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Bus Rapid Transit Stations and Stops

Abstract: This *Recommended Practice* provides guidance for planning and designing stations or stops for bus rapid transit systems.

Keywords: bus rapid transit, stations, stops

Summary: This document provides recommended practices for the planning and development of bus rapid transit (BRT) stations and stops. It is intended to guide transit agencies and their partners in planning and designing stations or stops for a BRT service, based on the experiences of other transit agencies.

Scope and purpose: This *Recommended Practice* provides guidance to transit agencies, local governments, planners, developers and others interested in developing new BRT systems or enhancing existing BRT systems. This document is part of a series of APTA documents covering the key elements that may comprise a bus rapid transit (BRT) system. Each document is intended to guide an organization when implementing a specific BRT system element. Because BRT elements perform best when working together as a system, each *Recommended Practice* may refer to other documents in this series. Agencies are advised to review all relevant reference documents for elements to be incorporated into their BRT service. In addition, there are some BRT system elements that equally apply to non-BRT service, so this document may reference other applicable APTA documents.

Participants

The American Public Transportation Association greatly appreciates the contributions of the **APTA Bus Rapid Transit Working Group**, who provided the primary effort in the drafting of this *Recommended Practice*.

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1. The role of stations and stops

BRT stations and stops play a key role in defining a BRT system and in the system's performance. Good BRT station or stop design can do the following:

- Attract new riders.
- Promote visibility and facilitate branding of the system.
- Provide shelter from the weather.
- Ensure safe accessibility for all, including people with disabilities.
- Provide passengers with information, including system maps and real-time arrival information.
- Provide passengers with a safe and secure environment by including such items as CCTV cameras, a public address system, public and security telephones, lighting and fencing.
- Enable passengers to board through multiple doors.
- Enable precise berthing at designated stopping points.
- Enable level boarding by matching platform height with vehicle floor height and using precision docking.
- Enable passengers to pay their fares before boarding using off-board fare payment equipment.
- Provide passengers with amenities such as newspaper boxes, signage, waste recycling, special lighting, seating and bicycle parking.
- Provide passengers with an attractive environment, using features such as landscaping and public art.
- Create a sense of place within the community, encouraging development and other activities to occur near the station or stop.
- Ensure ease of access to users of other modes, including bicyclists, pedestrians and automobile drivers.
- Ensure easy connections with other local and intercity modes of transportation.

2. Station and stop types

BRT station and stop types can range from simple bus stops to full-size stations comparable to large rail terminals. The type selected will depend on a number of parameters, including project budget, estimated passenger demand, surrounding area land use zoning, and available right-of-way. A single BRT corridor or system may use several station/stop types. The following is a summary of the basic types, their advantages and disadvantages, and recommended usage practices.

FIGURE 1
Basic Stops

Basic bus stop in Pittsburgh.

AC Rapid Transit stop.

2.1 Basic stop

A basic stop (**Figure 1**) is a designated point, typically on the side of a road, that provides a location for passengers to board and alight buses. This type of stop may include a small bus shelter but few, if any, additional passenger amenities.

The advantage of basic stops is that they are quick, easy and inexpensive to install. However, they have many disadvantages. They do little to distinguish BRT from traditional bus service and do not communicate permanence. They have low capacity and few, if any, passenger amenities. These features reduce a basic stop's ability to attract choice riders and its ability to encourage transit-oriented development (TOD).

Basic stops generally are not recommended for BRT service, but they may be used for temporary conditions or as a transitional strategy. If they are used, they should include branding elements at a minimum.

FIGURE 2
Enhanced Stops

MetroLink Scotia Square stop (Halifax).


Metro Rapid Stop (Los Angeles).

2.2 Enhanced stop

An enhanced stop (**Figure 2**) is a designated point for passenger boarding and alighting that may include a few amenities, such as a small shelter, passenger information, seating, lighting and branding elements. Typically, these stops are smaller in size and scale than stations.

The advantages of enhanced stops are that they are quick and easy to install and inexpensive in comparison to full stations. The disadvantages are that such stops may only moderately distinguish the BRT service from traditional bus service; may offer few, if any, passenger amenities; and may provide limited encouragement for TOD.

Generally, enhanced stops are recommended in the following situations:

- When there is a limited budget or a strong need to save money.
- When quick deployment is a priority.
- When travel demand is expected to be low.
- When space limitations preclude installation of stations.
- When the enhanced stop is planned for short-term use due to temporary conditions or as a transitional strategy.

FIGURE 3
Stations

Cleveland HealthLine.

Ottowa Transitway.

Los Angeles Orange Line.

Brisbane South Easy Busway.

2.3 Station

A station (**Figure 3**) is a substantial facility that can include many of the following attributes: shelter, level boarding, opportunity for advance fare collection, a unique name, a distinctive look and feel, passenger information, lighting and security, seating and other features typically associated with rapid or rail transit stations.

The advantages of stations for BRT are that they are attractive, convey permanence and can provide more substantial passenger amenities than those found in enhanced stops. They also offer higher capacity than simple or enhanced stops and are easy for passengers to identify and locate in a street environment. In addition, they may have enhanced security features.

These features maximize the BRT system image and reinforce the feeling of a rapid transit or “rail-like” system. Well-designed stations can be a major element in reinforcing a system’s brand. They can serve as gateways for the community and can encourage TOD. Stations also may be designed for future conversion to rail stations.

The disadvantages of stations are that they require greater capital investment, more physical space and more maintenance than basic or enhanced stops.

Stations are recommended for most BRT applications, especially under the following circumstances:

- When sufficient space permits installation of stations.
- When high demand is expected.
- When passenger experience is a high priority.
- When it is desired to protect passengers from weather conditions.
- When transit-oriented development is desired or proposed.

FIGURE 4
Transit Centers

VIVA Richmond Hill Transit Center (York Line).

MetroLink Portland Hills Transit Center (Halifax).

2.4 Transit center

A transit center (**Figure 4**) is a station located on or off a transit line that enables passengers to transfer to another transit line or service, generally without leaving the physical boundaries of the station. It also may function as an end-of-line facility for some routes.

Transit centers can increase convenience for transferring riders, allow for creation of a fare-paid zone that further eases transfers, and maximize the interface of BRT and local services. They also may provide a greater opportunity for commercial and food services and for TOD. Agencies should be aware that transit centers typically require much more space and a greater capital investment.

Transit centers are recommended where the BRT alignment interfaces with other modes and/or other transit services. In many cases, existing transit centers have been converted to support BRT.

FIGURE 5
End-of-Line or Terminus Facility

EmX Eugene Station (Eugene, Ore.)

2.5 End-of-line or terminus facility

An end-of-line or terminus facility (**Figure 5**) is an endpoint that may also include a place for vehicles to turn around and wait, a rest facility for drivers, an area to perform minor vehicle maintenance, the opportunity for transfers to local buses or other modes, a park-and-ride lot, and other facilities.

A terminus facility clearly identifies the endpoint of the BRT guideway. Agencies should keep in mind that this option may require more space to accommodate spare or replacement vehicles, and it may be less attractive for transit-oriented development.

A terminus facility is recommended under the following circumstances:

- When BRT alignment ends or interfaces with a network of other transit services on local streets.
- When demand warrants placement of an endpoint station.
- When operational strategies require it.

3. Location

Stations and stops may be located on-street or off-street, depending on the running way configuration. Systems may employ more than one station/stop location option.

3.1 On-street

Five location options may be considered with on-street stations. Two relate to the station position across the width of the running way, described in Section 3.1.1, while three relate to the station position in relation to intersections, described in Section 3.1.2.

FIGURE 6
Curbside Stations

VIVA curbside station (York Region).


HealthLine curbside station (Cleveland).

3.1.1 Location across the running way

Curbside

A curbside station or stop (**Figure 6**) is located adjacent to the curb or parking lane of a street and is often integrated into a surrounding sidewalk. Curbside stations can be located far side, near side or midblock, as described in 3.1.2.

The advantages of curbside stations/stops are that space is likely to be available, and it is possible to avoid taking street space by using existing sidewalk area. A curbside station/stop can be integrated with buildings and may complement other uses of the sidewalk. It will be possible to use a standard bus stop and to share the facility with traditional bus service. It also eliminates the need for some pedestrian street crossings.

The disadvantages of this option include that buses must use the curb lane to serve the stop, potentially creating conflicts with right-turning vehicles, parked cars, bicycles, etc. The use of a curb extension will help mitigate this issue. The curbside option generally requires two platforms (one in each direction) and may conflict with other uses of the sidewalk. In commercial areas, it may be difficult to distinguish station/stop signs from other signage. In cases where level boarding is desired, there may be grade issues, because the typical platform height (14 inches) is higher than the standard curb height (6 inches).

Median

A median station or stop is located in the median of a divided street or roadway, associated with a median running way or bus lanes. In many cases, the option for a median station may not exist.

The advantages of median stations/stops are that they can serve both directions simultaneously and feel more “rail-like.” Such stops maximize speed by minimizing car conflicts and make transit signal priority (TSP) easier because of unique signals and signal phasing. They can take advantage of unused medians and may enable curbside parking. Median stations/stops make it easier to create a distinct station or stop to identity and enhance system visibility. They do not create a visual obstruction for businesses and avoid having passengers waiting in front of nearby storefronts, which can be a concern for local businesses.

The disadvantages of median stations are that they may require taking of more street space than curbside options; may conflict with other uses of the road, such as left turn lanes (far vs. near side); and may require unique signal timing requirements. Also, such stations require all passengers to cross some street traffic at every stop, and they increase the travel time for pedestrians if the crosswalk is lengthened. In addition, median space may be limited, and the station may be more difficult to maintain.

Median platforms may be located on side platforms on each side of the running way or in the center of the median.

FIGURE 7
Median Side Platform

Median station with side platform for right-side boarding (Cleveland HealthLine).

- **Median side platform.** A side platform is located on each side of the median (**Figure 7**). The advantages are that conventional right-side boarding may be used, but this will require two station/stop units and more available space. Median side platforms can be located far side, side by side, near side or midblock, as described in 3.1.2.

FIGURE 8
Median Center Platform

Median station with center platform (Eugene EmX).

- **Median center platform.** A center platform is located on the center island of the median running way (**Figure 8**). The advantages of this option are the ability to have shared passenger facilities serving both directions of service and reduced space needs and costs. The disadvantages of this configuration are that it is necessary to have vehicles with left-side doors, and it also may complicate left turns for automobiles across the running way.

3.1.2 Location in relation to intersection

This analysis of location options applies to curbside stations/stops and to median station/stops with side platforms.

FIGURE 9
Near-Side Platform

Near-side curb station (Cleveland HealthLine).

Near-side

A near-side station or stop (**Figure 9**) is located just before an intersection with another roadway.

The advantage of this location is that it can be utilized where limited property is available at a far-side location. For curbside stations, the near-side position can be used where the BRT route makes a right turn and provides an opportunity for a queue-jump lane. The vehicle arrival is independent of traffic signal timing. Where there is no signal priority, passenger service time may occur while the signal is clearing. For both curbside and median-side platform stations, this option reduces the distance customers need to walk between the intersection and the front door of the bus (an important feature if fares are collected on-board).

The disadvantages of near-side stations are that they minimize the benefits or use of transit signal priority; that their platforms may conflict with right-turn lanes, especially where the bus stops at a green light (cars may try to pass the bus on the left); and that departures may be delayed by the traffic-signal cycle. These disadvantages do not apply for median stations with side platforms. For both options, disadvantages include that bus drivers could have difficulty seeing pedestrians crossing in front of the bus; passengers may be inclined to jaywalk, especially where they alight at the rear of the bus; and the near-side stop is set back from the intersection.

FIGURE 10
Far-Side Platform

Far-side median stations (Los Angeles Orange Line).

Far-side

A far-side station or stop (**Figure 10**) is located just after an intersection with another roadway.

The advantages of this location for curbside stations are improved travel time if signal priority is available, easier ability to implement bus bulbs, and facilitation of right turns by other vehicles. For example, a near-side station with signal priority could activate the signal priority system while the bus is in the station.

Another advantage is that a far-side station can be aligned with the left-turn lane. This makes the most efficient use of the available right of way.

The disadvantages of this location for curbside stations are that they could require buses to stop twice at an intersection — once for a red signal and a second time to load and unload riders. A disadvantage for both curbside and median-side platforms is that, with high-frequency BRT service, the stop may have to be moved two or more vehicle lengths beyond the intersection in order to accommodate multiple vehicles.

FIGURE 11
Midblock Station

Midblock stop curbside bus stop (Metrolink)

Midblock

A midblock station (**Figure 11**) or stop is located between intersections.

The advantages of this location are that both arrival and departure at the platform are independent of traffic signal timing and, for curbside stations, the possibilities are better for exclusive use of the lane at the platform. This option offers staging space to store buses between the preceding intersection and the platform, as well as between the platform and the subsequent intersection (important when service is frequent, such as headways equal to or less than traffic signal intervals).

In general, midblock stations apply in unique situations, such as a large trip generator located midblock. If there is a midblock station, consideration should be given to providing a designated crosswalk to enable passengers to access the station. Without such a crosswalk, customers may need to walk to one of the adjacent intersections to cross the street or may choose to jaywalk, especially where the block is particularly long.

FIGURE 12
Off-Street Stations

Dedicated transitway station (Ottawa).

Dedicated transitway station (Miami-Dade Busway).

3.2 Off-street

Off-street stations generally are located on an exclusive guideway or transit right-of-way (**Figure 12**).

The advantages of an off-street location are that it eliminates potential conflicts between motor vehicles and transit riders; may lend a feeling of permanence; and may provide opportunities for additional amenities, such as park-and-ride. Overall, it may enhance the system brand. In addition, it can become a new amenity for the surrounding community and enhance TOD potential.

The disadvantages of off-street locations may include diminished brand if the station is located too far from the surrounding community or if it is hidden. Additional security measures might be needed if the station is located in an area of limited activity. This option generally requires additional operating costs, because the station envelope becomes the responsibility of the transit agency, not the local municipality, and may require additional capital costs if the transit agency must purchase the right-of-way for the station.

A variation of an off-street station is an off-alignment station that is located some distance away from either the street or the dedicated running way. For example, if a BRT system is located in a highway environment, such as a highway median, the station may be located on the side of the highway. In such cases, buses leave the main alignment to access the station, then re-enter the main alignment to continue the trip.

The advantages of an off-alignment location are that it provides additional services to an existing transit node or customer base; may provide opportunities for additional amenities, such as a park-and-ride; and may become a new amenity for the surrounding community or enhance TOD or joint development potential.

The disadvantages may include diminished brand if the station is located too far from surrounding community activity or is hidden; increased running time to access the station, which increases operating costs; and the need for additional security measures if the station is located in an area of limited activity. This option may require additional operating costs if the station envelope is the responsibility of the transit agency, rather than the local municipality, and may require additional capital costs if the transit agency must purchase the right-of-way for the station.

Off-alignment station/stops are recommended under the following circumstances:

- When a BRT system uses highway lanes, and stations are needed where the BRT route diverges from the highway to serve communities along the highway (e.g., interchanges).
- When street and sidewalk widths do not permit stations and stops to be located within the roadway.

4. Station and stop spacing

The distance between stations or stops along a BRT corridor is one of the most important considerations in the system design and operating plan. However, this topic is beyond the scope of this document, which is focused on the attributes of stations rather the spacing between them. Please consult the APTA *Recommended Practice* “Bus Rapid Transit Service Design” for further information on station/stop spacing.

5. Station and stop dimensions

5.1 Platform length

Length is the distance of the station or stop running parallel to the flow of vehicles. Generally, length is easier to accommodate than width, especially with a station/stop in the median.

- In general, station length should exceed the length of the longest vehicle multiplied by the maximum number of vehicles expected to serve the station and stop concurrently. Space also must be provided for infrastructure and the transition area.
- Where a passing or through-travel lane is included, the station/stop length should be sufficient to allow vehicles to safely and efficiently merge into the traffic lane.

- If required by the service design, sufficient space should be provided to allow multiple vehicles to serve the station/stop without interfering with one another.

5.2 Designated location for vehicle servicing of station/stop

This is the place on the platform designated for particular vehicles to stop when servicing the station or stop. For example, local service may board and alight in one location while express service uses another location.

If only one such spot is used, it generally should be at the end of the platform.

If multiple vehicle stopping locations are used, the following should be taken into account:

- The locations should be sufficiently far apart to ensure that passenger waiting areas are clear within the station or stop and that vehicles do not interfere with one another when entering or departing the station or stop. The distance between vehicle stopping locations also should allow buses to pass and reduce the likelihood of congestion within the station or stop.
- For center platform stations at street median or for station islands at transit centers, the stops on one side of the platform should be offset from stop locations on the opposite side if high passenger volumes are anticipated or if the station/stop width is constrained.

FIGURE 13
Loading and Unloading

Orange Line Station canopies (Los Angeles)

On high-frequency service BRT systems, sufficient room should be available before entering the station or stop to enable buses to wait for a stop location to open up without blocking the through-travel lane. For example, in **Figure 13**, the two farthest canopies accommodate bus loading/unloading for two 60-foot articulated buses, while the nearest canopy is a non-paid area housing ticket vending machines that can accommodate a third 60-foot bus clear of the adjacent city street intersection. Sufficient space also is provided for a bus to pull ahead of a bus in front.

5.3 Platform area

The platform area is the interface for the customer between the station and the BRT vehicle. Some of the attributes that should be considered in the platform area include the following:

- efficient flow of pedestrians
- passenger amenities, including benches, weather protection, etc.
- compatibility with BRT vehicle door configuration
- accessibility for people with disabilities
- station name visible from inside the vehicle
- clear and simple way-finding signs
- fare collection and control systems
- safety and security
- emergency evacuation procedures

The total area of the platform is largely a function of the anticipated passenger load. Stations and stops that are too small can significantly increase dwell time and cause passengers to back up outside the station/stop.

In addition, consideration should be given to the area necessary for passenger circulation and passenger waiting areas. The passenger waiting area should be of sufficient size to accommodate the maximum number of passengers expected to wait for any particular vehicle, plus sufficient room for alighting passengers and others to circulate.

> **NOTE:** The overall station/stop area calculation excludes the tactile warning strips at the platform edge or the space for amenities and the access ramp.

The *2003 TCRP Transit Capacity and Quality of Service Manual* developed the following chart (**Figure 14**), which graphically depicts levels of service (LOS) regarding passenger circulation and estimates the area required for each level of service.

FIGURE 14
Level of Service Areas

LEVEL OF SERVICE A
Standing and free circulation through the queuing area possible without disturbing others within the queue.

LEVEL OF SERVICE B
Standing and partially restricted circulation to avoid disturbing others within the queue is possible.

LEVEL OF SERVICE C
Standing and restricted circulation through the queuing area by disturbing others is possible; this density is within the range of personal comfort.

LEVEL OF SERVICE D
Standing without touching is impossible; circulation is severely restricted within the queue and forward movement is only possible as a group; long-term waiting at this density is discomforting.

LEVEL OF SERVICE E
Standing in physical contact with others is unavoidable; circulation within the queue is not possible; queuing at this density can only be sustained for a short period without serious discomfort.

LEVEL OF SERVICE F
Virtually all persons within the queue are standing in direct physical contact with others; this density is extremely discomforting; no movement is possible within the queue; the potential for pushing and panic exists.

LOS	Average Pedestrian Area (ft^2/p)	Average Pedestrian Area (m^2/p)	Average Inter-Person Spacing (ft)	Average Inter-Person Spacing (m)
A	≥ 13	≥ 1.2	≥ 4.0	≥ 1.2
B	10-13	0.9-1.2	3.5-4.0	1.1-1.2
C	7-10	0.7-0.9	3.0-3.5	0.9-1.1
D	3-7	0.3-0.7	2.0-3.0	0.6-0.9
E	2-3	0.2-0.3	<2.0	<0.6
F	< 2	< 0.2	*Variable*	*Variable*

In general, the following formula can help determine the required area within the station or stop:

$$\text{Area} = P_{max} \times (\text{desired square footage per passenger}) + A_{inf}$$

where P_{max} is the maximum number of anticipated passengers in the station/stop at any given time, and A_{inf} is the area required for station/stop infrastructure.

5.4 Platform width

Platform width is the distance across the station/stop perpendicular to the direction of travel. Width is generally a more challenging problem than length, because width is often the most limiting factor and can cause conflicts with pedestrian and road space. To some extent, however, lack of width can be compensated for by additional length, particularly where stations or stops are located in unused medians.

Width generally is determined by right-of-way constraints. However, if right-of-way is not a constraint, then width generally is a function of the anticipated passenger load and the station/stop operational design. For example, width requirements can be reduced if stop locations on either side of the station/stop are not located directly across from each other, thus minimizing conflicts between passengers boarding and alighting in opposite directions. Width generally should be derived from the following considerations:

- Width required for infrastructure (stairs, ramps, elevators, trash receptacles, ticket vending machines, signage, bike racks, etc.) within the station/stop.
- Width required for passengers waiting for a vehicle to arrive.
- Width for passengers waiting for a vehicle to arrive in the opposite direction, particularly if the stop locations are directly across from each other.
- Width required for passengers to circulate within the station/stop, particularly for purposes of entering or exiting the station/stop.
- Width required to ensure access for passengers with disabilities (e.g., to accommodate wheelchair ramps and to permit maneuvering of wheelchairs). U.S. agencies should refer to federal guidelines or Americans with Disabilities Act (ADA) requirements for transit stations.

Each jurisdiction should consider its unique requirements based upon a number of factors, such as the length of the bus ramp and wheelchair turning radius.

5.5 Platform height

Platform height refers to the vertical height of the station platform above the roadway or transit way. Current BRT applications differ as to the optimal treatment of curb heights. Of major consideration in the various options are the additional costs and/or time impacts of the curb treatment. In general, three types of platform heights are available:

- standard curb
- level or near-level boarding
- raised platform

5.5.1 Standard curb

This option installs a BRT station on the existing curb, which is usually 6 inches above the roadway. This application generally requires no additional infrastructure and most closely resembles local bus boarding. While additional costs and timelines are minimized, this option does require one to two steps up into the vehicle, even with low-floor coaches. This could increase dwell times, especially for customers who are mobility impaired, elderly or traveling with small children. Access into the coach for passengers with disabilities is achieved with standard ramps or lift deployment, the use of which may increase dwell times. Examples of BRT systems using standard curbs include Los Angeles Metro Rapid, AC Transit Rapid, Kansas City MAX and the York VIVA.

FIGURE 15
Level and Near-Level Boarding

Level boarding (Las Vegas MAX).

Near-level boarding on the EmX.

5.5.2 Level or near-level boarding

This option attempts to most closely resemble rapid transit applications by almost eliminating the vertical and horizontal gap between the vehicle and the platform (**Figure 15**). While no comprehensive empirical data yet exist, level boarding suggests a seamless transition into the vehicle and a perception of reduced dwell times and faster boarding attributed to customer ease.

To achieve this, the curb is raised. Depending on the vehicle type, station platform heights are raised to 14 to 15 inches above the roadway. Level boarding consistently eliminates the step up into the vehicle, while near-level boarding may leave a very small step up for passengers. In addition, the horizontal gap between the vehicle and platform must be minimized to ensure passenger safety and ease of boarding and to meet accessibility requirements. To address this horizontal gap, several cities are utilizing special devices such as bridge plates or guidance systems to precisely dock vehicles. Level boarding should consistently eliminate the horizontal gap and comply with all applicable accessibility requirements.

The benefits of a level (or near-level) platform include increased customer perception of service; ease of boarding for all customers (anticipated to manifest as quicker boarding and reduced dwell times); potentially the elimination of the need for wheelchair access ramps or lifts; stronger brand identity; and greater similarity to rail-type services.

When contemplating a level (or near-level) platform, factors to be reviewed include any additional cost, infrastructure and time needed for construction. Concerns may include maintenance issues (e.g., possible damage to the vehicle body or lug nuts if the platform is hit); risk (potential liability if a customer falls from the platform); and the potential slowing of operations as inexperienced drivers approach the station. These obstacles can be overcome with additional mitigation measures. The potential for vehicle damage may be eliminated with the installation of a profiled curb or similar treatment; potential liability can be reduced with

tactile warning strips; and efficient operations will require additional focused training. There are accessibility implications regarding the sloped access from the street level to the end of the platform.

Examples of cities where level or near-level boarding has been implemented include the Las Vegas MAX; the EmX in Eugene, Oregon; and the HealthLine in Cleveland.

FIGURE 16
Raised Platform or Curb

A 6-inch step for passengers on the Orange Line.

5.5.3 Raised platform or curb

The raised platform/curb option (**Figure 16**) attains a platform height somewhere between a standard curb and a level platform. This option offers some of the benefits of a level platform but reduces the potential for vehicle damage.

A raised platform or curb reduces but does not eliminate the vertical gap. It may be described as still requiring passengers to take one step up to board the vehicle — in contrast to standard curbs, which may require two steps up, or level boarding, which eliminates the step. In keeping with the recommendations of the architectural community, the optimal step distance for most people is 5 to 7 inches. With U.S. vehicles averaging a floor height of 15 inches, the optimal curb height for a raised platform would be 8 to 10 inches above the roadway, slightly above a standard curb of 6 inches, but below a level height of 15 inches.

Similar to the level platform, some benefits of the raised platform include easier boarding than a standard curb, improved customer perception of the service and strong branding and identity. The raised platform addresses the problem of potential vehicle damage, reducing risk concerns. As with level boarding, when contemplating a raised platform, consideration must be given to the additional cost, infrastructure and time needed for construction, as well as accessibility implications regarding the sloped access from the street level to the end of the platform.

5.5.4 Summary

While no standard industry practices have yet emerged, attention to the curb height of a BRT station is a critical component of the overall planning for the system. While standard curbs may be easier and quicker to implement, raising the curb to a level or sub-level height may increase the benefits and improve perception of

the BRT service. Generally, the raised platform at a BRT station provides a qualitative improvement in customer convenience and helps reinforce the brand and image of BRT as a premium product.

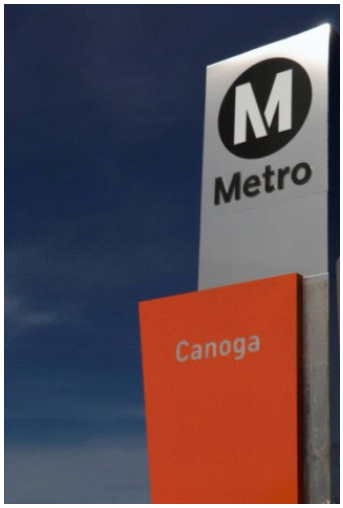
For additional guidance on this issue, agencies should also review the APTA *Recommended Practice* "Bus Rapid Transit Vehicle and Platform Interface."

FIGURE 17
Branding

A dual-purpose logo (Eugene).

A distinctive name (Cleveland HealthLine).

Standardized colors and logos (York Region, Ontario).



Distinctive color palette and name (Los Angeles).

Passenger information on station marker (Kansas City).

6. Branding

Branding (**Figure 17**) gives a service or product a distinct identity that results in clear and positive public recognition of the service. BRT stations are a key element in reinforcing the brand of the service and should be highly identifiable as a major component of the BRT identity. As the gateway into the BRT service, strong

branding of the station presents the initial opportunity to emphasize the system. The continuation of the brand on all individual station elements should emphasize a clear and consistent message about the service.

The look of the stations must ensure that they are easily identified as different from the conventional bus shelters in the region. They should tie into all other aspects of the overall BRT brand, including the vehicle, colors, logos, signage and other service components. The BRT brand should remain prominent at the stations for customer recognition and understanding. Where a more standard bus shelter is used, the distinctive branding can come from a unique paint or graphic package, easily identifiable as different from the standard service.

Elements of station branding can be included within the actual design of the station components (e.g., shapes and sizes) or included on all structures, customer information panels and amenities at the station with colors, logos or graphics. Attention to small details sends an important message. A unique branding feature for consideration could be the inclusion of an "iconic" marker or monument sign at each station to highlight the BRT service. Examples of this are found at York VIVA stations or at Kansas City MAX stations. The Orange Line stations feature system and station markets in the same orange-and-silver color scheme used throughout the system. Branding elements also can serve functional purposes. For instance, the marker for the Kansas City MAX incorporates system mapping and dynamic passenger signage. Another example of dual functionality is found at the Lane Transit EmX stations, where the logo is used not only to brand the system, but also to provide drivers with a visual cue for where to stop their vehicles. Finally, stations and the entire BRT system may feature distinctive names that distinguish them from conventional bus services.

The APTA *Recommended Practice* "Bus Rapid Transit Branding, Imaging and Marketing" contains a more in-depth discussion of BRT system branding practices.

7. Design characteristics and amenities

At a minimum, BRT stations should include platforms, canopies and associated support structures. Additional amenities increase a station's utility for transit riders and can enhance the appeal of stations for nearby residents and businesses.

7.1 Design considerations

7.1.1 Architectural treatments

Architectural treatments such as specially designed canopies or shelters help to make stations more visible and can help in developing a brand identity for the BRT system. Creative approaches to designing fencing, stairs and ramps will help to create community support for the BRT system and will add to the riding experience. Station art also may be able to be incorporated into fencing, walkways and shelters.

7.1.2 Visual and aesthetic impacts

While concerns may arise about visual and aesthetic impacts of a station, the planning process provides an opportunity to engage the public in developing a station that would be a source of community pride. This may be done through design workshops, charrettes and involving the community in decisions concerning architecture, colors, finishing materials, signage and pedestrian access. Installation of art would further enhance the appeal of a new station for residents and businesses.

7.1.3 Historic, archaeological and cultural resources

As BRT stations typically are located in urbanized areas, an assessment of impacts on historic, archaeological and cultural resources is likely to be required in the planning process. For example, the introduction of a

station could have a visual impact on nearby historic properties, or its construction may impact a historic structure or archaeological artifacts.

BRT stations, however, may provide an opportunity for mitigation of impacts on cultural resources. An example of this mitigation would be the incorporation of characteristics of the historic features of the station area into the station design.

7.1.4 Environmentally sustainable materials and practices

The design phase of a new station offers opportunities to introduce environmentally sensitive materials and practices into its construction and operation. Assessment of energy usage typically is performed for the overall project to determine the energy conservation benefits of a BRT system. However, architects also can consider energy conservation measures for BRT stations, such as designs that make use of natural lighting and low-power-consuming lighting, use of solar panels and incorporation of recycled materials in building construction. Transit operators pursuing Leadership in Energy and Environmental Design (LEED) certification for BRT stations may see the added benefit of reduced operating costs and local grants for "green" projects.

7.1.5 Noise and vibrations

In a new BRT project, stations may present more of a noise concern than the rest of the line or corridor, since noise emissions are greater where vehicles are accelerating from a stop. Noise associated with increased traffic generated by a station also will need to be considered, as will noise associated with other features such as passenger announcements or crosswalk signals. Determination of noise impacts requires identification of sensitive receptors near the station, such as retail establishments, residences, offices, hospitals, child care facilities, public buildings and historic structures.

The FTA provides guidance for assessment of transit noise vibration in the following document: www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Noise walls mitigate bus noise, but they can introduce negative aesthetic impacts. Other noise mitigation measures include acquisition of undeveloped property to use as buffer zones and noise insulation or soundproofing of residences.

7.1.6 Universal design

Incorporating elements of universal design improves accessibility of stations, improving accessibility for disabled people as well as other transit patrons, such as travelers with luggage. Some BRT systems require the implementation of these elements at stations, either due to an extended platform length or to the need for platform boarding to accommodate BRT vehicles.

U.S. disability advocates Easter Seals and Project Action provide guidance on the concepts of universal design in the following document: http://projectaction.easterseals.com/site/DocServer/06BSTK_Complete_Toolkit.pdf?docID=21443.

7.2 Passenger amenities

7.2.1 Shelter and seating

A primary objective in providing a convenient, comfortable BRT station environment is the provision of basic shelter and seating for passengers. Consistent with the system brand and local design and development requirements, each BRT station should incorporate a reasonable degree of weather protection and places to sit while waiting. Design considerations and elements are generally described in **Table 1**.

TABLE 1
Design Considerations for Amenities in Stations and Stops

Shelter	
Configuration	• Free-standing shelter with vertical wall panels and roof. • Canopy attached to adjacent privately owned building.
Modularity	• Comprised of standard components that can be modified to suit ridership levels. • Standard components can be oriented to site conditions.
Design considerations	• Provide consistency among all stations, distinction from other system bus stops and connection to the BRT brand. Use shelter design to enhance visibility of the service. • Explore concepts for integrating existing shelters, facilities and public amenities along each corridor while creating an overall design that can be read as an integrated whole. • Provide consistency (in materials, colors and design) with other site elements, including lighting, railings, signage, litter receptacles, bike racks, etc. • Materials and components must be easy to maintain, repair and refurbish; be proven vandal-resistant; be transportable; and have a proven and dependable performance history.
Area	• Minimum allowable shelter or canopy lengths and widths should be based on 10-square-foot coverage area per passenger served. • Provide maximum visibility of and access to adjacent development.
Furnishings within the shelter	• Benches or leaning rails may be considered inside all shelters. (See seating requirements below.) • Hardwired internal shelter lighting preferred. (See lighting requirements below.) Minimum 4-foot-candle illumination (average within the shelter) is recommended.
Vertical panels	• Shelter structure should accommodate the placement of advertising, art or information panels within or in place of some vertical panels. • Orientation of vertical panels to protect from prevailing winds and wind-driven rain is preferred. • Vertical panels should be sized to enable portability by one person for purposes of installation and maintenance. • Transparent vertical panels on the side of the approaching vehicle are required.
Roof	• Translucent roof panels should be considered for ambient light. • Avoid placing drip lines over pedestrian travel paths. • Cover over the boarding area is not required.
Seating	
Options	• Benches. • Leaning rails (appropriate where wait times are expected to be short due to short headways or at high-volume locations). • Retaining walls or landscape elements.
Quantity	• One seating or leaning position for every five waiting passengers is desirable. • At least one covered seating position is required. • Ample area under cover must be provided for at least one person using a wheelchair or other mobility device without obstructing other seating.
Design considerations	• Design must discourage the use of seating for sleeping: Maximum bench length is 4 feet, and dividers along the length of the bench are recommended. • Backs and arm rests are optional. • Seating must optimize pedestrian circulation and waiting capacity. Seating requirements may need to be minimized where passenger volumes are very high or where there is a high level of pedestrian activity. • Most provided seating should be located under cover when practical.

Size requirements	• Depth and height of leaning rails should provide maximum comfort and utility for the average user. • The size of the bench seating area should be minimized.

7.2.2 Real-time passenger information

One of the most significant barriers to using buses is customer uncertainty about bus arrival times. Posting schedule information can help reduce the uncertainty, but this may be impractical where BRT stations are served by many different routes, and posted schedules cannot reflect bus delays. Providing real-time information in the form of variable message signs at stations that provide current status of bus operations would eliminate this uncertainty for transit users. As many modern rail transit systems have this feature in their stations, this also would be another important element in making BRT more like a rail system.

An alternative to installing variable message signs at all BRT stations is making it possible for riders to access real-time information through cell phones. Customers can enter information about the station and routes through buttons on their cell phones. Bus status information can be provided through automated voice messages or text on cell phones.

For additional information, please refer to the APTA *Recommended Practice* "Bus Rapid Transit Intelligent Transportation Systems."

7.2.3 Maps and other way-finding devices

Maps and other way-finding devices can help riders who have just alighted to orient themselves with the area surrounding a station. Maps can be placed within the station itself. Way-finding can be comprised of special signage as well as special markings within pavement. Integration of design elements and way-finding can be a creative application of station art.

FIGURE 18
Lighting

Attractive lighting at Heron Station (Pittsburgh).

7.2.4 Lighting

Station lighting (**Figure 18**) serves several functions. It provides illumination, assists in station location and identification, and makes station features visible during periods of darkness. It aids bus operators in locating stations and determining whether passengers are waiting to board. Station lighting provides a sense of security for riders waiting to board a vehicle. Attractive station lighting can further highlight station architectural and

design elements, which enhance the rider experience and the appeal of the BRT station for the community. Lighting also communicates when the station is closed, such as by changing the color and intensity of the lighting when the station is closed.

7.2.5 Trash and recycling receptacles

Trash and recycling receptacles are necessary to minimize litter at BRT stations and on buses, as many riders have food and drink containers and other items to dispose of before boarding a vehicle. However, placement of trash containers at transit stations and stops may be considered a security issue, and thus specially designed trash receptacles may be required.

7.2.6 Newspaper vending boxes

Placement of newspaper vending boxes at BRT stations addresses the desire of many transit users to read while waiting for a bus and traveling to their destinations. Typically, the newspaper publisher would be responsible for purchasing, installing and maintaining the vending boxes, as well as replenishing the newspaper supply on a daily or weekly basis as needed.

In communities with numerous daily or weekly publications, the transit agency may be pressured to allow several boxes at the stations. This could create visual clutter, with publishers having different styles and colors of vending boxes. One solution would be to install a vending device that has the ability to store several different publications at the same time.

The benefits of having newspaper vending boxes must be balanced against security concerns.

FIGURE 19
Landscaping

Landscaping along the Orange Line (Los Angeles).

7.2.7 Landscaping

Landscaping (**Figure 19**)adds visual interest to both the station and the area around the station. It can also soften the aesthetic impacts of “hard” edges associated with BRT infrastructure. Where sufficient space is available (i.e., along busways), landscaping can help to define station areas. Landscaping and other

improvements enhance the appeal of the station to new riders and to the community and make the station more attractive to potential developers.

Landscaping should be attractive and blend in well with the local environment. It should be designed to make the station or stop a comfortable and desirable place to be. In order to minimize maintenance costs, native species requiring minimal amounts of watering should be used.

FIGURE 20
Bike Lockers and Racks

Bike rack at Ingram Station (Pittsburgh).

7.2.8 Bike lockers and racks

Providing bike racks or lockers at stations (**Figure 20**) provides another option for riders to access the BRT system. In places where it is feasible for commuters to regularly use bicycles throughout the year, the provision of bicycle storage facilities can reduce the number of park-and-ride spaces needed.

Bike racks are relatively inexpensive and pose no security issues, but they leave bicycles exposed to the elements and to theft. Enclosed bike lockers cost more and may pose security concerns, but many patrons are more comfortable leaving their bicycles in an enclosed, secure facility. Bike racks should be placed in a location that does not impede access for other passengers to the station.

FIGURE 21
Parking

Park-and-ride lot with direct access to HOV/bus lane (Houston).

7.2.9 Parking

When planning stations, it is important to take into consideration potential parking demand. Some BRT systems provide park-and-ride lots (**Figure 21**). At stations where no off-street parking is provided, commuters may use existing streets near the stations. This could lead to concerns from residents and businesses about commuters reducing available parking.

Development proposed near stations also could create additional demand for parking, which must be accommodated. Ideally, the parking would be accommodated within the development (e.g., in a garage), but parking sharing arrangements with other property owners such as churches or theaters or with the transit agency (sharing use of a park-and-ride facility) also could be considered.

8. Support systems

Once the desired station and stop amenities are identified, they should be considered in context with one another and within the surrounding environment. It is critical to identify requirements upfront and to inventory the existing support systems. The following support system needs should be addressed early in the design phase.

8.1 Planning and design considerations

8.1.1 Foundations

Foundation requirements for all installations need to be identified and the locations evaluated to determine whether space and soil conditions are adequate. Areaways or underground utilities may limit the ability to install heavy signage or structures. Station platforms need to be of adequate strength and durability to support the weight and activity of all maintenance vehicles that will service the station. Local agencies may require special building code compliance and structural review during the design and permitting phases.

8.1.2 Platform layout

The station design will establish the placement of items on the platform such as shelters, lighting, electronic and static signage, and benches. In addition, there may be additional items, such as newspaper boxes and other vending machines, bicycles and local way-finding signage, that are placed in the area by third parties.

To control the placement of third-party items so that they do not interfere with pedestrian movement within the station or boarding or alighting areas, it can be helpful to create specific locations for those items. A bike rack or a corral with anchors for newspaper boxes are examples of what can be installed.

8.1.3 Maintenance

Determine how the station amenities will be cleaned, repaired and refurbished. Consider whether the work will be done on site or will require that components be removed and replaced. Consider the impact on the riders and transit operations at the location as well as other traffic operating near the facility during maintenance activities. These requirements will suggest what support systems are needed for maintenance, such as pressure-washer trucks, flatbed trucks or direct access to water and electricity.

8.2 Utility considerations

Many station and stop amenities and systems will require access to utilities. It will be necessary to discuss the plan with local utility companies to determine whether existing utilities are present and the transit agency's ability to access them. Consider the different ways to calculate payments for utilities, such as a calculated flat fee based on consumption estimates or installation of a meter. It is helpful to know upfront whether a utility has minimum usage levels or charges.

The following sections discuss electrical, water and sewer, and communications. However, other utilities may need to be considered, depending upon particular circumstances.

8.2.1 Electrical

Determine what power is needed to support the amenities at the location. Evaluate the utilities to determine whether existing power is compatible with the station's needs. If providing lighting, then consider opportunities to rely on existing street or area lighting rather than assume that all-new lighting must be installed. At the time of the initial station or stop construction, consider running conduit to various locations for future power needs, such as lit signage, security cameras, vendors, ticket vending machines, fare transaction processors and tree lighting not in the initial plans.

8.2.2 Water and sewer

The need to have access to water and sewer will depend on the design decisions and the amenities provided. In some cases, a bathroom or other wash facility may be desirable. Access to water also may be desirable for landscaping and other purposes. Consider using low-water or native plants in landscaping. Using a truck-mounted, self-contained power washer for routine cleaning will eliminate the need for installing a water line. This could be less expensive than running water lines to smaller stops that do not have other needs for water.

8.2.3 Electronic communications

Determine the requirements for the communications infrastructure needed to support the amenities at the location. These requirements include the bandwidth, protocols, physical requirements and security measures. Wired communications include a fiber or copper network or telephone service, which generally requires conduit or overhead lines. Wireless communications include Wi-Fi, radio and leased data service, which generally requires line of sight between transmissions points. All communications equipment will need to be housed in an enclosure that protects it from weather, theft and vandalism.

9. Property needs

An important consideration in planning and designing stations or stops is the amount of property required for the station or stop and supporting infrastructure, such as pedestrian linkages or park-and-ride lots.

Acquiring sufficient right-of-way for a transit station or stop can be a difficult task. Whenever possible, right-of-way should be acquired as soon as possible, ensuring that sufficient space is reserved for future needs. Depending on the project scope, this may require public consultation.

BRT stations and their support facilities may require displacement of existing residences and businesses. Moreover, where a BRT alignment is proposed adjacent to a railroad right-of-way, stations may require property in addition to what is needed for the running way.

10. Safety and security

In planning BRT stations or stops, consideration should be given to crime prevention through environmental design (CPTED) recommendations, which include the following:

- Having no entrapment areas.
- Providing escape routes.
- Creating clear and unobstructed sight lines and using convex mirrors where necessary.
- Conducting regular inspections and maintenance to deal with hazards.
- Ensuring that platforms and pedestrian pathways are well-lit and highly visible.
- If the station or stop is not attended, considering providing remote video monitoring and a call box that connects directly with the system operator and/or the police.
- Creating signage, announcements, etc.
- Removing ice and snow
- Choosing plant species to prevent screening issues and ensure proper sightlines.

Care must be exercised to balance the requirements of CPTED with the provision of an attractive, comfortable station. CPTED guidelines generally recommend a lack of furniture, greenery or other amenities that can impede sight lines. If a station is designed solely using CPTED guidelines, without consideration of other environmental design principles, the result may be a “sterile” station environment. This would run counter to attempts to brand the station as being part of an attractive, premium service, and ultimately could impact ridership.

In the U.S., transit projects eligible for FTA Section 5309 funding or other forms of federal assistance are required to implement a safety and security certification program as part of a project management plan. In addition, for all FTA New Starts projects, a safety and security management plan is required. Stations are one component of this plan and certification process. (For more information, refer to 40 CFR Part 633.5, Chapter IV, of *FTA Circular 5800.0*.)

Excellent guidance can be found in *TCRP Report 90: Bus Rapid Transit, Volume 2: Implementation Guidelines*. Some specific points to consider include the following:

- Implement proactive safety and security practices and train staff and customers to recognize and act on potential threats.
- Develop procedures to deal with threats.
- Facility design should include a review by safety and security staff.
- Implement a preventative maintenance program that identifies standards, response times, inspections and a documentation trail.
- Consider installation of tactile strips.
- Develop an appropriate maintenance program to minimize and respond to equipment failures, such as lighting, video monitoring, alarms, call box, phones, etc.
- Conduct threat risk assessment on facilities based on an established schedule.
- Develop a program for regular patrols.

- Ensure that enforcement staff have adequate enforcement powers and a joint service agreement with the local police authority.
- Establish database and analysis tools to tabulate safety and security data to identify trends and areas of concerns, and implement corrective measures.
- Consider waste containers that avoid concealment of foreign objects and avoid materials that could become a projectile.
- Secure benches, bike racks and other accessories to avoid theft and damage.
- Determine civic addresses for all BRT facilities so that emergency responders can locate them on their systems.
- Consider implementing a routine graffiti-removal program.

Additional information is available in the APTA *Recommended Practice* "Bus Rapid Transit Intelligent Transportation Systems."

11. Maintenance and life cycle cost considerations

Decisions on station/stop and platform configuration, location and design should be influenced by operating and capital costs, and also by the ongoing arrangements for life-cycle maintenance. This is the maintenance beyond day-to-day cleaning and repairs, when major reconstruction is required, or when important elements of the station/stop require replacement.

Planning should consider how the station/stop will operate during exceptions. For example, will vehicles continue to operate normally, and will customers be able to use the platforms normally? An agency may decide that the best approach is to build redundancy into the design, for example allowing two lanes in a station/stop so that buses can pass a work zone, two stairways to a platform or two shelters on a platform so that customers can use one while the other is repaired or rebuilt. Or an agency may decide that immediate capital savings are worth more than future short-term inconvenience and decide that when the station/stop roadway is rebuilt, buses will detour off the normal route, or when a stairway is rebuilt customers will cross the busway at grade, or that the station/stop will be temporarily closed.

Design should include elements that help reduce maintenance. For example, stainless steel railings can be self-polishing, and minimizing vertical surfaces can reduce graffiti, posters and other unwanted markings.

Space for maintenance activity, maintenance vehicles, materials and snow storage (where applicable) should be considered in the design. Consideration should be given to ensuring that service vehicles can access stations and stops and park near them, if required. Also, standardized components, power and water needs, and other issues should be considered in the design.

Agencies should consider lifecycle maintenance procedures and costs along with construction costs and regular operating costs.

If the BRT alignment is built adjacent to an active right-of-way, such as a railroad, the operator of that facility may require access through the BRT right-of-way for maintenance activities.

12. Transition area

The transition area is the space that connects the station with the adjacent area. In general, the transition area should support the goal of treating passenger facilities as permanent community assets that reinforce the positive, defining qualities of the neighborhoods and contributing to the street-level environment. Among other things, the transition area should coordinate with and support street-level functions and elements, including intersections, building entrances, vehicular movement, adjacent pedestrian circulation patterns, and existing street furniture and landscape elements. It also should work within existing site conditions to provide

strong visual and physical access while enabling the character of the surrounding area to be expressed in some way.

The transition area also should be welcoming and should provide passengers with system information before they enter the platform. If fare gates are used, then fare collection and ticket vending machines should be located in the transition area.

A planned pedestrian and cycling network in the community can be used to encourage alternative and healthy transportation to the BRT service. In order to support these measures, the transition area should facilitate passenger access through clearly marked pedestrian pathways, curb cuts or ramps, and pedestrian-activated crossing signals where warranted by volume and crossing distance. Also, where practical, the transition area should provide facilities for bicycle parking. This could include bicycle lockers, secured bicycle areas and racks. Consideration should be given to installing way-finding indicators in a two- to three-block area around each station/stop.

The transition area may include other passenger amenities, such as the following:

- Newspaper vending boxes so that riders can read while riding.
- A coffee or snack kiosk. (This will depend on whether food and drink are allowed on the system. In addition, these may cause some maintenance or cleaning issues.)
- Information on other transportation services and the surrounding community.

13. Land use, development activity and zoning

As with rail transit lines, BRT stations have the ability to function as development nodes in a BRT corridor. The stations can introduce new activity centers into a community or reinforce existing activity centers in an urban area. They benefit developers by attracting new markets (people who either do not have automobiles or prefer not to drive) and by reducing the parking requirements for new development.

Significant development has been identified at and near BRT stations in several North American cities. Along Phase I of Boston's Silver Line, $1.2 billion worth of development has been identified since planning began in 1997. An estimated $4.3 billion worth of development has occurred to date along the Greater Cleveland Regional Transit Authority's Euclid Corridor BRT line, which opened in October 2008. In Pittsburgh, approximately $500 million worth of development (both construction of new buildings and renovation of older structures) occurred along the original 6.8 miles of the Martin Luther King, Jr. East Busway between 1983 and 2004. The lower amount in Pittsburgh is reflective of regional economic conditions as well as rugged topography and the presence of a major railroad line parallel to the busway, which limits new development opportunities.

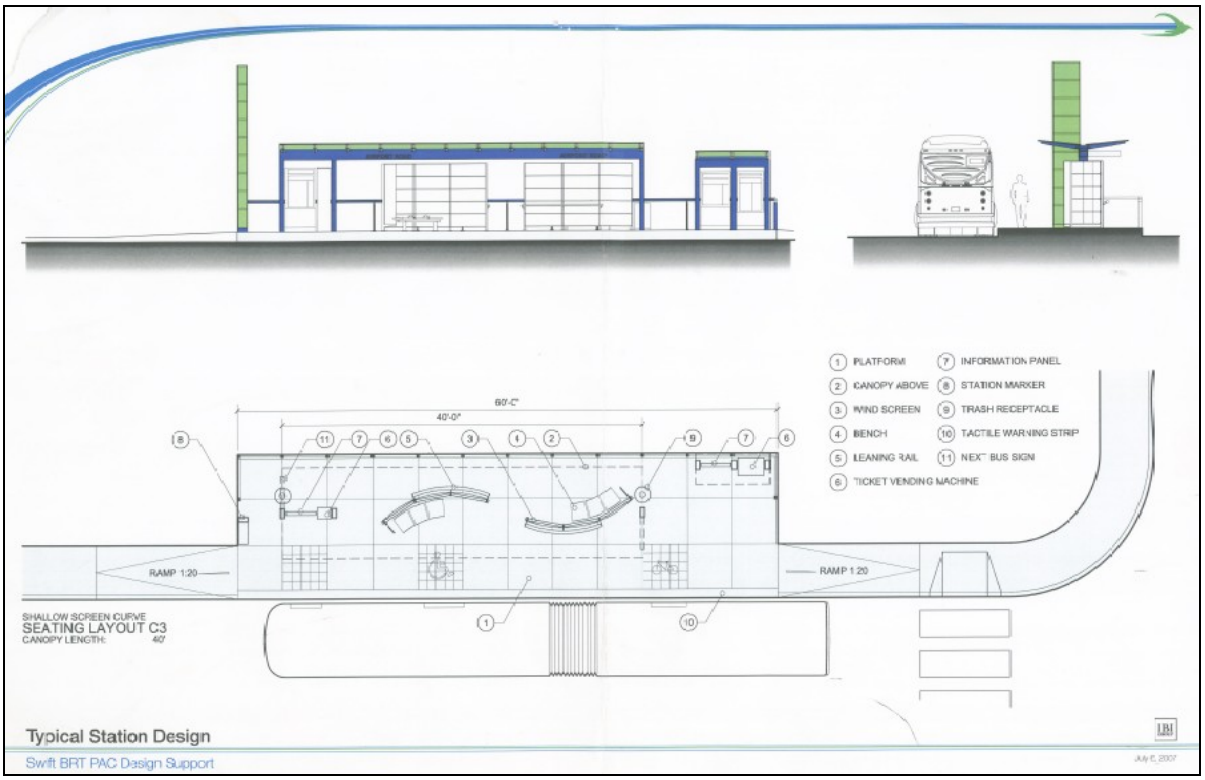
When planning for BRT stations, local zoning ordinances should be reviewed to ensure that existing regulations allow for stations and support facilities. The zoning also should be reviewed to determine what uses are permitted within walking distance of the station. If a station is proposed for an area zoned for industrial or automobile-oriented commercial uses, planners can recommend a change in zoning or consider moving the station to another location. Conversely, areas zoned for high-density residential or a mixture of residential, commercial and office uses would be compatible with a new transit station.

Local plans should be reviewed to determine how the BRT station would support the community's vision for the area. For example, the city of Pittsburgh's Baum-Centre Corridor Development Strategy specifically calls for transit-oriented development at three hubs defined by two existing stations and one stop along the Martin Luther King, Jr. East Busway. Conversely, it also is possible that local residents and businesses in other cities may believe BRT stations to be incompatible with their visions for their communities.

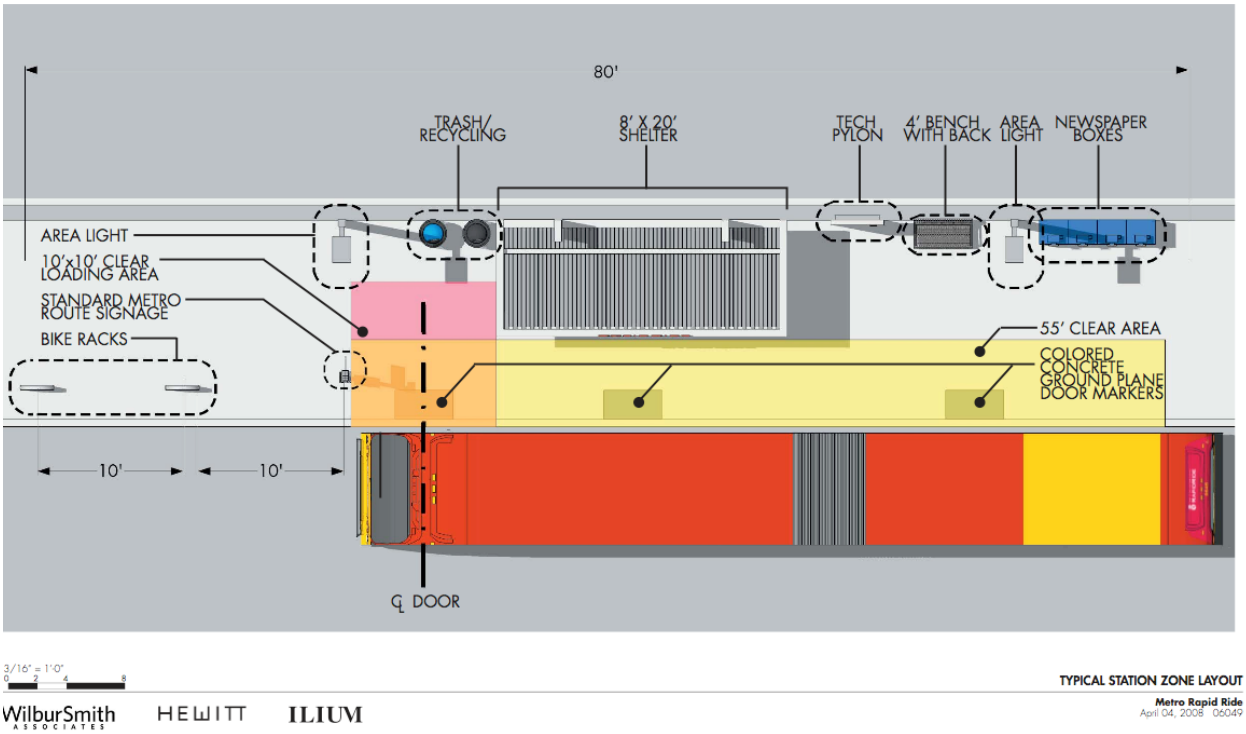
When considering existing and future development activity, both the type and amount of development should be evaluated. Stations proposed in areas with high levels of existing or future development activity have the benefit of maximizing ridership for the BRT system and helping to alleviate potential community concerns about traffic generated by the new development.

In addition to being a factor considered in environmental assessments, land-use factors are a key criterion in the FTA's evaluation of projects being considered for New Starts funding. The factors considered include transit-supportive plans and policies, performance and impacts of policies and other land use considerations. The FTA's document *Guidelines and Standards for Assessing Transit Supportive Land Use* provides further information on the land use information required by FTA for New Starts projects.

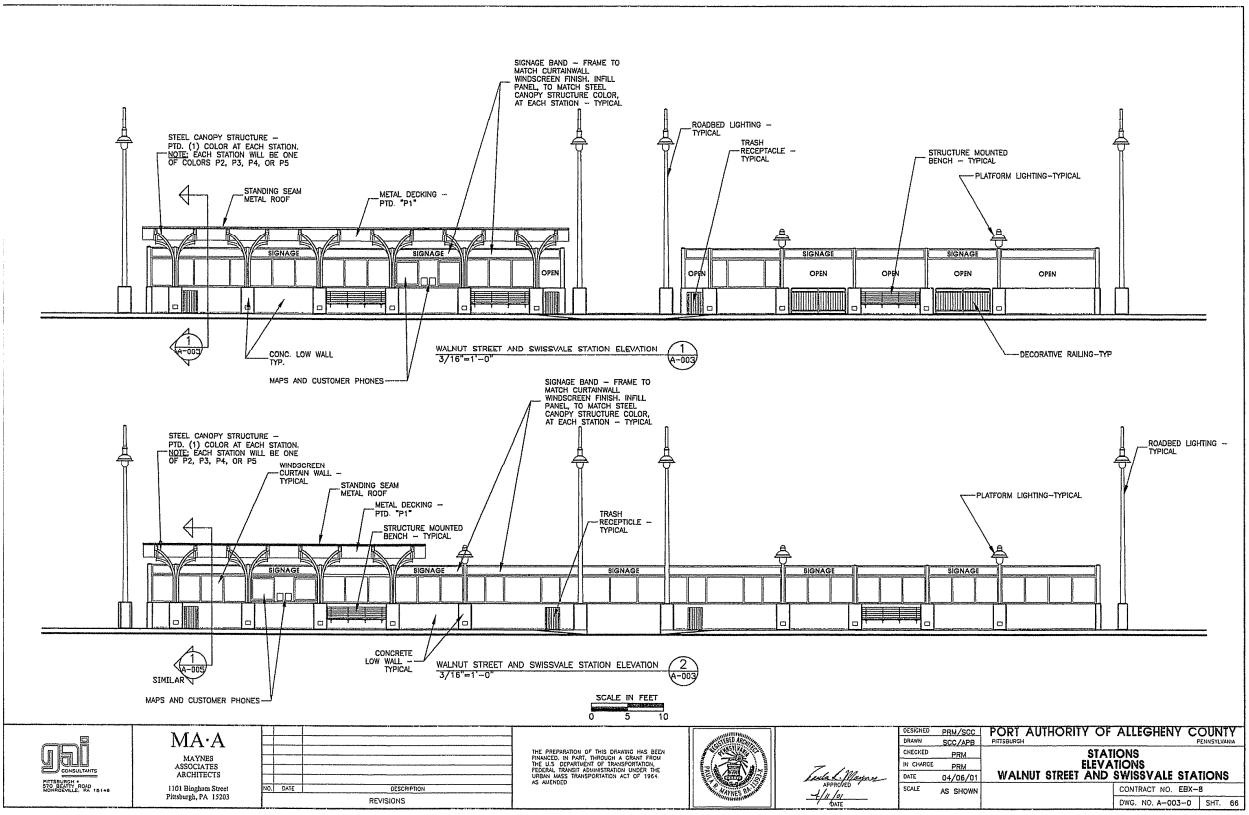
Appendix A: Station layout diagrams



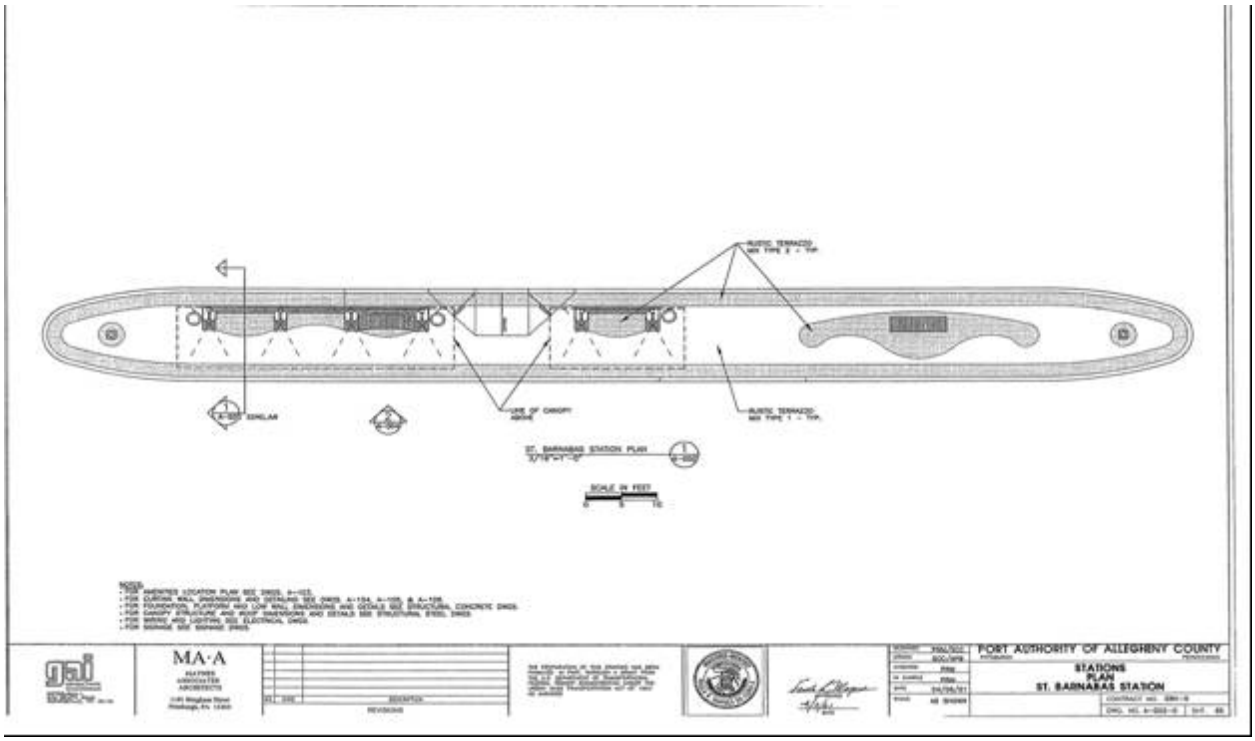
Enhanced BRT station layout (Everett, Wash.)



Enhanced station zone layout (King County, Wash.)



Off-street station with curbside platform layout (Allegheny County)



St. Barnabas Station layout (Allegheny County)

End-of-line station with center island layout (Ottawa).

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Abbreviations and acronyms

ADA	Americans with Disabilities Act
BRT	bus rapid transit
CCTV	closed circuit television
CPTED	Crime Prevention Through Environmental Design
FTA	U.S. Federal Transit Administration
LEED	Leadership in Energy and Environmental Design
LOS	level of service
TCRP	Transit Cooperative Research Program
TOD	transit-oriented development
TSP	transit signal priority