Countywide Transit Corridors Functional Master Plan

Appendix 13
BRT Station Typology

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Memorandum

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Date: November 30, 2012

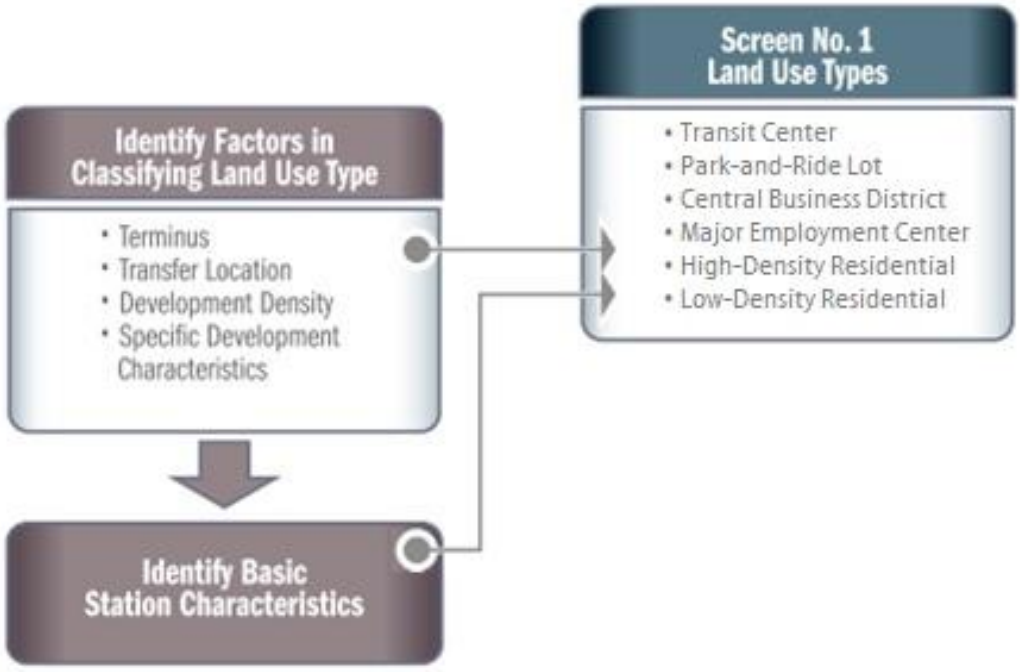
Subject: BRT Station Typology Assessment (FINAL)

1.0 INTRODUCTION

This memo documents the process proposed to develop a typology for BRT stations associated with the planned Montgomery County BRT system. Identifying the facilities associated with each typology is an important part of the Functional Plan because it will inform the amount of right-of-way that needs to be reserved at each station location. The process starts at a broad station area level to develop classifications by land use type, and then proceeds into a methodology for identifying and refining specific station locations and configurations along corridors. This methodology would be applied as decisions advance in later engineering phases (see "Section 4.0 – Developing Site-Specific BRT Station Footprints" for more discussion). The screening process for identifying the station land-use types is presented in Figure 1.

The preliminary station-area land-use typology was applied to eight stations to validate these classifications. More detailed station location and development of site-specific footprints will require further assessment during the follow up alternatives analysis or preliminary design efforts for specific BRT corridors.

Figure 1: Identifying Station Land-Use Typology



2.0 STATION LAND USE TYPES

The initial assessment in station typology identification is to identify the appropriate land-use type for the area around a station location. In this assessment, a station area is defined as the area immediately adjacent to and within one-half-mile of an identified BRT station location. Ideally the one-half-mile would be defined in terms of pedestrian accessibility to a station given the street or sidewalk connectivity, but for initial station area classification a more simplified "as the crow flies" one-half-mile was applied. In PB's proposal for the Functional Plan, a distinction of six land-use types around BRT stations was identified.

- Transit Center
- Park-and-Ride Lot
- Central Business District
- Major Employment Center
- High-Density Residential
- Low-Density Residential

Table 1 identifies the basic characteristics of the different BRT station areas related to the six land-use types.

Table 1: Characteristics of Station Land-Use Typologies

Typology	Development at Station	Development within 1/2-Mile Station Area	Pedestrian/Bicycle Connections	Basic BRT Station Provisions
Transit Center	• Bus to rail transfer - Metrorail or MARC Station • Bus to bus transfer – at other than Metrorail/MARC station	• Could be any land use type or density	• If residential or mixed-use around station, good street connectivity and pedestrian/bicycle treatments	• Multiple bus bays • Kiss-n-ride area • Potential shared facilities with rail - platform/ticketing/passenger information/bike racks/security system • Park-and-ride lot (associated with rail)
Park-and-Ride Lot	• Separate park-and-ride without major bus transfers	• Normally lower-density development	• More limited with limited surrounding development; focus on major access roadway	• Larger dedicated park-and-ride lot (typically greater than 200 spaces) • Substantial shelter • Other station amenities pending level of parking development
Central Business District	• Street-side retail and/or office development	• Downtown area of suburban community – mixture of retail, office and higher-density residential; meets minimum BRT density threshold for employment	• Focus on sidewalk accessibility; bike facilities could be limited due to downtown traffic conditions – exclusive bike facilities desired	• Size of shelter pending level of development/major attractors around station • Possible integration into adjacent plaza • Street-side bus access – connection with local bus service
Major Employment Center	• Large retail/office development adjacent to station or in close proximity, such as major federal complex, regional shopping mall, or major hospital	• Normally added higher density land uses in support of major development, typically supporting retail, office, and higher density residential	• Pedestrian/bicycle connections will be dependent on the form of the development – if in suburban environment, could have circuitous access in some locations	• Substantial shelter • Potential for shared-use parking • Potential for some station facilities shared with development • Local transit circulator for large scale developments
High-Density Residential	• One or multiple apartment/condo residential complexes	• Normally lower-density single-family residential	• Good pedestrian access given level of sidewalk development; bike facilities could focus on major access roadways	• Moderate shelter • Bike racks • Connections to local bus
Low-Density Residential	• Single-family residential within defined local neighborhood with potential smaller-scale apartment/condo complex	• Single-family residential	• Pedestrian access could be circuitous without street grid; bikes normally share street with traffic	• Minimal shelter • Bike racks • Possible on-board fare collection

2.1 Transit Center

A BRT station centered on a transit center involves major transit transfer opportunities—either bus-to-rail (Metrorail and/or MARC) or bus-to-bus. In such locations, there are substantial bus transfer facilities (several dedicated bus bays and passenger platform area), as well as kiss-and-ride provisions, bike racks, real-time passenger information, and off-board ticket vending machines. These facilities are typically shared by both local and premium bus services. Some park-and-ride could also be provided. Transit centers are normally located in urban or highly developed suburban areas, with a higher level of surrounding development that could include transit-oriented development adjacent to the station with enhanced local pedestrian and bicycle connections to the station.

2.2 Park-and-Ride Lot

A BRT station tied to only a park-and-ride lot would normally be provided at the terminus of a route, where BRT users would have to drive to the parking facility to make the transfer to BRT service. At terminus locations, given the larger service area, a greater number of parking spaces would typically be provided than at intermediate park-and-ride or shared parking lots, as these tend to be in more developed pedestrian areas with more transit and pedestrian/bicycle access opportunities. At stations focused on parking, the size of the passenger waiting area and degree of shelter would depend on the relative number of parking spaces and the level of transit service provided. With higher ridership, there is a greater warrant for real-time passenger information, off-board fare collection, and other amenities. Bike racks may be more prevalent at intermediate park-and-ride lot locations.

2.3 Central Business District

A BRT station in a central business district would typically be an on-street facility along an existing sidewalk area, serving immediate adjacent development and other retail/office/residential development beyond the block where the station is located. In these locations, there is normally a well-developed pedestrian street grid, which will allow pedestrian access to and from the station from all directions. At these locations, the station could be integrated into the adjacent sidewalk or an adjacent pedestrian plaza. The extent of shelter provided depends on the amount of area available for a station; in some locations, awnings or extended roofs from adjacent development could provide some weather protection. Developing the station into the street using a curb extension is one way to expand the passenger waiting area without right-of-way impact, particularly where on-street parking could be removed to develop a curb extension. Bus access to the station is provided by buses stopping along the curb, in a linear bay configuration if there are both BRT and local buses sharing a station.

2.4 Major Employment Center

A major employment center is defined as a single or cluster of higher-density development outside of a central business district, either as a single use or mixed-use. Examples include federal complexes (such as Walter Reed National Military Medical Center), suburban office parks, regional shopping malls (such as Montgomery Mall), and hospitals (such as Montgomery General Hospital). In these situations, a BRT station could either be developed slightly off its main route to serve the heart of the development or remain on-street. The development tends to be transit-supportive due to its higher density. Given the higher density nature of the

surrounding development, access to the BRT station would focus on pedestrian connections to and from the station, with the potential for a local bus circulator to serve larger adjoining developments (particularly federal complexes spread out over a larger area). There is also the potential opportunity to provide smaller shared-use parking opportunities, which would allow some BRT users to drive to such a station. More extensive shelter at these BRT stations should be provided, as well as real-time passenger information and off-board fare collection. Local bus service could also serve such a site, pending the location of adjacent arterial or collector roadways.

2.5 High-Density Residential

A BRT station in a higher density residential area would focus on serving adjacent or nearby multi-family housing, particularly senior housing and higher-rise apartment and condo buildings. Such housing could be developed in an area with or without an adjacent street grid, and hence in some circumstances new or improved pedestrian connections to the adjacent development will need to be provided. As with major employment centers, a private bus circulator could operate from the station to serve adjacent senior or assisted living residences. Given the greater development density and anticipated higher ridership, a greater level of shelter would typically be provided at a BRT station, as well as real-time passenger information and off-board fare collection.

2.6 Low-Density Residential

In many locations along a BRT corridor, a station serving a particular lower-density residential neighborhood would be appropriate. In these cases, the BRT stations would usually be located on-street, with access focused on walk-in or bike access from the adjacent area. If the station is located at a major cross-street intersection, riders transferring to and from a local bus route could also be served. At these stations, typically less shelter and overall passenger amenities would be provided, given the probable lower ridership. Pedestrian connections in these areas could be associated with an established street grid if in an older, more established, or more limited and circuitous associated with new suburban housing developments.

3.0 VALIDATION OF STATION LAND-USE TYPOLOGIES

To test the appropriateness of the identified station-area land-use typologies, eight stations identified in the Functional Plan's BRT network were evaluated. Table 2 presents a summary of this evaluation, and preliminary station area classification. As mentioned previously, the identification of specific station footprints within these station areas will require resolution of the transitway treatment and desired transit service operating plan in the particular corridor serving the area, and development of refined ridership projections to establish the level of access mode and passenger amenity provisions.

3.1 Rockville Metrorail Station (Figure 2)

Development at the Station

This proposed BRT station location is sited on the west side of the Rockville Metrorail station and would serve the following three BRT corridors:

- Corridor 3: Veirs Mill Road
- Corridor 5: Rockville-LSC
- Corridor 10: MD 355

It is a major intermodal transit center, serving passengers using MARC, Amtrak, local bus, and commuter bus. Surface lot and garage parking is also available to commuters, as well as bicycle storage and kiss-and-ride drop-off locations.

Development within 1/2-Mile of Station Area

With the station located along the edge of Rockville Town Center, it is adjacent to BRT-supportive employment. There is some degree of BRT-supportive population within the station area in Rockville Town Center. The east side of the station connects to low-density single-family detached houses. Rockville Town Center also contains a branch of Montgomery County Public Library. About one-half mile from the station is Richard Montgomery High School.

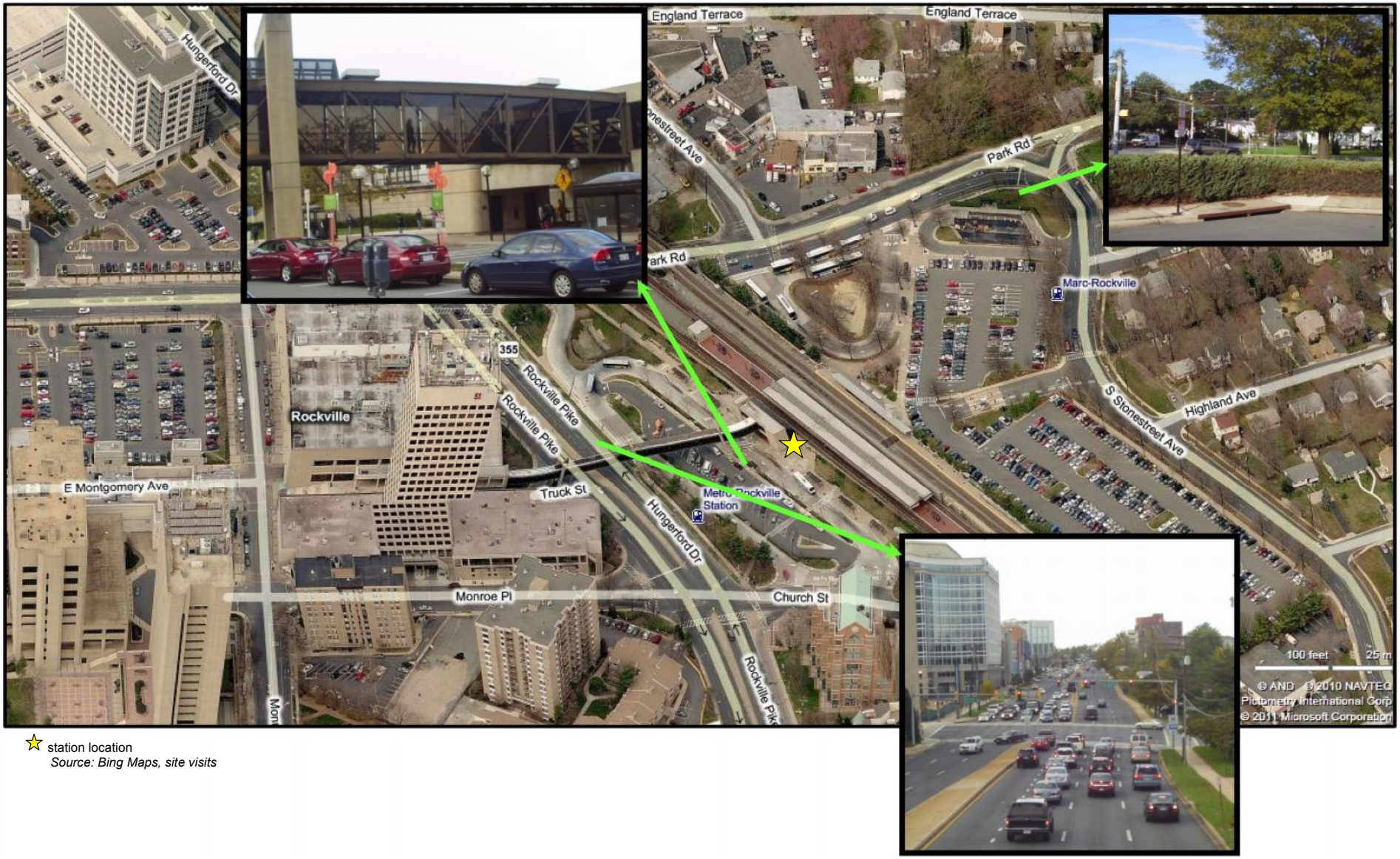
Pedestrian/Bicycle Connections

The area provides good pedestrian connectivity to the station. Pedestrian access is provided either at the street level or by using a pedestrian bridge that extends into Rockville Town Center. There are limited bicycle facilities within the station area: only one location provided on-street bicycle lanes along East Middle Lane between MD 355 and Gibbs Street. Current Metrorail riders are likely using existing roadway and sidewalk facilities to travel to and from the station, as bicycle storage is present at the station.

Typology

Based on the development at and surrounding the station area, Rockville Metrorail Station best fits the transit center typology.

Figure 2: Rockville Metrorail Station Area



☆ station location
Source: Bing Maps, site visits

3.2 White Oak Transit Center (Figure 3)

Development at the Station

The proposed BRT station location would be sited at the White Oak Transit Center and serve Corridor 11: MD 650/New Hampshire Avenue and Corridor 19: US 29. The transit center currently serves four local bus routes (one of which terminates at this location) and is located next to White Oak Shopping Center. While it is a regional shopping center, it is more representative of a neighborhood shopping center with local eateries, a major supermarket, and Sears as its anchor.

Development within 1/2-Mile of Station Area

A couple of locations surrounding the station location house small medical/office complexes and light industrial uses such as a self-storage facility. Most of the station area is surrounded by clusters of BRT-supportive housing, with high-density garden-style apartments to the east and a larger, high-rise apartment complex to the west. There is a smaller presence of low-density single-family detached housing within the area.

Pedestrian/Bicycle Connections

There are good pedestrian connections to the station location, with sidewalks present throughout the station area. Only one bicycle facility exists within the area, and it is located along the east side of New Hampshire Avenue between Hillandale Park and Lockwood Drive alongside the FDA complex.

Typology

The station location appears to be influenced by the surrounding BRT-supportive population rather than by either the regional shopping center or transit center. Based on the development at and surrounding the station area, White Oak Transit best fits the high-density residential typology.

Figure 3: White Oak Transit Center Station Area

☆ station location
Source: Bing Maps, Google Maps

3.3 Briggs Chaney Park-and-ride (Figure 4)

Development at the Station

The proposed BRT station location would be sited at the Briggs Chaney Park-and-Ride Lot, which provides 240 spaces for commuter parking. This station would serve as the terminus for Corridor 19: US 29, and it would provide connections to five local bus routes, two of which terminate at the lot.

Development within 1/2-Mile of Station Area

The Eastern County Regional Service Center is a short walk from the station location. Although this location does not meet the minimum threshold for the BRT-supportive population densities (at least six households per acre), Briggs Chaney consists of a number of attached dwelling units (primarily condominiums and townhomes). Auto sales parks, light industrial facilities, and a community shopping center closer to the western edge of the station area also surround the station location.

Pedestrian/Bicycle Connections

There are sidewalks present within the area to provide connectivity to the station location. However, as this station location caters to automobile commuters, many potential riders would need to access the station using circuitous paths due to limited connectivity to the station location. Bicycle facilities are also not present within the stations area but access could be provided along roads in the area.

Typology

Based on the development at and surrounding the station area, Briggs Chaney Park-and-Ride Lot best fits the park-and-ride lot typology.

Figure 4: Briggs Chaney Park-and-Ride Lot Station Area

☆ station location
Source: Bing Maps, site visit

3.4 Bethesda Metrorail Station (Figure 5)

Development at the Station

The proposed BRT station location would be sited at the Bethesda Metrorail Station, either at the current bus terminus at the station or a near-by on-street location. This station would serve as the terminus for Corridor 10: MD 355 and Corridor 12: MD 187/Old Georgetown Road, and it would provide connections to Metrorail and numerous local bus routes that also terminate at the station. Bicycle storage facilities are also provided at this station. The location is at the center of the Bethesda Central Business District (CBD) area, which provides a variety of BRT-supportive employment, retail, residential, and entertainment options.

Development within 1/2-Mile of Station Area

The Bethesda CBD extends beyond the station location and encompasses the majority of the station area. Also present within the area are single-family detached housing, Bethesda Chevy Chase Senior High School, the Bethesda/Chevy Chase Regional Services Center, and the Bethesda branch of Montgomery County Public Library.

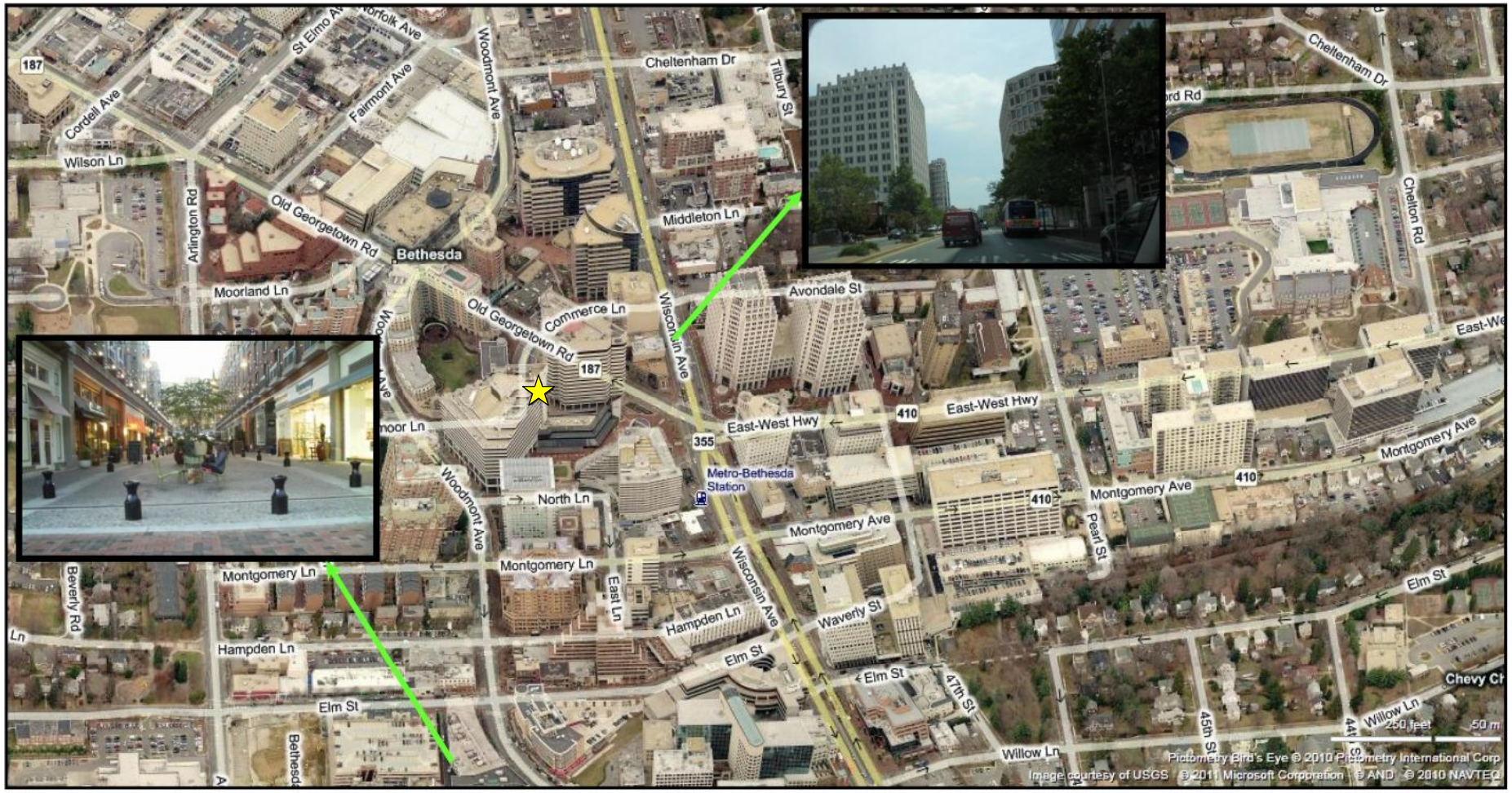
Pedestrian/Bicycle Connections

There are sidewalks and crosswalks throughout the CBD and in areas leading to the station, with some blocks having wider sidewalks than are typically found in other parts of Montgomery County. The only existing off-road bicycle facility within the station area is along the Georgetown Branch Trail; however, it does not provide a connection to the station location through other intersecting bicycle facilities. It can be assumed that people are using existing roads and sidewalks to access the station and store their bicycles as that is typical of urban areas.

Typology

Based on the development at and surrounding the station area, Bethesda Metrorail Station best fits the central business district typology.

Figure 5: Bethesda Metrorail Station Area



☆ station location
Source: Bing Maps, site visit

3.5 Medical Center Metrorail Station (Figure 6)

Development at the Station

There are two proposed BRT station locations sited near the Medical Center Metrorail Station. One location would be at the Metrorail station, serving Corridor 8: Connecticut Avenue. At this location, there would be connections to Metrorail, 12 local bus and shuttle routes (shuttles serve National Institutes of Health (NIH) and Walter Reed National Medical Center (WRNMC)), park-and-ride/kiss-and-ride facilities, and bicycle storage.

The other location would be on-street along MD 355, serving Corridor 10: MD 355. It is centrally located between NIH and NNMC, two major employment centers in this area.

Development within 1/2-Mile of Station Area

Both proposed station locations share common development types. Both are within the NIH and WRNMC employment centers, which encompass the majority of the station area. There is also a small degree of single-family attached and detached housing in the area. The station location that would serve Route 10 is within walking distance of the Medical Center Metrorail station and connecting bus routes.

Pedestrian/Bicycle Connections

There is good pedestrian connectivity leading to and surrounding both station locations. There are two main paths leading from the Medical Center Metrorail station to the NIH campus. The WRNMC campus is also reasonably accessible from the station location, especially the location serving Route 10. Riders accessing Route 8 will benefit from a planned pedestrian underpass connecting Medical Center Metrorail station and WRNMC, defined in Montgomery County's "Medical Center Metro Crossing Project."[1]

A shared-use bicycle path exists along MD 355 heading south, beginning at Cedar Lane. It provides direct access to both station locations and travel around the NIH campus to connect to the Bethesda Trolley Trail.

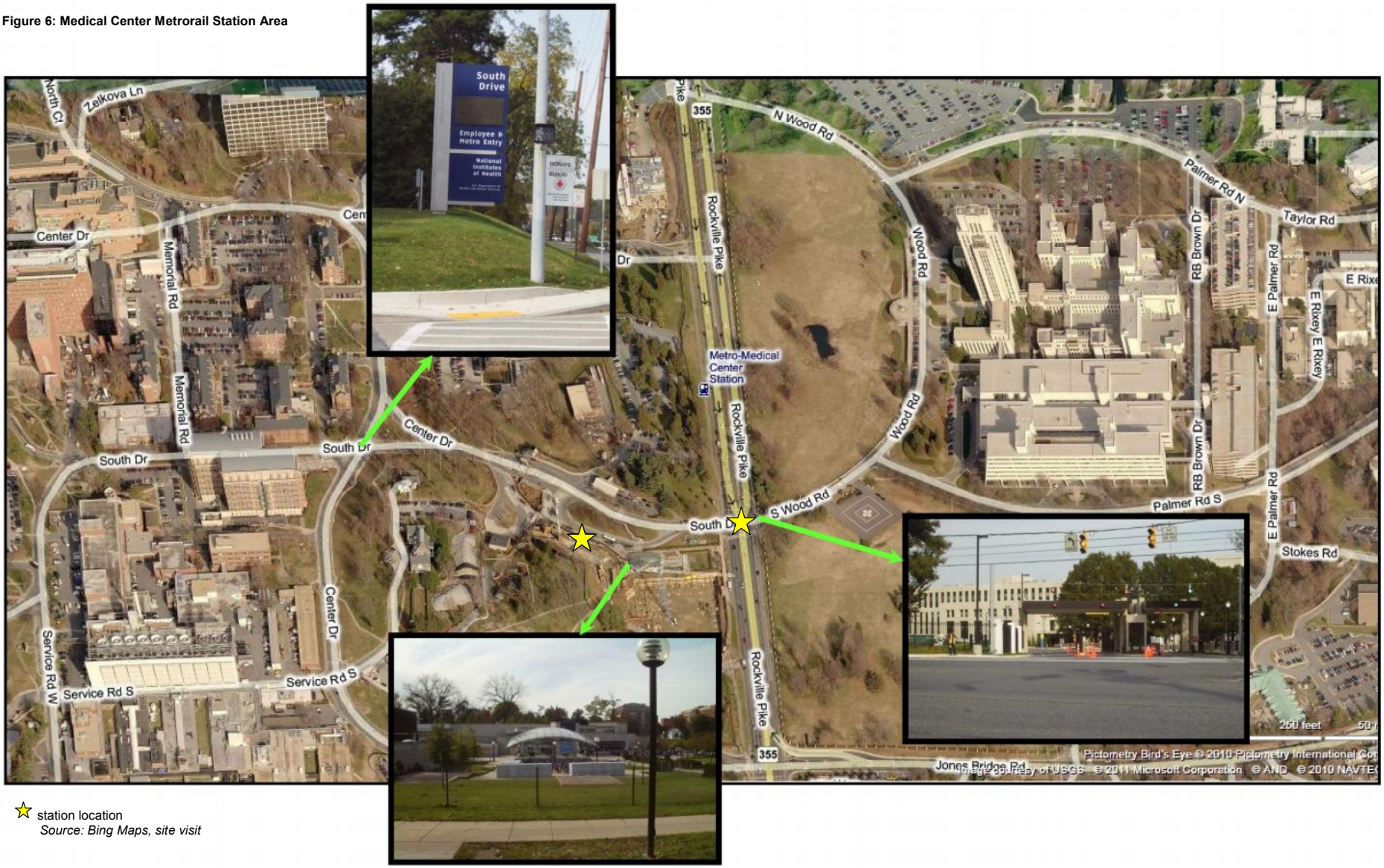
Typology

Based on the development at and surrounding the station area, Medical Center Metrorail Station best fits the following typologies:

- Transit center, for Corridor 8
- Major employment center, for Corridor 10

[1] http://www.montgomerycountymd.gov/brctmpl.asp?url=/content/exec/brac/projects/metro_mc.asp; accessed on October 21, 2011.

Figure 6: Medical Center Metrorail Station Area



☆ station location
Source: Bing Maps, site visit

3.6 Tuckerman and Sugarbush Lanes (Figure 7)

Development at the Station

The proposed BRT station location would be sited at the intersection of Tuckerman and Sugarbush Lanes. This location will serve Corridor 21: North Bethesda Transitway. There is high-density residential housing at the station location.

Development within 1/2-Mile of Station Area

Within short walking distance of the station location is high-density residential housing. This type of development primarily encompasses the station area.

Pedestrian/Bicycle Connection

Sidewalks are present throughout the area; however, riders would have to travel circuitous paths from their residences to the station location. This is especially the case for housing units located south of the station, due to a berm separating the residential development from Tuckerman Lane. A shared-use bicycle path is location along Tuckerman Lane, providing direct access to the station location.

Typology

Based on the development at and surrounding the station area, Tuckerman and Sugarbush Lanes best fits the high-density residential typology.

Figure 7: Tuckerman and Sugarbush Lanes Station Area

☆ station location
Source: Bing Maps, site visit

3.7 Connecticut Avenue and Dean Road/Kelsey Street (Figure 8)

Development at the Station

The proposed BRT station location would be sited along Connecticut Avenue, between Dean Road and Kelsey Street. This location will serve Corridor 8: Connecticut Avenue. There is low-density residential housing at the station location. There is a local bus stop at the corner of Connecticut Avenue and Dean Road, serving three bus routes.

Development within 1/2-Mile of Station Area

The station area is encompassed by low-density residential development in the form of single-family detached housing. A junior high school is also located within the station area.

Pedestrian/Bicycle Access

The station location is within a suburban neighborhood. There are sidewalks present within the area and while there is adequate connectivity provided to the station location, some riders from the area will have to walk routes that are more indirect. There is a shared-use bicycle path along Connecticut Avenue between Georgia Avenue and Dean Road. There is also the Matthew Henson Trail that can provide a connection between the station location and some residential housing along Turkey Branch Parkway in Wheaton.

Typology

Based on the development at and surrounding the station area, Connecticut Avenue and Dean Road/Kelsey Street best fits the low-density residential typology.

Figure 8: Connecticut Avenue and Dean Road/Kelsey Street Station Area

☆ station location
Source: Bing Maps, site visit

3.8 Muddy Branch Road and West Side Drive (Figure 9)

Development at the Station

The proposed BRT station location would be sited at the intersection of Muddy Branch Road and West Side Drive. It is next to Festival Shopping Center, a community shopping center. This location will serve Corridor 7: MD 124/Muddy Branch Road. There is a local bus stop at the corner of Muddy Branch Road and West Side Drive, serving one bus route.

Development within 1/2-Mile of Station Area

There is an even balance of BRT-supportive employment and residential within the station area. On the east side of the station is high-density attached dwelling units, while on the west side of the station location is the back entrance of National Institute of Standards and Technology.

Pedestrian/Bicycle Connectivity

The station location is along a major county roadway and intersections are widely spaced. There are sidewalks present within the area and while there is adequate connectivity provided to the station location, some riders from the area will have to walk routes that are more indirect. There is an existing multi-use path along Muddy Branch Road through the station area.

Typology

The station location appears to be influenced by the surrounding BRT-supportive population rather than the community shopping center. Based on the development at and surrounding the station area, Muddy Branch Road and West Side Drive best fits the high-density residential typology.

3.10 Summary

Table 2 summarizes the validated station land-use typologies.

Figure 9: Muddy Branch Road and West Side Drive Station Area

☆ station location
Source: Bing Maps, Google Maps

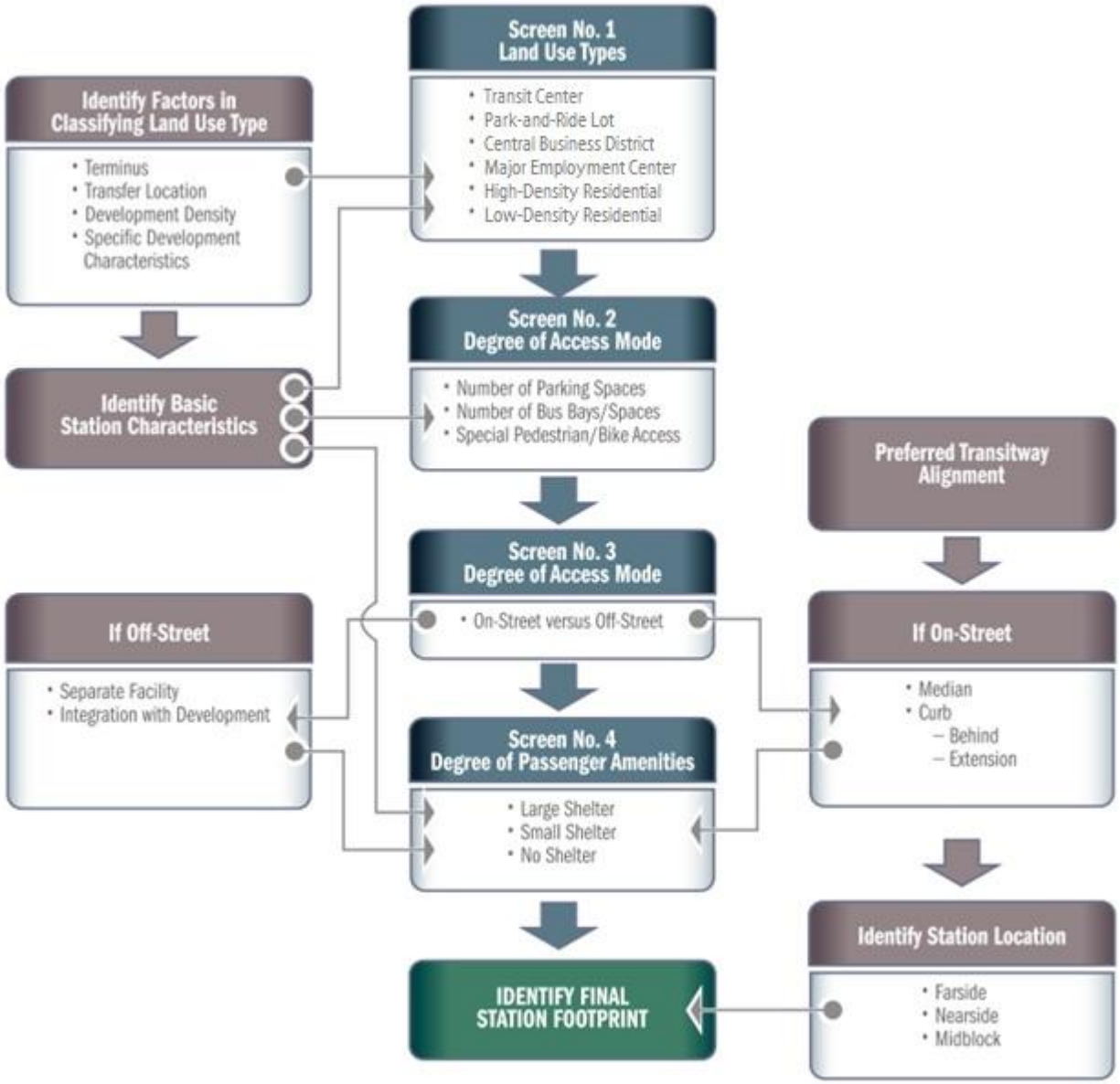
Table 2: Validated Station Land-Use Typologies

Station Location	Development at Station	Development Away from Station	Pedestrian/Bicycle Connections	Typology
Rockville Metrorail Station	• Metro station • MARC station • Amtrak station • Bus terminus (multiple bays; numerous local and commuter bus routes) • PnR/KnR • Bicycle storage	• BRT-supportive employment: Rockville Town Center • BRT-supportive population: some amount found within area • Library • High school • Low-density residential closer to east side of station	• Good pedestrian connectivity surrounding station • On-street bike lane observed on E. Middle Lane between MD 355 and Gibbs Street	Transit center
White Oak Transit Center	• Bus transit center (serves four local bus routes) • Regional shopping center	• BRT-supportive population: high-rise apartment complex and clusters of low-rise garden-style apartments • BRT-supportive employment: White Oak/FDA Campus • Lesser amount of low-density residential	• Good pedestrian connectivity • Primarily auto-centric development • Bike lane along MD 650 (NB)	High-density residential
Briggs Chaney PnR Lot	• Park-and-ride lot (240 spaces) • Service from five local bus routes bus	• Attached dwelling units • Auto sales park • Light industrial • Community shopping center • Eastern County Regional Service Center	• Sidewalks present; limited direction station connectivity • Auto-centric development • No existing bike lanes in station area	Park-and-ride lot
Bethesda Metrorail Station	• Metro station • Bus terminus (multiple bays; serves 13 local and circulator bus routes) • Bicycle storage • Central business district with mixed-use development: Commercial, residential, office • BRT-supportive population and employment	• CBD • Library • High school • Some presence of single-family detached housing in station area	• Prevalence of sidewalks • Existing shared-use bike path along Georgetown Branch Trail; no direction connection to station	Central business district
Medical Center Metrorail Station	• Metro station (Medical Center) • Park-and-ride • Kiss-and-ride • Bus terminus (multiple bays; serves 12 local bus and shuttle routes) • Bicycle storage	• BRT-supportive employment: NIH/NNMC (major employment centers) • Small degree of single-family attached and detached housing	• Good pedestrian connectivity; plans for construction of improved pedestrian facility at MD 355 and Jones Bridge Road • Shared-use bike path on MD 355 adjacent to NIH campus	Transit center (Route 8)
	• BRT-supportive employment: NIH/NNMC (major employment centers)	• Metro station (Medical Center) • BRT-supportive employment: NIH/NNMC (major employment centers) • Small degree of single-family attached and detached housing	• Good pedestrian connectivity • Shared-use bike path on MD 355 adjacent to NIH campus	Major employment center (Route 10)
Tuckerman and Sugarbush Lanes	• BRT-supportive population: high-density residential	• BRT-supportive population: high-density residential	• Pedestrian facilities present, connections to station more circuitous • Shared-use bike path along Tuckerman Lane	High-density residential
Connecticut Avenue and Dean Road/Kelsey Street	• Low-density residential • Bus stop (serves three local bus routes)	• Low-density residential • Junior high school	• Sidewalks present; suburban residential street network provides adequate connectivity • Shared-use bike path along Conn. Ave btw Georgia Ave and Dean Rd • Matthew Henson Trail	Low-density residential
Muddy Branch Road and West Side Drive	• Community shopping center • Bus stop (serves one local bus route)	• BRT-supportive pop: High-density residential to east of station • BRT-supportive employment: NIST (back entrance)	• Sidewalks present; suburban residential street network provides adequate connectivity • Sidewalk within NIST campus, but heart of campus more than 0.5 miles from station • Multi-use path along Muddy Branch Road	High-density residential

4.0 DEVELOPING SITE-SPECIFIC BRT STATION FOOTPRINTS

Once areas around desired BRT stations are designated by land use type, a process needs to be developed to define required station footprints at specific locations by identifying a final set of access modes to serve the station and passenger amenities. Figure 10 presents a four-step screening process (including Screen Number 1, which initially defined and validated the station land-use typology in Section 2 of this memo) to arrive at a final station footprint and set of amenities at each station along a BRT route. This overall process, particularly the remaining screening steps, would be integrated into more detailed corridor master planning and alternatives analysis beyond the Functional Plan; it is presented for informational purposes, but would be used during those phases of implementation.

Figure 10: Screening Process for Identifying Station Footprint and Amenities



The process starts at a broad station area level by classifying station areas by land use type, and then proceeds into a methodology for identifying and refining specific station locations and configurations along corridors, which could be applied as decisions advance in later engineering phases. The corridor station classification process accounts for the following:

- The basic function and surrounding land use of a station (Screen Number 1, discussed in Section 2 of this memo)
- The type of access modes and the degree of ancillary parking and bus transfer facilities to serve a station (Screen Number 2)
- Whether stations would be located off-street or on-street (Screen Number 3). If on-street their relationship to the median or curb and placement along the street pending the particular BRT alignment and operation.
- The level of passenger amenity provision given the estimated ridership patterns at a station and the degree of shelter to be provided (Screen Number 4)

The following three sections discuss the latter screening steps of the methodology.

4.1 Identify Degree of Access Mode

Once the basic BRT station location is established and surrounding area classified, the degree of access modes serving the station should be identified. This should focus on identifying the following three items:

- Level of bus service and associated number of bus bays/spaces required
- Whether parking should be provided and the number of parking spaces required
- Provisions for pedestrian/bicycle access

Intersecting Bus Service

The number of bus bays or spaces should be derived from the BRT service plan and associated local bus access plan at a particular station. Bus bays (either sawtooth or linear configuration) would be applicable to off-street stations and linear bus spaces applicable to on-street stations. The preliminary plan at intermediate BRT stations would be to have one space for BRT vehicles (60-foot length) and a second space for local buses (40-foot length). Stopping area for cross-street bus routes would also be provided, with cross-town bus stops located to facilitate transfers to and from the BRT service to the extent possible.

Parking

Parking is an integral part of the park-and-ride lot classification, at shared parking locations, and probably at rail transit centers as well. The number of parking spaces should be derived from the BRT ridership estimation model to identify demand. Most of the parking should be located at dedicated park-and-ride facilities, though if there is an ability to develop some shared parking facilities at intermediate BRT stations, which would be desirable. These shared parking facilities would involve dedicating the outer portion of an adjacent development park-and-ride use during at least weekdays.

Pedestrian and Bicycle Access Connections

At any BRT station, adequate sidewalks or pathways meeting ADA accessibility requirements are critical. This includes making sure adequate curb ramps are provided at adjacent intersections, and that safe pedestrian crossing of the street that BRT is operating on and the adjacent cross street are provided, through established traffic signals or special pedestrian signals, with properly marked crosswalks. Sidewalk widths should generally be wider near and at stations (minimum 8 feet).

Related to bicycle connections, either bicycle lanes along the street the BRT is operating on or on the cross street at the station should have provision for getting bicycles up to the sidewalk area next to the station so that bicycles can be parked at the station if desired. This will require some way finding signage to divert bicycles from on-street at nearby intersections to the BRT station.

For major employment center and high-density residential classifications, and in central business districts, where there are building setbacks and higher BRT ridership anticipated, special pedestrian treatments from nearby development could be developed. This could include integration of a pedestrian plaza facility into the BRT station.

4.2 Determine On-Street vs. Off-Street

Once a station area land-use type and access mode requirements have been identified for a particular BRT station along a corridor, the next step in identifying station location would be to verify whether the station should be on-street or off-street. Basic station placement will be dictated by whether the BRT route operates along curbside bus lanes or in a median transitway. In general, particularly for intermediate stations along a BRT corridor, as many stations as possible should be located on-street to minimize BRT diversion and improve travel time, with enhanced pedestrian and bicycle connections to adjacent and nearby development. For stations along a median busway alignment, intermediate stations will need to stay on-street, given the fixed facility development.

Transit center and park-and-ride stations tend to be off-street facilities, given that many are at terminus stations and have greater bus bay needs and parking space requirements. Stations with adjacent smaller shared parking facilities and minor bus transfers would have a greater tendency to be on-street. Stations in central business district and lower-density residential areas also tend to be located on-street, given the lesser space available for station facilities in CBDs and less ridership in lower-density residential areas.

4.3 Identify Specific Station Location

The specific station location could be located far-side or nearside of an intersection, or midblock (if there is a particular development to be served), assuming a protected pedestrian crossing of the street where the BRT is operating on a more heavily-travelled, higher-speed arterial roadway. If transit signal priority is provided at a station location, stations should be located far side of the intersection if possible. If a median transitway is developed, staggered side platforms are preferable at signalized intersections to facilitate potential transit signal priority application. A median center platform could be considered where there is limited right-of-way (recognizing signal priority could not be as effective in one direction with a nearside stop, and the need for bus crossover operation before accessing a station, left side running, or doors on both sides of the BRT vehicle (only possible with articulated buses).

Figure 11 illustrates the side vs. center median platform concepts. Figure 12 identifies in further detail a potential layout of a far side median station at an intersection illustrating the opportunity and need to provide space for passenger amenities and maintain ADA accessibility.

Figure 11: Staggered Side vs. Center Platforms Associated with Median Transitway Treatment

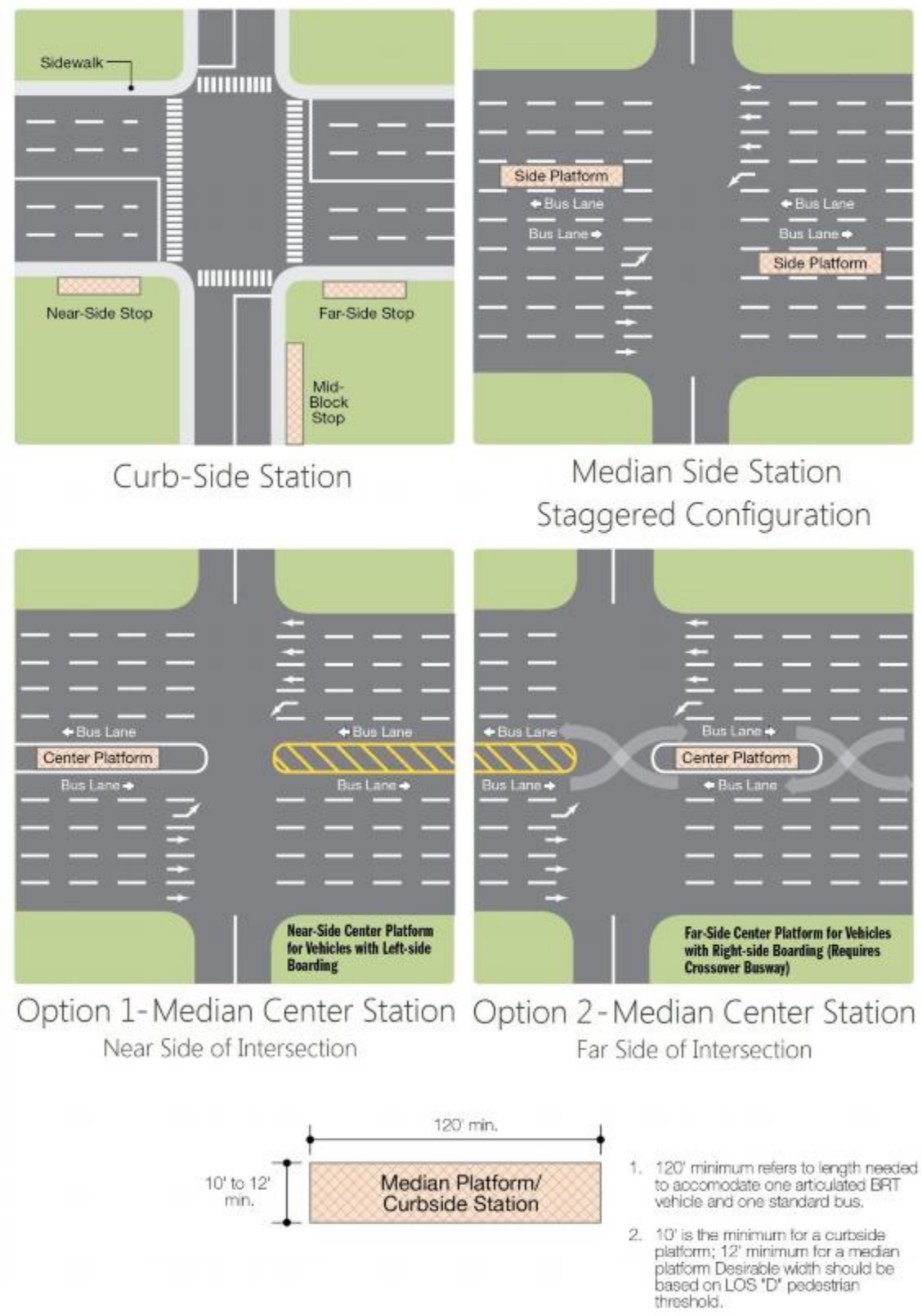
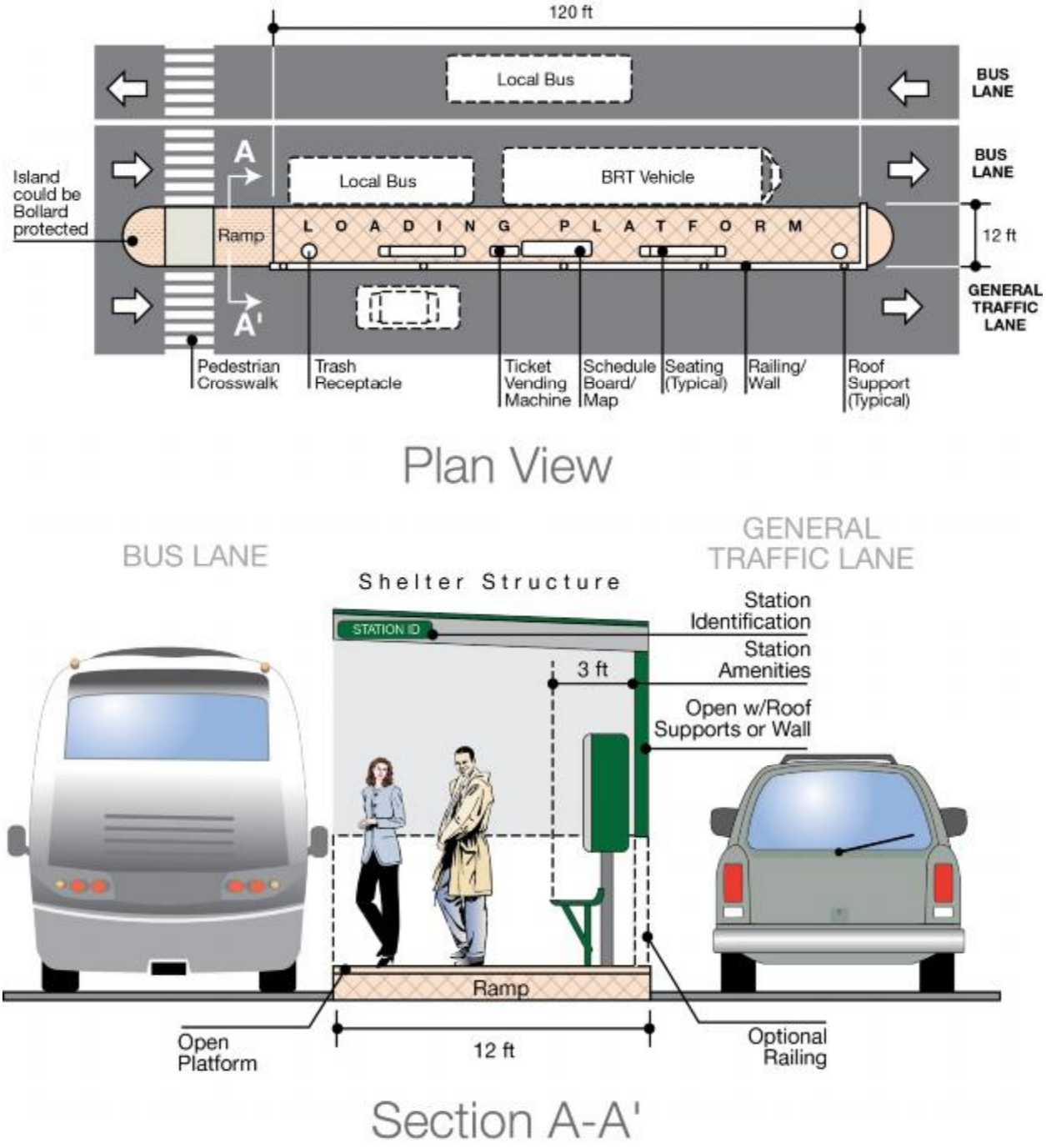


Figure 12: Illustration of Typical Median Busway – Far-side Station Layout



The basic station platform (or passenger waiting area) length and width can either be established by policy or using the ridership projections and estimated number of bus spaces needed during peak period BRT operation. If determined by policy, the station could be a certain length to accommodate flexibility in the number and size of buses to serve the station in the future. A minimum station footprint on-street of 120 feet in length, would allow for both one 60-foot articulated bus and one 40-foot standard bus to berth at the station at the same time (with some separation between the vehicles).

A key decision that could be established either by policy or restricted right-of-way or local access impacts is to separate the BRT station from the local bus operation, rather than having a combined station. In situations where constructing BRT passing lanes within the busway would be precluded by right-of-way or cost, having BRT service in the median and local bus service in the general traffic lanes would be the appropriate treatment.

If it is decided that a particular station should be located along the curb, there are three options for specific station placement.

- In an attached sidewalk
- In a parkway area between the curb and a detached sidewalk
- In a curb extension out into the street (which could remove some on-street parking, pending the length of station provided).

These options would depend on the placement of a sidewalk and whether there is on-street parking or a shoulder provided. In choosing a particular configuration, it is important to minimize right-of-way impacts to the extent possible.

4.4 Identify Degree of Passenger Amenities

Finally, once the basic station location and configuration is established, the degree of passenger amenities provided at different stations—whether on the platforms or passenger waiting area—should be identified. Such amenities include the extent of shelter, real-time passenger information, off-board fare collection, security system provision, and whether bike racks are provided. Again, this can be set by policy or ridership projections (boardings and alightings) at stations. In the initial Montgomery County BRT Study, it was decided to use a threshold of 500 boardings per day to trigger provision of more shelter and off-board fare collection equipment. The original concepts presented during that study identified a set of median/side of road stations that may be needed to accommodate boardings/alightings in peak and off-peak directions. In situations where the primary purpose of the station is alightings only, minimal or no passenger amenities could be included.

For the current transitway plan effort, a more refined passenger boarding threshold is presented, reflective of the provision of 1) extensive shelter covering the whole station waiting area 2) use of a smaller shelter(s) with less station waiting area covered, and 3) no shelter where few boardings but primarily passenger alightings are envisioned.

Table 3 presents a matrix that identifies one possible way to classify the extent of passenger amenities at stations – using the extent of shelter (which would be based on policy or ridership projections ridership projections) as the key variable to trigger added passenger amenities. A threshold of at least 500 passenger boardings per day is still used to trigger an extensive shelter treatment, where 50 passenger boardings per day (common threshold used by several transit agencies) would warrant any shelter provision. Where a large shelter would be provided, real-time passenger information, off-board fare collection, security system, landscaping/public art, and bike racks would be provided, while if no shelter is to be provided, perhaps only real-time

passenger information is provided (at all stations, but mounted on a sign post as opposed to within a shelter).

Table 3: Potential Classification of Passenger Amenities at Stations

Extent of Shelter		Other Passenger Amenities				
	Daily Passenger Boardings	Real-Time Passenger Information	Off-Board Fare Collection	Security System	Landscaping/ Public Art	Bike Racks
Large	>500	X	X	X	X	X
Small	50-499	X		X		
None	<50	X				

An example of how specific footprints for on-street side of road stations have been defined can be found in the alternatives analysis for the expansion of the LYMMO premium bus circulator in central Orlando. Figure 13 shows nine footprint classifications developed for the LYMMO circulator. These footprints could potentially be used for the Montgomery County BRT system, depending on the relative location of the station with respect to the street (in a curb extension, back of curb, or in the parkway strip) and the extent of passenger amenities provided (high, medium and low – reflective primarily on the extent of shelter provided). A major difference of the Montgomery County BRT system is that a 120-foot station length is planned, as opposed to the 45-foot length in Orlando. However the basic placement of shelter and amenities is applicable. Decisions on specific station passenger amenity requirements and placement criteria would be finalized as the Montgomery County BRT network advances to later detailed corridor alternatives analysis and design phases.

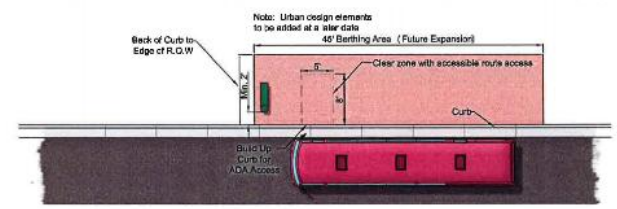
4.5 Identify Final Station Footprint

As noted previously, a 120-foot BRT station length has been established as a basic length for intermediate station locations along a BRT route in Montgomery County. For each station, an assigned station width will be assigned once updated passenger boardings and alightings are identified from the regional travel demand model. A minimum width of 10 feet for side of road stations and 12 feet for median side platforms already has been identified. Certain stations may require a greater width to accommodate a higher number of passengers based on a desired pedestrian level of service on the platform (to accommodate waiting, alighting, and circulating passengers on the platform at the same time, given the extent of platform furnishings within the platform area). Stations requiring more than the minimum platform width will be identified based on required square feet per passenger to meet an identified pedestrian level of service standard, using calculation procedures in the Transit Capacity and Quality of Service Manual, Second Edition.

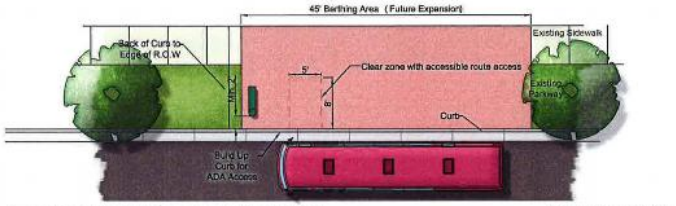
It is important to realize that final determination of specific station locations will occur during subsequent alternatives analysis/detailed corridor planning or preliminary design associated with BRT corridor development. Given the transitway plan is intended to identify right-of-way requirements at this time, a widened station footprint of 120 feet length on both sides of an intersection (from edge of pedestrian crosswalk) is recommended. This would preserve the opportunity to develop either a far- or near-side BRT station once issues of transit signal priority, connecting bus service and major passenger transfer patterns, and physical constraints are further evaluated. The width of the footprint—whether 10 feet, 12 feet, or wider—can be established through the pedestrian level of service assessment mentioned earlier.

Final off-street station footprints will require further assessment of alternate locations based on the required size of parking and bus transfer facilities, and coordination with property owners and adjacent development on integration of such stations into certain locations.

Figure 13: LYMMO Expansion On-Street Station Classifications

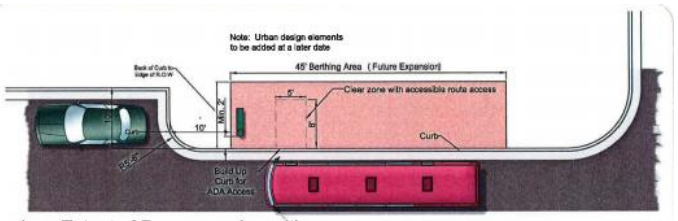


Low Extent of Passenger Amenities

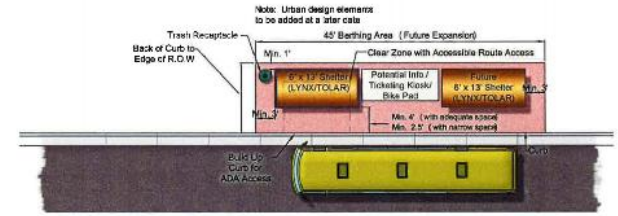


Low Extent of Passenger Amenities

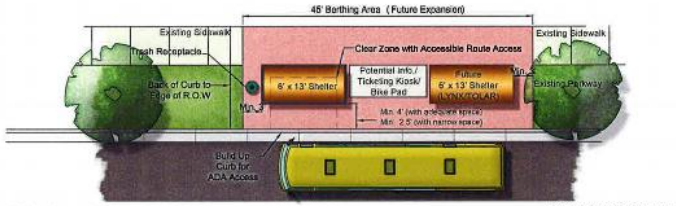
Note: Urban design elements to be added at a later date



Low Extent of Passenger Amenities

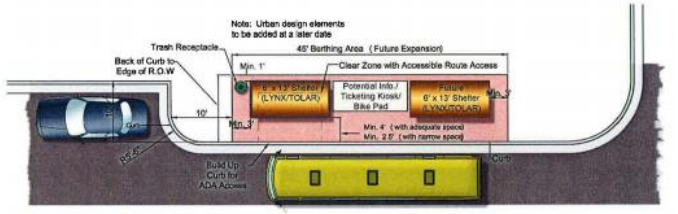


Medium Extent of Passenger Amenities

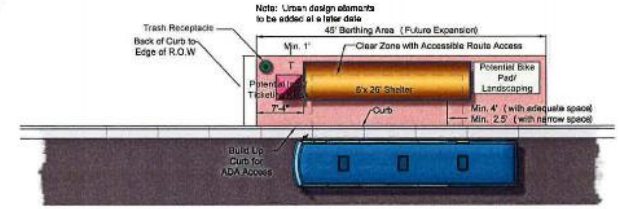


Medium Extent of Passenger Amenities

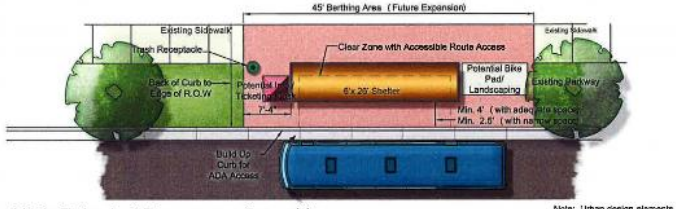
Note: Urban design elements to be added at a later date



Medium Extent of Passenger Amenities

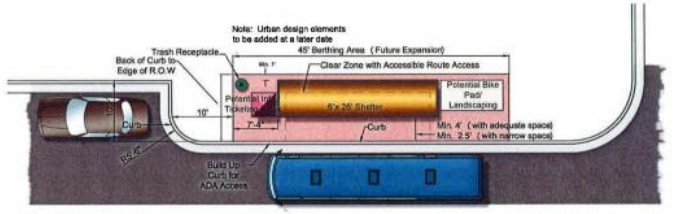


High Extent of Passenger Amenities



High Extent of Passenger Amenities

Note: Urban design elements to be added at a later date



High Extent of Passenger Amenities

Prototypical Layout – Back of Curb Station

Prototypical Layout – Parkway Strip Station

Prototypical Layout – Curb Extension Station