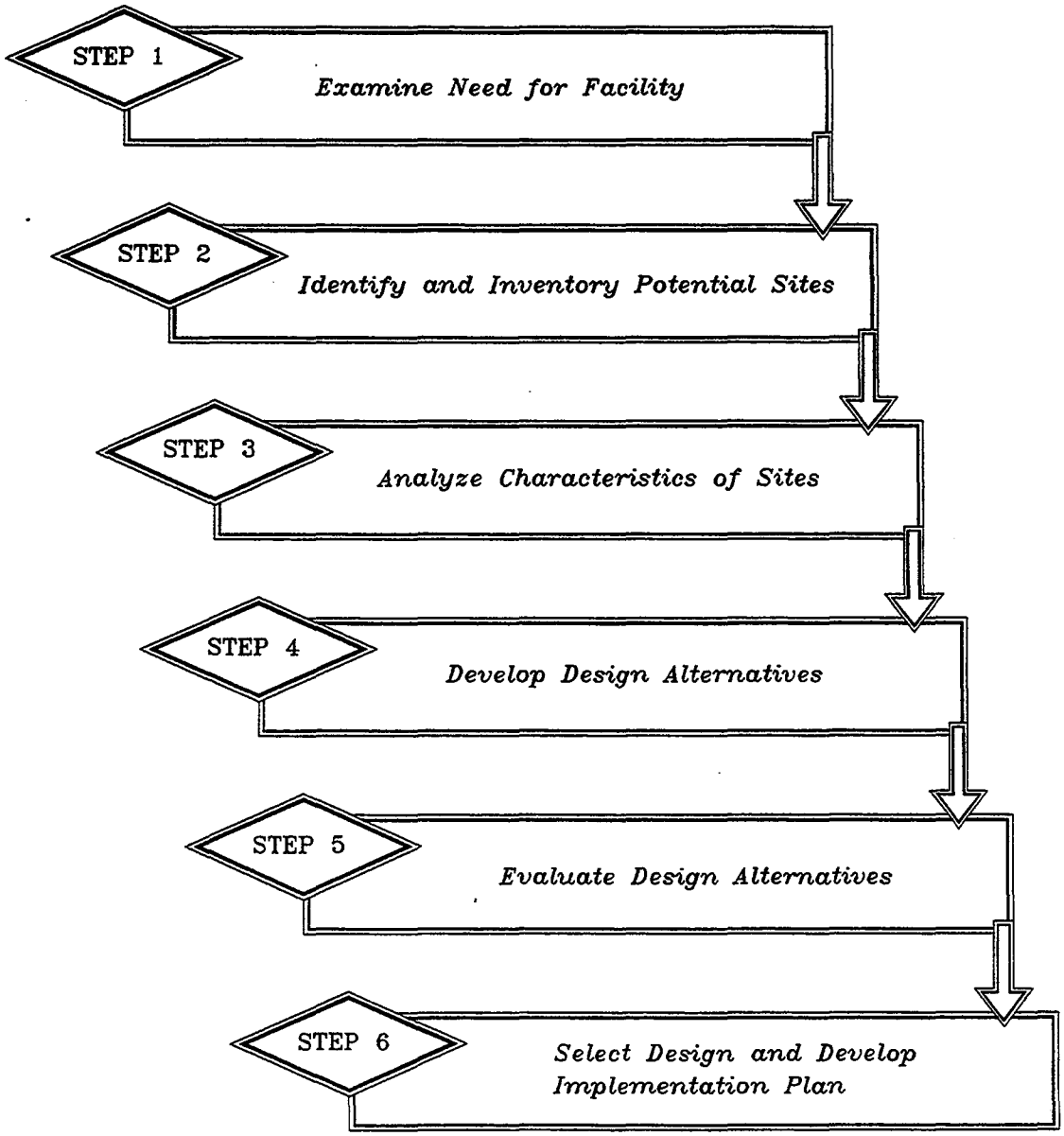


Figure 28. Six Step Design Process

In addition, the facility should be consistent with the goals and objectives of the transit agency, state DOT, and community. These goals and objectives will help identify the need for certain types of facilities. For example, some transit systems have identified thresholds for consideration of passenger shelters. Stops with over a certain number of passengers are targeted for shelters or other improvements. In other cases, the development of new systems, such as park-and-ride lots, HOV lanes, express bus services, and LRT or rail systems will all require consideration of transit facilities. Further, the agency goals and objectives will help define the general approach that can be considered and the parameters within which a project can be considered.

A variety of information can be used to identify the need for new or remodeled transit facilities based on the local goals and objectives. Passenger volumes, special surveys, and requests or complaints can all be used to target locations for improvements. In addition, new services may provide the opportunity to enhance existing facilities or to develop new ones.

**Step 2—Identify and Inventory Potential Sites.** This step involves the identification of potential locations or sites for a transit facility. It also includes completing an inventory of the physical and environmental features of each site. Potential sites can be identified through the techniques briefly summarized below. Obviously the methods used and the level of analysis should be matched to the type of facility being considered.

- *Field Observation.* One may use field studies of the major travel corridors and neighborhoods in the area to obtain information on current transit use, traffic conditions and major congestion points, informal park-and-ride arrangements, major access points, and potential sites. Ultimately, field observations will be used to assist in identifying the best location for a facility. Including it as a step early is encouraged, however, as firsthand knowledge of the area is important in planning and designing transit facilities;

- *Current Transit Routes and Ridership Levels.* Examining the current route structure and ridership level in an area provides a good indication of the need for new or expanded facilities. Stops with high service and ridership levels may be candidates for new or renovated facilities;

- *Aerial Photographs.* Aerial photographs can be used to provide an idea of the size and nature of residential neighborhoods and commercial areas. Aerial photographs also show the local and regional roadway system, providing an indication of access from different areas. Finally, aerial photographs can be used to identify vacant land and existing buildings that may be candidates for the desired transit facility;

- *Land Use Maps.* Along with aerial photographs, land use maps can be used to provide an indication of both existing and future land use patterns and densities. This can help identify current demand, as well as potential future demand. Reviewing

land use maps, comprehensive plans, and zoning maps provides a further indication of anticipated growth areas and community goals;

- *Special Surveys and Other Information.* One may use a variety of special surveys to help identify the demand for new transit facilities. For example, surveys may be conducted of existing transit riders, commuters in the corridor, employees and shoppers at major activity centers, and residents in the neighborhood. On-board, mail, telephone, and direct interview techniques may all be used to conduct these surveys. In addition, census data, traffic counts, and other information may be of help in identifying potential sites.

  Once the potential sites have been identified, an inventory can be conducted to document the characteristics and features of each location. This inventory should include elements related to both the natural and manmade environment. Table 1 provides examples of some of the features that should be included in this inventory. A checklist could be developed for each type of transit facility to highlight the characteristics important to each. This checklist could then be used to compare the advantages and disadvantages of different sites.

**Step 3—Analyze Characteristics of Sites.** This step involves analyzing the information collected in the inventory of all the sites under consideration. The characteristics of each site should be examined and the advantages and disadvantages of each location should be identified. How well each site meets the agency goals and objectives can also be assessed. The level of analysis should be matched to the type of facility, the complexity of the issues, and the staff and financial resources available. Depending on the needs of the local area, the outcome of this step may be a ranking of all the sites from most to least preferable, or the identification of the preferred site or sites.

**Step 4—Develop Design Alternatives.** In this step, design alternatives for the preferred site or sites are developed. The number of sites and the number of design alternatives should be kept to a reasonable number to ensure that resources are not wasted. In addition, the level of effort should be matched to the type of facility and the complexity of the setting. In many cases, a transit agency, DOT, or community may have a standard theme or design treatment that is used with all fixed facilities. In other cases, there may be a desire to match the design to the unique characteristics or features of an area. The use of prefabricated shelters and other elements may be considered, or individual design treatments may be utilized.

Table 1. Example—Transit Site Inventory Checklist

| Characteristics |
|---|
| Natural Environment<br>•Trees<br>•Vegetation<br>•Topography<br>•Sun/Shade<br>•Climate<br>•Seasonal variations |
| Manmade Environment<br>•Adjacent land uses<br>•Adjacent buildings<br>•Traffic levels<br>•Unique architectural features<br>•Sidewalk condition<br>•Bicycle facilities<br>•Lighting<br>•Landscaping<br>•Telephones<br>•Street Furniture<br>•Trash receptacles<br>•Walls, fences, or berms<br>•Location of utilities<br>•Planned land use or buildings |

**Step 5—Evaluate Design Alternatives.** In this step, the different design alternatives are evaluated. The criteria used in this analysis should reflect the agency goals and objectives noted earlier. Commonly used evaluation criteria include cost considerations, compatibility with the surrounding buildings and area, projecting a positive image for the transit system and community, and ensuring that the design enhances the comfort, convenience, and safety of passengers. Compromises may need to be made in some design elements due to funding limitations.

**Step 6—Select Design and Develop Implementation Plan.** This step involves the selection of the final design and the development of an implementation plan to complete construction of the facility. The final design may be selected by senior staff or a policy board. The selection process should follow the normal decision making process and should reflect the goals and objectives of the agency or community. Once a decision has been made and a design has been selected, an implementation plan can be developed. This should include the identification of funding sources, the process to be

used to select a developer, and a schedule. This plan can then be followed for the actual construction and operation of the facility.

# CHAPTER FIVE

## CONCLUSIONS

This report has examined design treatments that can be used to enhance the convenience, comfort, and safety of transit facilities, and to improve pedestrian and transit interaction. It has summarized the human factors and the environmental characteristics that should be considered in designing transit facilities. Examples of good design treatments to enhance passenger comfort, convenience, and safety have been identified and illustrated. Further, a six step process has been outlined to provide guidance on planning and designing pedestrian-friendly transit facilities.

A number of other alternatives are also available to enhance the interaction between pedestrians and transit, and to encourage more transit-friendly developments and land uses. These policies and provisions are examined in more detail in a separate report (2). A few of the approaches related to land use and pedestrian facilities are outlined next, however.

**Create Pedestrian-Friendly Environments**—Making walking more attractive within a community can help enhance transit use, since walking is the most common way people reach transit stops. Creating a pleasant environment for pedestrians can be accomplished through the provision of sidewalks, pathways, landscaping, and other techniques. Interest is increasing in creating livable communities focusing on more traditional styles of development. These types of developments are oriented to the human scale by juxtaposing multiple land uses within close walking distance and by enhancing the experience of walking or bicycling.

**Transit-Friendly Developments**—Many developments and buildings have been constructed without any consideration of transit. Providing service to these facilities as an afterthought is often difficult. Including provisions for transit early in the design stage can make new developments more transit friendly. This can include provisions for access for transit vehicles to and from the building or development complex and designing passenger waiting areas into the facility.

**Transit Linkages**—On a larger scale, transit linkages between developments and areas should be thought of before construction actually occurs. Developing a system of transit, pedestrian, and bicycle networks can help ensure accessibility to all areas.

**Land Use Policies**—Land use policies and zoning ordinances can be used to encourage more transit-friendly development patterns. This may include allowing mixed land uses within certain areas or encouraging higher densities around major transit facilities.

**Transit Oriented Developments**—Transit Oriented Developments (TODs) is a term used to describe new communities focused around transit services. The concept, which is being used in Sacramento and other areas, focuses on developing mixed-use communities and neighborhoods oriented toward transit, walking, and bicycling.

The use of these approaches can help enhance the transit design treatments discussed in this report. These techniques can also improve access to transit service for all groups. Further, they can make it easier and more cost effective for transit agencies to provide services to all areas of a community. From the private sector perspective, they can also improve the attractiveness and accessibility of developments.

The information in this report should be of benefit to transit agencies and TxDOT personnel, city staff, private developers, architects, and other groups interested in enhancing the convenience, comfort, and safety of transit passengers through enhanced facility design treatments. As such, it can help transit services continue to meet the diverse needs of residents and visitors in large metropolitan centers, smaller communities, and rural areas throughout Texas.

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