Bus Stop Planning, Design and Placement Guidelines for Westchester County Municipalities

Westchester County
Department of Public Works and Transportation
100 East 1st Street
Mount Vernon, New York 10550

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16. Abstract

The Westchester County Department of Public Works and Transportation administers the operations of the Bee-Line Bus System, largely within Westchester County. The County contains six cities, 16 towns and 23 villages, each with its own home rule powers over local land use, zoning and other development issues. Within this milieu of local jurisdictions, the planning issues and operational details associated with bus stops need to be publicized in order to facilitate safe and efficient bus operations.

These guidelines have been written to serve as a basic planning tool for municipal staff, governmental agencies and consultants engaged in site design and review activities. Through the distribution of this report, it is anticipated that operational concerns regarding bus stops will be addressed in the field in order to accommodate Bee-Line Bus Service in a timely manner and to the greatest extent possible.

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1. INTRODUCTION AND GOALS

This publication is intended to create a greater awareness of the supportive role that public transit can play when local governments consider new or modified land development proposals. It is crucial to consider public transit services at the appropriate time in the land use approval process, so the benefits of accessible mass transit are fully realized and integrated with local planning policies. Furthermore, public transit programming is a key element for the successful planning of communities that are designed for users of all modes of transportation. Complete Streets designs, as well as transit-oriented developments (TODs) require a focus on connecting destinations, including bus stops, with safe, convenient and accessible pathways.

This publication includes public transit design guidelines that should be used as a reference when planning the design of road and sidewalk rehabilitation or improvement projects that impact bus operations. Minimum standard requirements for buses are highlighted as a basic reference tool for use by municipal staff, governmental agencies and private consultants engaged in site design and review activities. By using these guidelines, bus public transit needs can be considered strategically and addressed in a systematic and timely fashion.

This document will primarily affect sites located on or near streets already served by routes of the Bee-Line Bus System. However, large development projects could influence the placement of new or modified stops, an extension or diversion of bus routes or even warrant the initiation of an entirely new bus route depending on the characteristics of the project and available resources.

This planning guide, through distribution to each municipality, local staff members and members of the development community, should promote a better understanding of bus characteristics, operational needs and dimensional requirements. By establishing a consistent and systematic set of procedures, it is hoped that Westchester County's Bee-Line Bus System will be of even greater utility as a major contributor to the county's economic, environmental and social well-being.

In summary, the goals of these guidelines are to:

- Promote the development or re-development of land and roadways in a consistent, transit-friendly manner with consideration given to bus stop placement and design that aims to improve system performance and efficiency while minimizing adverse impacts;
- Encourage local jurisdictions and private developers to integrate and design bus stops which meet the operational needs of the Bee-Line Bus System and comply with Federal regulations;
- Assist in the development of integrated transit stops that will improve system performance and efficiency while minimizing impacts; and
- Encourage members of the public to use public transit through the provision of safe, accessible, comfortable and convenient bus stop facilities.

If any portions of these guidelines are found to be inconsistent with any federal, state or local regulations, the developers, design professionals, engineers, contractors or others should be responsible for complying with applicable laws. Additional information on any of the material contained in this publication can be obtained by contacting the Planning Division of the Westchester County Department of Public Works & Transportation (WCDPW&T) at (914) 813-7700 or via emailing BeeLine@westchestergov.com

2. POLICIES AND PROCEDURES FOR MUNICIPALITIES

2.1. General Operating Principles

The Bee-Line Bus System uses three types of buses: a 40-foot "standard" bus, a 60-foot "articulated" bus and a smaller 30-foot bus. Specialized shuttle and para-transit services use the more flexible 26-foot vans. These guidelines primarily address the 40-foot and 60-foot buses. General bus operational principles to keep in mind include the following:

1. For bus drivers, left turns are preferable to right turns due to greater ease and safety.

2. Reverse bus movements are to be avoided and used only in emergency situations.

3. Passengers board and alight buses via doors on the right side of the bus.

4. In accordance with the *Americans with Disabilities Act of 1990 (as amended)*, all buses are wheelchair-accessible. Though the *Act* does not necessarily require each of the system's existing facilities to be fully accessible, the system as a whole should be readily used by individuals with disabilities. However, an unobstructed pathway to and from a bus stop served by an accessible bus is ideal and required with alterations or new construction. A brief summary of the major provisions of the *Act* is provided in *Appendix A: Americans with Disabilities Act Requirements*.

5. Each Bee-Line bus stop location is marked with a rectangular blue sign atop a tall curbside pole. It is usually accompanied by a display of schedules for each bus route serving the stop as well as signs that restrict parking. Unauthorized parking negatively impacts bus operations, limits sight distance and reduces passenger access to board/alight the bus. It is important for local municipalities to enforce these regulations consistently and expediently.

2.2. Bus Stop Maintenance

Well maintained bus stops are vital to the safety and security of passengers and to the attractiveness of the bus system. Please note that all bus stop amenities (including shelters, benches, posts, signs and in some cases trash receptacles) are considered Westchester County's property and **should not be tampered with in any way**. The following table identifies the responsible parties and necessary actions for various issues:

Damaged Shelters, benches, signs, posts	- Email notification immediately to BeeLine@westchestergov.com
Garbage Removal	- The local municipality is responsible for removing trash from the receptacle and around the bus stop.
Snow Removal	- If no shelter, the local municipality is responsible for removing snow at the stop and providing a path from the curb to the stop - If the stop has a shelter, WCDPW&T is responsible for removing snow within the shelter and providing a path from shelter to curb - The local municipality or property owner is responsible for removing snow from the sidewalk and in the street
Graffiti Removal	- Email notification to BeeLine@westchestergov.com
Lighting	- If there is an issue with lighting that is part of a bus shelter email BeeLine@westchestergov.com - If no shelter, local municipality is responsible for street lighting
Tree Removal	- Local municipality is responsible for weed-whacking, and tree-trimming

2.3. Requests for Modifications

Although bus stop locations are designated by WCDPW&T, modification requests may be initiated by department staff, bus operators, local municipalities, developers or anyone from the public. Municipalities should send their request directly to WCDPW&T with a detailed description of the proposed change and justification. Requests should be submitted with sufficient review time prior to implementation. Response time may vary depending on the request's complexity, as planning and operations staff will need to evaluate the potential impacts and feasibility. Requests may include some of the following modifications:

Request:	Please Provide:	WCDPW&T Actions:
1. Bus stop relocation	- Detailed description and map of proposed changes - Justification	- Field visit - Review and analysis of impacts and feasibility - Determination of recommendation - Notify requestor and affected entities - Implementation plan - Post-implementation monitoring - - Stop activity analysis-
a. Temporary relocation due to emergency construction - **Please call 914-813-7769**		
b. Short or long-term relocations (*see next *Section 2.4*)		
c. Permanent relocation		
2. New bus stop		
3. Bus stop elimination		

4. Route modification/Layover locations/turn-arounds		
5. New amenities		

2.4. Construction Modifications

If a planned construction project interferes with a bus stop or route, municipalities or their contractors should provide WCDPW&T staff with sufficient advanced notice, so that they can review the plans and meet prior to construction. Together, both teams will ensure that passengers and operations are minimally affected and identify any opportunities to improve the stop. In addition, contractors should take note of the following guidelines:

- Provide name and telephone of construction manager.
- Provide timeline of construction with expected start and completion dates.
- Maintain access to existing stop, if possible, as long as safety is not compromised.
- Together with department staff, identify the preferred alternative stop location and if any amenities need to be temporarily stored. Contractors should not remove any bus stop amenities themselves, but rather contact WCDPW&T staff.
- Adhere to the ADA requirements for the temporary access to and from the temporary bus stop locations.
- Upon completion, coordinate with staff to re-install stop.

2.5. Development Plan Review

WCDPW&T should be provided the opportunity to review development and roadway improvement plans early in the process, as they may affect bus operations. This may include:

- Streets with existing bus routes or those identified as having potential for route modification;
- New developments that are high-density or anticipated to have a high number of riders; or
- Other projects that may be assessed for current or future transit needs.

Coordination with staff should be ongoing throughout the development process in order to ensure that public transit needs are well integrated into the plan.

2.6. Bus Shelter Agreements

Under present practice, a limited number of bus shelters are provided by WCDPW&T under an Inter-Municipal Agreement (IMA). Many, but not all municipalities have entered into such an agreement. A copy of the standard IMA can be found in *Appendix B*. In other instances, private parties have installed their own bus shelters. See *Section 6* for acceptable standard specifications.

3. VEHICLE CHARACTERISTICS

The standards expressed in this document represent those which have been judged to be acceptable by the WCDPW&T's Bee-Line Bus System. When questions arise in their applications, the department staff should be consulted for a determination on a case-by-case basis.

3.1. Bee-Line Bus Dimensions and Passenger Capacities

With the many available bus manufacturers, a range of dimensions and passenger capacities are to be expected. For our purposes, however, the following data are applicable to Bee-Line buses in Westchester County. At the date of publication, Westchester County has two models of 40-foot buses in service (NABI and Orion), and a 60-foot articulated bus (Neoplan). New 60-foot articulated buses (New Flyer) have also been procured. Seating capacity varies with the specific model bus according to chart below. All seating numbers exclude the driver.

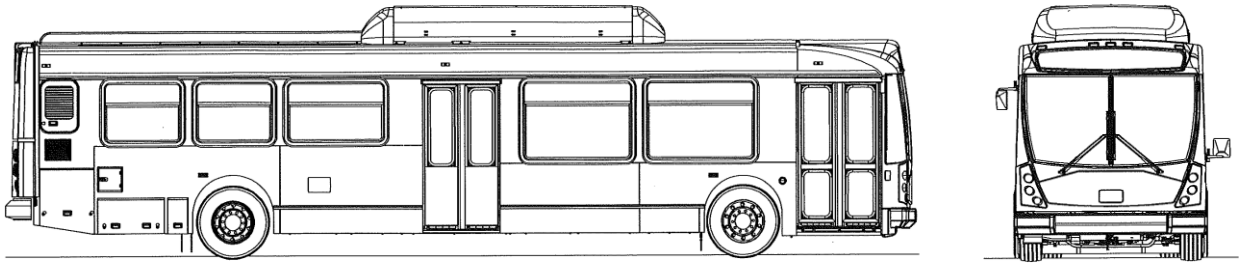
NABI Hybrid	**Orion**	**Orion Coach**	**Neoplan Articulated**	**New Flyer Articulated**
Seated 39 Standees 29	Seated 45 Standees 22	Seated 45 Standees 30	Seated 68 Standees 51	Seated 61 Standees 62
Total 68	**Total 67**	**Total 75**	**Total 119**	**Total 123**

While the different types of buses vary slightly in their dimensions, the figures below reference the larger measurements of the models for both the standard and articulated buses. More detailed specifications for each model can be provided upon request.

Figure 3-1: Typical Dimensions of 40-foot Standard Buses

Exterior Bus Dimensions			Loading Door Locations (Measured from Front of Bus)			
			Front Door		Rear Door	
Length	Width[1]	Height	Location	Width	Location	Width
40'9"	10' – 3"	11' – 5"	3' – 0"	3' – 4"	22' – 8"	3' – 4"

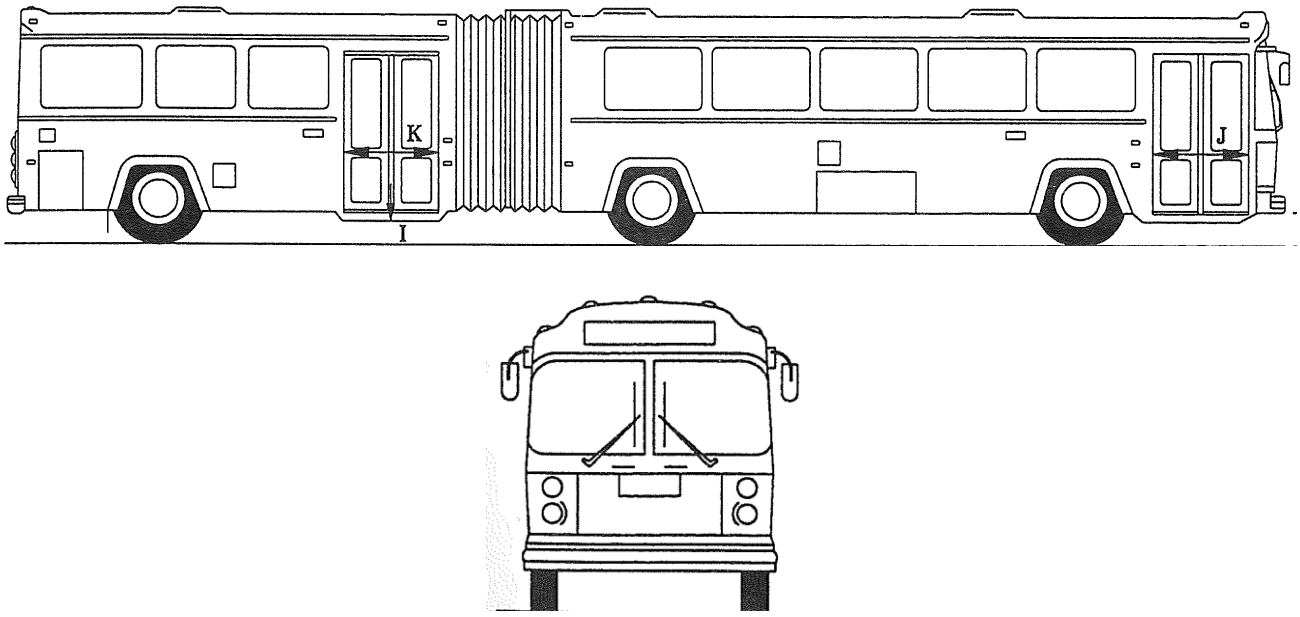
[1] 10' – 3" is the width of the bus including the rear view mirrors extended to the standard driving position. Not including the mirrors the body of the bus is 8' – 5" wide.



NABI LOW-FLOOR HYBRID BUS

Figure 3-2: Typical Dimensions of 60-foot Articulated Buses

Exterior Bus Dimensions			Loading Door Locations (Measured from Front of Bus)			
			Front Door		Rear Door	
Length	Width[2]	Height	Location	Width	Location	Width
60’ – 10”	10’ – 6”	11’ – 6”	3’ – 5”	3’ – 2”	44’ – 8”	2’ – 10”

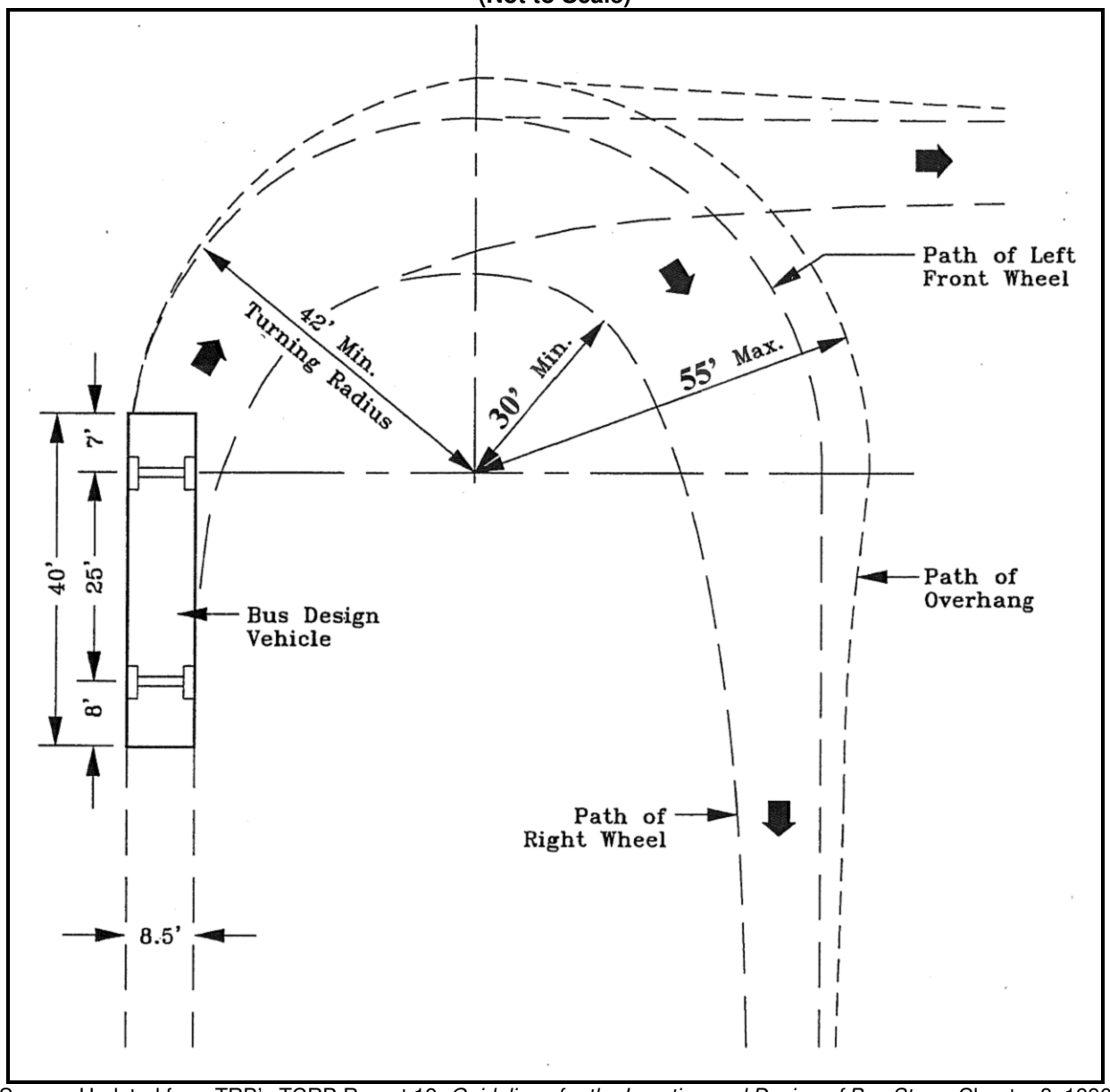


3.2. Bee-Line Bus Operating Characteristics

[2] 10’ – 4” is the width of the bus including the rear view mirrors extended to the standard driving position. Not including the mirrors the body of the bus is 8’ – 6” wide.

A key element in transit-friendly design is the attention paid to the turning radius requirements of the bus. For both its 40-foot and 60-foot buses, the Bee-Line System recommends a 50-foot outside and 30-foot inside turning radius. (While the 60-foot articulated bus is longer, it has a hinge that allows maneuverability comparable to the 40-foot standard bus]. Of course, shorter buses and vans will require shorter turning radii.

Figure 3-3: Bus Turning Template
(Not to Scale)



Source: Updated from TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

4. BUS STOP PLACEMENT

4.1. Bus Stop Spacing

Spacing between bus stops will vary based on many factors, including density, land use, trip generators, ridership demand, service type (express or local), transfer points, accessibility and safety. Trade-offs must be made between providing closely spaced stops, which may decrease walking distances while increasing bus travel time, and providing stops further apart, which will result in longer walking distances but higher speeds and shorter bus travel times. Typical bus stop spacing for various environments, based on prevailing practices, is described below. The spacing between stops is largely based on travel behavior research, which has found that most riders are willing to walk up to a quarter-mile (1320 feet) to access a bus stop.

Figure 4-1: Typical Bus Stop Spacing

Environment	Spacing Range	Typical Spacing
Central Core Areas of CBDs	300-1000 feet	600 feet
Urban Areas	500-1200 feet	750 feet
Suburban Areas	600-2500 feet	1000 feet
Rural Areas	650-2640 feet	1250 feet

Source: TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

The table above shows a wide variation within each type of environment. As Westchester County encompasses all these environments, stop spacing falls within these ranges but varies widely as well. See *Section 4.3* below for further factors that are considered as WCDPW&T aims to improve bus stop spacing.

4.2. Bus Stop Location

Bus stops can be placed on the near side of an intersection, the far side or midblock. The table below summarizes the advantages and disadvantages of bus stop placement and when each placement is recommended. While locating a bus stop on the far side is generally preferred under most conditions, individual circumstances and professional judgement will play a large role. The next section highlights the in-depth analysis required when considering bus stop placement.

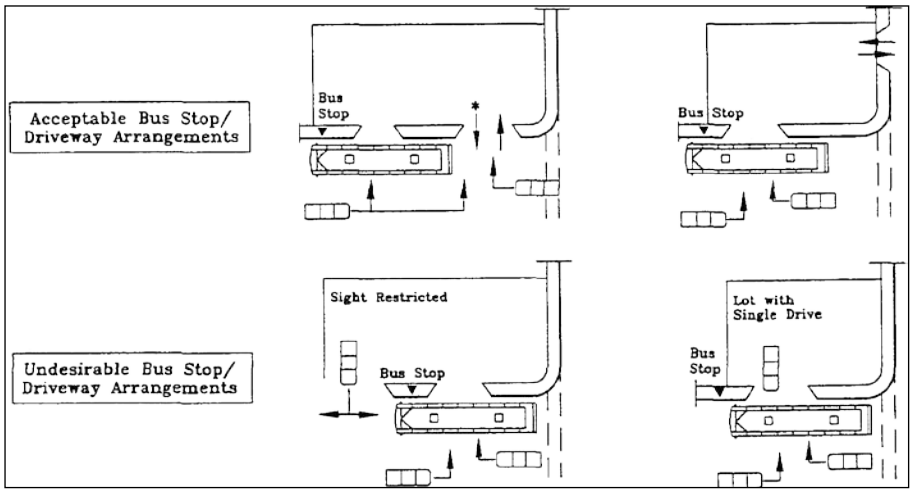
Figure 4-2: Near Side vs Far Side Placement Advantages and Disadvantages

	Advantages	Disadvantages	Where Recommended
Far Side Stop	▪ Minimizes conflicts between right-turning vehicles and buses ▪ Provides additional right turn capacity by making curb lane available for general traffic ▪ Minimizes sight distance problems on approaches to intersections ▪ Encourages pedestrians to cross behind the bus ▪ Creates shorter deceleration distances for buses since the bus can use the intersection to decelerate ▪ Results in bus drivers being able to take advantage of the gaps in traffic flow that are created at signalized intersections	▪ May result in the intersection being blocked during peak periods by multiple stopping buses ▪ May obscure sight distance for crossing vehicles, pedestrians ▪ Can cause a bus to stop after stopping for a red light, which interferes with both bus operations and all other traffic ▪ May increase number of rear-end collisions since drivers do not expect buses to stop again after stopping at a red light ▪ Could result in traffic queued into intersection when a bus is stopped in travel lane	▪ High volume of right turns ▪ Bus route requires left turn at intersection ▪ Complex intersections with multi-phase signals or dual turn lanes ▪ Heavier volumes and/or more delays on near side ▪ Better and/or safer pedestrian elements on far side ▪ When intersection has transit signal priority
Near Side Stop	▪ Minimizes interferences when traffic is heavy on the far side of the intersection ▪ Allows passengers to access buses closest to crosswalk ▪ Results in the width of the intersection being available for the driver to pull away from the curb ▪ Eliminates the potential of double-stopping ▪ Allows passengers to board and alight while the bus is stopped at a red light ▪ Provides driver with the opportunity to look for oncoming traffic, including other buses with potential passengers	▪ Increases conflicts with right-turning vehicles ▪ May result in stopped buses obscuring curbside traffic control devices and crossing pedestrians ▪ May cause sight distance to be obscured for cross vehicles stopped to the right of the bus ▪ May block the through lane during peak period with queuing buses ▪ Increases sight distance problems for crossing pedestrians ▪ May increase delay if buses are loading during green phase	▪ Higher volumes or delays on far side that has potential to block up intersection ▪ Better and/or safer pedestrian elements on near side
Mid-Block	▪ Minimizes sight distance problems for vehicles and pedestrians ▪ May result in passenger waiting areas experiencing less pedestrian congestion	▪ Requires additional length for no-parking restrictions ▪ Encourages jaywalking ▪ Increase walking distances for passengers crossing at intersections	▪ Bus route involves right turn and curb radius is too tight ▪ Problematic traffic conditions at intersection ▪ Major trip-generator is located mid-block ▪ Compatible with corridor or district plan

Source: Updated from TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

Ideally, bus stops should not be located near driveways. However, it is often unavoidable because driveways for gas stations or other developments are frequently located at intersections throughout the County. Acceptable and undesirable bus stop placements are depicted in the figure below. Placing the stop at the far side of the driveway is preferred, as a stopped bus on the near side may obstruct visibility for exiting vehicles. Having two exits and entrances can also help minimize conflicts.

Figure 4-3: Bus Stop Placement at Driveway



Source: TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

4.3. Bus Stop Consolidation

In an effort to improve transit performance and reduce bus travel times on existing routes, WCDPW&T staff may consider bus stop consolidations as an effective measure of balancing the needs of passengers. Consolidation may involve relocating or eliminating stops, with the ultimate goal of redirecting service away from underperforming stops towards high-demand, high-performances stops.

While eliminating a stop will involve an analysis of the benefits that will be gained by not having it, relocating a stop would require comparing the performance of an existing stop to the proposed location. Though there are no specific thresholds that must be met for stop elimination or relocation, the table below summarizes the list of questions that are analyzed during the investigation.

Figure 4-4: Factors to Consider in a Stop Consolidation Program

When considering stop consolidation:	
Ridership	- How many people are getting on and off at that stop, for all affected routes?
Spacing	- What will be the new distance between the previous and the next stops? - How much extra will riders have to walk?
Land Use	- What are the adjacent land uses? - Are there major trip generators nearby (e.g. medical facilities, employment centers, education centers, senior housing, shopping centers, etc)?
Transfers	- Does the stop serve as a transfer point to other bus routes or train stations?

	- What is the best placement of the stop to shorten pedestrian paths for transfer?
Safety	- Is the new stop safe for passengers waiting, boarding and alighting? - Is there a safe way to access the new stop? Are there sidewalks, curbs and crosswalks? - Are the waiting passengers safely visible to bus drivers? - Does the new stop pose a safety risk to other pedestrians or drivers? - Is there a conflict with existing driveways or other physical obstructions?
Bus Operations	- Is the bus safely able to access bus stop? - Is the stop zone long enough for regular bus, articulated, or if necessary, multiple buses? - Is the bus safely able to re-enter traffic stream? - Does the bus driver have adequate visibility of the street and pedestrian areas? - Is the 'No Parking' regulations enforced at the bus stop? - Does the stop location impede the bus route or create a circuitous path?
Traffic	- Does the stop impact traffic delay? - Does the stop have the potential to block an intersection or lane? - How do vehicles maneuver around the stopped bus?
Accessibility	- Is there a concrete pad at the stop for passengers in wheelchairs? - Are there ADA-accessible curb ramps and adequate sidewalks at intersections and surrounding streets? - Is the stop on a slope?
Amenities	- Are the shelters or benches currently at the stop or is there sufficient sidewalk width at a proposed location?
Reciprocity	- Is there a paired stop, in the opposite direction?

Input and review by the public is always an important consideration when making these modifications. Westchester County coordinates with municipalities prior to implementing these types of changes. Municipalities can also contact WCDPW&T staff to initiate an analysis for a specific route or area.

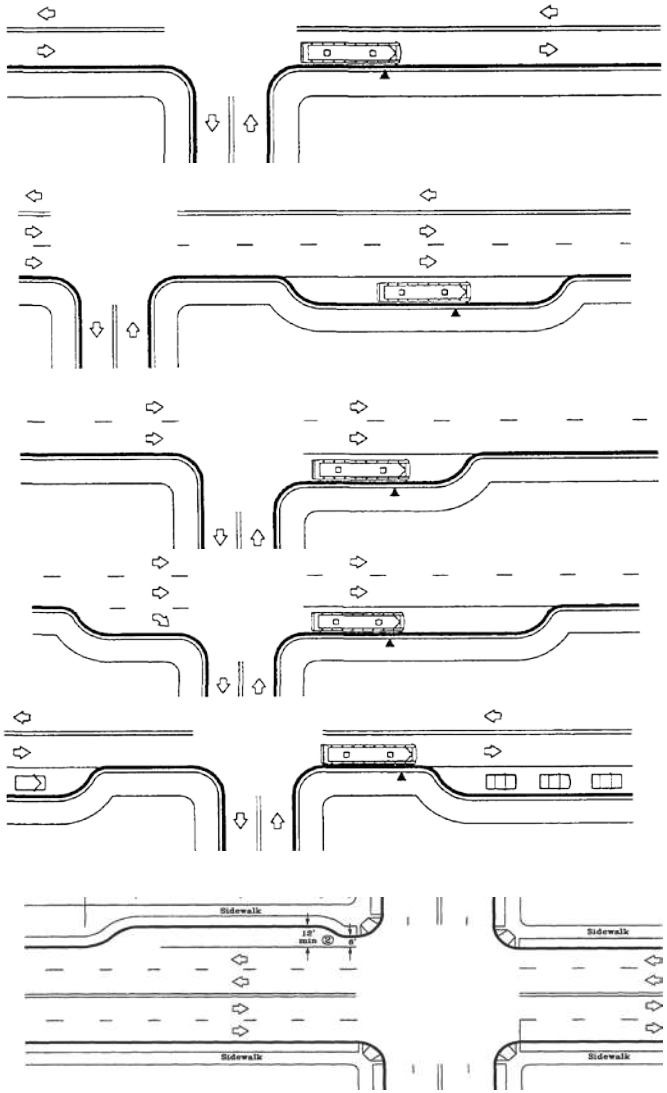
5. BUS STOP DESIGN: STREETSIDE

5.1. Bus Stop Types

Bus stops can be designed in a number of configurations, each with their own set of advantages or disadvantages, as described below.

Figure 5-1: Advantages and Disadvantages of Bus Stop Configurations

Source: Updated from TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

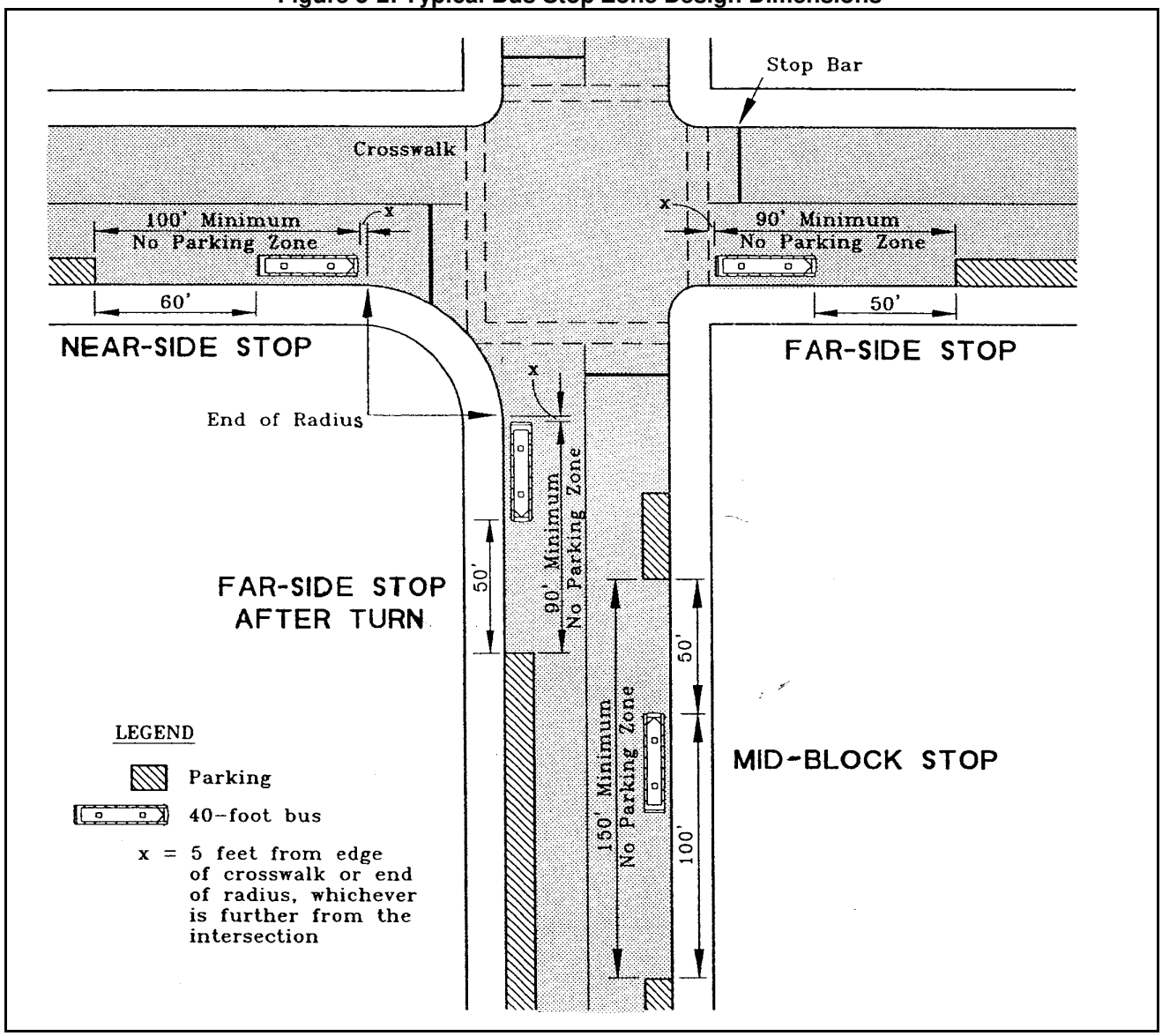


Bus Stop Type	Advantages	Disadvantages
Curbside Stop	• Provides easy access for bus drivers as they do not need to re-enter traffic stream • Less delay for bus passengers • Easy and inexpensive to install or relocate	• Can cause traffic to queue behind stopped bus • Drivers may attempt unsafe maneuvers to serve around bus
Bus Bay (with acceleration and deceleration lanes)	• Allows passengers to board/alight out of travel lane • Provides protected area away from moving vehicles • Minimizes delay for general traffic	• May be more difficult for bus drivers to re-enter traffic stream • More expensive to install or relocate • May reduce sidewalk width for pedestrians
Open Bus Bay	• Allows bus to decelerate through the intersection • See Bus Bay advantages	• Increases pedestrian crossing distance • See Bus Bay disadvantages
Queue Jumper Bus Bay (with acceleration lane)	• Removes buses from general traffic stream • Allows buses to bypass queues at a signal	• May cause delay to right-turning vehicles • See Bus Bay and Open Bus Bay disadvantages
Bus Bulb (or curb extension, nub)	• Less delay for buses • Decreases walking distance for pedestrians crossing the street • Provides additional sidewalk area for waiting passengers and stop amenities • Removes fewer parking spaces for bus stop	• More costly to install • See Curb-side disadvantages
Partial Open Bus Bay (or partial sidewalk extension)	• See Open Bus Bay Advantages • Shorter pedestrian crossing distance with partial sidewalk extension • Slows down right-turning vehicles	• See Bus Bay disadvantages

5.2. Bus Stop Dimensions

Curb-side bus stop zone dimensions are one of the most variable factors due to each stop's particular circumstances. Therefore, much is often left to professional judgment. As an ideal standard, however, this graphic illustrates typical dimensions for curb-side bus stops.

Figure 5-2: Typical Bus Stop Zone Design Dimensions



Notes: Lengthen bus stop zones by 20 feet for 60-foot articulated buses. Add 50 feet for each standard bus and 70 feet for each articulated bus expected to use the stop at the same time.
Source: TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 3, 1996

5.3. Minimum Horizontal and Vertical Clearances for Buses

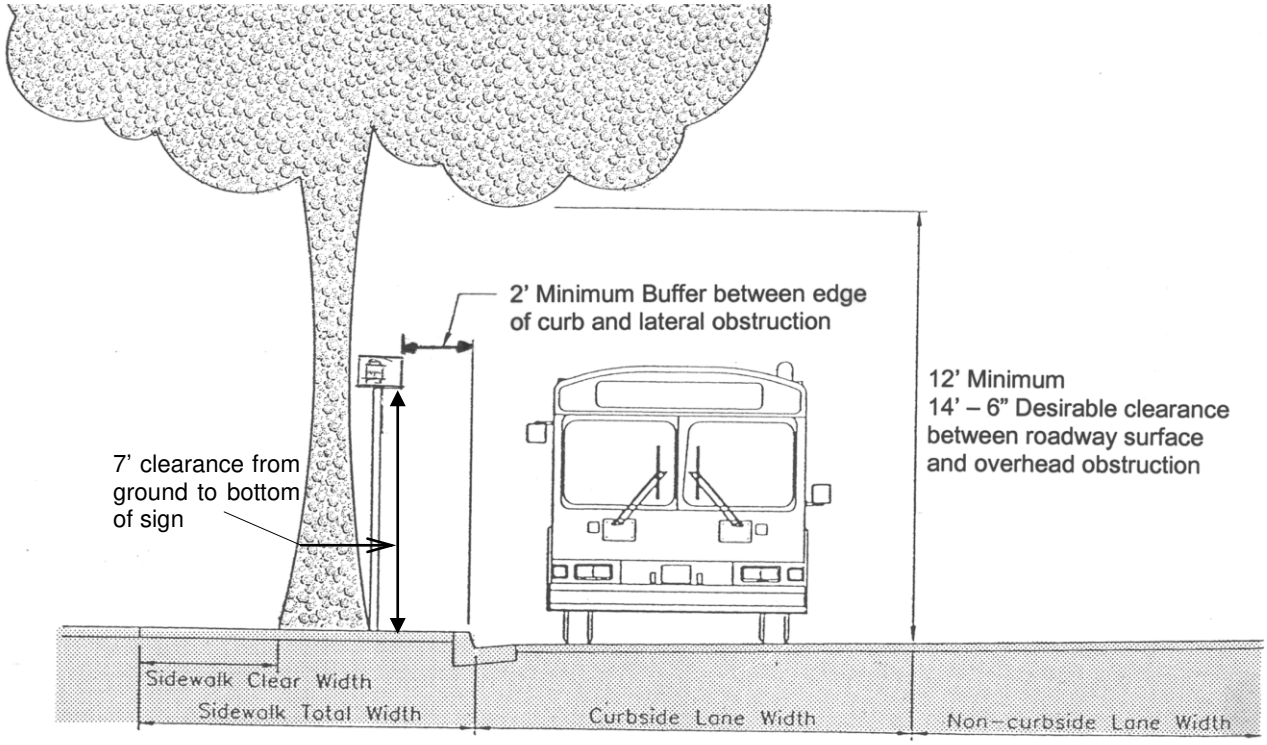
5.3.1 Horizontal Clearances

Buses generally travel along the outside lane of roadways, next to the curb if parking is prohibited. For this reason, a two-foot minimum lateral clearance must be maintained between the curb and any signs or other obstructions along the curb edge of the street.

5.3.2 Vertical Clearances

The maximum height for most buses is up to 11.5 feet high. The minimum vertical clearance for buses should be no less than 12 feet, with 14.5 feet as the desirable clearance.

Figure 5-3: Horizontal and Vertical Clearances for Buses
(Not to Scale)



SIDEWALK		CURBSIDE LANE		TRAVEL LANE
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:	4' Minimum 8' Desirable	With Parking:	18' Minimum 20' Desirable	

Notes:
Sidewalk clear width should be 4' minimum, 6' desirable; where pedestrian traffic is heavy, up to 8' of clear width should be reserved.
Typical maximum grade for 40-foot buses is 6-8%.
Recommended curb height is between 6 and 9 inches.

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

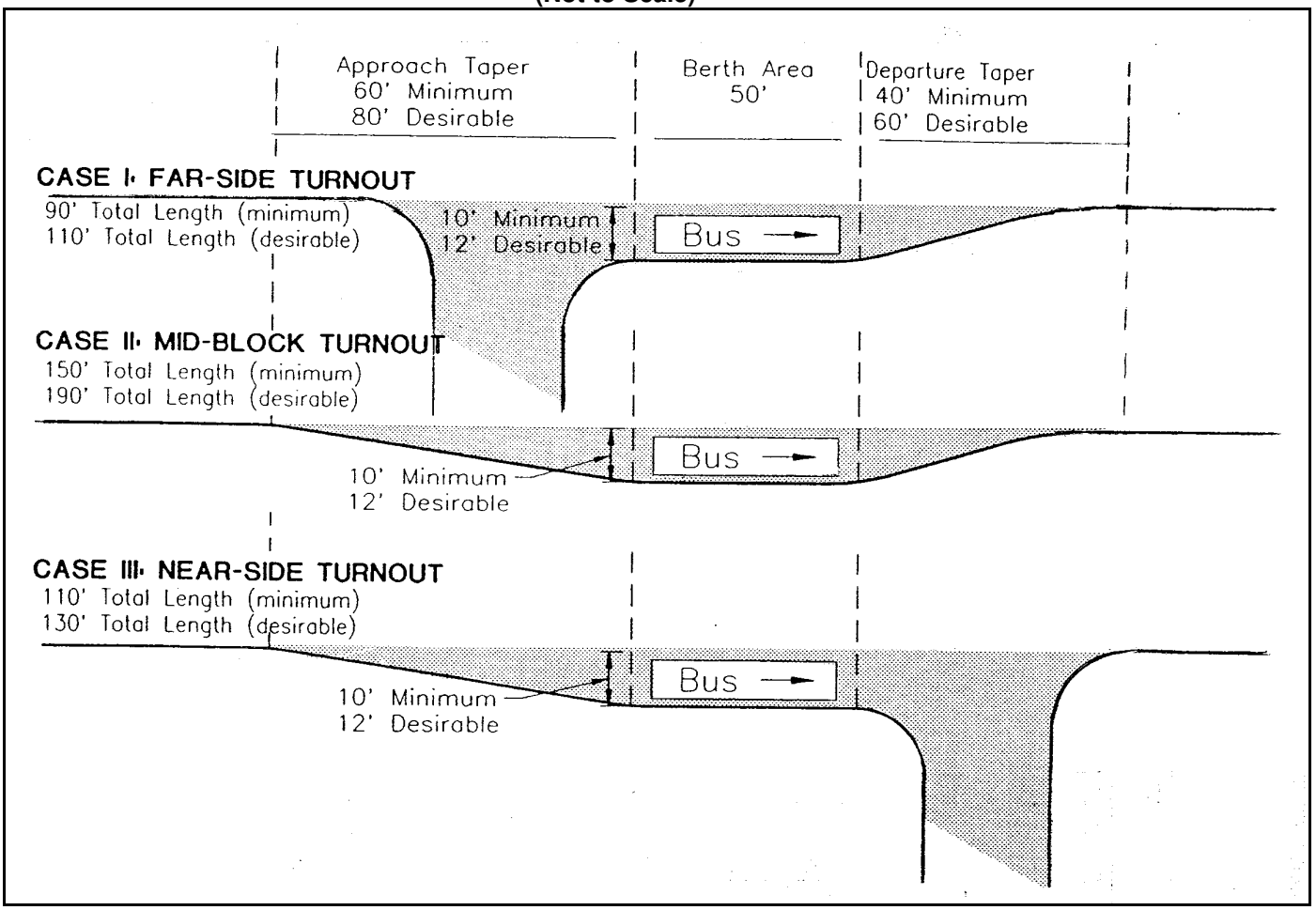
Source: Updated from San Diego, California, Metropolitan Transit Development Board's *Designing for Transit*, 1993

5.4. Bus Bays (Turnouts)

Typically, bus bays are designed so that buses may exit and re-enter the traffic stream without blocking general traffic. They are usually placed on roadways with high volumes, speeds, bus frequencies and passenger volumes. Bus bays may be placed mid-block (between intersections) before an intersection (near-side) or after an intersection (far-side), which is generally preferred. They are often placed at far-side stops so the bus can take advantage of the width of the intersecting street in order to move over to the curb lane. See *Figure 4-2* for other considerations.

For near-side and mid-block bays, an approach taper is needed to complete the bus deceleration which typically starts while still in the approaching travel lane. For far-side and mid-block bays, a departure taper is needed for bus acceleration to re-enter the flow of traffic. Much of the bus acceleration will occur in the departing travel lane; however, for high-speed corridors, extra length is recommended for acceleration and deceleration purposes.

Figure 5-4: Bus Bays
(Not to Scale)



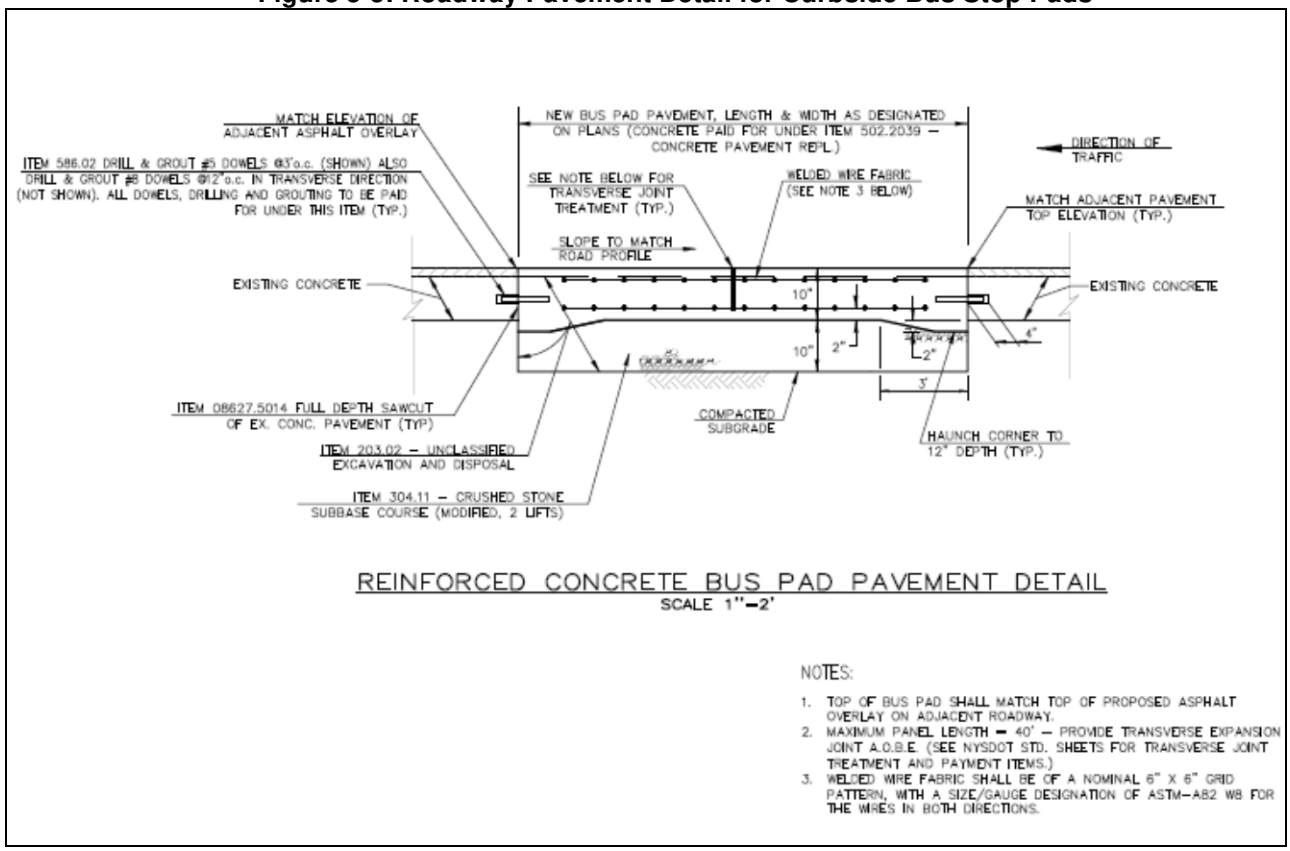
Berth Area Notes: Lengthen 20 feet if 60-foot articulated buses use the turnout. Add 50 feet for each standard bus and 70 feet for each articulated bus expected to use the bus bay at the same time.
Source: San Diego, California, Metropolitan Transit Development Board's *Designing for Transit*, 1993

5.5. Concrete Bus Pads

For curbside lanes at frequently used bus stops, a special Portland cement concrete bus pad is recommended, whether the rest of the street is paved with asphalt or a Portland concrete surface. A standard threshold for the installation of special concrete bus pads is based upon the actual frequency of stopping buses, due to the increased loads associated with heavy buses starting and stopping. Special Portland cement concrete (PCC) bus pads should be installed at bus stops having **five** or more buses stopping during the peak hour each weekday. Granite curbs, rather than pre-cast concrete or asphalt curbs, are also desired at these busy bus stops.

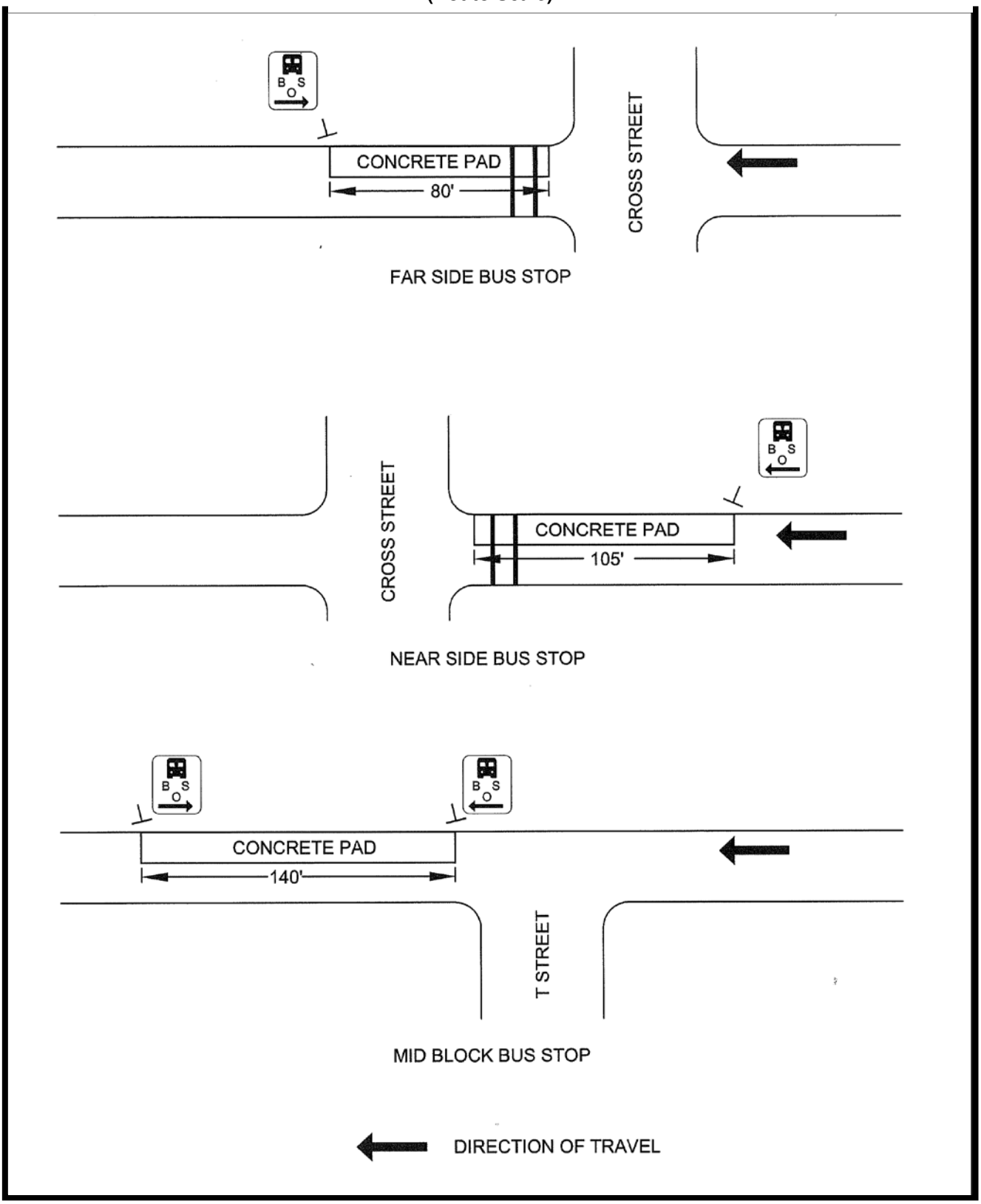
Without PCC bus pads, a washboard-like surface could develop along roads with heavily used bus stops on asphalt pavement, especially during hot weather. If the roadway surface consists of sub-standard Portland cement concrete, it too will show signs of cracks and general deterioration. Bus pads should be planned for at the beginning of project development in order to minimize disruption after the project is complete.

Figure 5-5: Roadway Pavement Detail for Curbside Bus Stop Pads



Source: Westchester County DPW&T

Figure 5-6: Minimum Sizes of Concrete Area for Curbside Bus Stop Pads
(Not to Scale)



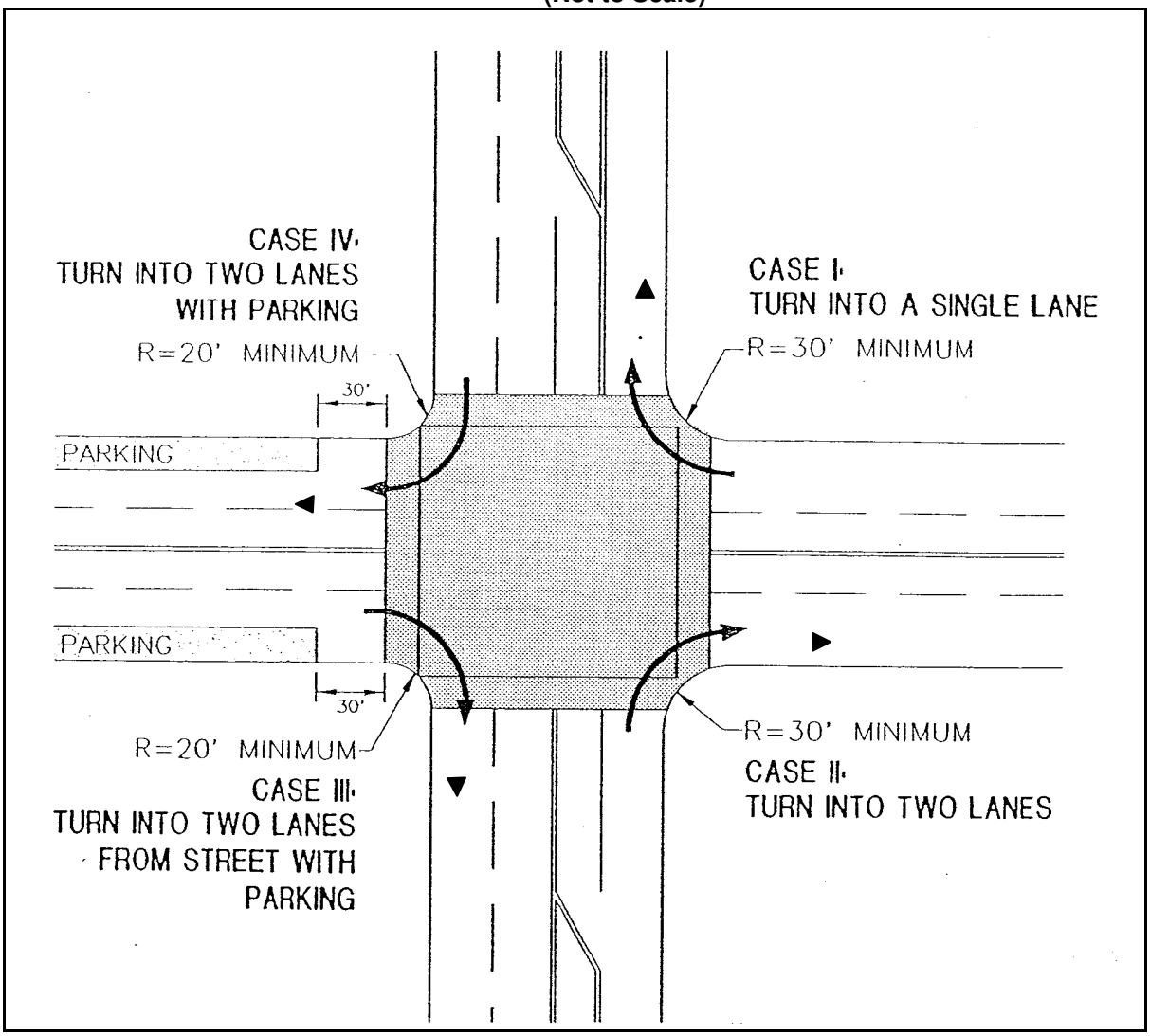
Source: Westchester County DPW&T

5.6. Intersection Design for Bus Turning Movements

Many factors impact bus operations at an intersection, including the turning radii design, lane widths of the streets involved, where parking is permitted, the angle of the intersection, operating speeds and pedestrian volumes. Smaller curb radii are generally recommended in order to decrease turning speeds and improve pedestrian safety with shorter crossing distances. However, larger turning radii are required for the safe turning of buses, emergency vehicles or trucks. Each roadway should, therefore, be planned for a specific design vehicle, the type of vehicle that will use it most often. Please refer to NACTO's Urban Street Design Guidelines for further details.

When planning bus routes on an existing street network, a field test with the actual bus to be used along the route is often the best way to test out the feasibility of bus operations. The importance of setting curbside parking to no less than 30 feet from each intersection should be emphasized.

Figure 5-7: Intersection Design for Bus Turns
(Not to Scale)

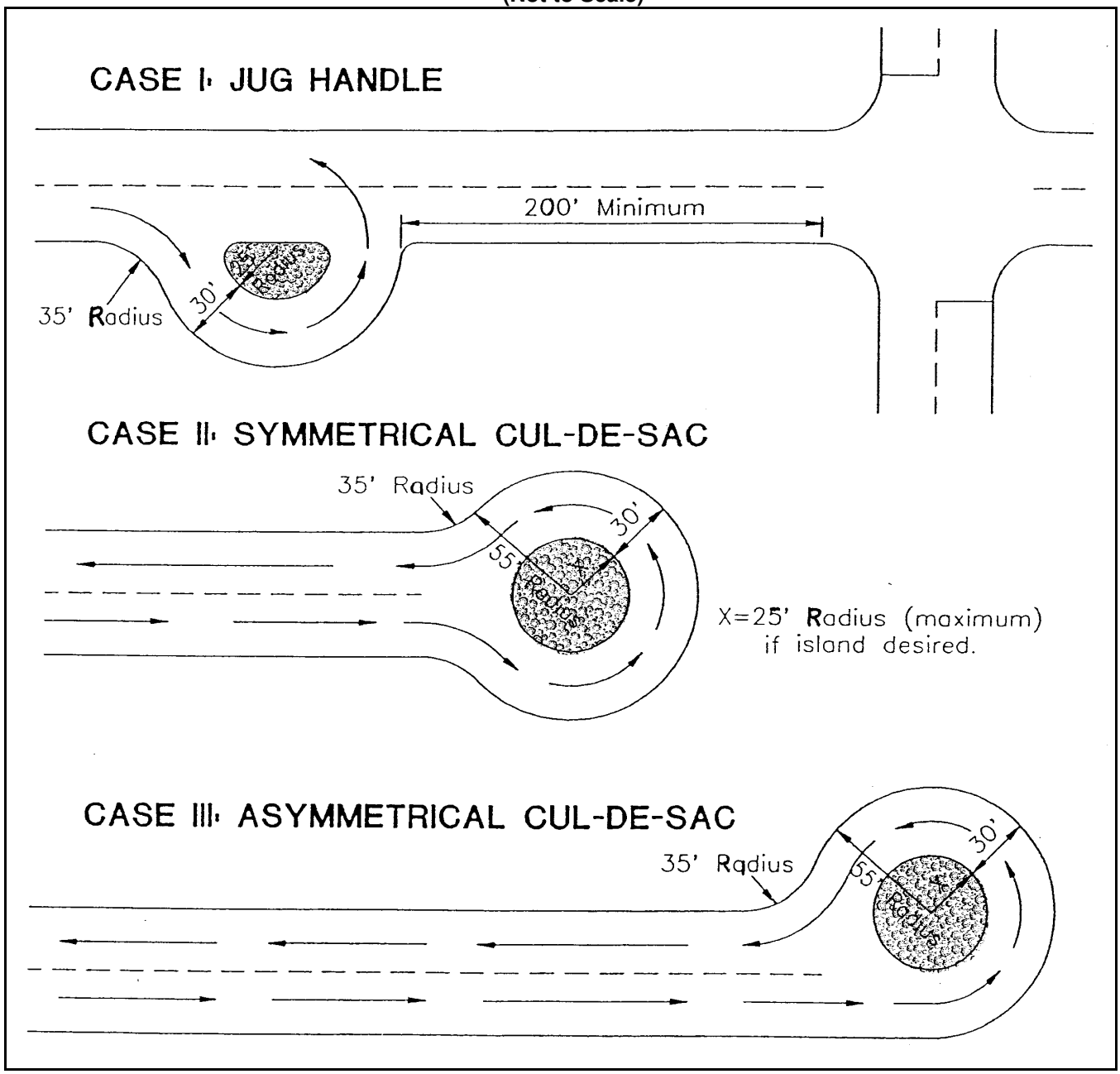


*Encroachment into adjacent lanes may be allowed on certain low-volume streets or those with low frequency bus routes. Stop sign and pavement marking placement may be set further back to accommodate encroachment.
Source: San Diego, California, Metropolitan Transit Development Board's *Designing for Transit*, 1993

5.7. Bus Turnarounds

Three possible methods are illustrated below in the rare instance when a bus needs to reverse directions completely. Only low plantings should be placed within any islands to maintain clear sight distances. These turnarounds assume no parking is allowed on the approach and departure lanes and/or within the 30-foot loop lanes.

Figure 5-8: Bus Turnarounds
(Not to Scale)



Source: San Diego, California, Metropolitan Transit Development Board's *Designing for Transit*, 1993

5.8. Roundabouts

An important factor for determining a roundabout's layout is the need to accommodate the largest motorized vehicle likely to use the intersection. The turning path requirements of the vehicle will dictate many of the roundabout's dimensions. Before beginning the design process, the designer must be conscious of the design vehicle and possess the appropriate vehicle turning templates or a CAD-based vehicle turning path program to determine the vehicle's swept path.

All roundabouts should be designed to allow single passenger cars, pickups, single-unit trucks and bus operation without the use of the truck apron. Larger trucks will require the use of a truck apron, especially on single lane roundabouts. Operation of all roundabouts shall be checked using the turning characteristics for the design vehicles using vehicle turning templates.

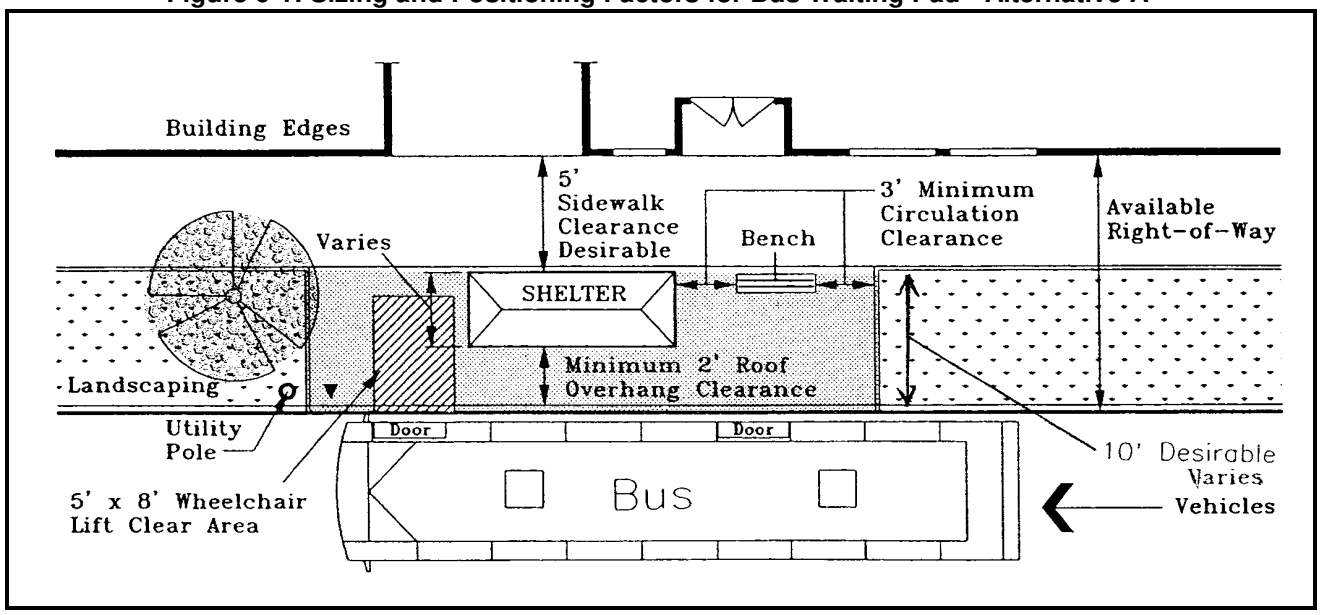
Roundabout design plans should be reviewed and approved by the Westchester County Department of Public Works &Transportation prior to construction.

6. BUS STOP DESIGN: CURBSIDE

6.1. Bus Stop Waiting Pad Layout

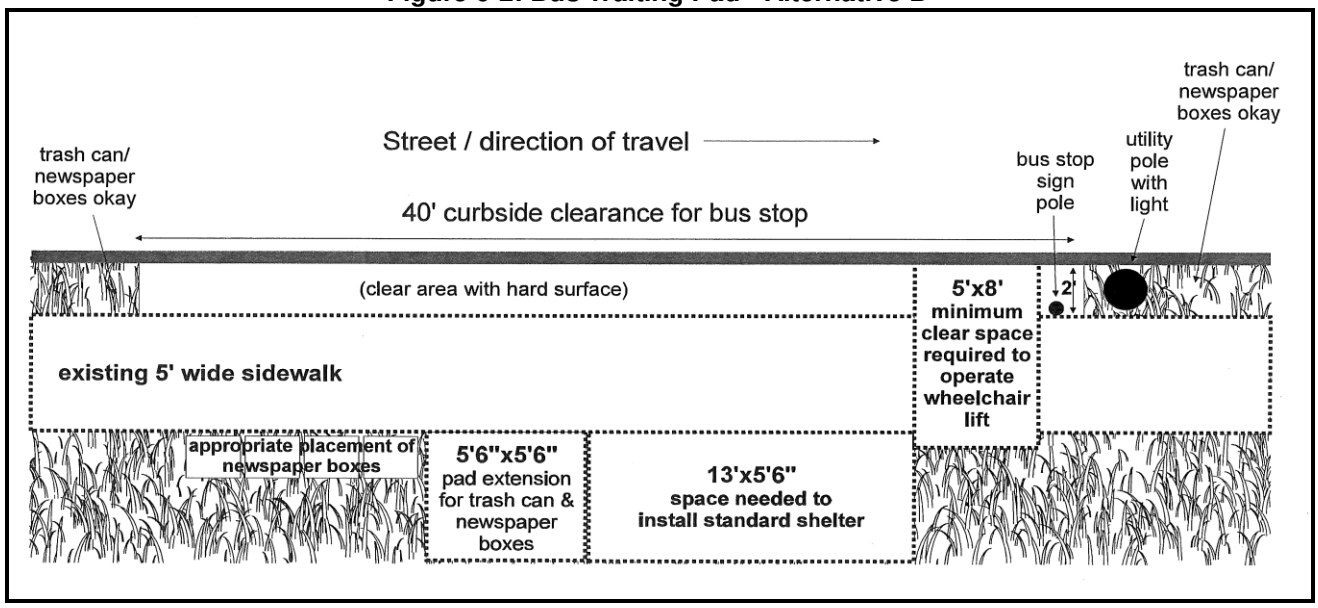
Curbside design for bus stops should provide a safe, accessible and comfortable waiting area for passengers. At a minimum, all new or renovated stops are required by the ADA to be accessible to the maximum extent possible. The waiting pad should be a firm, stable surface for lift deployment and made from impervious, slip-resistant materials. Ideally, the bus stop pad is an 8-foot to 10-foot wide extension to a 5-foot continuous sidewalk and extending 25 to 30 feet along the street frontage. The minimum ADA requirement calls for a 5' x 8' wheelchair lift clear area, however, a 6' x 10' area is recommended. Bus stops should also be connected to sidewalks, crosswalks and curb ramps to provide a more connected path. Some factors on waiting pad size are illustrated below.

Figure 6-1: Sizing and Positioning Factors for Bus Waiting Pad - Alternative A



Source: TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 4, 1996

Figure 6-2: Bus Waiting Pad - Alternative B

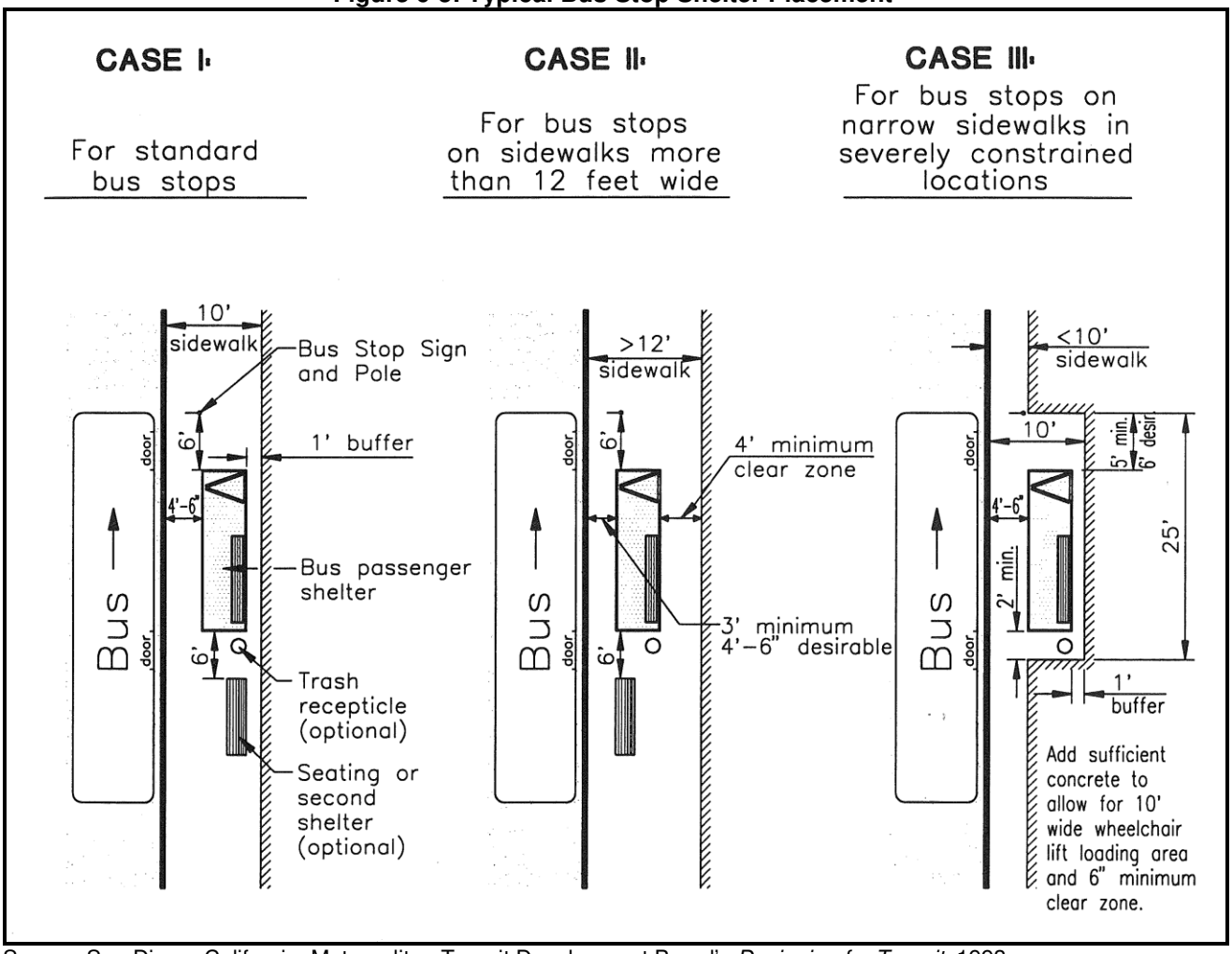


Source: Westchester County DPW&T

6.2. Bus Stop Shelter Placement

This graphic illustrates the placement of bus shelters under three varying sidewalk width conditions. In all Cases, a 6' wide by 10' or longer wheelchair lift clear area is shown and noted as a 6' x 10' wheelchair lift loading area in Case III. The minimum ADA wheelchair requirement calls for a 5' x 8' area.

Figure 6-3: Typical Bus Stop Shelter Placement



Source: San Diego, California, Metropolitan Transit Development Board's *Designing for Transit*, 1993

6.3. Bus Stop Shelter Design:

WCDPW&T's bus shelter program provides participating municipalities with repair and maintenance of County owned shelters as well as a portion of sales revenue from advertising. The various styles are illustrated in the following photos and are selected based on ridership, right-of-way limitations and street flow. Shelters are installed by a county-approved licensee within cities, towns and villages with valid Inter-Municipal Agreements (IMAs), per the sample in Appendix B. The IMAs each cover a five-year period and detail such issues as insurance, advertising displays, maintenance, fees, relocation costs, etc. For

bus shelter needs on private properties, owners have a choice of acquiring the County's design and installation services or seeking their own suppliers.

Figure 6-4: Sample Shelter Style: 9 ft.

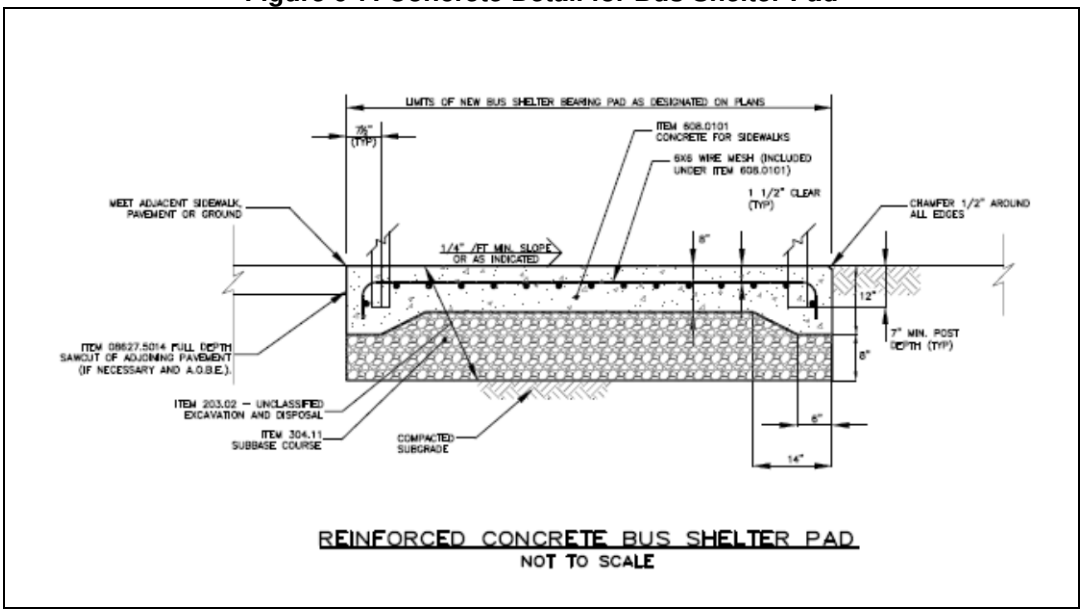
Figure 6-5: Sample Shelter Style: 13 ft.

Figure 6-6: Sample Shelter Style: 17 ft.

Plans and dimensions for these shelters are available upon request.

Bus Shelters are to be located on concrete pads, per the graphic below. The minimum required size of the pad varies with the size of the shelter. The bus shelters are bolted into the concrete pad.

Figure 6-7: Concrete Detail for Bus Shelter Pad



Source: Westchester County DPW&T

These shelters use LED lighting for illumination of the ad boxes and shelter lighting. Solar panels are deployed when possible, which eliminates the need to run 110v power to the sites.

6.4. Summary Tabulation of Desirable Bus Stop Features

With over 3,300 bus stops throughout the system, the inclusion of certain features or amenities is generally based on ridership levels. This table summarizes the standard or desirable bus stop features:

Figure 6-8: Summary Tabulation of Desirable Bus Stop Amenities

Dedicated pole with sign	- Standard for all stops, along with ride guides that include appropriate schedules and route maps for stop
Bench	- Desirable at stops with over 50 daily boarding passengers
Shelter	- Desirable at stops with over 100 daily boarding passengers
System Map	- Desirable at stops with bus shelters
Trash Receptacle	- Optional at all stops, but desirable at stops with over 200 daily boarding passengers
Bus Pad	- Suggested for stops with 5 or more weekday buses per peak hour

7. ADDITIONAL RESOURCES

The Planning Division of the Westchester County Department of Public Works and Transportation has developed these planning guidelines in order to facilitate the incorporation of public transit facilities within new development projects as well as at existing service locations.

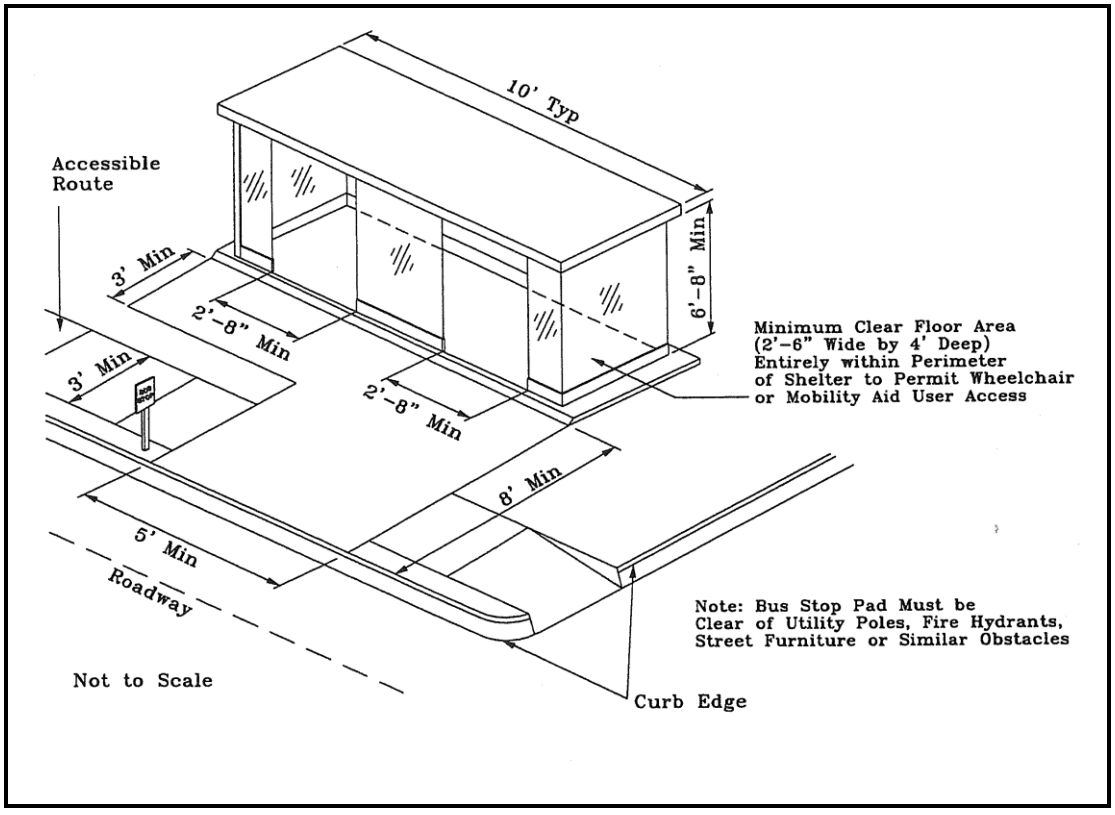
WCDPW&T staff is available to provide additional information and expertise regarding bus stop locations, bus routing, site plan review to facilitate transit and ways to encourage alternatives to single occupant vehicle travel. For additional information, please call us at (914) 813-7700 or email BeeLine@westchestergov.com.

APPENDIX A: AMERICANS WITH DISABILITIES ACT REQUIREMENTS

The Americans with Disabilities Act of 1990 covers a host of subjects dealing with equal opportunity for the disabled as a civil right. Following enactment of the ADA, regulations covering transportation services provided by both public entities (under Title II) and private entities (under Title III) were issued by the US Department of Transportation (USDOT).

The USDOT regulations include design standards for both facilities and vehicles issued by the Architectural and Transportation Barriers Compliance Board (Access Board). Vehicle design standards are included as Part 38 of the regulation. The total document covering ADA regulations for public transportation can be found in the Federal Register of Friday, September 6, 1991, titled, Part IV, Department of Transportation, 49 CFR, Parts 27, 37, and 38, Transportation for Individuals With Disabilities; Final Rule.

All new bus stops should be located in accessible locations to the maximum extent practicable. Modifying existing stops to comply with ADA, though desirable from an accessibility perspective, is not required under ADA. The following graphic illustrates ADA minimum design dimensions for accessible bus stop pad and bus shelter placements. This assumes a direct connection to sidewalks leading to and from the bus stop. Such connections, if lacking, should be mandated by local jurisdictions as part of the site plan approval process for new developments and new bus stops. Until such time as they are provided by the local jurisdictions, Bee-Line bus drivers must ask wheelchair passengers to use the bus stop with sidewalk connections that is closest to their final destinations. An ADA paratransit service is also provided, for passengers unable to use the fixed route service.



Source: TRB's TCRP Report 19: *Guidelines for the Location and Design of Bus Stops*, Chapter 4, 1996

APPENDIX B: INTER-MUNICIPAL AGREEMENTS FOR BUS SHELTERS

Westchester County has a License Agreement with a private franchisee to construct and maintain bus passenger shelters within municipalities which have signed a cooperative agreement with the County for this purpose. This cooperative agreement is commonly referred to as an "Inter-Municipal Agreement" or "IMA." Almost half of the 45 municipalities within Westchester County have signed Inter-Municipal Agreements with the County. The following pages contain a sample IMA for Bus Shelter installations. (The Attachment "A" referenced in the agreement refers to individual sites in each municipality; therefore, it is not included.)

SAMPLE BUS SHELTER INTER-MUNICIPAL AGREEMENT

INTERMUNICIPAL AGREEMENT

THIS AGREEMENT entered into this ___ day of _____, 20__ by and between

> **THE COUNTY OF WESTCHESTER**, a municipal corporation of the State of New York, having an office and place of business in the Michaelian Office Building, 148 Martine-Avenue, White Plains, New York 10601 (the "County")

and

> **THE VILLAGE OF** _____, a municipal corporation of the State of New York, having an office and place of business at _____**, New York** _____ (the "Cooperating Municipality")

W I T N E S S E T H:

WHEREAS, the County has entered into a License Agreement with a private franchisee to construct and maintain bus passenger shelters at various locations within the County; and

WHEREAS, the Cooperating Municipality is desirous of having the County provide bus passenger shelters within the Cooperating Municipality pursuant to said License Agreement for the comfort and benefit of its citizens.

NOW, THEREFORE, in consideration of the terms and conditions herein contained, the parties agree as follows:

FIRST: The County is hereby authorized to provide and maintain shelters pursuant to a License Agreement between the County and _____., or its successors at locations within the Cooperating Municipality, all as shown on Attachment "A" attached hereto and made a part hereof. The Cooperating Municipality warrants and guarantees to the County and its Licensee that all sites shown on Attachment "A" have been reviewed by the Cooperating Municipality and that each and every site conforms with traffic and safety standards, with all local, state and federal laws, rules and regulations, and that it is either wholly contained on a public right-of-way or the appropriate easement has been requested and granted, and a private property release is on file with the Westchester County Department of Transportation. The Cooperating Municipality further certifies and guarantees that the sites designated on Attachment "A" are legally designated bus stop locations or that the sites will be so designated prior to installation of new bus passenger shelters. If such designation is the responsibility of a governmental agency other than the Cooperating Municipality, the Cooperating Municipality will use its best efforts to obtain such designation.

Attachment "A" shall consist of:

1. A list of all bus shelters built under the County Bus Shelter Program located in the Cooperating Municipality.

2. A list of all necessary permits and the name of the municipal official who should be contacted. As the bus shelters are going to be provided as a municipal service, all permit fees shall be waived.

The Cooperating Municipality shall have the opportunity to request additional bus passenger shelters other than those in Attachment A. Requests shall be made to the Westchester County Department of Public Works & Transportation. The County will provide shelters to cooperating municipalities, as they are available based upon the terms of

License Agreement. They will be installed according to site suitability and passenger usage.

SECOND: The term of this Agreement shall be for five (5) years commencing on April 1, 20__ and expiring on March 31, 20__, which term coincides with the expiration of the License Agreement with _____. A copy of the License Agreement is on file with the Westchester County Department of Public Works &Transportation ("WCDPW&T") and may be examined by an authorized representative of the Cooperating Municipality upon reasonable notice to the County. This Agreement shall encompass presently existing bus passenger shelters and those constructed pursuant to the License Agreement.

THIRD: The design and installation of any bus passenger, shelters to be erected within the Cooperating Municipality shall be similar to, but may vary in details from the design drawings titled "Westchester County Bus Shelter Detail" dated August 5, 2010, copies of which are on file with the Cooperating Municipality and the County (hereinafter the "Design Drawings"). In no event, however, shall the size and illumination of the advertising signs vary from those shown in the Design Drawings without prior approval of the Cooperating Municipality.

FOURTH: After the County has deducted $_____ for administrative expenses, the remaining revenue received by the County from the Licensee shall be divided between the County and the Cooperating Municipalities on a 50/50 ratio. The share of the revenue due the Cooperating Municipality will be determined by the ratio of that number of shelters operated by the Licensee and producing revenue in the Cooperating Municipality to the total County-wide number of shelters operated under the License Agreement during one annual payment period. Payment will be made by the County to the Cooperating Municipality after April 15th of each year of this Agreement, beginning on or after April 15th, 20__.

FIFTH: The Licensee of the County shall be required to hold harmless and defend the Cooperating Municipality and its employees, officers and agents from all claims. suits and actions arising from the construction and maintenance of the shelters.

SIXTH: All advertising to be displayed on the bus passenger shelters will be submitted to the County Commissioner of Public Works & Transportation for approval. The Cooperating Municipality agrees that this approval shall be sufficient approval for the display of such advertising within the Cooperating Municipality. The County agrees that no political or religious advertising shall be allowed. The County further agrees that no advertising for alcohol or tobacco products will be allowed, nor shall the County accept any advertising which does not meet reasonable standards of good taste.

SEVENTH: The Licensee of the County shall be required to maintain all shelters in good condition. They shall clean each shelter on a regular basis, and shall be required to repair any damaged shelter.

EIGHTH: The Cooperating Municipality shall not enter into bus shelter advertising programs on its own. The Cooperating Municipality shall waive all municipal fees for the bus shelters.

NINTH: If during the term of this Agreement any bus passenger shelter is required to be removed or relocated for any reason at the request of the Cooperating Municipality, said removal or relocation shall be done only by the County's Licensee, at the sole cost and expense of the Cooperating Municipality.

TENTH: This Agreement and its attachments constitute the entire Agreement between the parties with respect to the subject matter hereof and shall supersede all previous negotiations, commitments and writings. It shall not be released, discharged, changed or modified except by an instrument in writing signed by a duly authorized representative of each of the parties.

ELEVENTH: This Agreement shall not be enforceable until signed by both parties and approved by the Office of the County Attorney.

TWELFTH: This Agreement may be executed simultaneously in several counterparts, each of which shall be an original and all of which shall constitute but one and the same instrument. This Agreement shall be construed and enforced in accordance with the laws of the State of New York.

THIRTEENTH: In the event of any conflict between the terms of this Agreement and those of its attachments, the terms of the Agreement shall control.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in triplicate.

THE COUNTY OF WESTCHESTER

By: _____

(Name)

Commissioner of Public Works & Transportation

COOPERATING MUNICIPALITY

By: _____

(Name & Title)

Authorized by the Board of Legislators of the County of Westchester pursuant to Act No. _____ adopted on the __ day of _____, 20__.

Authorized by the Board of Acquisition and Contract of the County of Westchester on the ___ day of _____, 20__.

Authorized by the governing board of the Cooperating Municipality on the ___ day of _____, 200__.

Approved as to form and manner of execution:

_____

Sr. Assistant County Attorney
County of Westchester

ATTACHMENT A

BUS SHELTER LOCATIONS

List of all necessary permits

_____

_____

_____

_____

Name of the municipal official who should be contacted.

_____
Name

_____
Title

_____ _____
Phone Number **Cell Phone Number**

_____
E-mail Address

APPENDIX C: GLOSSARY OF TERMS

ACCESSWAY OR PATHWAY - a paved connection, preferably non-slip concrete or asphalt, that connects the bus stop waiting pad with the back face of the curb.

ADA – American's with Disabilities Act of 1990. The Act supplants a patchwork of previous accessibility and barrier-free legislation with a comprehensive set of requirements and guidelines for providing *reasonable* access to and use of building facilities and transportation.

BUS BAY OR BUS TURNOUT -- a recessed**,** specially constructed area separated from the moving traffic lanes for bus loading and unloading purposes.

BUS STOP ZONE -- the length of a roadway marked or signed as available for use by a bus loading or unloading passengers.

BUS STOP DIMENSIONS – typical distances needed for ideal bus stop operations at near-side, far-side or mid-block curb-side locations.

BUS STOP WAITING PAD -- a paved area, often as an extension along a sidewalk, that is provided at a bus stop and may contain a bench, shelter and other bus patron amenities.

BUS STOP SHELTER -- a curb-side amenity designed to provide protection and relief from the elements while patrons wait for the bus.

BUS TURNAROUND -- a roadway system which allows buses to return to the street they are serving, generally in the opposite direction of travel.

BUS TURNING RADII -- the dimensions needed to accommodate a bus turning movement, often shown for 90-degree or 180-degree turns.

FAR-SIDE BUS STOP -- a bus stop located immediately after an intersection.

IMA FOR BUS SHELTERS -- a cooperative legal agreement between an incorporated city, town or village and Westchester County through which the County agrees to provide bus shelters to those municipalities for designated periods and under specified conditions.

MID-BLOCK BUS STOP -- a transit stop located within the block between intersections.

NEAR-SIDE BUS STOP -- a transit stop located immediately before an intersection.

PEAK TRAVEL PERIOD -- those hours during the day when traffic volumes reach their highest levels. The peak period hours generally are between 6 A.M. to 10 A.M. and 3 P.M. to 6:30 P.M., Monday through Friday.

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