DESIGNING FOR TRANSIT

A Manual for Integrating Public Transportation
and Land Development
in the San Diego Metropolitan Area

Prepared by the
Metropolitan Transit Development Board (MTDB)
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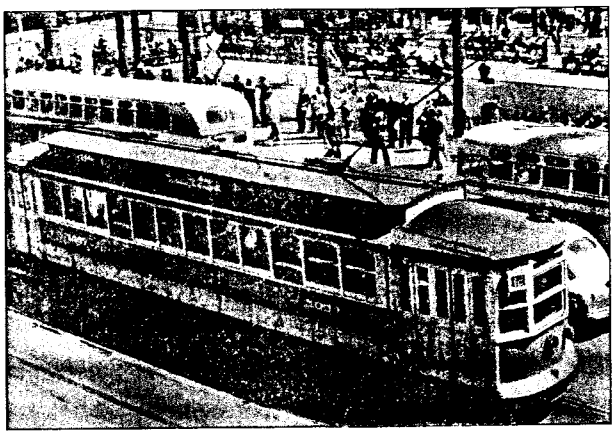
1. INTRODUCTION

There was a time when public transportation was an integral part of San Diego. Streetcar and bus lines developed along with the city itself, often preceding development and directing its growth. As a result, transit provided convenient access to most of the activities San Diego had to offer. All this began to change after World War II. The popularity of automobiles diverted attention away from public transportation; we became preoccupied with developing highways and auto-oriented suburbs. Many of these suburbs were poorly laid out for walking or public transportation, leaving no choice for many residents but to use their cars.



As we approach the end of the century, the limitations inherent in this unbalanced approach are becoming obvious. In spite of increased road building, traffic congestion in the region is growing. Auto-related air pollution, noise, and energy consumption are growing, as well. For many people, our metropolitan area seems to have lost some of the appeal it once had.

These problems can be dealt with—and, in some cases, overcome—by rediscovering the potential of public transportation. This manual describes how bus and light rail transit can again be integrated into new development. It also discusses the related role of improving conditions for pedestrians. The overall objective, simply stated, is that land use patterns and transit development should be mutually supportive, not at odds with each other. Greater reliance on walking and transit can result in a healthier and more vibrant urban environment, as well as a higher quality transportation system. By diminishing the public's dependence upon automobiles for mobility, even motor vehicles will perform more efficiently. The result will be a net gain for everyone concerned—developers, government agencies, and the public at large.

About this Manual

This manual has been designed to help planners, developers, architects, and engineers understand the physical requirements of public transportation. It should also be of value to elected officials and city administrators in formulating transit-supportive policies.

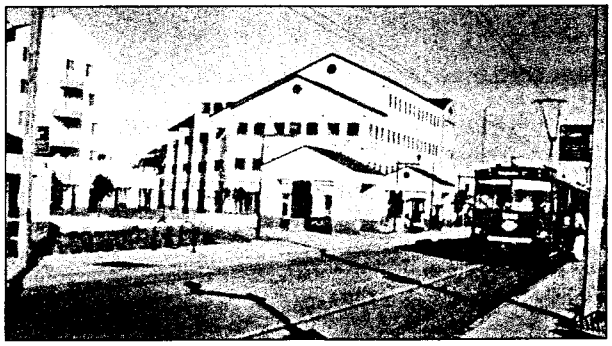
The manual consists of five sections. This introduction is the first section, providing background material on transit in the San Diego region and the need for its coordination with land development. The second section presents some general guidelines on how to design development in a more transit-supportive way. It explains how to make residential and commercial areas more conducive to walking and to the use of buses and light rail. It is followed by two sections giving specific design standards for public transportation facilities and vehicles,

one section for bus transit and one for light rail transit. The final section of the manual discusses how to establish local government policies that can foster transit-oriented communities.

This manual will be updated from time to time. Your ideas and contributions are welcomed. Please send them to the Director of Planning & Operations, MTDB, 1255 Imperial Avenue, Suite 1000, San Diego, CA 92101-7490.

Public Transportation in San Diego

The whole subject of public transportation may be somewhat unfamiliar to many readers. In a nutshell, public transportation, or transit, refers to the movement of people in groups, generally in large vehicles operating on fixed routes and schedules. These services are available to the general public at established rates of fare. The most common vehicles in transit service are buses, but there is also a growing light rail system in San Diego. *Light rail transit* (LRT), also



known locally as "the Trolley," utilizes trains of electric rail cars, which can operate both on city streets and in exclusive rights-of-way. Two light rail lines are currently in service, with numerous extensions planned throughout the decade.

Allied with these services are the taxis, jitneys and dial-a-ride operations sometimes known as *paratransit*. Because paratransit uses small vehicles which are generally accommodated in our urban environment, it is not dealt with in this manual. The emphasis here is on conventional bus and LRT service.

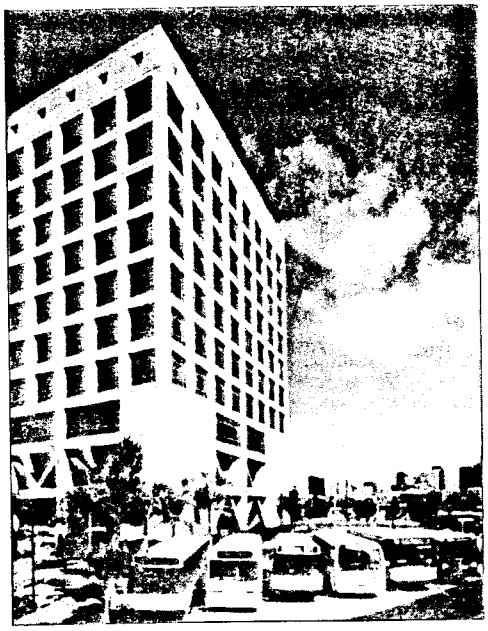
Historical Background.

Public transportation in San Diego has a long and colorful history. The first streetcars began operation in 1886, pulled by horses or mules, and later by steam and cable power. Under the leadership of the San Diego Electric Railway Company, these were soon replaced by electric streetcar lines, which expanded throughout the city. Long-distance runs into the countryside were served by heavier interurban electric railways.

The first motor buses appeared during World War I on independently operated "stage lines" to outlying communities. The San Diego Electric Railway eventually bought out many of these lines and also began substituting buses for streetcars on its lightly used routes. Such substitutions became more numerous after

World War II. It was cheaper for the company to initiate bus service than to renew the tracks and streetcars worn out from heavy wartime use. The last of the old streetcar lines closed down in 1949.

Meanwhile, in 1948, the company had been sold and reorganized as the San Diego Transit System. It faced many challenges. Strong competition from private automobiles was developing in the postwar years. In addition, the auto-oriented design of the newly developing suburbs was difficult to serve by transit. Steadily declining ridership eventually spelled financial disaster. To forestall massive service cuts, the system was purchased by the City of San Diego and began operating as San Diego Transit Corporation in 1967. Several suburban jurisdictions started public transit services, as well. These communities purchased their own buses, but turned day-to-day operations over to private companies.



The increasing number of transit providers in the region began to result in confusion. To help address this problem, the Metropolitan Transit Development Board (MTDB) was created by the State Legislature in 1975. It introduced standardization and coordination for all the operators in the metropolitan area. MTDB also began the development of a light rail transit system, to be operated by a subsidiary known as San Diego Trolley, Inc. Its first line opened in 1981. In 1985, the City of San Diego turned responsibility for San Diego Transit over to MTDB; this was followed four years later by the authority to regulate its taxis and jitneys.

Current Organization.
MTDB has the responsibility for setting fares, planning routes and schedules, and constructing transit facilities in the southwest portion of San Diego County. In MTDB's area of jurisdiction, six different agencies actually operate transit service. These six agencies are united with MTDB into a federation known as the Metropolitan Transit System (MTS), consisting of the following operators:

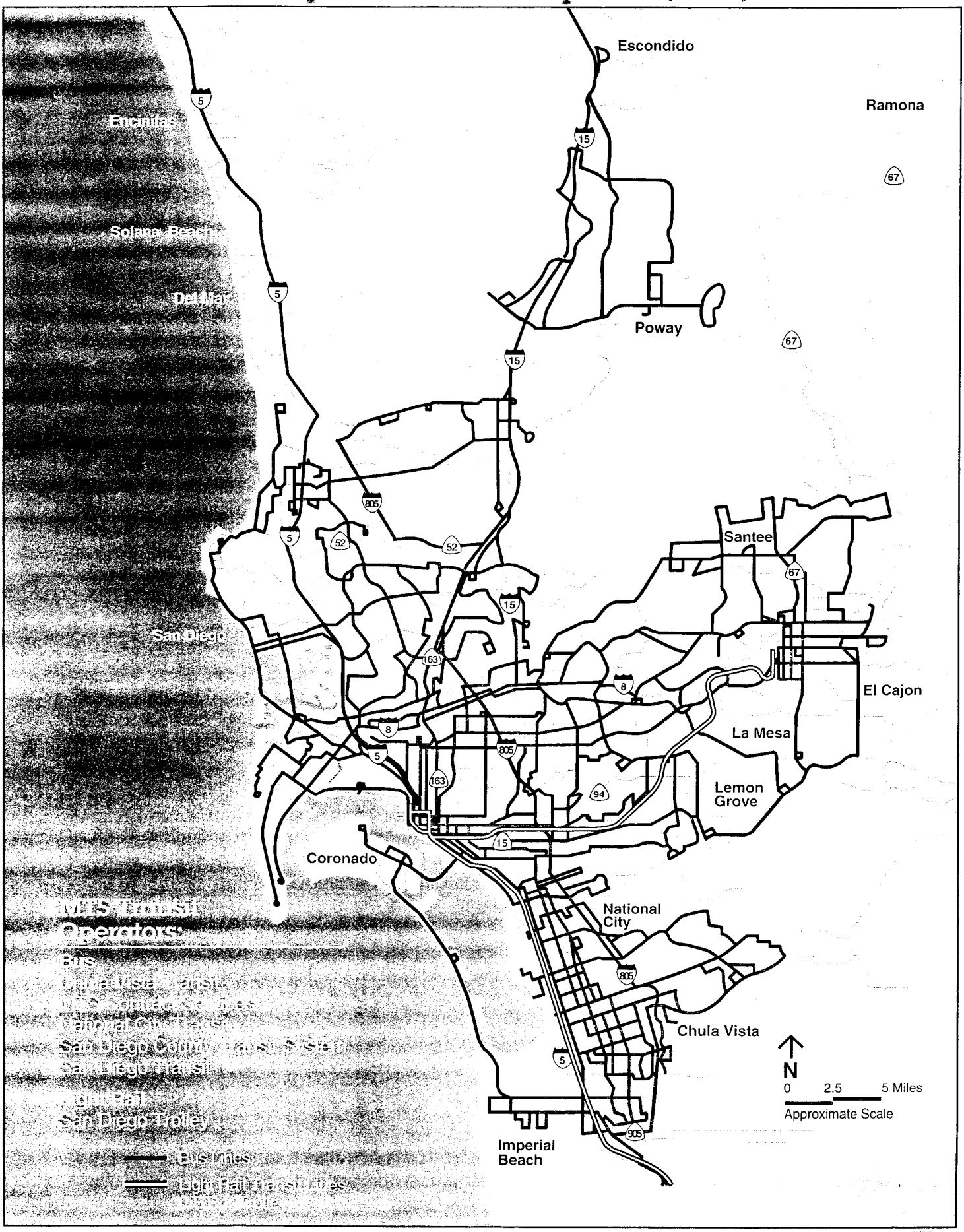
- Chula Vista Transit
- MTS Contract Services
- National City Transit
- San Diego County Transit System
- San Diego Transit
- San Diego Trolley

All the MTS operators share a common fare structure, route numbering scheme, and public information system. Thus, riders are assured of the benefits of one unified system, even though its components are operated by different service providers.

Making the Land Use Connection

In fulfilling MTDB's responsibility for improving public transportation, one fact has become very clear: The environment in which transit is operated is no less critical to its success than the quality of service that is offered. That is why this manual has been prepared. It is intended as an aid for those shaping our urban and suburban environments to create patterns of development that are compatible with the needs of transit. It is also intended to complement similar design guidelines already developed by both the City and County of San Diego.

Metropolitan Transit System (MTS)



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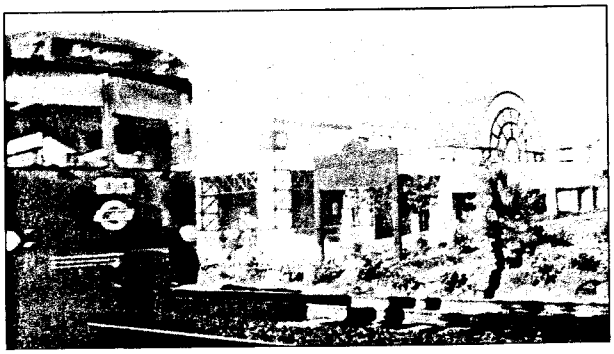
II. TEN WAYS TO DESIGN MORE TRANSIT-ORIENTED COMMUNITIES

There are many ways in which the design of new development can encourage greater use of public transportation. Most of them involve little cost or effort if they are followed early enough in the planning of a project. The key word in this concept is "early." It is usually cheaper and easier to design something in advance than it is to try to fit it in later. While the guidelines are oriented primarily to new development, many of them are applicable to redevelopment, as well. The task in transforming existing development is often more challenging, but the rewards are just as great.

Success in using such guidelines requires a change in how we approach the issue of transportation planning. Instead of relying upon a single-minded effort to accommodate automobiles, both public planners and private developers must consider reopening the urban area to travel of all sorts. Plans should reflect the needs of pedestrians, transit riders, and bicyclists. Although much "lip service" has been paid to other modes of travel, the very design of newer communities has discouraged their use. The guidelines that follow offer suggestions on how to foster more diversity in transportation as our region grows.



In addition to helping attain regional goals of congestion management and pollution control, transit-oriented communities can be more desirable places to live. This is because they allow their residents a diversity of travel options, thereby reducing the dependence on any one way of getting around. As regional regulations on the automobile become more stringent, the value of communities that foster walking and the use of transit will rise. Thus, market forces will eventually reinforce those design standards which result in more versatile communities.

Ten principles for developing more transit-oriented communities are presented on the following pages. They are:

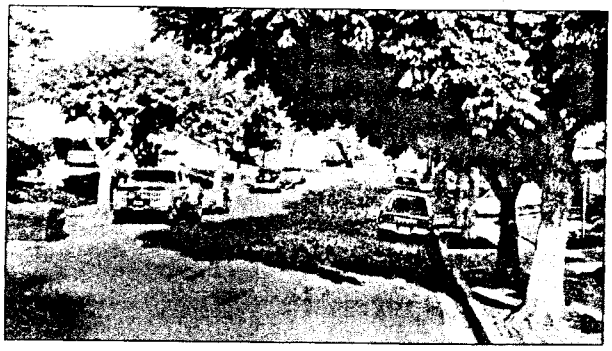
1. Create a pedestrian-friendly environment.
2. Make pedestrian facilities a priority.
3. Design building sites to serve many users.
4. Encourage a mixture of land uses.
5. Provide appropriate densities.
6. Interconnect the street system.
7. Narrow the neighborhood street.
8. Be cautious of major streets.
9. Integrate transit into the community.
10. Consider transit linkage in advance.

1 Create a Pedestrian-Friendly Environment

The simplest way of increasing the use of public transportation is to establish communities where walking is more attractive. Walking is the most common way that people reach bus and light rail stops. In a recent countywide survey, two-thirds of all transit riders reported that they walked to the stop. The factors that encourage people to walk are often subtle, but they all focus upon the creation of a pleasant environment for the pedestrian.

An important underlying principle is the formation of an outdoor "space." Most people don't feel comfortable walking in a wide open area with busy traffic passing closely by.

Pedestrians are, instead, drawn to streets with a feeling of intimacy and enclosure. This feeling can be created by locating buildings close to the sidewalk, by lining the street with trees, and by buffering the sidewalk with parked cars.



Pedestrians enjoy small details, such as displays in shop windows.

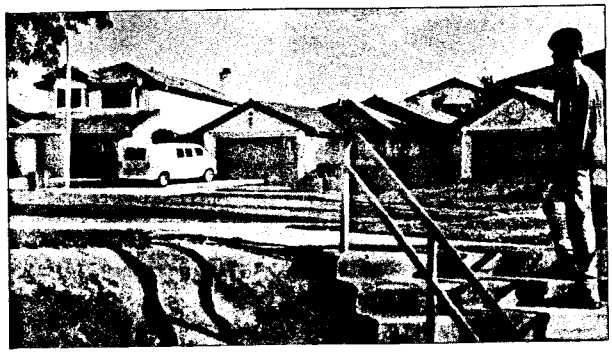
This is in sharp contrast to the landscape that caters to motorists, consisting of large signs, frequent driveways, and little detail at eye level. Such landscapes discourage walking and the use of public transportation.

2 Make Pedestrian Facilities a Priority

One obvious way of creating a pedestrian environment is to ensure that there are adequate sidewalks, pathways and crosswalks. In some post-war residential subdivisions, sidewalks were omitted completely! Fortunately, we have come to realize the importance of these facilities, but greater forethought is needed in their design and placement.

Sidewalks in residential areas should be of sufficient width for two people to walk abreast comfortably. In commercial areas, sidewalks should be even wider. The minimum standards listed in local design ordinances are often just that—minimum. More generous designs (such as six feet wide in residential areas and ten feet wide at bus stops) make pedestrians feel they are valued.

Pedestrians need shortcuts when blocks are long and street patterns are circuitous. These are vital in many areas to get people from their homes to nearby bus stops. Paths are needed at the end of cul-de-sacs and at other strategic points in the street system.

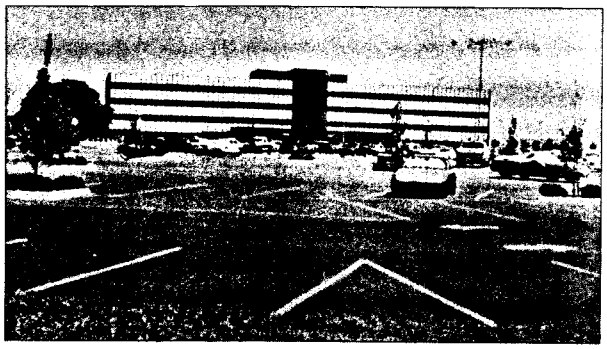


Pedestrian pathways located behind buildings are fine supplements to sidewalks, but they should not be used as substitutes for them. It is important that pedestrians be part of the activity that occurs in the street environment and not separated from it. Sidewalks along public streets can enhance safety, as well, by making pedestrians visible to more people.

Pedestrians should be allowed to cross at all corners of an intersection. Crossing prohibitions should be necessitated only by safety factors, such as reduced sight distance. The increase in turn lane capacity afforded by these prohibitions must be balanced against the delay and inconvenience they cause to people on foot.

3 Design Building Sites to Serve Many Users

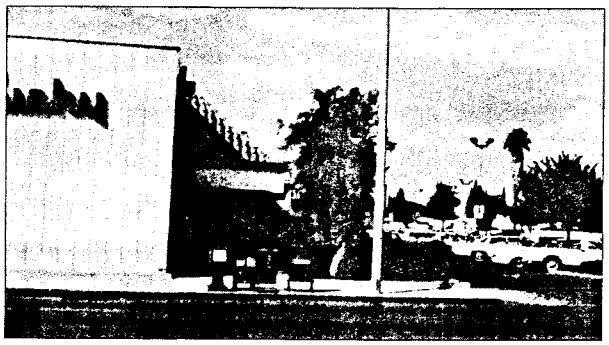
The design and orientation of buildings contribute to transit use—or discourage it—in ways which are not always obvious. Most suburban buildings are oriented to one clientele: people arriving by automobile. Access by other modes of transportation is too often ignored. Buildings should be designed and sited in ways which cater to transit riders, pedestrians and cyclists, as well as those arriving by car.



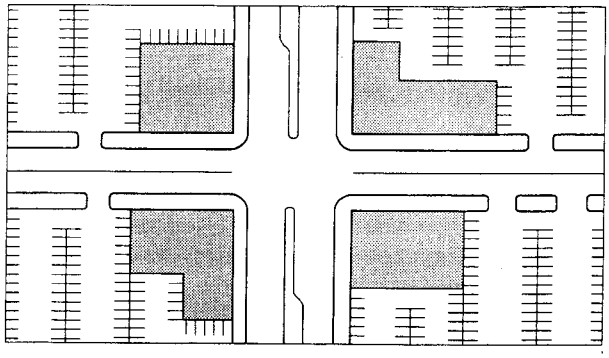
When a major store or office building is set too far back from the street, walking distance to sidewalks and bus stops is increased. This drawback is even worse if transit users must wade through a sea of parked cars to reach the building entrance.

Even landscaped setbacks, while attractive to passing motorists, can create an environment which is not functional for transit. Walking distances are too long, and there is little shade or protection from the elements.

Shopping and employment areas should be designed closer to the street, with at least one entrance oriented to pedestrians and transit users. The parking lots of office and industrial buildings can be placed behind the buildings, away from the street.



In suburban office and industrial parks, buildings should be clustered at intersections, close to the street line. This orientation makes them convenient to existing or potential bus stops. It also encourages people to walk between different buildings to conduct business or get lunch.

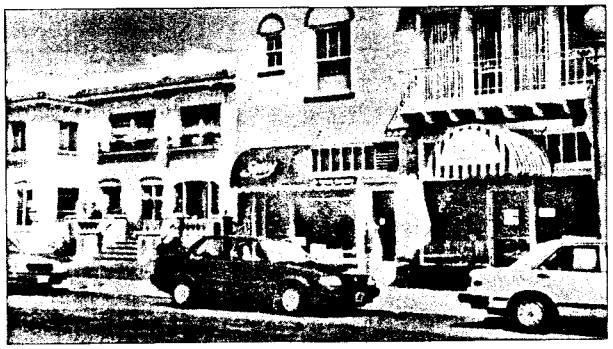


4 Encourage a Mixture of Land Uses

A basic element often overlooked in creating a pedestrian environment is the need to mix different types of land use. Mixed uses create opportunities to substitute walking for driving. Diverse uses along a street also create activity and a sense of security for those waiting for a bus.

Current zoning regulations generally require strict separation of residential, shopping, and employment uses into large, homogeneous areas. In these kinds of developments, the distances between home, work, and shops are too great, and there are often no direct pathways connecting them. Walking is just too difficult.

In contrast, mixed uses are a common attribute of our older neighborhoods. When different types of land uses are located in close proximity, it is possible to walk instead of having to drive. Moreover, the pedestrian environments which they create encourage people to walk to bus and trolley stops by providing interesting pathways and places to stop along the way.



Different types of uses can be incorporated in the same building to conserve the use of land and further diminish the need for driving. For example, apartments can be located above small shops. As a bonus, the lower development costs of these kinds of units can be passed on to consumers as lower rents.

5 Provide Appropriate Densities

High density is a factor that is often associated with high transit ridership. This does not mean that only high-rise apartments and office buildings should be constructed near transit stops. However, for transit to be cost-effective, certain thresholds of development should be encouraged.

The table below summarizes the thresholds which are recommended as rules-of-thumb for transit-oriented development. While these thresholds may be superseded by other site-related circumstances, such as topography, they are useful guidelines. A gradient of densities should exist within the walking radius of a transit stop, with the highest intensity of use located nearest the transit facility.

In some instances, density is indicated in the table by the type of urban environment within which it is located. Three such environments have been distinguished: (1) "urban centers" (such as Downtown San Diego or Mission Valley) are characterized by a concentration of high-intensity buildings with mixed uses in close proximity; (2) "urban areas" (such as Pacific Beach or Mid-City) consist of moderately dense clusters of single- and multi-family houses and related commercial districts; and (3) "suburban areas" (such as Mira Mesa or Chula Vista) are low- to moderate-density areas in which single-family homes predominate.

	Within 1/2-mile of LRT Stations or Bus Transit Centers	Within 1/4-mile of Bus Stops
RESIDENTIAL		
URBAN CENTERS	45 units/acre* average density 30 units/acre minimum density	30 units/acre average density 18 units/acre minimum density
URBAN AREAS	25 units/acre average density 18 units/acre minimum density	12 units/acre average density 7 units/acre minimum density
SUBURBAN AREAS	18 units/acre average density 12 units/acre minimum density	7 units/acre average density 5 units/acre minimum density
COMMERCIAL: OFFICE		
URBAN CENTERS	1.00 FAR minimum**	0.50 FAR minimum
URBAN AND SUBURBAN AREAS	1.00 FAR minimum	0.35 FAR minimum

COMMERCIAL: RETAIL

Type of use is more important than density in this category. Neighborhood retail (such as dry cleaners or luncheonettes) and services (like daycare centers) can support transit facilities by providing riders with conveniences close to their points of boarding or alighting. Large regional retail facilities (such as shopping malls) can become transit focal points in themselves, when sited close to the transit facility.

Community retail (large discount stores and supermarkets) tend to be auto-oriented and are generally not good neighbors for transit stations and bus stops.

INDUSTRIAL

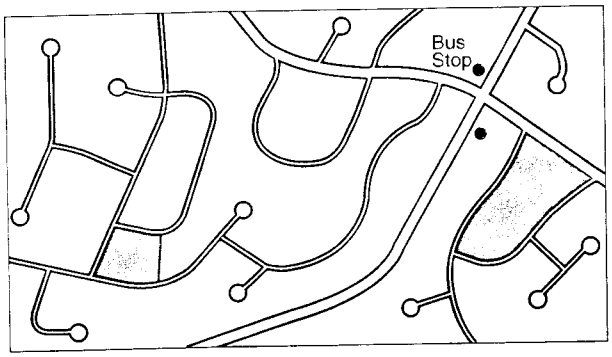
Manufacturing and warehousing/distribution facilities, if isolated from other land uses, are usually not compatible with transit. Many are space-intensive, rather than labor-intensive, creating areas with few employees and long walking distances. Those plants employing a high concentration of employees may be served by transit if they are located near existing services or can contract with a transit provider for shuttle service to the nearest transit center.

* Figures shown are net residential densities; gross densities are about 20% lower (e.g., 45 units/acre net= 36 units/acre gross).

** These are minimum FARs (floor area ratios); higher FARs are encouraged, but the maximums should be those specified in community or general plans.

6 Interconnect the Street System

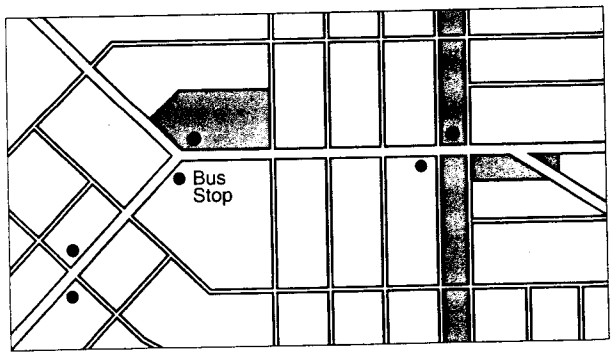
The layout of streets in a neighborhood or commercial district can be the single greatest limiting factor on the provision of good transit service. Once in place, street layouts are changed only with great difficulty and expense. For this reason, all proposals for new streets should be reviewed with MTDB early enough for potential problems to be identified and modifications made.



Recent practice has emphasized discontinuous streets, such as loops and cul-de-sacs, in order to discourage through traffic. Unfortunately, such streets also make it impossible for buses to pass through these areas. Transit service is relegated to peripheral streets which are not convenient to most residents in the development.

Moreover, discontinuous street patterns make it difficult for pedestrians to walk to bus stops, even though they may be close in terms of linear distance.

An interconnected street pattern can solve these problems by allowing buses to penetrate neighborhoods. Interconnected streets also give pedestrians many alternative walking paths and help shorten walking distances. When streets are connected in this way, auto drivers have many routes to follow, as well. This disperses traffic and reduces the volume of cars on any one street in the network.

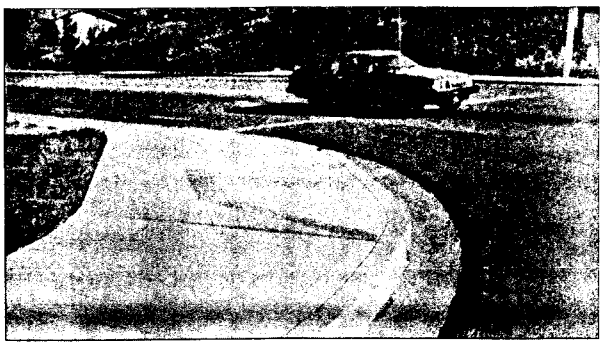


7 Narrow the Neighborhood Street

Local and collector streets are intended to carry relatively low volumes of traffic through neighborhoods and serve abutting property. Many, however, are too wide. They act as barriers which divide communities and discourage walking and the use of transit.

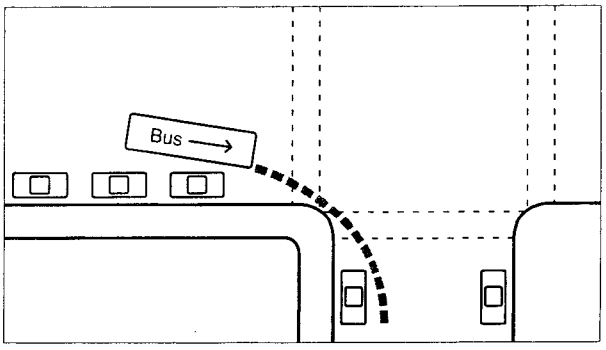
Neighborhood streets that are too wide increase the distance that must be crossed by pedestrians. They also encourage traffic speeds that may be higher than desired, and they increase the costs of construction and maintenance.

Street standards need to be revised in many communities to allow for more flexibility. Local streets can be very narrow to emphasize the slower speeds and more intimate nature of these areas. These streets are good for walking but may not be suitable for bus service. Therefore, such considerations should be reviewed with MTDB in advance to ensure that other streets in the area can accommodate buses.



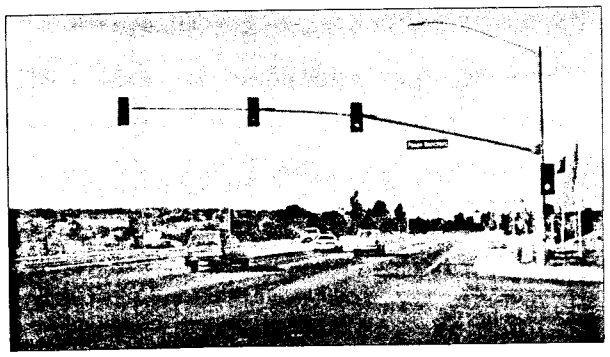
Wide curb radii, used to allow traffic to turn at higher speeds, are not appropriate for local and collector streets. Such radii increase the distance pedestrians must cross at intersections.

To permit large vehicles—such as buses and fire apparatus—to turn, parking should be allowed on the street. A lane of on-street parking effectively increases the available turning radius. In low volume streets, encroachment of a turning vehicle into an oncoming lane may be an acceptable way of dealing with small radius curbs.

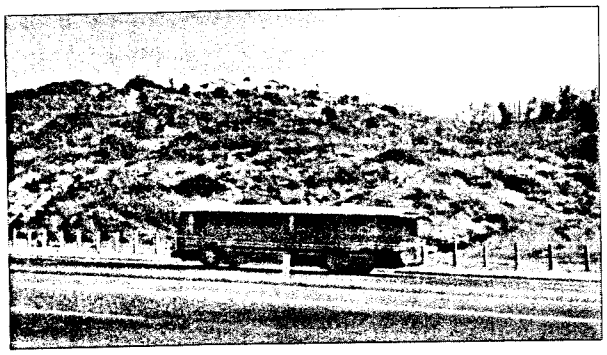


8 Be Cautious of Major Streets

Major streets and arterials accommodate—and encourage—high levels of traffic. They also pose special problems for transit. Major streets were historically the focus of public transportation and were designed accordingly. Unfortunately, many of them are now configured in ways which create a hostile environment for both pedestrians and transit users. While major streets can be useful to expedite the flow of express buses, they are generally not well suited to local bus traffic.



Major streets and arterials are being designed more like expressways. They are wide, with infrequent intersections, and many lack abutting land uses. These kinds of roads cater only to high-speed traffic. They are difficult places for buses to stop and for pedestrians to cross. To encourage transit use, safe street crossings must be allowed at frequent intervals. Pedestrians must also be buffered from traffic by parking or landscaping.



In order to take advantage of local topography, many major streets have been developed along canyon floors. The nearest development is often located on the hilltops, inaccessible to transit service on the road below. As a result, residents must drive their cars for almost every trip they make. To deal with this problem, alternative through streets should be incorporated into new development. These through streets would serve the hilltops and allow transit to penetrate the neighborhoods.

Rather than developing major streets at all, consideration should be made to substituting collectors. These have the transit-oriented attributes of abutting land uses, buffered sidewalks and narrower roadways. Needed traffic capacity can be achieved by spacing such collectors more closely together.

9 Integrate Transit into the Community

Quite often, transit service is relegated to the periphery of a development as a practical necessity. A bolder approach is to bring transit service—bus or rail—right to the heart of a community, integrated into its fabric. Instead of being considered a nuisance to be avoided, public transportation is thus treated as an asset to be embraced.

In many instances, the value of transit to a development is ignored. Transit facilities are frequently located at the edge of activity centers to avoid "adverse impacts." In the process, transit is less visible and less convenient. Any chance of capitalizing on this public investment is lost.

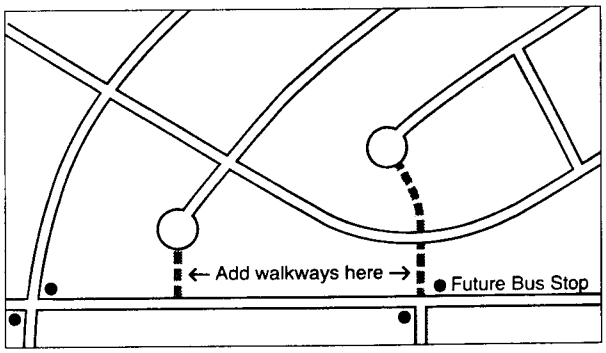
With a little creativity, transit stops can serve as the focal point of a community. They can be combined with convenience stores, daycare centers, restaurants, and other neighborhood amenities. Combining such uses reinforces the focal point, making it a real part of the community.

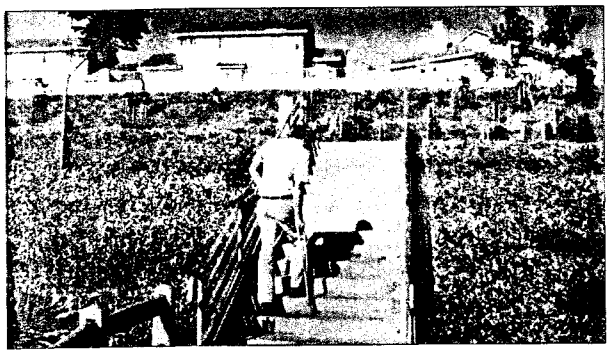
This strategy shortens walking distances and allows transit riders to combine many chores into one trip (such as picking up dry cleaning on the way home from work). In this way, transit can be as convenient as the automobile, making it a more attractive option. Integration of transit requires consideration in advance. For this reason, this strategy should be discussed with MTDB very early in the planning stage of new development.

10 Consider Transit Linkage in Advance

"Linkage" is the term often used to describe the physical and psychological ways in which transit can be tied in with new development. Much of this section of the manual has dealt with linkage in one form or another. There are several other guidelines that can be considered to strengthen linkage in a new or redeveloping community.

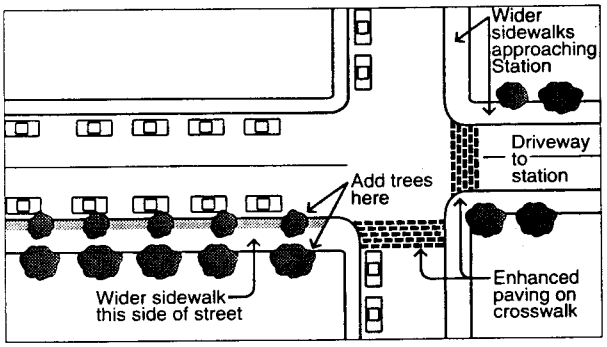
The pathways likely to be used by pedestrians to reach nearby transit stops should be anticipated. If there are no transit stops at present, consultation should be made with MTDB staff to determine the most likely locations where service might be added in the future. Sidewalks and crosswalks can then be laid out accordingly.





Don't forget about mobility needs of the disabled. Curbs and stairways can be formidable barriers to those in wheelchairs or for whom walking is difficult. The Americans with Disabilities Act (ADA) provides specifications to help overcome such barriers to mobility.

The pathways leading to light rail stations and transit centers warrant special attention. Pavement textures, trees and street furniture should be specified to create an easily followed route which encourages use by pedestrians and cyclists.



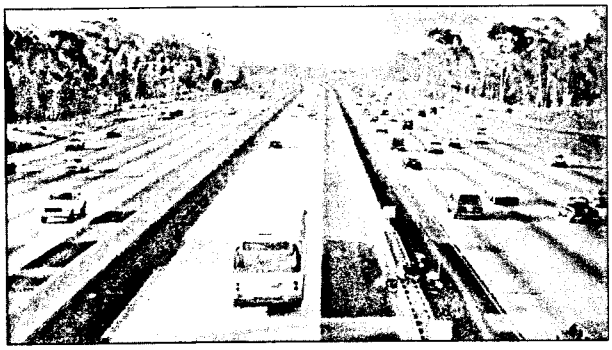
Walls are an impediment to foot traffic, and they create a bleak and isolated environment for waiting passengers. They are often employed along busy arterial streets to reduce noise. Existing walls should be breached, where possible, to allow for pedestrian connections to the neighborhoods behind them.

III. DESIGN STANDARDS FOR BUS TRANSIT

Designing for bus transit means creating suitable facilities in which buses can operate and passengers can wait. In most cases, these facilities are the streets and sidewalks controlled by the jurisdictions in which they are located. These streets and sidewalks utilize a wide range of standards. The pages that follow explain the ranges needed to allow bus transit to function properly.

Those in the private sector proposing new development should be familiar with these standards to assure that their projects will accommodate buses. Likewise, public agency staff must understand bus transit needs in order to properly review the development proposals submitted to them. Agency staff can also utilize these standards when designing street and sidewalk improvements in older neighborhoods.

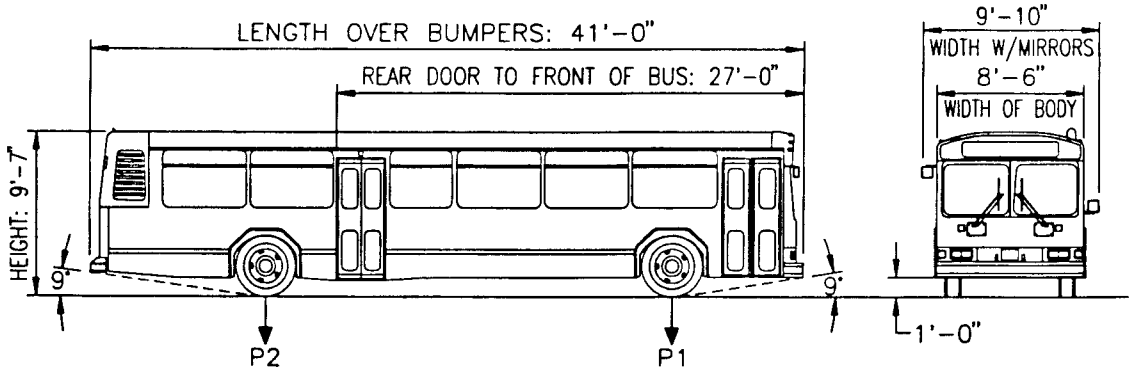
The design of our communities should recognize possibilities that may exist several years in the future. Thus, even when a proposed project is not served by buses at the present time, designing for buses is still desirable. This will allow future extensions of service to be accommodated economically.



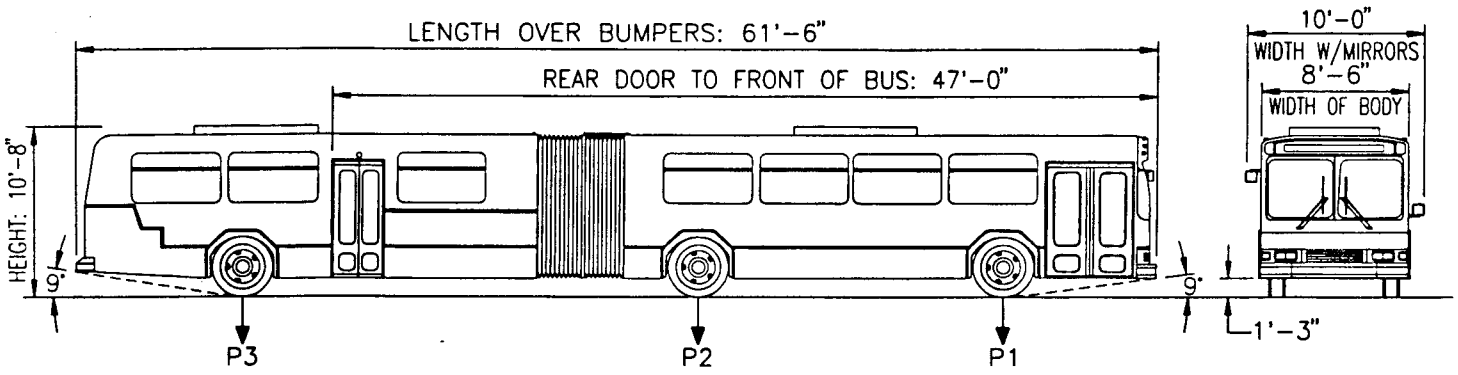
There may be instances where following the design standards in this section (such as using large turning radii for buses) seems to conflict with the urban design principals of the previous section of the manual (such as encouraging small curb radii at intersections). Such conflicts can often be reconciled by consultation with MTDB staff. Many of the "standards" provided here are simple guidelines that can be flexibly interpreted in certain situations. This reinforces a statement made earlier in this manual: It is important for those contemplating new development to contact MTDB as early as possible in the planning process. Incorporation of transit-friendly designs from the start will be less expensive than adding them later.

BUS VEHICLE DIMENSIONS

Scale 1" = 12' (approximate)



STANDARD BUS



ARTICULATED BUS

WEIGHT (LOADED)	STANDARD BUS	ARTICULATED BUS
TOTAL WEIGHT	40,600 POUNDS	55,200 POUNDS
AXLE LOADING AT P1	14,600	14,600
AXLE LOADING AT P2	26,000	14,600
AXLE LOADING AT P3	-----	26,000
GRADE LIMITATIONS		
	UPHILL: 6%	UPHILL: 6%
	DOWNHILL: 12%	DOWNHILL: 12%

TURNING RADIUS

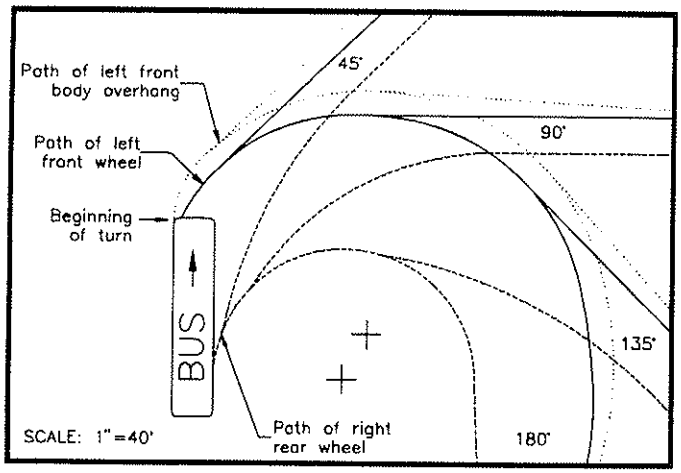
48-FOOT MINIMUM OUTSIDE RADIUS (WITH OVERHANG), 50-FOOT DESIRABLE

27-FOOT MINIMUM INSIDE RADIUS, 30-FOOT DESIRABLE

BUS TURNING TEMPLATE

Scale 1" = 20'

REV 6/94



SCALE: 1"=20'

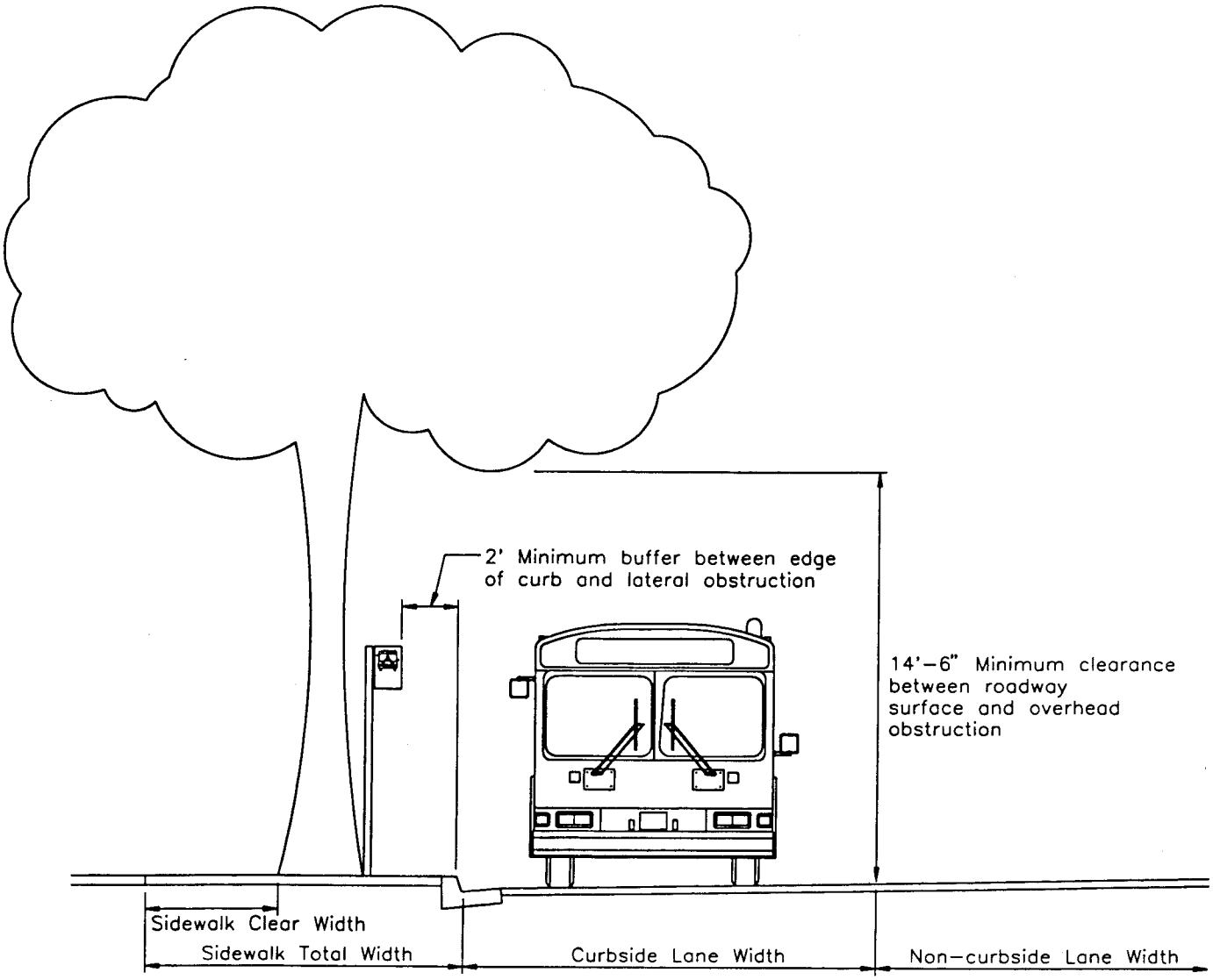
NOTES:

The above diagrams indicate the dynamic envelope of a standard bus. Radii of 55' (outside) and 25' (inside) are recommended for pavement edges or obstructions.

Articulated buses can be accommodated within the above envelope.

VERTICAL AND HORIZONTAL CLEARANCES FOR BUSES

Scale 1" = 6' (approximate)



Total Width At Bus Stops:	10' Minimum 15' Desirable in Commercial Areas	With No Parking:	12' Minimum 14' Desirable	11' Minimum* 12' Desirable
Between Bus Stops:	5' Minimum 8' Desirable	With Parking:	18' Minimum 20' Desirable	

Note:
Sidewalk clear width should be 4' minimum, 6' desirable; where pedestrian traffic is heavy, up to 8' of clear width should be reserved.

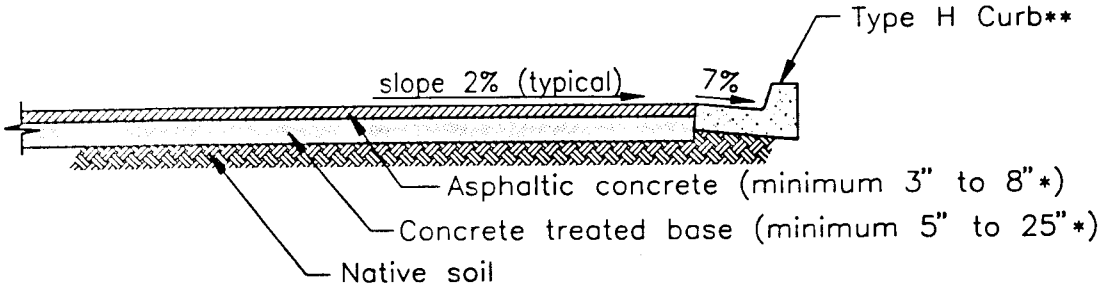
*Lane widths narrower than 11' will result in encroachment into adjacent lanes.

PAVEMENT COMPOSITION

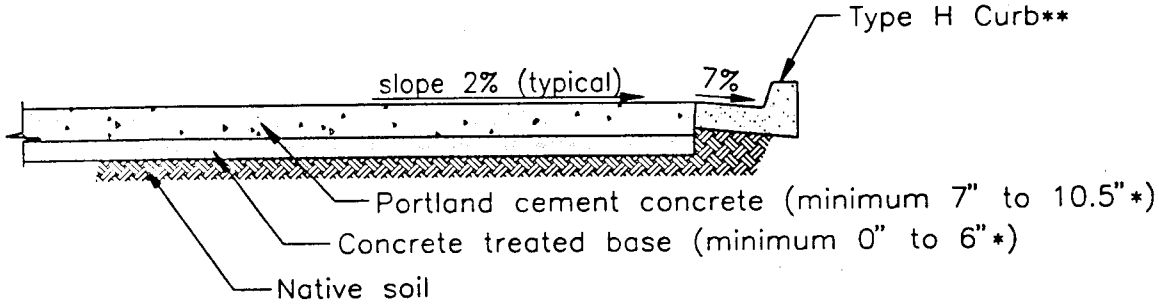
FOR STREETS SUITABLE FOR REGULAR USE BY BUSES

Scale 1" = 4'

CASE I: ASPHALT ROADWAY

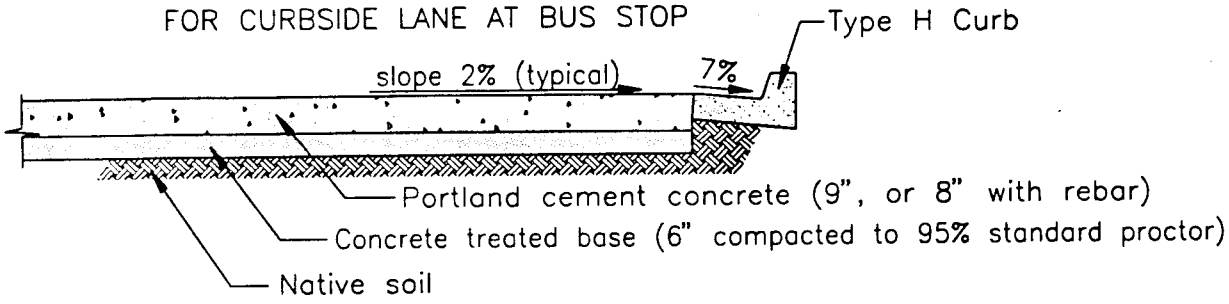


CASE II: CONCRETE ROADWAY



CASE III: CONCRETE BUS PAD

FOR CURBSIDE LANE AT BUS STOP

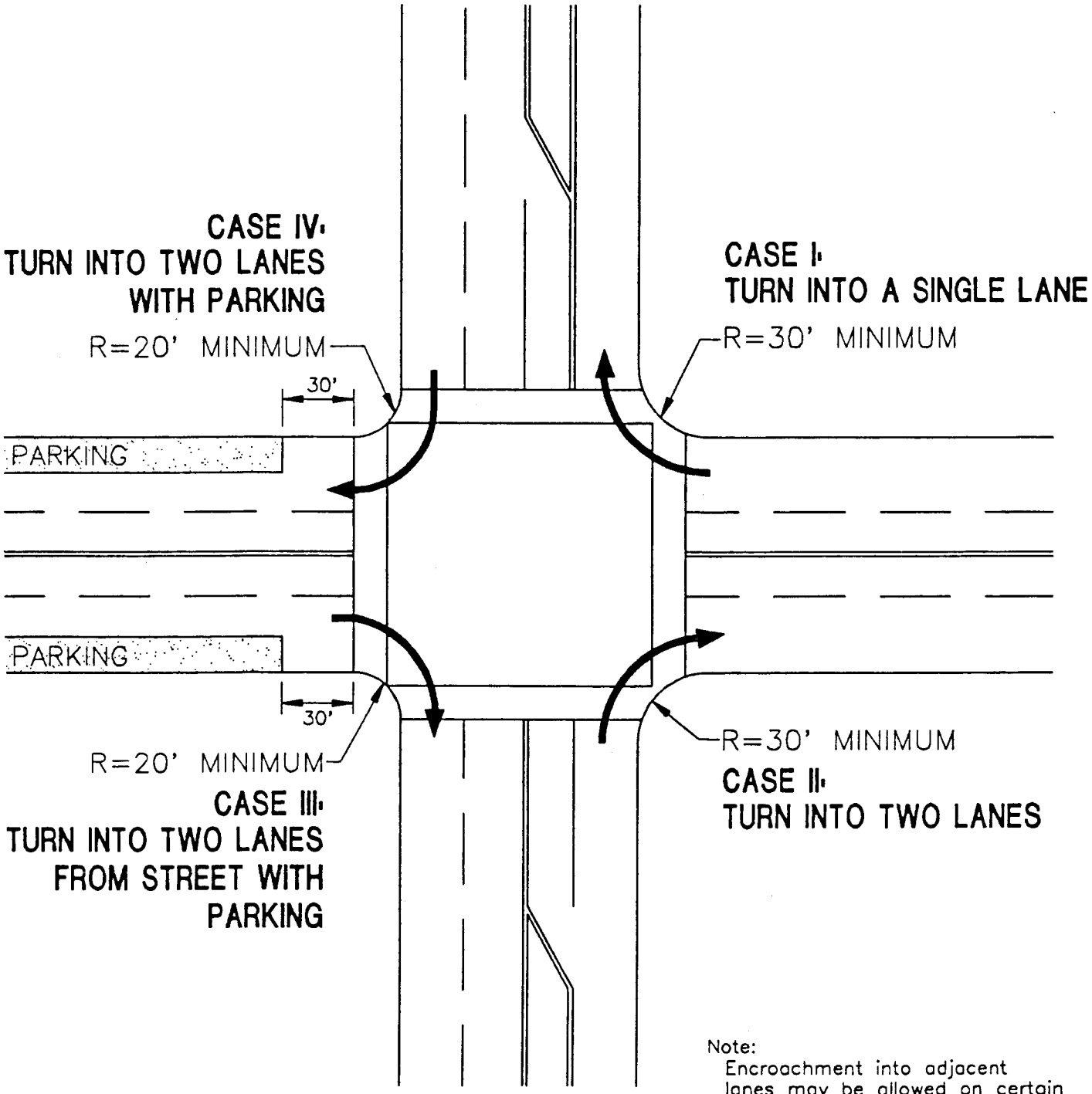


Note: *Thickness of layers depends upon average daily traffic volume and resistance value of native soil. For exact specifications, see San Diego area Regional Standard Drawings, Pavement Design Standards, Schedule J for roadways categorized as collector or higher.

**Type G curb is acceptable on collector streets.

INTERSECTION DESIGN FOR BUS TURNS

(WITH NO ENCROACHMENT ON ADJACENT LANES)
Not To Scale

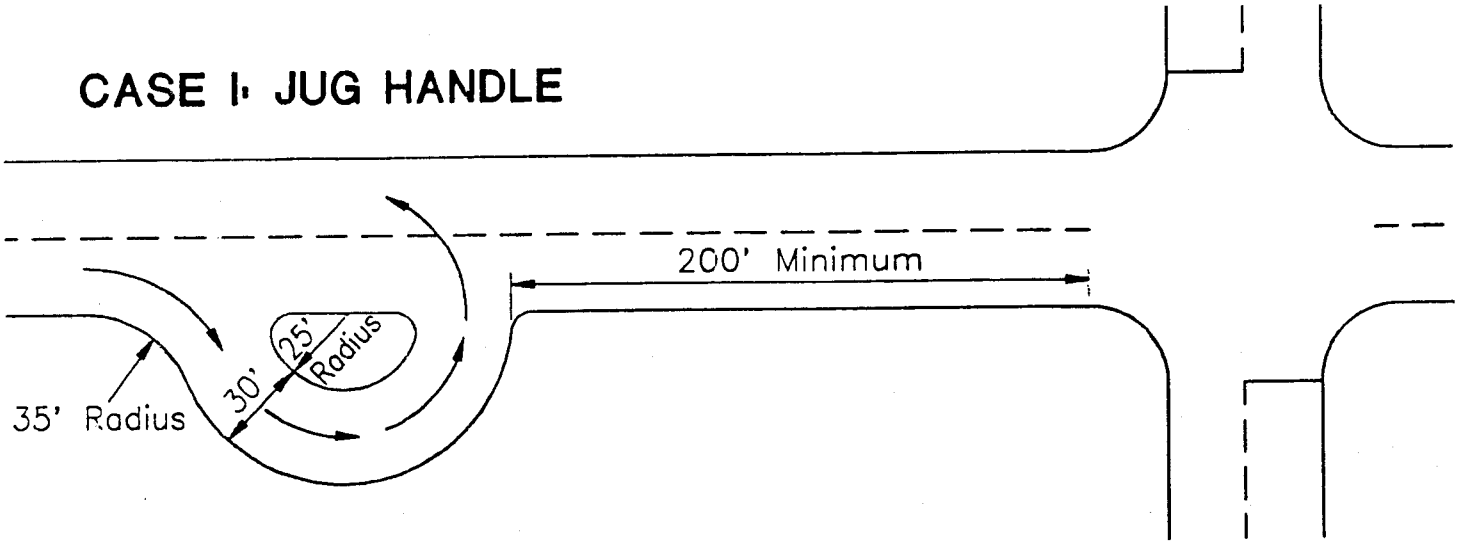


Note:
Encroachment into adjacent lanes may be allowed on certain low-volume streets. Consult with MTDB staff on a case-by-case basis.

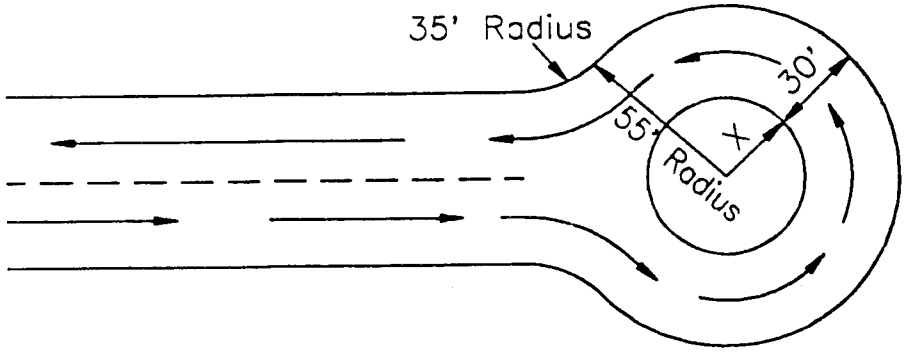
BUS TURNAROUNDS

Scale 1" = 60'

CASE I: JUG HANDLE

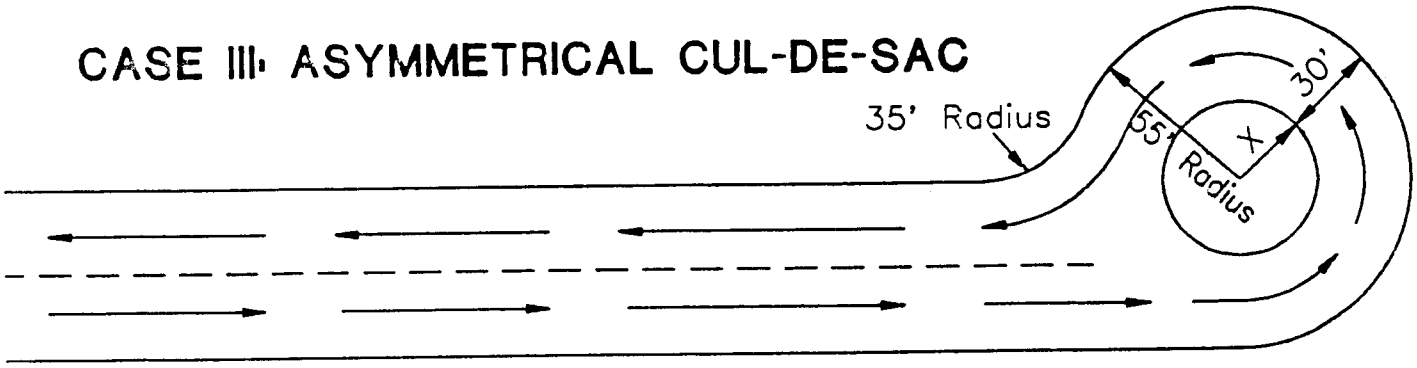


CASE II: SYMMETRICAL CUL-DE-SAC



X=25' Radius (maximum)
if island desired.

CASE III: ASYMMETRICAL CUL-DE-SAC



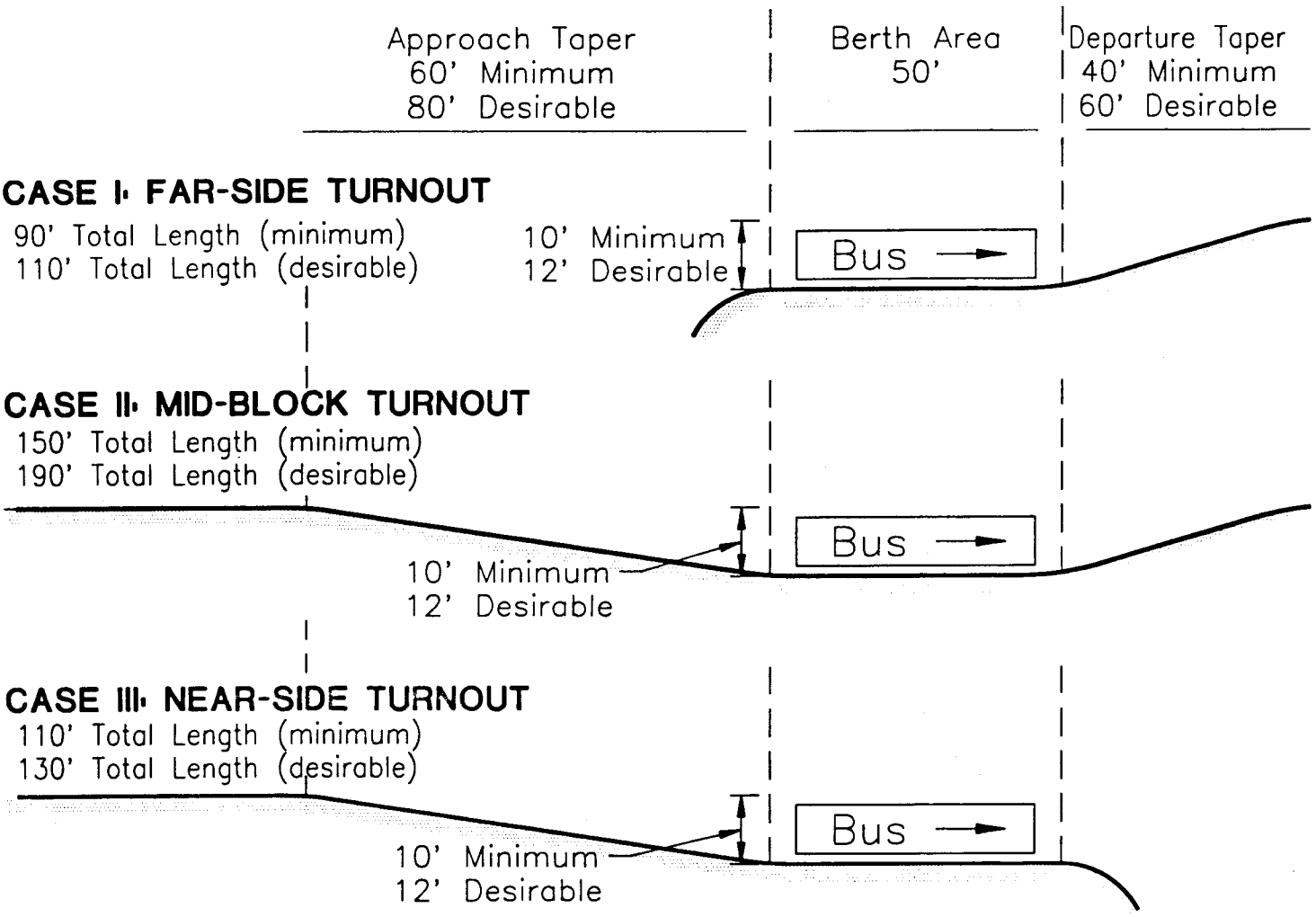
X=25' Radius (maximum)
if island desired.

Note:

- To maintain sight distance, only low plantings are recommended in island areas.
- 30' lane width assumes no parking in loop area.

BUS TURNOUTS

Scale 1" = 30'



Approach Area Note:
Dimensions of taper assume that buses will decelerate mostly in the approaching travel lane.

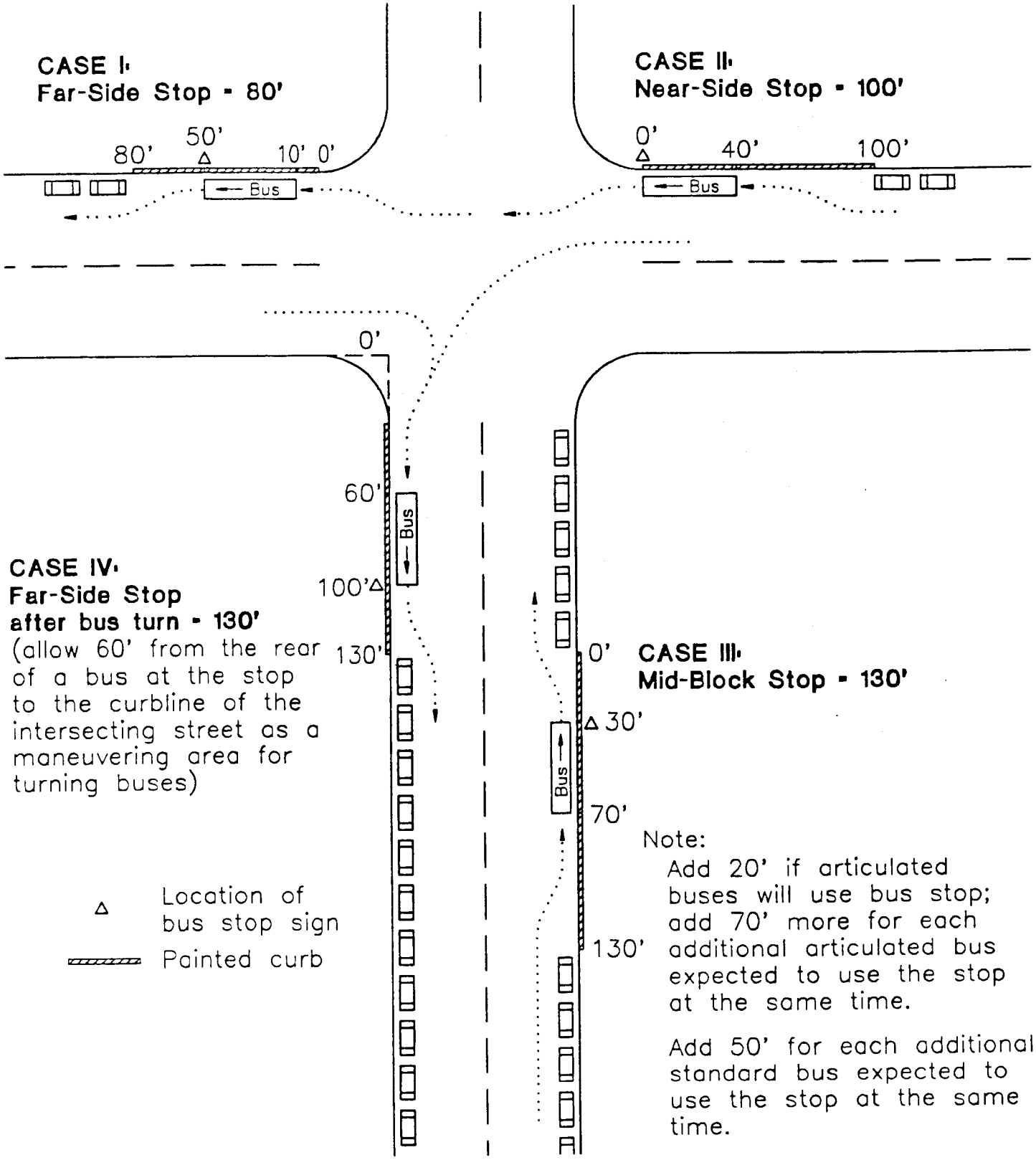
Berth Area Notes:
- Add 20' to length of berth area if articulated buses will use turnout; add 70' more for each additional articulated bus expected to use the turnout at the same time.
- Add 50' for each additional standard bus expected to use the turnout at the same time.

Departure Area Note:
Dimensions of taper assume that buses will accelerate mostly in the departing travel lane.

General Note:
Bus turnouts are widened sections of roadway designed for buses to pull out of the traffic stream. While advantageous to general traffic, turnouts make it difficult for buses to re-enter the flow of traffic. **They should therefore be used only under special circumstances. Consult with MTDB staff on a case-by-case basis.**

BUS STOP DIMENSIONS

Scale 1" = 60'

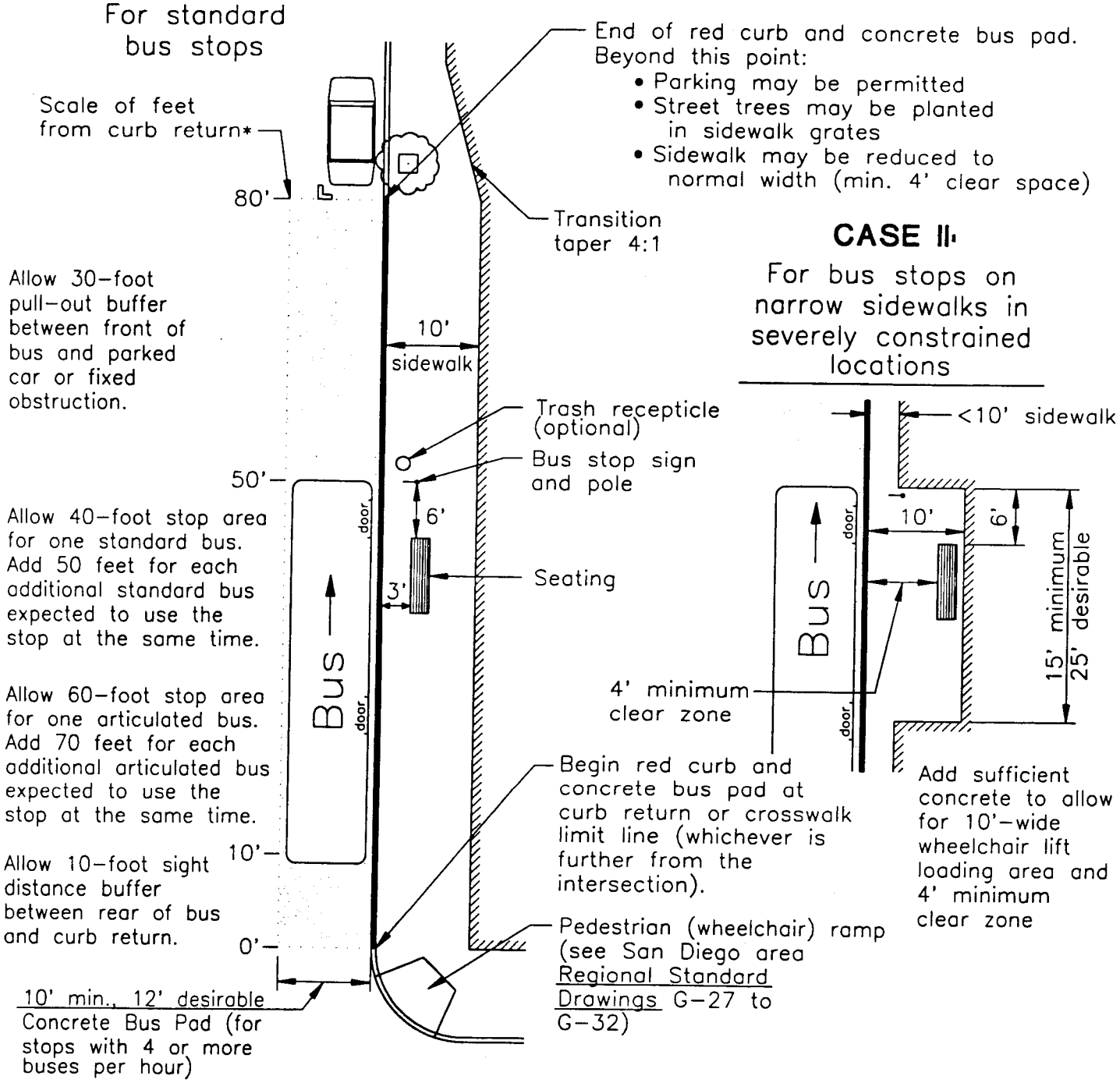


BUS STOP LAYOUT

Scale 1" = 16'

CASE I:

For standard bus stops



CASE II:

For bus stops on narrow sidewalks in severely constrained locations

Add sufficient concrete to allow for 10'-wide wheelchair lift loading area and 4' minimum clear zone

*Note: These dimensions apply to a typical far-side bus stop. For a near-side bus stop, mid-block bus stop or far-side bus stop after a turn, see figure on Bus Stop Dimensions.

BUS PASSENGER SHELTER PLACEMENT

Scale 1" = 16'

CASE I.

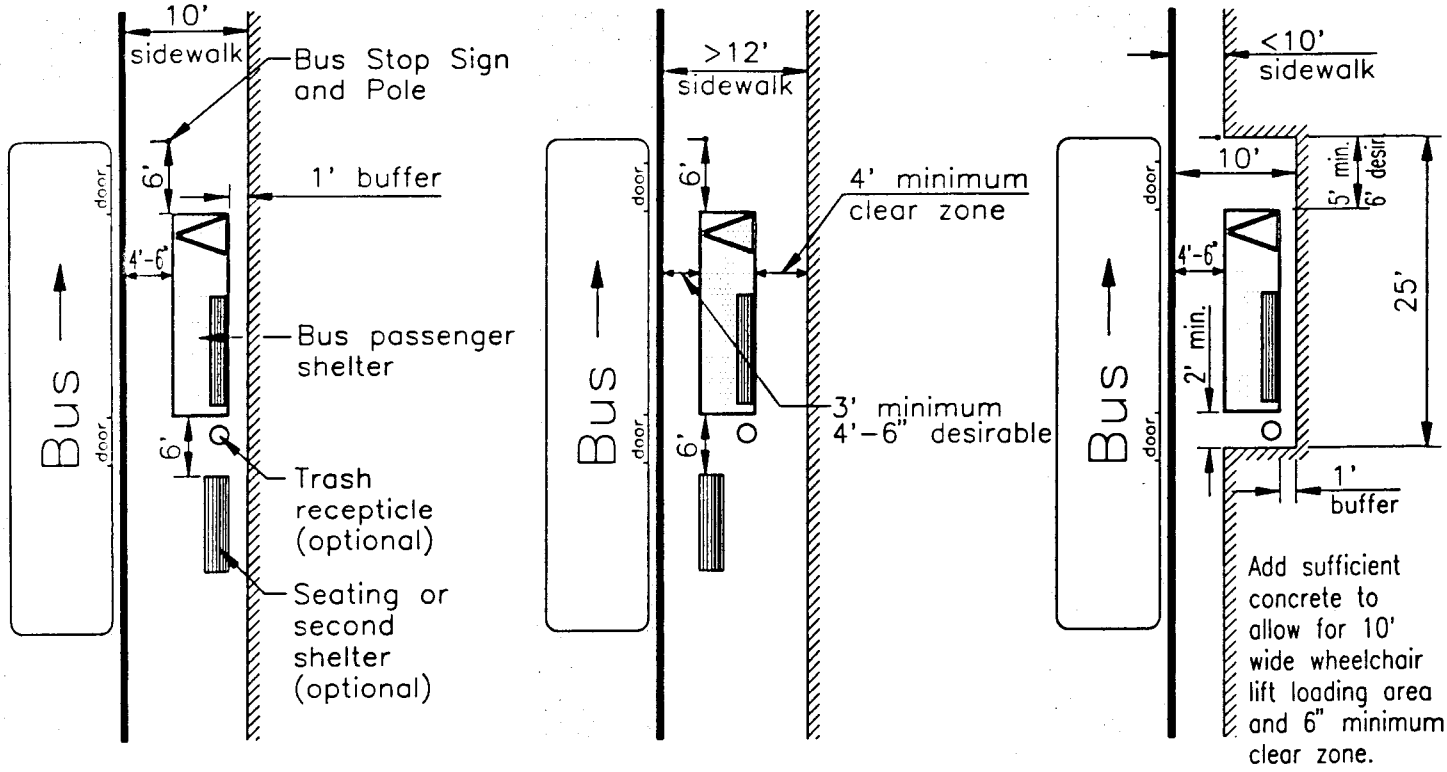
For standard bus stops

CASE II.

For bus stops on sidewalks more than 12 feet wide

CASE III.

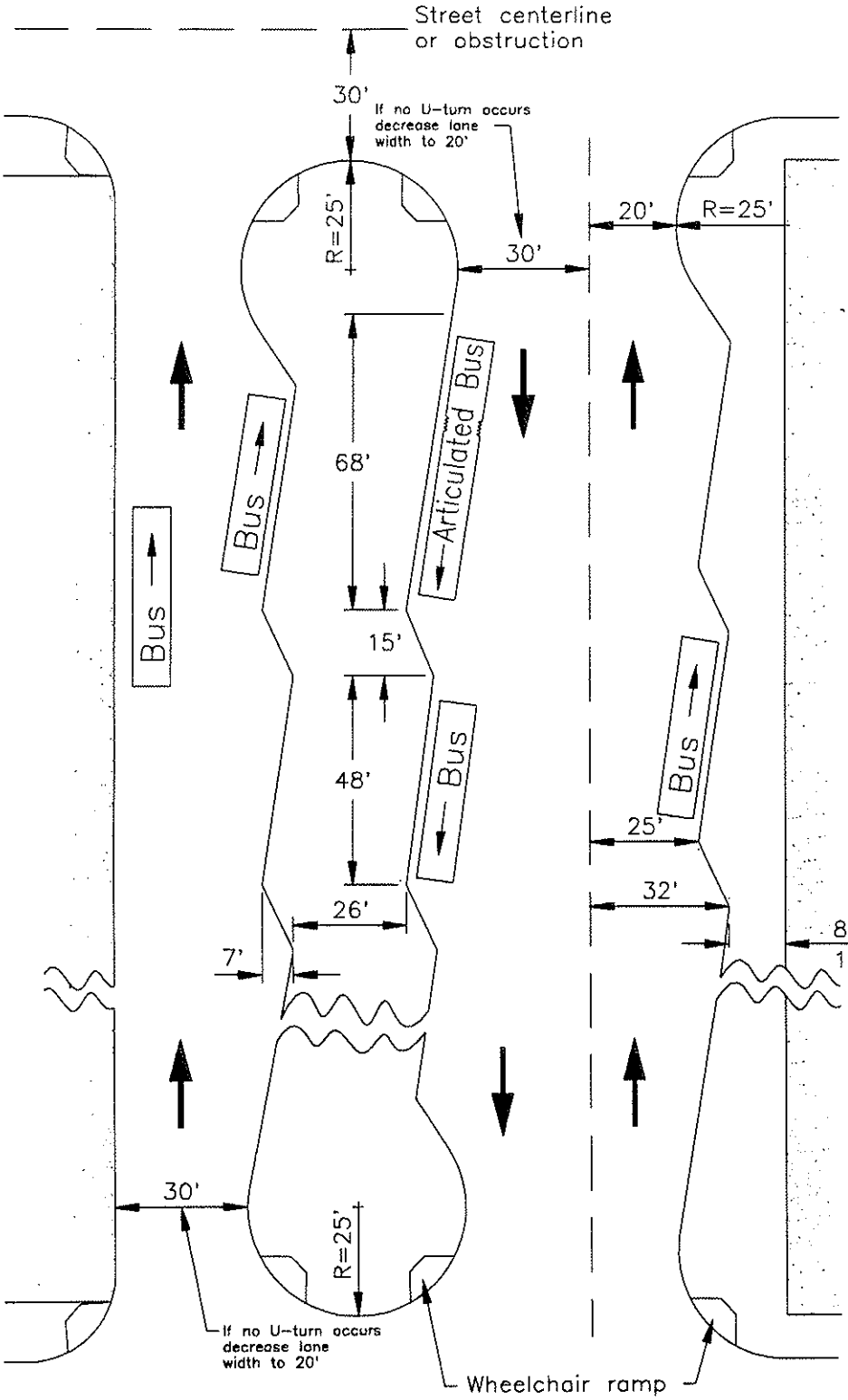
For bus stops on narrow sidewalks in severely constrained locations



OFF-STREET BUS STATIONS

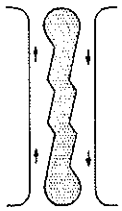
Scale 1" = 40'

REV 6/94

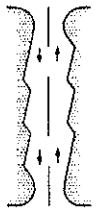


CASE 1·
Single Side Platform

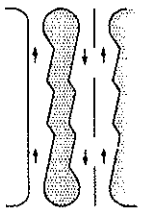
CASE 2·
Island Platform



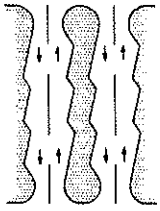
CASE 3·
Two Side Platforms



CASE 4·
Island and One Side Platform



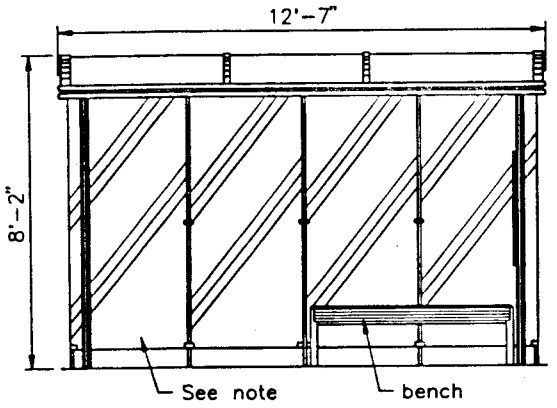
CASE 5·
Island and Two Side Platforms



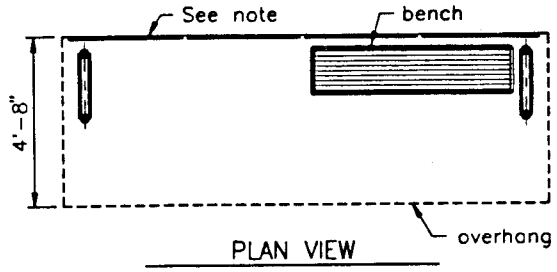
BUS PASSENGER SHELTERS
(Non-Advertising)

Scale 1" = 5'

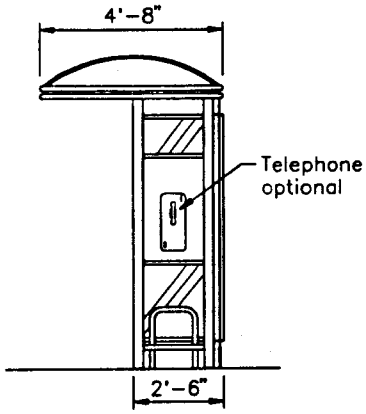
STANDARD SHELTER



FRONT ELEVATION



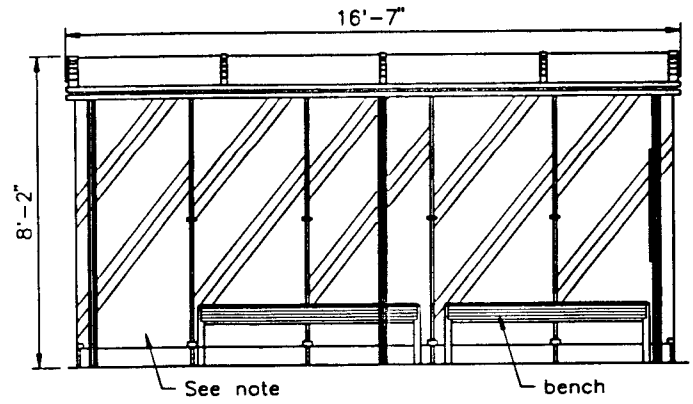
PLAN VIEW



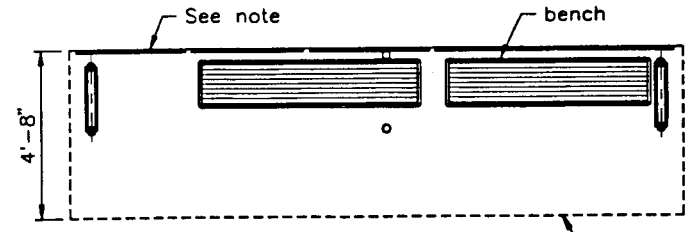
RIGHT SIDE ELEVATION

Note: Left-most rear glass panel may be removed if access from the rear of the shelter is required.

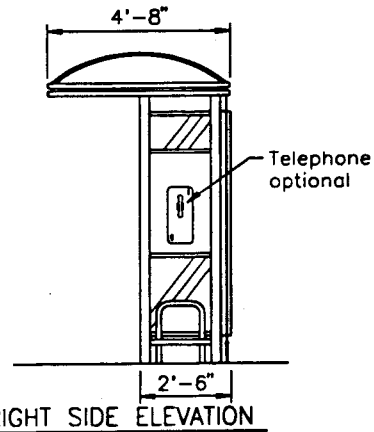
LONG SHELTER



FRONT ELEVATION



PLAN VIEW



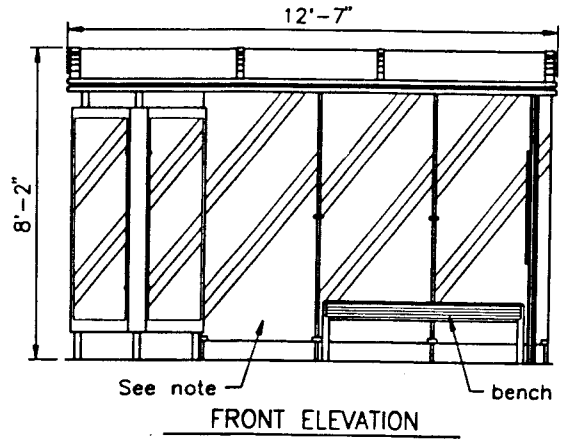
RIGHT SIDE ELEVATION

Note: Left-most rear glass panel may be removed if access from the rear of the shelter is required.

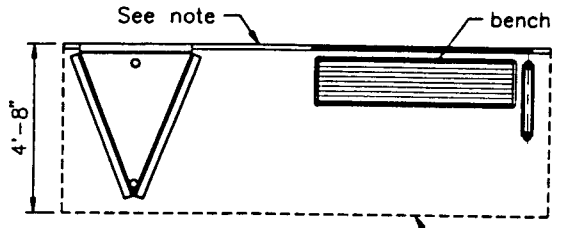
BUS PASSENGER SHELTERS
(Advertising)

Scale 1" = 5'

STANDARD SHELTER

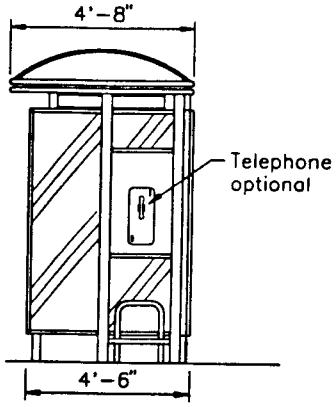


FRONT ELEVATION



PLAN VIEW

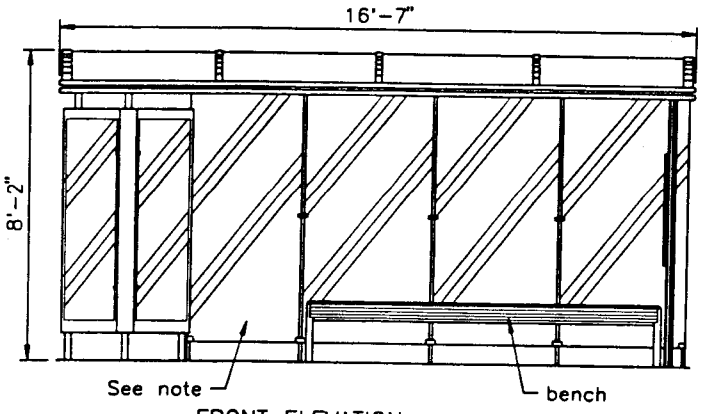
overhang of roof



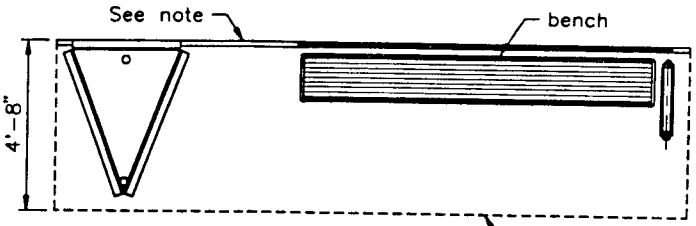
RIGHT SIDE ELEVATION

Note: Left-most rear glass panel may be removed if access from the rear of the shelter is required.

LONG SHELTER

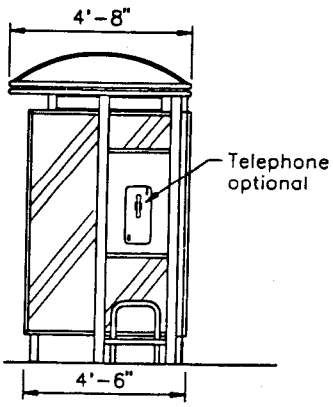


FRONT ELEVATION



PLAN VIEW

overhang of roof



RIGHT SIDE ELEVATION

Note: Left-most rear glass panel may be removed if access from the rear of the shelter is required.

SUMMARY OF BUS STOP FEATURES

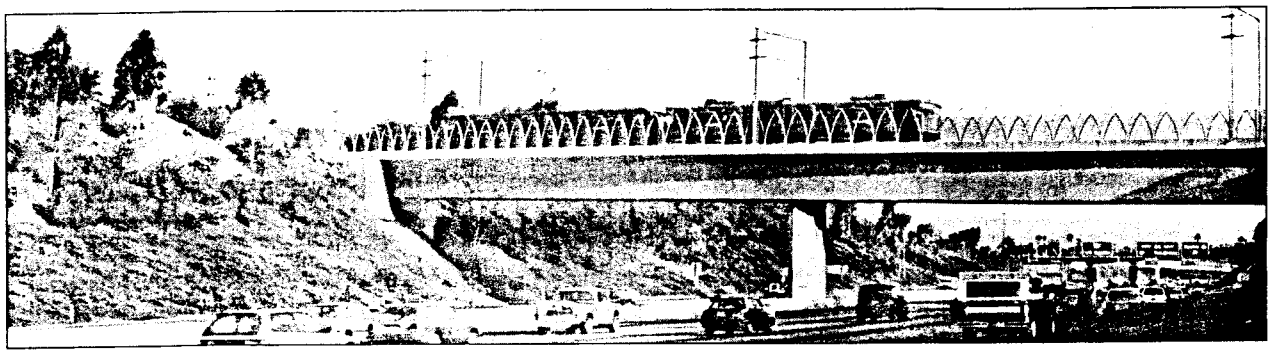
Feature	Daily Passenger Boardings				
	<50	50–100	101–200	201–500	>500
Sign and Pole	S	S	S	S	O
Built–in Sign	–	–	–	O	S
Public Roadway	S	S	S	S	–
Non–Public Roadway	–	–	–	–	S
Expanded Sidewalk	O	O	S	S	S
Accessible	S	S	S	S	S
Seating	O	S	S	S	S
Passenger Shelter	O	O	S	S	S
Permanent Structure	–	–	–	–	S
Route Designations	S	S	S	S	S
Timetable	O	O	O	S	S
Route Map	O	O	S	S	S
System Map	–	–	O	O	S
Trash Recepticle	O	O	O	S	S
Telephone	–	O	O	O	S
Individual Bus Bays	–	–	–	–	S
Park–and–Ride	–	O	O	O	O
Bus Pads	*	*	*	*	S
Red Curbs	S	S	S	S	O
Lighting	O	O	S	S	S

NOTE:
- S = Standard feature
- O = Optional feature
- * = Required for stops with four or more buses per hour
- – = Not applicable

The table above summarizes the features which are appropriate at bus stops. Five levels of bus stops have been defined, based upon the intensity of daily passenger boardings at the stop.

IV. DESIGN STANDARDS FOR LIGHT RAIL TRANSIT

The design of facilities for light rail transit (LRT) is a highly technical procedure. MTDB maintains an extensive manual, **LRT Design Criteria**, to guide its engineers in laying out new lines. For most urban planners or developers, however, a few basic guidelines are all that are generally needed. For this reason, the following pages present a brief summary of the most important light rail design standards. Those readers desiring more extensive information may consult with MTDB's Director of Engineering and Construction.

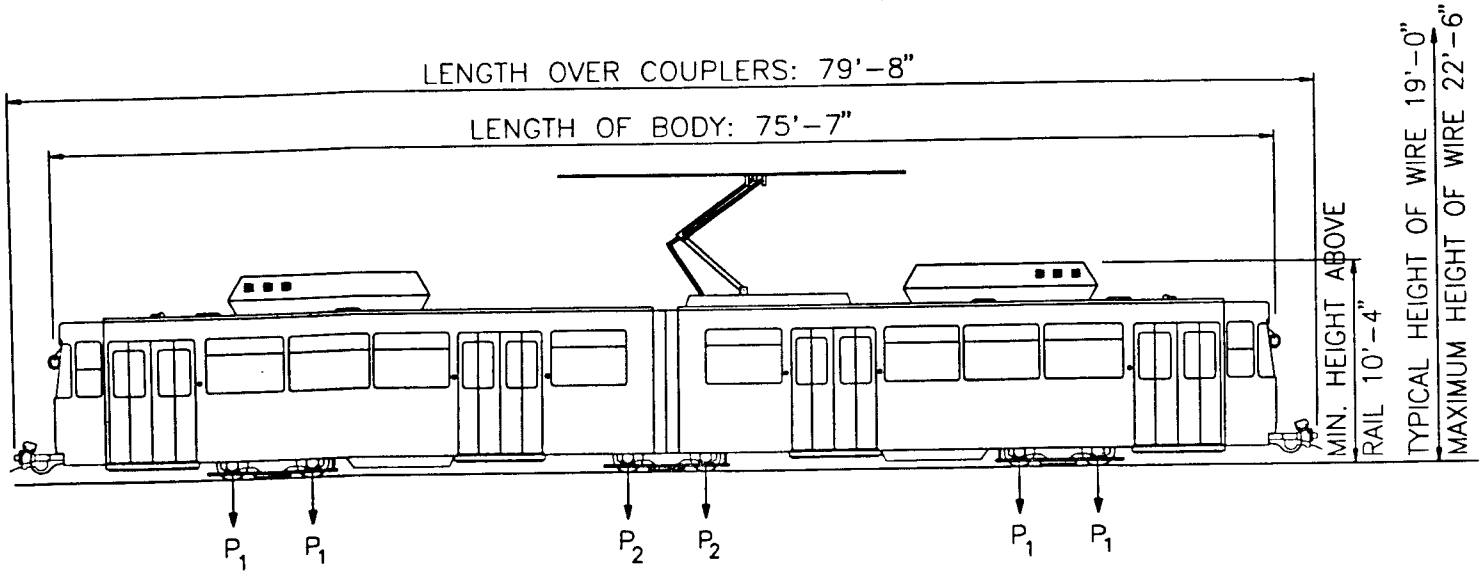


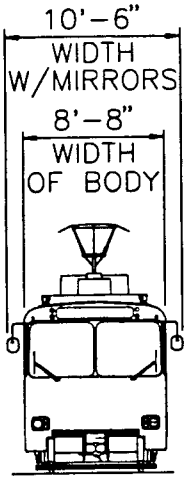
LRT is a relatively flexible form of rail transit in that it can adapt to many different situations. It can operate in city streets, on exclusive rights-of-way, and even in tunnels or on aerial structures. Stations may be simple or elaborate, depending upon their location and function. Trains can vary in length from one to four cars. However, this flexibility has its practical limitations. Exceeding these limitations can result in degraded levels of service and expensive operating and maintenance costs. The standards that follow help explain the limits of desirable tolerances.

Most of the illustrations on the following pages consist of plan views and cross sections of light rail rights-of-way in different circumstances. Generally, light rail on exclusive right-of-way requires at least a 35-foot-wide path to accommodate two tracks, traction power poles and fences. Adjacent slopes may require additional width. Narrower paths are possible in a street environment. At station areas, additional width is required for platforms and other facilities. The illustrations provide standards suitable for general planning purposes.

LIGHT RAIL VEHICLE (LRV) DIMENSIONS

Scale 1" = 12'





WEIGHT (LOADED)

TOTAL WEIGHT	116,680 LBS
AXLE LOADING AT P_1	21,980 LBS
AXLE LOADING AT P_2	14,380 LBS

GRADE LIMITATIONS

4.3% MAXIMUM GRADE

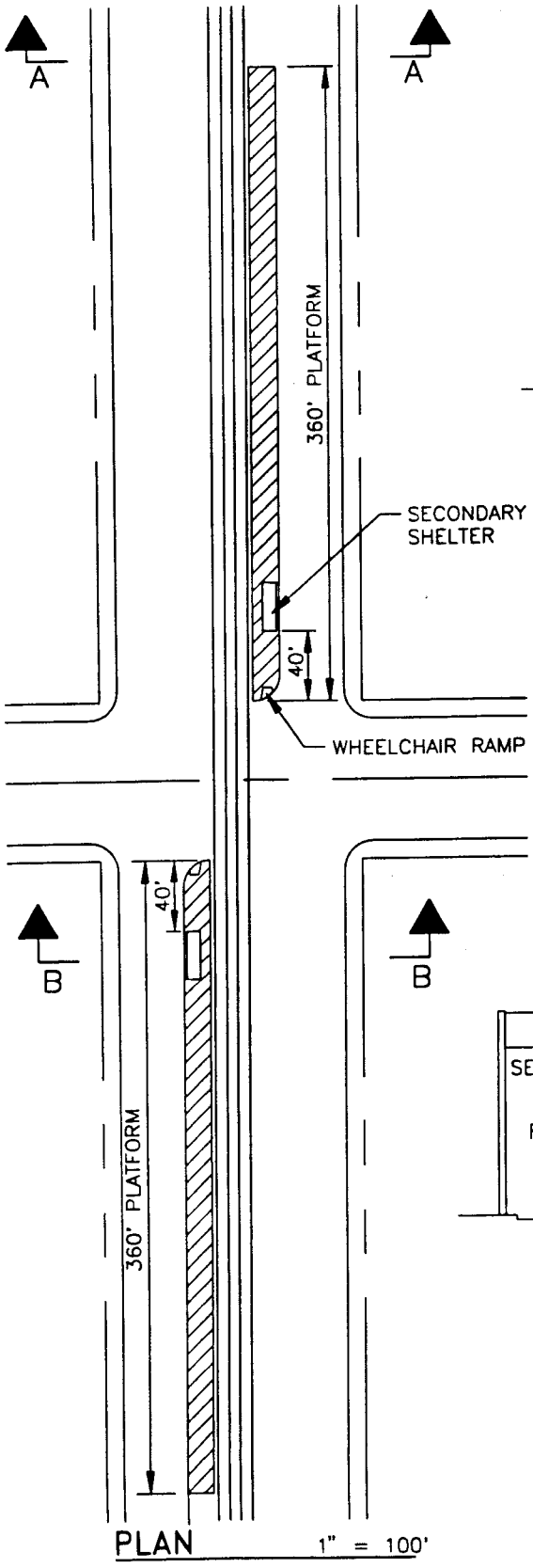
TURNING RADIUS

1500 FT. RADIUS MINIMUM FOR MAINLINE;
SMALLER RADII POSSIBLE FOR STREET RUNNING

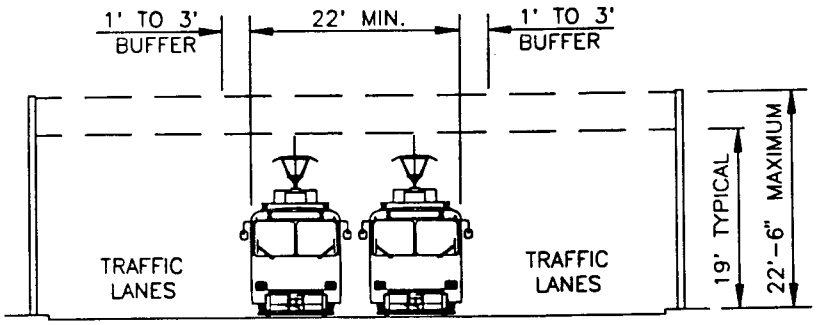
(NOTE: ALL HORIZONTAL CURVES ARE SPIRAL CURVES)

LRT STREET RIGHT-OF-WAY

Scale As Noted

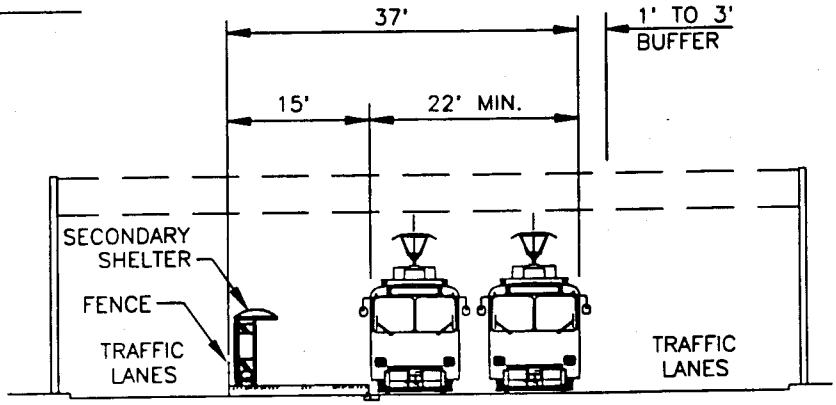


PLAN 1" = 100'



SECTION A – A

1" = 20'

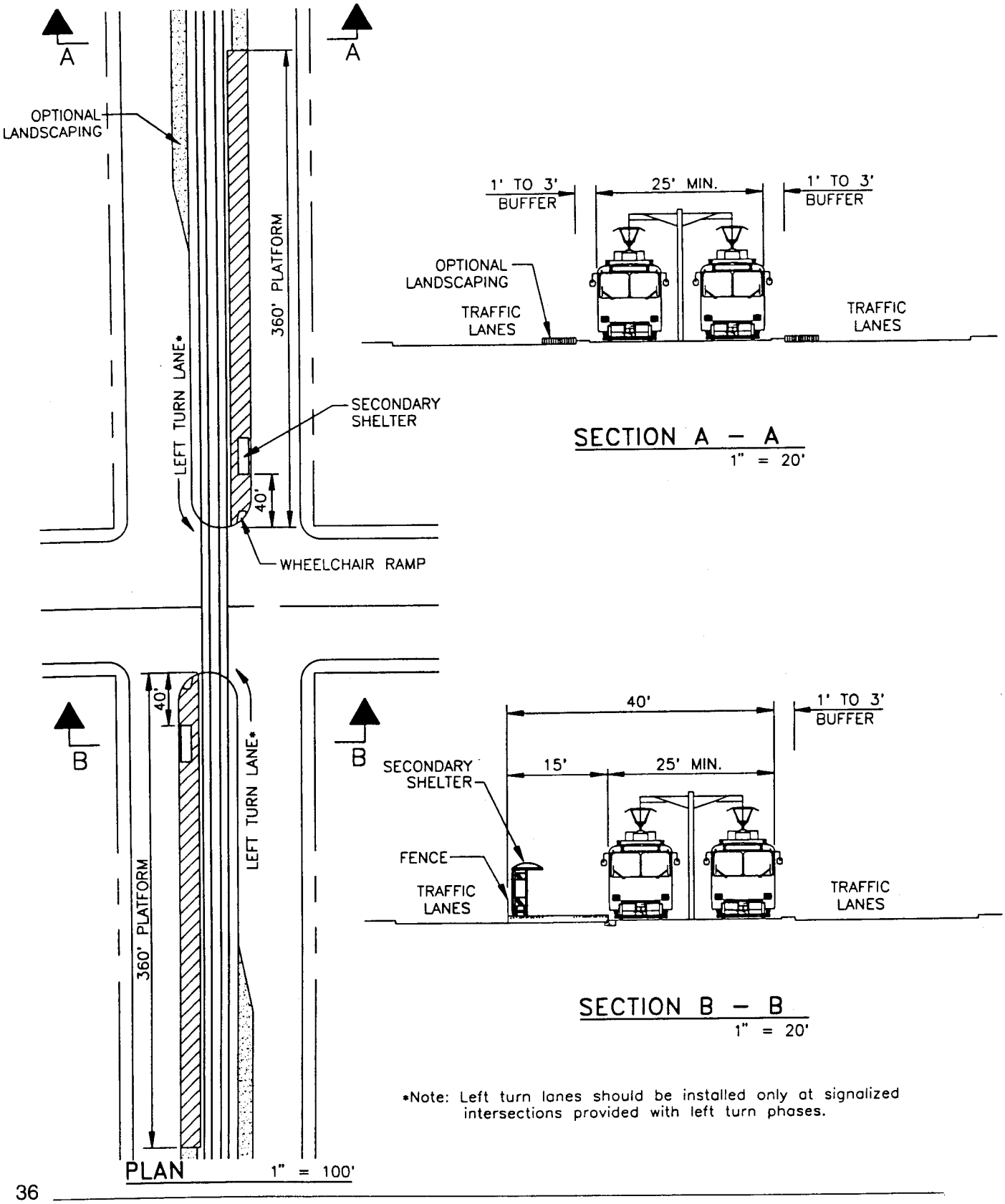


SECTION B – B

1" = 20'

RESERVED LRT RIGHT-OF-WAY: CENTER OF STREET

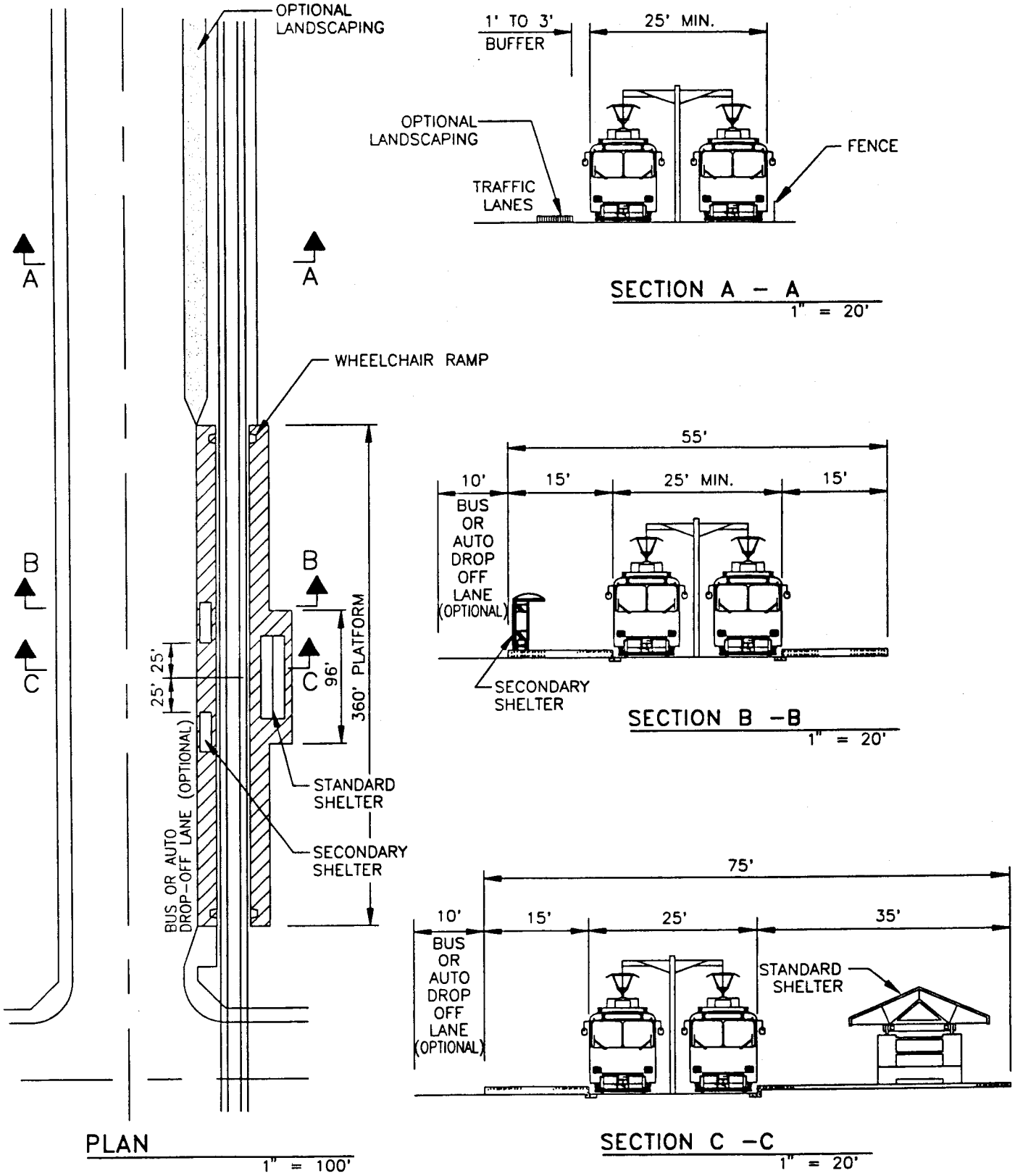
Scale As Noted



*Note: Left turn lanes should be installed only at signalized intersections provided with left turn phases.

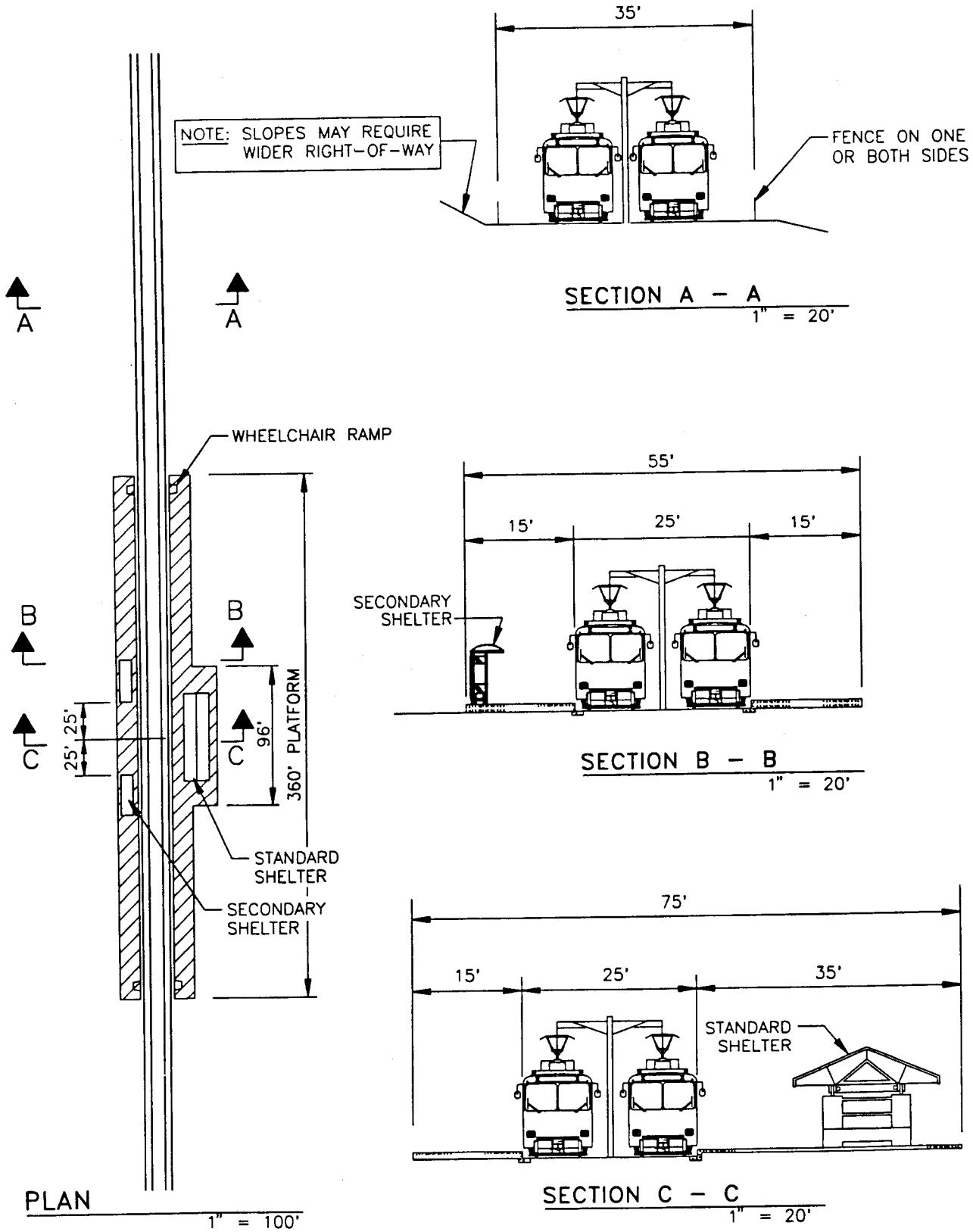
RESERVED LRT RIGHT-OF-WAY: SIDE OF STREET

Scale As Noted



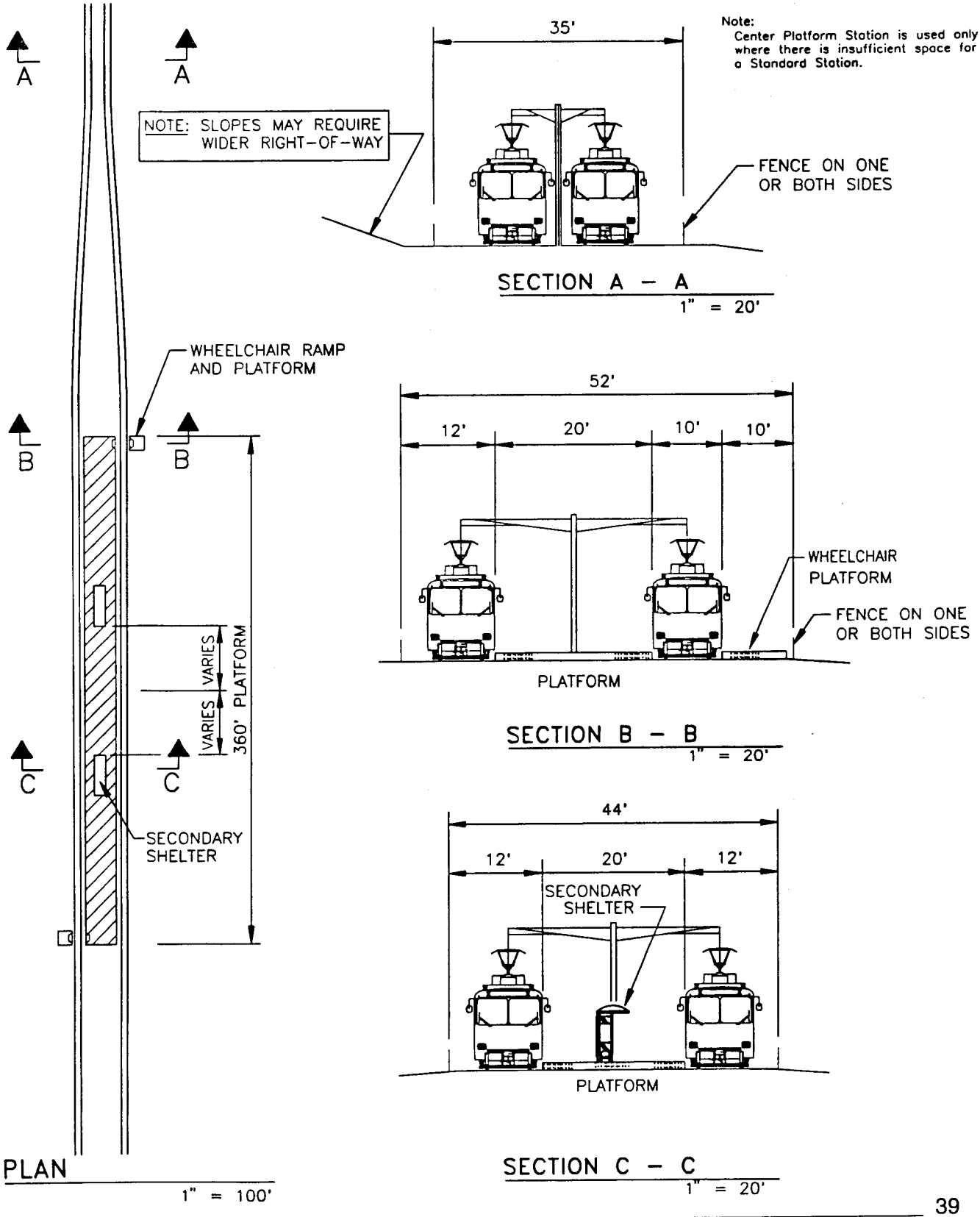
EXCLUSIVE LRT RIGHT-OF-WAY WITH STANDARD STATION

Scale As Noted



EXCLUSIVE LRT RIGHT-OF-WAY WITH CENTER PLATFORM STATION

Scale As Noted

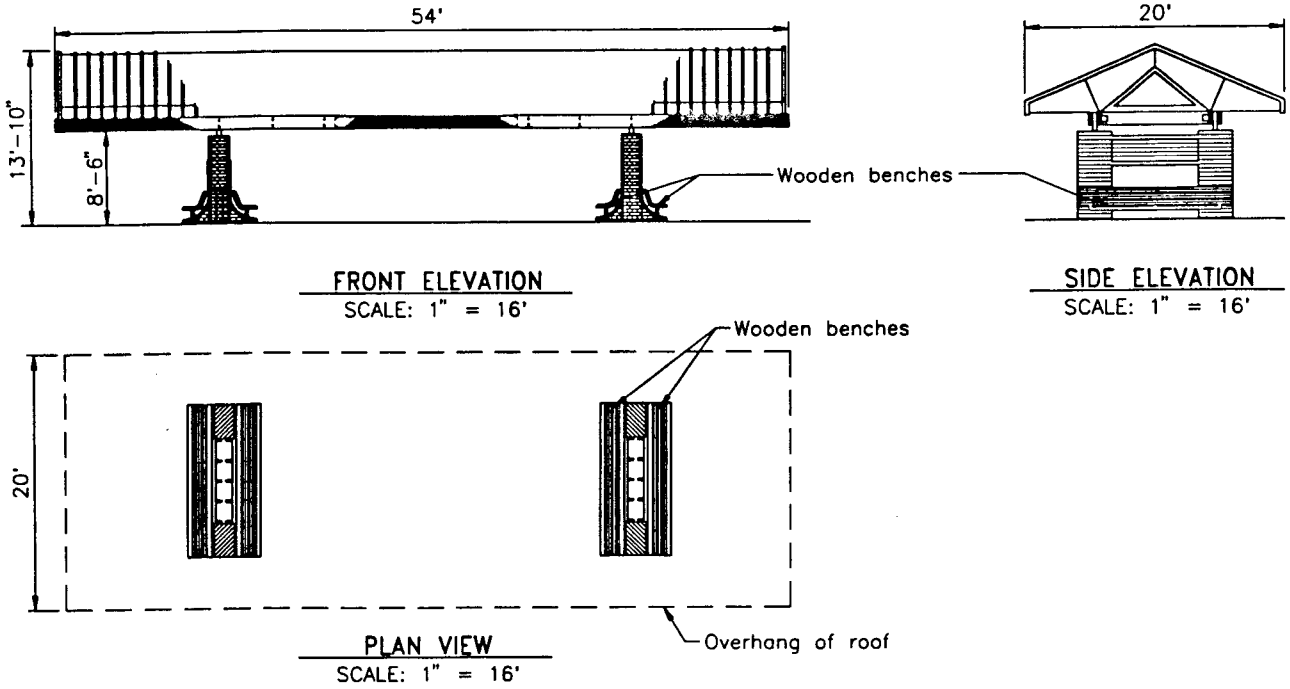


Note:
Center Platform Station is used only where there is insufficient space for a Standard Station.

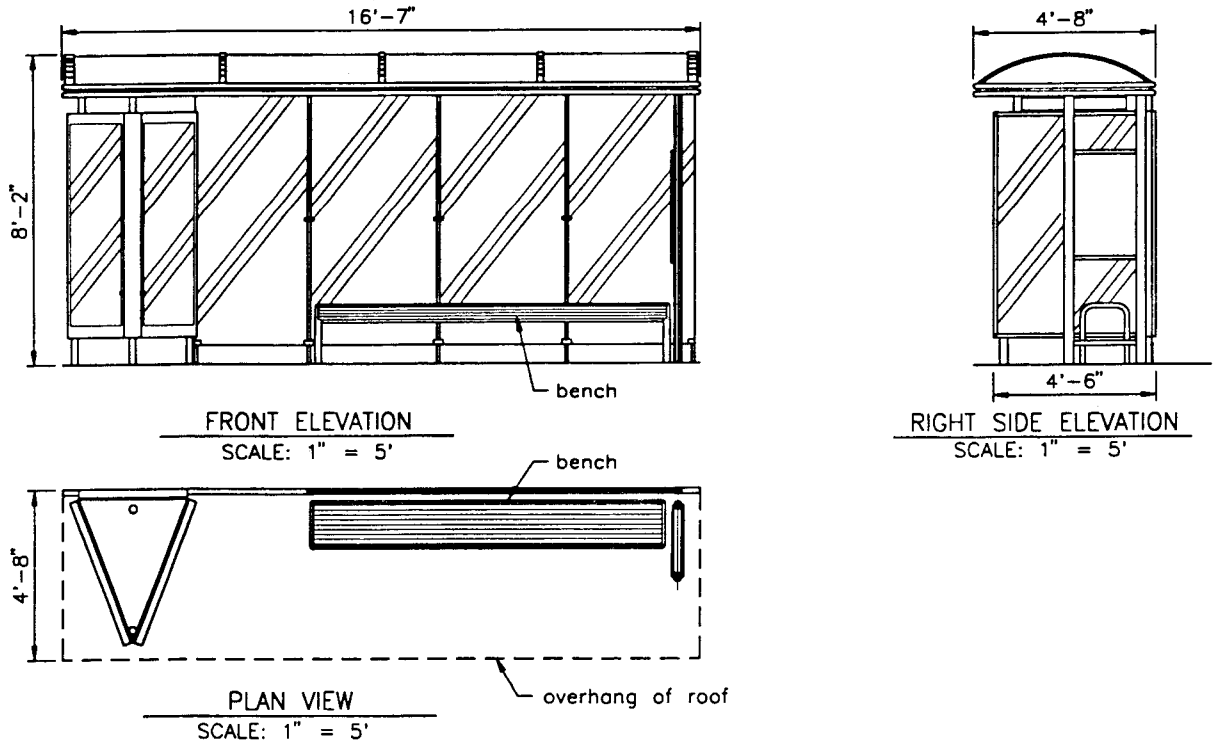
LRT STATION SHELTERS

Scale As Noted

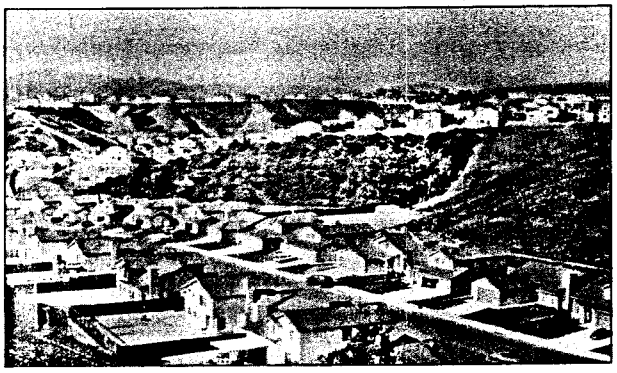
STANDARD SHELTER



SECONDARY SHELTER



V. TRANSIT-ORIENTED LAND DEVELOPMENT POLICIES



The second section of this manual discussed design and land use considerations that support transit. Included were specific actions to promote a balanced transportation system consisting of automobiles, public transit, bicycles and walking. This section of the manual discusses how local governments can implement these guidelines—from broad general plan policies to specific development review procedures.

This section begins with an overview of the relationship between a city's urban form and its transportation system. It points out the need for a balanced transportation system and discusses the impact of the land use pattern on transportation choices. This section goes on to provide examples of policies and objectives that should be included in a strong transit policy.

OVERVIEW

The most critical element in the creation of transit-oriented communities is urban form. Transit is intended to serve a large number of people making similar trips. The optimal urban form for transit is, therefore, one of well-defined linkages between a dense urban core and subordinate activity centers. The antithesis of this model, and the least desirable from a transit perspective, is the post-World War II development pattern of urban sprawl. Sprawl is typified by low densities, a strict segregation of land uses and numerous minor activity centers.

Low-density city development cannot be effectively served by transit because of its disparate trip making characteristics. Without a central focus, trips are distributed in all directions, rather than along well defined corridors. Urban sprawl and its trip pattern can only be supported by an automobile-centered transportation system. As discussed earlier in this manual, neighborhoods that are designed for the automobile are ill-equipped to accommodate any other mode of transportation.

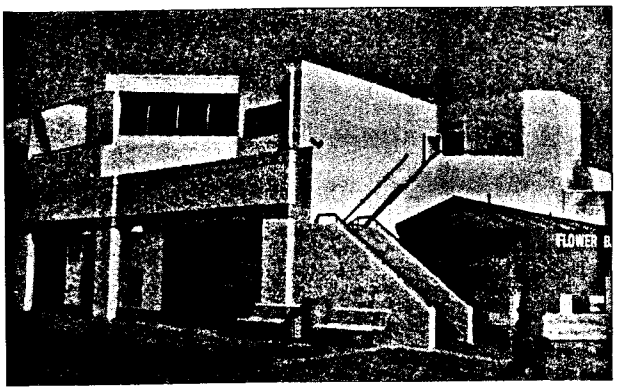
The successful reintegration of public transportation into the urban fabric of our cities requires a strong transit policy that provides the framework for future development. This policy must recognize the compelling role of public transportation in the economic and social development of our urban centers. Such an affirmation is necessary to move towards a balanced transportation system and away from our nearly sole reliance on the automobile for our mobility needs.

In one sense, it will not be easy to redirect the public commitment from an automobile-dictated infrastructure to that of transit. The subsidies that have provided the underpinning for the automobile to develop into the dominant mode of transportation are firmly entrenched in our public attitudes and policies. Times are changing, however, and this institutional bias to the automobile may be changing, as well.

The cost for subsidizing the automobile is measured not only in dollars, but also in environmental and social costs. For example, policies that continue to promote the use of the automobile undermine strategies to improve air quality, conserve energy, reduce congestion, and transform city streets into public places. This contradiction will have to be addressed by local governments if progress is to be made in any of these areas.

WHAT LOCAL GOVERNMENT CAN DO

A strong transit policy may take many forms but will focus on transit and walking as fundamental components of land use decisions. The commitment to transit should be comprehensively woven into the land development process. From the general plan to the final development permit, land use



decisions and the expenditure of public funds should be predicated on this realization: that the sustained economic development of our cities requires a new development pattern that can be supported by a balanced transportation system. Transit policies for a local or regional government can be structured around the following five objectives:

Transit preference
Transit should be the preferred mode of transportation to meet urban mobility demands. Increased street capacity for general traffic should be limited to specific circumstances.

Land use determinant
Growth should be directed to transit corridors. Access can be conveniently provided by public transit if sufficient density thresholds are achieved. Directing growth to transit facilities will ensure the most cost-effective use of transit and the most direct form of access for nearby uses. Such focused growth will also promote efficient use of other urban facilities and services.

Automobile disincentives
Employer-provided, long-term parking is a direct subsidy for automobile use. Parking management is an effective way to reduce the incentive for people to drive to work. Parking costs should be borne as part of the cost of driving, included with gasoline, insurance, and car repairs. Monies spent on providing parking spaces should be redirected to providing transit passes.

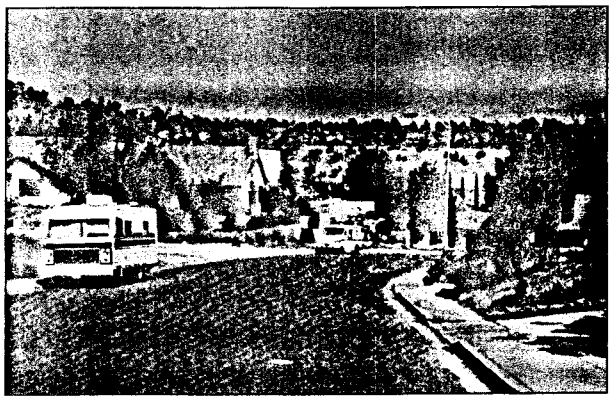
Designing for pedestrians
Walking is a critical part of a transit trip. Improving the pedestrian environment will make people feel comfortable walking from place to place. Buildings should give first consideration to pedestrian access. Streets should be provided with amenities that reinforce pedestrian activities. Examples include drinking fountains, areas for resting, protection from the elements, and ground floor businesses that serve pedestrians.

Providing for public/private partnerships in transit
The private sector should be included in helping to finance transit directly. Through the project review process, and based on the general and community plans, transit dedications or facilities should be included as normal infrastructure improvements.

Based upon these five objectives, the following discussion will illustrate specific actions needed to move toward an urban form supported by a balanced transportation system. This urban form generates trips of all modes: walking, bicycling, transit and automobile.

GENERAL PLAN

The general plan is the guiding policy document for urban planning, providing the framework for future development. In order to effect the fundamental changes necessary to support a balanced transportation system, the general plan must clearly articulate a commitment to a multimodal transportation system. Policies promoting a balanced transportation system should be included in the land use element, as well as in the circulation element of the general plan.

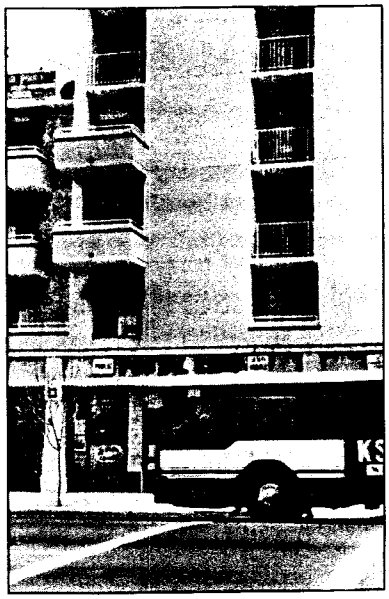


A clear statement on the desirable form of the urban environment will provide the underpinning for land use and circulation policies. There should be an overarching goal to create an urban form supported by a balanced transportation system. The following policy statements reflect this goal and are offered as examples of transit-supportive General Plan language:

- Integrate land use and circulation plans to create an urban environment that supports a multimodal transportation system.
- Use the transportation system to guide future development. Direct development to areas with a confluence of transportation facilities; limit development in areas accessible by only a single transportation mode.
- Recognize that transportation facilities are the primary organizing element of the built environment, and carefully balance the intensity of development with the capacity of the circulation system. (Note: in this regard, public transportation can be used as a tool to increase densities in areas where traffic capacity alone would ordinarily limit intense development.)

CIRCULATION ELEMENT

Within the circulation element of the general plan, more specific objectives and policies related to a multimodal transportation system should be provided. These proposals should reinforce the harmonious integration of land use and transportation. Policy direction related to all modes of transportation— including transit, pedestrian and bicycle circulation, vehicular circulation, and parking—should be provided. These policies should assert the compelling role of public transit in the economic, physical and social development of the city.



In downtown and other densely developed areas, it may be appropriate to designate transit as the preferred mode of access, as San Francisco did in 1973. The imperative for this policy was the recognition that downtown was constrained by an automobile-oriented transportation system that was inadequate to support the desired level of downtown development. San Francisco turned to a balanced circulation system, with public transit as its cornerstone, primarily as an economic development strategy. A similar strategy was taken by Portland, Oregon around the same time, including the establishment of a cap on downtown parking spaces.

In densely developed areas, such as well-defined downtowns with limited expansion capabilities, similar strategies may be

beneficial to promote the economic vitality of the area. The significant infrastructure costs that would be incurred to support public streets and private off-street parking could be reinvested in other productive ways.

For downtown development, the foremost objective should be to develop transit as the primary mode of travel to and from downtown. This objective should be supported with action policies to increase transit service and to give public transit priority over automobiles. Four such policies are suggested:

1. Do not increase the existing automobile capacity of the streets and freeways into downtown.
2. Control the growth of long-term (i.e., commuter) parking spaces within downtown and along its fringes.
3. Establish exclusive transit lanes on freeways and city streets where significant transit service exists. (These transit lanes may need to extend a considerable distance outside downtown in order to relieve congested sections of radial roadways serving downtown-bound commuters.)
4. Improve the speed of transit travel and service by giving priority to transit vehicles where conflicts with auto traffic occur.

The circulation element should also provide criteria for determining the most appropriate mode of transportation. Automobiles should be identified as the most appropriate for trips between low intensity land uses. Automobile trips are also justified where, relative to the number of transit riders served, it would be prohibitively expensive to provide public transit.

SPECIFIC PLANS, MASTER PLANS AND CORRIDOR PLANS

More detailed than general plans are specific plans, master plans and corridor plans. These documents influence urban form with varying degrees of specificity. They are typically the critical intermediary between city-wide policies and the implementing zoning ordinance. These documents implement general plan policies on a project- or area-specific basis.

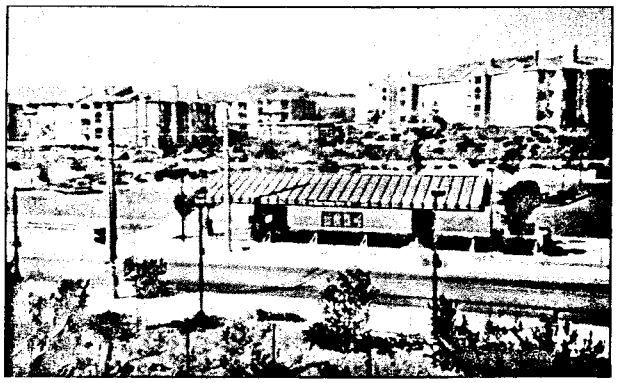
It is critical that development proposals be evaluated for contextual consistency with broad urban form goals before the proposal undergoes the more myopic site review process. This broad perspective is necessary if area and specific plans are to be interconnected and complementary to the surrounding community and to the region at-large.

This is a particularly appropriate level of planning at which to create a transit- and pedestrian-based environment. It is at this stage that specific transit facilities needed to serve the plan area can be identified. Concomitant with this determination should be the financing plan for these transit improvements. Transit should take equal financing priority with other necessary community infrastructure needs, such as water and sewer facilities.

Private sector contributions to support the transit facilities should be explicitly stated. Included would be the provision of transit right-of-way, construction costs, and ongoing operating and maintenance requirements. Private sector funding sources include impact fees, benefit assessment districts, linkage fees, development agreements, and air quality and traffic congestion mitigation fees.

IMPLEMENTING ORDINANCES

Development regulations that ensure transit- and pedestrian-sensitive site designs should be included in zoning ordinances. This could include adding language to existing zones, including planned districts and overlay zones, or creating new transit area zones, districts or overlays.

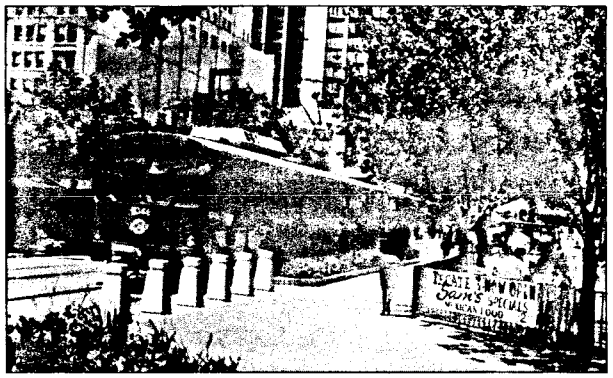


San Francisco has incorporated transit-appropriate development regulations within its downtown district ordinance, while Portland, Oregon has transit-overlay zones.

Transit criteria might include minimum front yard setbacks, reduced off-street parking requirements, pedestrian linkages to adjacent properties, and a prescription of ground floor land uses that depend on interaction with the street.

CONCLUSION

As stated at the outset of this section, urban form is the primary determinate of whether transit is a desirable alternative to the automobile. For this reason, the planning process must include the comprehensive consideration of transit, from policy through to implementation. This inclusion will help ensure that transit and walking become viable alternative modes of transportation. As this occurs, we will see real progress in reducing the social, economic and environmental impacts of the automobile on our metropolitan area.



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The following documents were helpful in compiling this manual and may provide further information on integrating transit and land use. Telephone numbers have been provided for those readers wishing to order copies.

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