Station and Support Facility Design Guidelines User Guide

A Supplement to the Regional Transitway Guidelines

Metropolitan Council

This document supplements the Station and Support Facility Design discussion in the Regional Transitway Guidelines by providing additional information for topics discussed in the Guidelines.

Table of Contents

1. Introduction

This document supplements the Station and Support Facility discussion in the Regional Transitway Guidelines by providing additional information for topics discussed in the Guidelines. The User Guide is organized into seven sections:

1. Introduction
2. Station Design
3. Station Engineering
4. Station Operations & Maintenance
5. Station Safety & Security
6. Station Costs
7. Transitway Support Facilities

Some topics are discussed in more than one section in this document; review the entire User Guide when looking for information on a topic and remember this information only supplements the Regional Transitway Guidelines. For example park-and-rides are discussed in the Transitway Guidelines and also in sections 2.1.8 and 2.3.7 of this User Guide.

The remainder of this Introduction summarizes existing laws, regulations, standards, and guidance, and identifies several topics that do not otherwise fit within one of the six sections that follow.

1.1. Existing Laws, Regulations, Standards, and Guidance

A number of national, state, and local regulations, standards, and practices presently address transit station design. These include but are not limited to those listed below. Local coordination is essential.

1.1.1. Laws and Regulations

- Americans with Disabilities Act (ADA)
- National Environmental Policy Act (NEPA)
- Federal Railroad Administration (FRA)/Federal Transit Administration (FTA) Joint Policy on Shared Corridors
- Title VI of the Civil Rights Act of 1964
- Minnesota Environmental Policy Act (MEPA)

1.1.2. National/State Design Standards

Design requirements for stations and support facilities should comply with current the State of Minnesota Uniform Building Code, and all laws, ordinances, rules, regulations, and lawful orders of any public entity bearing on the performance of the work. Resource documents in addition to the Minnesota State Building code include:

- *American Public Transportation Association (APTA) Guidelines for Design of Rapid Transit Facilities*
- Relevant American Railway Engineering and Maintenance of Way Association (AREMA) standards and recommended practices
- Relevant American Association of State Highway and Transportation Officials (AASHTO) standards and recommended practices
- Relevant National Fire Protection Association (NFPA) standards and recommended practices
- *Minnesota Manual on Uniform Traffic Control Devices for Streets and Highways (MnMUTCD)*
- *MnDOT Road Design Manual*
- MnDOT State Aid guidance
- State of Minnesota Sustainable Building Guidelines

The Station and Support Facility Guidelines support the use of sustainable methods and materials. APTA defines sustainability as "practices that make good business sense and good environmental sense. It is balancing the economic, social and environmental needs of a community." Relative to transit station design, this means:

"Employing practices in design and capital construction, such as sustainable building materials, recycled materials and solar or other renewable energy sources to make facilities as 'green' as possible." (source: TriMet Design Criteria, rev. January 2010)

As the transit industry continues to advance in this area, the Metropolitan Council supports increased consideration of the long-term benefits of more sustainable techniques in evaluating cost-effective transit facility construction and maintenance. Current national, state, and local design standards, which form the basis for these guidelines, should be considered in this light.

1.1.3. Local Design Guidance

It is the intent of the Regional Transitway Guidelines to support better alignment of transit and land use planning. Information about the region's Corridors of Opportunity initiative, including its vision, principles, and the most up-to-date project deliverables, is available on the Metropolitan Council's website.

The Regional Transitway Guidelines are also intended to support the U.S. Department of Housing and Urban Development's (HUD) six Livability Principles established through the Partnership for Sustainable Communities. More information about the Partnership for Sustainable Communities is available at: http://www.sustainablecommunities.gov/. In addition to these principles, examples of design guidance is available in several local sources:

- *Central Corridor LRT Report for Design Criteria (CCLRT Design Criteria)* and subsequent updates
- *Northstar Corridor Rail Project Design Criteria (Northstar Design Criteria)* and subsequent updates
- Metro Transit LRT Fire Life Safety Code
- All local jurisdictional standards and requirements

- *2040 Transportation Policy Plan*, *Appendix G Transit Standards*
- *Metropolitan Council 2030 Park-and-ride Plan*

Local jurisdictions may also have zoning and ordinance requirements, design guidance and/or local policies relevant to integrating municipal facilities when transit runningways traverse or cross city streets, sidewalks, and bikeways.

1.2. Property Acquisition and Remnant Parcel Reuse or Resale

Where it is determined that property should be acquired for a transitway station or support facilities, and that such acquisition is feasible and cost-effective, such acquisition should follow all applicable local, state, and federal regulations, including NEPA requirements for environmental clearance before property acquisition.

Where remnant parcels are indicated as unneeded, transfer of ownership should also follow local, state, and federal regulations and procedures. The owning entity should consult with local jurisdictions prior to initiating a transfer of ownership as local considerations for connections to the adjacent community and support for transit oriented development may affect the disposition of remnant parcels.

1.3. Context Sensitive Solutions and Transit-Oriented Development

As stated in Guideline 4.1 Guiding Principles, stations and support facilities should be aesthetically pleasing and complement the character of their surroundings. Consistent with the new Federal emphasis on valuing communities and neighborhoods, stations and support facilities should be designed to take advantage of attractive, existing site features, and be compatible with surrounding land uses and development patterns. Where consistent with land use policies, stations can form the nucleus for transit-oriented development (TOD) which strengthens both the surrounding area and opportunities for economic development. Refer to the Metropolitan Council's Guide on Transit Oriented Development and comprehensive planning guidelines for more discussion of land uses near transitways.

1.4. Integration with Existing Systems

When new rail corridors and BRT services are added to the existing Twin Cities transit system, three guidelines should prevail:

- Station elements should be consistent with existing stations, updating with improvements where lessons learned from previous implementation indicates better results can be achieved in passenger information, efficient operation, life-cycle maintenance, and operational costs.
- Station area vehicle requirements should be consistent. Bus fleets from multiple operators should be able to access any bus drop off or layover facility within the regional network of transit stations. One corridor's LRVs must be able to use another regional LRT corridor's stations.
- Vehicles serving BRT corridors will be serviced and stored at bus garages serving non-BRT buses. Garage facilities may require modification to accommodate BRT vehicles, and operating procedures may require revision to ensure consistent and correct assignment of BRT vehicles.

Stations and support facilities should be upgraded with more sustainable elements as technology improvements in lighting, coatings, building materials, and construction techniques become cost-effective.

2. Station Design

Transitway stations fulfill two primary functions: they provide access to the transitway and transit information to customers. To fulfill these functions, transitway planners and designers should carefully consider each station including facilities provided, facility sizing, components and transitway information included, and materials used. Planners and designers should ensure each station fits with and enhances the neighborhood surrounding it in terms of both function and aesthetics.

2.1. Station Facilities

One of the primary functions of transitway stations is the provision of facilities so that transit patrons can access the transitway. All transitway stations should provide:

- Facilities that support access for customers of all ages and abilities
- Facilities that support access for pedestrians and people using wheelchairs or bicycles, including providing bicycle parking
- Station platform(s)
- Waiting shelters for all public transit routes serving the station
- Provision for short-term pick-up/drop-off of transit patrons by shuttle, taxi, etc.

Stations may also include facilities for additional functions listed below. The factors to consider in deciding which additional facilities to provide at each station, if any, are existing and future passenger demand, market needs; transit service plans (transitway and other transit services); capital, operating, and maintenance costs, available right-of-way; and consistency with surrounding development plans and land use policies.

- Transit Center (informally called a hub) - A transitway station may serve as a transit center, which is a place where two or more transit routes make scheduled connections. The center may or may not include transit layover facilities. Transit centers typically serve higher daily passenger volumes as compared to bus stops and have greater investment in the physical infrastructure and amenities.
- Transit Layover - A transitway station may serve as a location where transit vehicles, either bus or rail, layover as they wait to enter service at that location. Bus layover facilities are paved areas, sometimes with separate circulation drives, sized to accommodate the required number of vehicles needed at any one time and their turning requirements. Rail layover facilities are areas of trackage separate from platform-access trackage where trains wait to enter service at that location. Rail layover facilities may be extensions of trackage at the end of terminal stations, or siding tracks adjacent to operating tracks within the transitway.
- Park-and-Ride - A transitway station may include park-and-ride facilities, which provide for daytime (and sometimes limited overnight) parking for transit customers' automobiles and bicycles. A park-and-ride may or may not function as a transit center or include transit layover facilities.

2.1.1. Station Circulation System Hierarchy

Stations include circulation systems, which may include pedestrian, bicycle, bus, auto/taxi pick-up and drop-off, park-and-ride, and bus layover facilities. A hierarchy should be followed to give priority of access – directness of route and proximity to platforms – to transit customers in the following order:

- Pedestrians
- Bicyclists
- Feeder buses and shuttles
- Taxi and auto pick-up/drop-off
- Auto park-and-ride

2.1.2. Pedestrian and Bicycle Access

Special attention should be given to providing convenient and safe access to and through transitway stations for people walking, in wheelchairs, and on bicycles. Bicycle parking should be provided at transitway stations because on-vehicle bicycle storage is limited. Bicycle racks are preferred to lockers except when substantial space and bicycle demand exists because racks provide more storage capacity per square foot and have lower maintenance cost. Covered bike parking and security amenities (such as cameras) may be provided at transitway stations where space and station technology infrastructure are available.

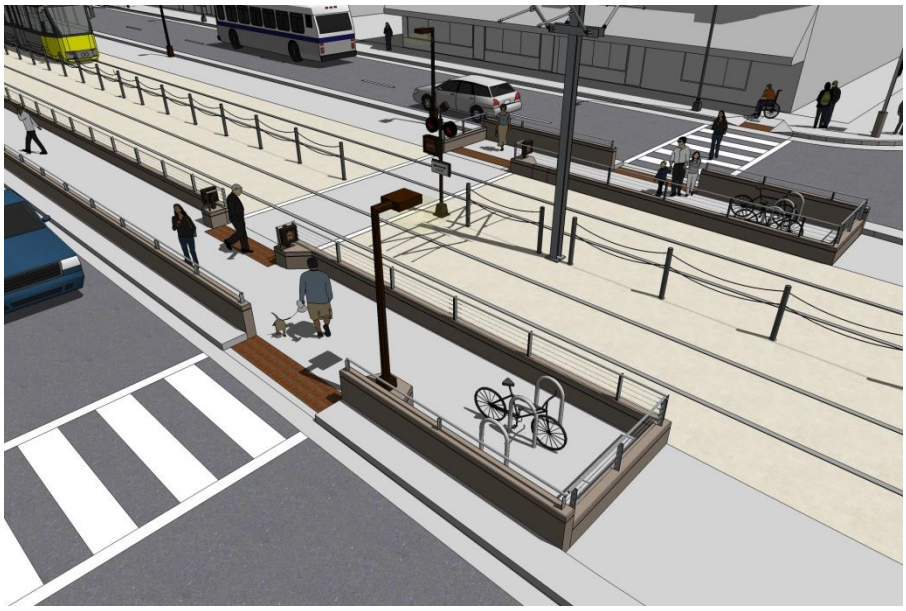
Bicycle and pedestrian access paths to transitway station platforms should:

- Be visible from access drives and parking areas
- Avoid crossing or passing through runningways, vehicular access drives, and parking areas

Pedestrian and bicycle paths should be designed to provide the most direct route, paved, clearly marked, lighted, and buffered to improve bicycle and pedestrian experiences and discourage people

from crossing tracks or roadways in other than designated areas. Transit stations developed as part of TOD should coordinate platform access, sight lines, and safe crossing paths with the development team to maximize transit patron-friendliness within the development. At transitway stations not incorporated into a transit oriented development the maximum walking distance from parking or drop off space to the nearest platform access point should be 1,000 feet *(source: CCLRT Design Criteria)*.

At-grade station access paths, including track and roadway crossings, should be used where feasible and should include improvements. Improved bicycle and pedestrian facilities include features such as more visible crossings using pavement treatments, colors, or markings, pedestrian refuge medians, roadway curb extensions, intersection countdown timers, or crosswalks with passive crossing control. Mid-block crossings between stations and street intersections should be avoided. The Central Corridor LRT figure below illustrates a pedestrian crossing at a non-signalized intersection on University Avenue. For stations in the median of a roadway, access to platforms should be clearly marked and managed with traffic signals at roadway intersections, signage and railing or fencing to discourage patrons from crossing elsewhere. For all types of stations, grade separated bicycle/pedestrian crossings may be considered per the guidance in Section 0.



Source: CCLRT Project Office

Roadway modifications that improve bicycle/pedestrian experiences should also be considered and implemented when feasible. Roadway modifications include features such as adjusted intersection traffic signal timings to accommodate bicycles/pedestrians, additional traffic signals, elimination of conflicting turn movements such as free-right turn movements, and intersection modifications to provide more convenient and safe bicycle and/or pedestrian crossings.

2.1.3. Passenger Waiting Area with Weather Shelter

Together with platforms, passenger waiting areas function as primary features of a transitway station. All transitway stations should provide one or more weather shelters for waiting passengers. Shelters and canopies should be constructed to ADA standards and provide protection for passengers from snow, rain, wind, and sun. Shelters are generally free-standing structures, but may be incorporated into other buildings.

Shelter design should consider passenger safety, passenger comfort, functional similarity, and ease of maintenance. Factors to consider in sizing shelters include average peak period passenger usage, length of average wait time, location-specific conditions such as wind, and optimized sight lines. Shelters may be enclosed (provision of enclosure is discussed in Section 2.2), or may consist of overhead canopy alone, overhead canopy with transparent windscreens, or structures with both roof and transparent walls to permit easy surveillance.

Shelters should be designed to maximize the benefit of overhead radiant heat, where heat is provided. Shelters should not impede passenger circulation and ease of movement to platforms.

At transfer points, sheltered waiting areas should be provided for all connecting transit passengers at the location(s) of the connections. Both the local street level and the trnasitway platform level should be considered equally important when designing two-level stations. As an example, the Franklin LRT station positively integrates the street-level bus stop/waiting area with the LRT station entrance. Waiting areas along local streets for connecting buses should also be designed with clear visibility and sight lines.

2.1.4. Transitway Boarding Areas – Platforms

All transitway stations should include platforms constructed to ADA standards or better that allow passengers to board and alight from transitway vehicles. Platforms may be an existing sidewalk/boulevard like existing local bus stops, or they may be newly constructed facilities dedicated exclusively to transitway service. Due to high costs, grade separated stations should be avoided wherever a feasible at-grade alternative exists.

Table 2-1 illustrates station platforms may be configured as center, side, or split platforms to fit within the station area context. The solid blocks represent the platform and the lines illustrate runningway, which could be rails or a road.

Table 2-1 Transitway Station Platform Configurations

Platform Configuration Type	Center	Side	Split
Illustration			
Local Examples (in 2011)	▪ Downtown Minneapolis LRT stations ▪ Orange Line (I-35W) 46th Street Station ▪ I-394 Louisiana Avenue and Plymouth Road Transit Centers	▪ Northstar Elk River, Anoka, and Coon Rapids stations ▪ Blue Line (Hiawatha) 46th Street and 50th Street/Minnehaha Park stations ▪ Red Line (Cedar Avenue) Apple Valley Transit Station	▪ Blue Line (Hiawatha) American Boulevard Station ▪ Green Line (Central Corridor) Snelling Avenue Station
Number of Platforms	One	Two	Two
Platform Position Relative to Transitway Runningway	Middle – served by vehicles traveling in both directions	Outside – served by vehicles traveling in one direction only	Outside – served by vehicles traveling in one direction only
Platform Position Relative to Each Other	Not Applicable	Directly Opposite	Offset Opposite

2.1.5. Short-term Transit Patron Pick-up/Drop-off

Transit patron drop-off and pick-up activities ("kiss-and-ride") should be expected at all stations and should be considered in the design process. As short-term pick-up activity tends to involve longer wait times than drop-off, off-street areas for pick-up should be provided where needed. Where both bus connections and pick-up/drop-off functions are provided, closest proximity to the platforms should be designed and designated for bus patrons.

2.1.6. Transit Center

Transit patrons may transfer to the transitway from local bus routes at some stations. Depending on the scale of the station and the number of feeder buses connecting at the station, bus drop off areas may be located on adjacent streets or facilitated by surface parking along the runningway. Where both bus connections and pick-up/drop-off functions are provided, closest proximity to the platforms should be designed and designated for bus patrons.

2.1.7. Transit Layover

When a transitway station is also the terminus of a transitway or a feeder bus route, off-street bus layover areas should be provided that include bus access drives and layover area with adequate turnaround space. Bus layover facilities should be provided off-street whenever possible and paved with asphalt or concrete.

Rail layover space may be provided through tail track, station platform space (with track crossovers as needed), or other means.

Bus layover facilities should be positioned so as to not impede passenger functions at a station, including access to station platforms.

Depending on transit service plans, station gates may provide layover parking for buses, provided they do not impede revenue service.

Transit operator restrooms should be provided for at stations which function as layover facilities and at terminal stations. Where provided, such facilities should be as described in the project *Design Criteria* (available from Metro Transit on request). Public restroom facilities are addressed in Section 2.5.6.

2.1.8. Park-and-Ride

Where transitway market analysis demonstrates a need and local policy permits, parking areas for patrons may be provided adjacent to stations. Park-and-ride facilities may be surface lots or multilevel structures. Surface lots are generally preferred for cost reasons, but the type, size, and footprint of the parking facility should be evaluated to achieve the best balance between available space, cost, and funding.

In general, the amount of parking provided at stations is inverse to the density of surrounding land uses; i.e., less parking is provided at stations with higher surrounding populations and employment densities. Urban stations, such as those within the cities of Minneapolis and St. Paul, experience heavy pedestrian, bicycle, and feeder bus demand; park-and-ride facilities do not generally fit within Minneapolis or St. Paul policies or the *2030 Park-and-Ride Plan* and thus are discouraged. Suburban stations are generally located in areas where the development pattern is more widely dispersed, with more customers arriving via auto; park-and-ride facilities are generally recommended where space and local policy permits. Stations in exurban or developing areas usually need park-and-ride facilities as the customer travelshed is generally large and connecting bus service is less available and cost effective than at suburban or urban stations.

The Metropolitan Council's *2030 Park-and-ride Plan* identifies site selection criteria and three common types of land ownership strategies used for park-and-ride facilities: public right-of-way, joint-use opportunity, and private land. The site selection criteria fall into two groups, essential and preferred.

Essential site selection criteria for park-and-ride sites include:

- In lower-density areas with limited local transit service coverage
- On a major highway corridor to a major regional activity center
- Convenient access to the regional highway system, typically within ½-mile of the nearest interchange or intersection accessing the regional highway system.
- Convenient vehicle access into and out of the facility
- Local area factors including community or land use compatibility, environmental constraints, and economic implications.

Preferred park-and-ride site selection criteria are:

- Congested highway corridors

- Upstream of major traffic congestion
- Presence of transit advantages on highway
- Transit travel time to a major activity center
- Good visibility from primary roadways
- Located on inbound side of primary roadway access
- Future expansion potential
- Opportunity for joint use with adjacent development (existing or planned)

Station parking shall include ADA-accessible parking and should be designed to provide the most direct pedestrian paths to station platforms.

2.2. Enclosures at Transitway Stations

All transitway stations should include sheltered waiting areas. Some transitway stations may also include one or more enclosures when justified. Enclosures should be reserved for high volume stations or when station equipment requires protection from the elements. When making the decision between shelter or enclosure at high volume stations, the following should be considered:

- Presence of circulation systems like elevators or escalators that provide access to transitway boarding platforms, such as at stations located in freeway medians
- Stations located within multiuse buildings, such as an airport terminal
- Transit transfer points with a total of 500 or more boardings per day
- Site conditions including spatial constraints like available right-of-way

2.3. Sizing Station Facilities

Transitway station facilities should be sized in accordance with level-of-service C or better capacity standards cited in the project *Design Criteria*, which consider the projected number of customers during peak 15-minute intervals. Site elements such as fare vending equipment should be sized and located so as not to block pedestrian flow. *(source: CCLRT Design Criteria, Sec. 6.4.2.)*

2.3.1. Pedestrian and Bicycle Facilities

Platforms, shelters and waiting areas should be designed with pedestrian and wheel chair users' safety and comfort in mind. Minimum pedestrian/wheelchair path clear width should be 6-feet, with 8-feet preferred. Specific components should be standardized throughout the system, and follow material and maintenance recommendations as described in the project *Design Criteria*.

The number of bicycle parking spaces should be based on anticipated ridership and spatial constraints.

2.3.2. Passenger Waiting Area

A station's public occupancy area consists of all areas in which customers may be allowed to enter. Passengers primarily wait on platforms, but may also wait within other elements of the station such as plazas, ramps, and passageways. Passenger waiting areas should be sized based on Minnesota State

Building Code square footage-based criteria for sizing public occupancy areas for safe exiting. *(source: CCLRT Design Criteria, Sec. 2.2.7.)*

2.3.3. Sheltered Area

Canopied shelter from snow, wind, rain, and sun should be provided to accommodate average peak hour, per-vehicle passenger volume projected for that station and shelter fare vending and validation equipment when necessary. Shelter size will vary depending on passenger loads and typical wait time. Bus shelters should provide a minimum of five square feet per person during peak period use *(source: CCLRT Design Criteria, sec. 6.6.4)*. Rail station shelters should assume an average of approximately 3.5- to 6-square feet per person (*source: TriMet Design Criteria Manual, rev. Jan 2010 Portland OR.)*

At Commuter Rail stations, a minimum of one shelter should be provided on each outbound platform. A minimum of two shelters should be provided on each inbound platform.

2.3.4. Platforms

Station platforms should be located along tangent track or BRT runningway to maximize level boarding capacity and minimize dwell times for transit vehicles.

Elevation - Station platforms for LRT and Commuter Rail will be designed for level boarding, following ADA requirements and the design criteria in the CCLRT and Northstar design documents. Platforms should have at least one elevated, accessible platform for ADA access.

LRT platforms should be one foot, six inches above the top of adjacent LRT rails. Commuter Rail platforms should be eight inches above the top of adjacent rails, except for special ADA circumstances addressed in Northstar design criteria.

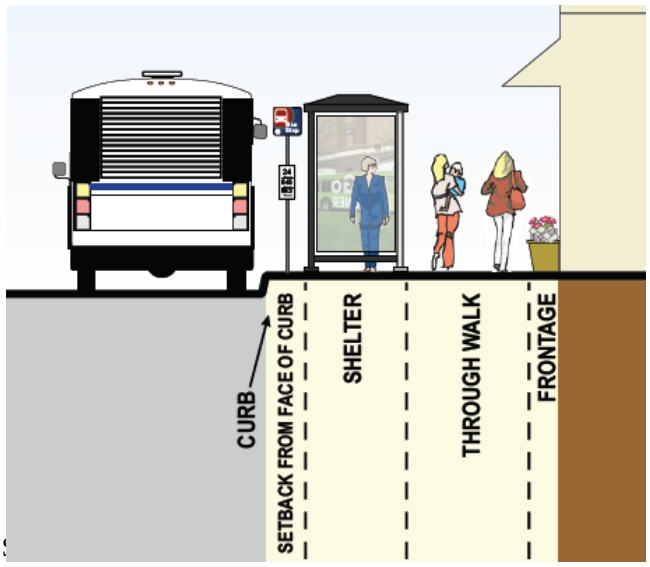
For BRT, station platforms should accommodate all transit vehicles serving the station. Raised curbs should be installed where practical, depending on platform width, stormwater considerations, and ADA requirements. This may allow for level boarding (roughly 13 inches above runningway) or higher curb heights (~ten inches above runningway) to facilitate rapid boarding. Standard curb height platforms (~six inches above runningway) are acceptable for lower volume stations or in constrained rights of way. Higher curbs may be more feasible where curb extensions are constructed. Curb heights should reflect drainage needs and accommodate snow and ice removal.

Width - The desired minimum platform width for LRT platforms should be 20 feet for center platforms (preferred) and 13 feet (12 feet absolute minimum per *CCLRT Design Criteria*) for side platforms. Platform width should include space for a safety barrier along the platform edge opposite the track when there is a grade difference of two feet, six inches or greater, or adjacent to a roadway.

The recommended standard platform width for Commuter Rail platforms is 26 feet for side platforms (13 feet absolute minimum per *Northstar Design Criteria, September 2006*, which includes no space for shelters, lighting, fare collection, etc. on the platform). Platform width should include space for a safety barrier along the platform edge opposite the track when there is a grade difference.

Minimum Highway BRT platform width should be 20 feet for center platforms (preferred for highway on-line BRT stations), 12 feet for side platforms for on-line BRT stations.

Arterial BRT platforms are the boarding areas provided by sidewalks and sidewalk extensions. Ten-foot width is the desirable minimum, but dimensions may vary depending on spatial constraints. For Arterial BRT, ADA requirements (minimum width of eight feet perpendicular to curb) are applicable at both boarding and alighting doors.



and Sidewalks, Chapter 10 Pedestrian Facility Design

For all platform types and all modes, the platform should include a continuous clear space free from surface utility infrastructure and street furniture for the length of the platform. For LRT stations, preferred width from platform edge to obstruction should be eight feet; minimum width is six feet, eight inches *(source: CCLRT Design Criteria, sec. 6.12.3.3)*. For Commuter Rail stations, minimum width is 15 feet from the track centerline to any obstruction more than eight inches higher than the top of rail.

Length - Platform length should correspond to the number of passenger vehicles stopped at the platform at any one time.

For LRT, minimum platform length should be 270 feet, to accommodate a three-car train (consist). Station design must consider through-routing with other routes and accommodate expected train lengths for applicable routes.

For Commuter Rail, each passenger car is 85 feet long. Platform length should be a minimum of 425 feet to accommodate a five-passenger-car train, with expansion capability to 600 feet at a minimum. It should be noted that special event service may require additional platform length, which should be negotiated with the owning railroad.

BRT platform length will vary based on the size of buses and the operating plan for the number of buses concurrently at a station platform. For Highway BRT stations, minimum platform length should be 120 feet to accommodate two articulated buses or over the road coaches concurrently. Arterial BRT will use sidewalks and sidewalk extensions to provide platform or boarding areas. Arterial BRT station boarding areas lengths should be 60 to 80 feet to facilitate boarding at all doors for one articulated or two standard buses, depending on the branded vehicle type(s) to be used for the service.

Platforms may be constructed in stages, but right of way for both platform extensions and runningway alignments to clear expanded platforms should be planned to accommodate future extensions.

2.3.5. Short-Term Transit Customer Pick-up/Drop-Off

Of the functions provided at all stations, short term auto pick-up and drop-off ("kiss-and-ride") is the most flexible. Off-street facilities should be considered and provided wherever feasible. Safety for transit customers, and for adjacent traffic if the drop off is on an adjacent street, should be considerations in allocating space for this function at stations.

2.3.6. Bus Transfers

Space allocated for bus drop-off should be based on corridor service planning for the number of routes concurrently serving the station. Off-street facilities should be considered and provided wherever feasible. Safety for transit customers, and for adjacent traffic if the drop-off is on an adjacent street, should be considerations in allocating space for this function at stations.

2.3.7. Park-and-ride Lots

Parking areas should be sized based on the market analysis methodology provided in Chapter 5 of the region's *2030 Park-and-ride Plan* (Metropolitan Council, May 2010). Surface facilities are preferred, but structured facilities may be needed. Surface facilities may be developed into structured facilities over time as passenger demand and development interest grow. Park-and-ride sizing should include an assessment of opportunity for joint use with adjacent existing and planned developments.

Park-and-ride facilities should have an opening year demand of at least 150 spaces. Facilities with lower demand may not justify a park-and-ride investment and this demand should be accommodated at other larger facilities along the transitway.

2.3.8. Staged Development

The staged development of station facilities to support increases in passenger volumes should be considered in designing and preserving right of way for extensions to platforms and expansions of waiting and sheltered areas. Increased access needs for pedestrians, bicycles, feeder bus, drop-off, and parking where appropriate should also be considered. Staged conversion of surface parking facilities to structured ramps may occur as demand grows and development interest increases. Structured ramps might also be considered for future vertical or horizontal expansion during initial design.

2.3.9. Special Consideration at Specialized Facilities and Major Activity Centers

Specialized facilities and major activity centers hosting large-scale events may require additional consideration in sizing transitway station facilities. Specialized facilities and major activity centers hosting large-scale events include:

- Union Depot in St. Paul and Minneapolis Interchange
- Downtown Minneapolis and St. Paul, including the Capital Complex area
- The University of Minnesota Twin Cities
- Major sports facilities or convention centers such as Target Field, Mall of America Metrodome, University of Minnesota TCF Bank Stadium, and the Xcel Energy Center
- Major shopping/commercial centers such as Mall of America

When sizing station facilities at major activity centers, designers should address the potential for a station's heavier than normal use during special events by considering:

- Proximity to major activity center
- Projected ridership, including average daily, peak-period, and event
- Available space for fully loaded trains or buses

Stations projected to regularly experience heavy patronage during special events may need to provide facilities which exceed system norms.

2.4. Station Materials

Transitway station aesthetics are important and objectives should be accomplished through the choice of context-appropriate, durable, low-maintenance materials which are sustainable. The evaluation of sustainability should consider both a station's function as a high-use, high-traffic location, and Minnesota's natural environment. As an example of context-suitable materials, prairie grass landscaping is sustainable; rose bushes are not.

Materials for transitway station elements are provided in the CCLRT and Northstar design documents. General provisions address standardization for long life and cost-effective maintenance, repair and replacement. Materials should be difficult to deface, damage, and remove. Anti-graffiti coatings may be appropriate. Slip-resistant materials should be considered on passenger walking surfaces to account for snowy and rainy conditions. Readily available, standard materials are preferred. Such materials:

- Are compatible with the climate
- Have consistent wear, strength and weathering qualities
- Are capable of good appearance throughout their useful life
- Can be colorfast or integrally-colored
- Do not soil or stain easily
- Can be easily and cost-effectively maintained with commonly used equipment
- The use of low volatile organic compounds (VOC) and water-based paints and solvents should be considered to reduce the amount of toxic waste to be managed *(source: Transit Sustainability Practice Compendium, APTA, August 2009)*.

2.5. Station Components

Because transitway stations generally serve higher daily passenger volumes, transitway stations typically include greater investment in components. Examples of components discussed below are climate control, lighting, customer seating, fare collection systems, litter receptacles, restrooms, pavement markings, landscaping/streetscaping, and public art.

2.5.1. Climate Control

Radiant heat and passive cooling should be used in all passenger waiting areas at transitway stations. Where heat and/or air conditioning is required for equipment operation, geo-thermal or other environmentally friendly options should be explored taking into account both capital and long-term operating and maintenance cost. Non-waiting spaces in transitway stations such as stairways or overpasses should be vented but not heated or cooled.

2.5.2. Lighting

All stations should incorporate pedestrian, platform, vehicle circulation, and emergency lighting, selected and located to achieve the required illumination level for each element of the facility, consistent with the project design documents. Stations including park-and-ride facilities should also

provide lighting in the parking areas. Lighting level and height should be specific to the needs of pedestrian/cyclist circulation and vehicular circulation, and illuminate any areas of potential hazard. Luminaries should be standard to maintain consistent color and level of light.

Lighting should complement station architecture and surrounding station elements. Special care should be taken to design station lighting and shelters to avoid "spill" light which could negatively affect adjacent land uses. Considerations should include reducing glare to transit operators.

Lighting should be waterproof and vandal-resistant. Lighting fixtures and poles should be designed for ease of maintenance, and readily serviceable by system maintenance equipment.

Consideration should be given to energy-efficient, low-maintenance lighting fixtures such as LED lighting.

2.5.3. Seating

Seating at stations may or may not be an element of waiting area design. Where seating is provided, materials should be selected to discourage use as sleeping facilities, and designed for ease of installation and repair. Seating may be replaced by leaning rails. Where provided, seating placement should prevent access to overhead heaters.

The location of seating should not impede customer access to station platforms. Transitway station seating, if provided, should be controlled by the lead transit organization. Advertising bench contracts may be pursued as part of a coordinated program tailored to the transitway implementation.

2.5.4. Fare Collection Systems

Any fare vending and validation equipment provided at stations should be convenient to passenger use and sheltered when necessary. Ticket vending machines or comparable technology should be provided at all rail stations, and all BRT stations should be constructed to support the inclusion of ticket vending machines.

2.5.5. Litter Receptacles

Blast resistant litter receptacles should be provided at all transitway stations to minimize litter and debris. Litter receptacles may be provided in passenger waiting areas rather than on platforms, based on local conditions with transit authority approval. At Commuter Rail stations, U.S. Department of Homeland Security requirements stipulate a minimum of two litter receptacles on platforms.

2.5.6. Restrooms

Transit operator restrooms should be provided for at stations which function as layover facilities and at terminal stations. However, transitway stations generally should not include public restrooms unless the station is part of a multiuse building or a major transfer point requiring significant wait times.

Where stations are located within, or they themselves qualify as, an assembly area according to the State Building Code, public restrooms may be provided. Evaluation criteria include the number of passengers, and the routine length of wait times of one hour or more. Where public restrooms are provided, stations should be staffed for security and maintenance.

Public restrooms may be included as a local betterment as defined in Guideline 4.11.

2.5.7. Special Pavement Markings

Station site plans should include surface area striping and pavement markings such as required by the MnMUTCD to identify directional paths for station functions. Special pavement markings, which may include pavement texture and/or color changes should be used to indicate areas of special concern, including tactile warning strips of distinct color and/or texture from the platform surface marking the boarding edge of platforms.

2.5.8. Other Components

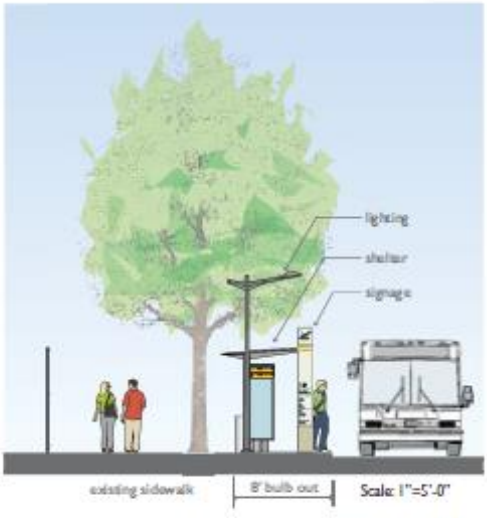
Concessions – Concessions should not be provided at free-standing stations. Concessions may be appropriate and should be considered when stations are incorporated in multiuse buildings

Newspaper vending – Stations may have a designated area for newspaper vending boxes. Where they are appropriate, such boxes should be secured. Vending equipment is prohibited on platforms and should not block passenger entry or exit from platforms or station entrances.

Acoustic treatments – Based on an assessment of benefits and costs, stations may consider acoustic treatment within shelters to mitigate ambient noise, for example, in Highway BRT median stations.

2.6. Landscaping/Streetscaping

Landscaping and streetscaping should be considered in combination with public art, addressed in the following section. Landscaping, streetscaping, and public art seek to enhance station quality and attractiveness. Either technique can support this goal.



Station landscaping includes plant materials, mulch, and irrigation systems. Emphasis should be placed on low-maintenance plant material appropriate to Minnesota climate and soil conditions, including tolerance to sand/salt used to clear paths during winter. Prior to designing for natural plant material, irrigation needs should be considered; irrigation, an alternate engineered irrigation system, or an interagency agreement regarding watering is required where irrigation is essential to the life of the plants. Plantings that require no additional irrigation other than rainfall once the material is well-established are preferred. Landscaping that can assist in passive cooling or wind blockage to improve passenger comfort in waiting areas should be considered. Passive drainage, tied to stormwater maintenance wherever feasible, should be provided.

Station streetscaping (hardscape) may substitute for plant material or public art where streetscaping is more effective at enhancing the quality of the station area. Streetscaping elements should appropriate to the individual station setting, consistent with the surrounding community context, and cost-efficient to maintain.

Both landscape and streetscape design should:

- Provide clear sight lines which do not impede visibility to transit waiting passengers and transit vehicles in the runningway

- Avoid creating areas of concealment
- Avoid interference with pedestrians, bicycle, bus, and auto paths.
- Discourage vandalism
- Be easily accessible for maintenance

Landscaping within the above criteria which can assist in passive cooling or wind blockage to improve passenger comfort in waiting areas should be considered.

Streetscaping should:

- Be designed to complement surrounding community context
- Avoid interference with required traffic control and MnMUTCD provisions
- Avoid elements requiring non-standard maintenance procedures

Consistent with Federal Highway Administration (FHWA) guidelines, the cost of landscaping and streetscaping should be no more than five percent of the above-ground construction cost (i.e., the percentage should not be associated with the cost of underground utility relocation).

2.7. Public Art

Public art may be included at transitway stations. Funds spent on the art component of projects should be appropriate to the overall costs of the transit project and adequate to have an impact. These costs should be all-inclusive and generally should be at minimum one-half percent of construction costs, and should not exceed five percent of construction costs, with larger percentages typically associated with lower cost projects (*source: FTA Circular 9400.1A: Federal Transit Administration Design and Art in Transit Projects, June 1995*). The region currently spends one-half to one percent of a station's cost on public art. Where possible, public art should be integrated into the functional elements of the station. The station railing at the 50th Street LRT station on the Hiawatha line is an example of effective public art as an integral station element.

Above the level stipulated in funding agreements, additional public art may be included as a local betterment as defined in Guideline 4.11.

2.8. Transitway Passenger Information

One of the primary functions of transitway stations is the provision of transit information in and around station areas. Signage should incorporate the transitway branding scheme per direction in the Identity and Branding Guidelines. The placement and general content of signage should be consistent within station areas whenever possible. Signage should be designed to clearly guide passengers to and through the station and its functions, including passengers who are not familiar with the transit system, with disabilities, who are non-English speakers, and/or who are non-readers. Signs and graphics in transitway stations should be consistent with ADA, AASHTO, and MnMUTCD standards.

Station signage should offer system-wide consistency in materials, finishes, and placement to discourage vandalism as well as withstand normal wear. Signs may include some or all types of signage:

- Static: permanent signage of text and graphics/maps

- Changeable/Variable: printed information on routes, service times which may change and be updated by replacing hard copy material within protected display areas
- Real-time: electronic information providing current information on next train or bus, route number, and emergency conditions

In general, at least one variable message sign per station is recommended; real-time information may or may not be provided within that signage, as transit system information technology becomes available cost-effectively.

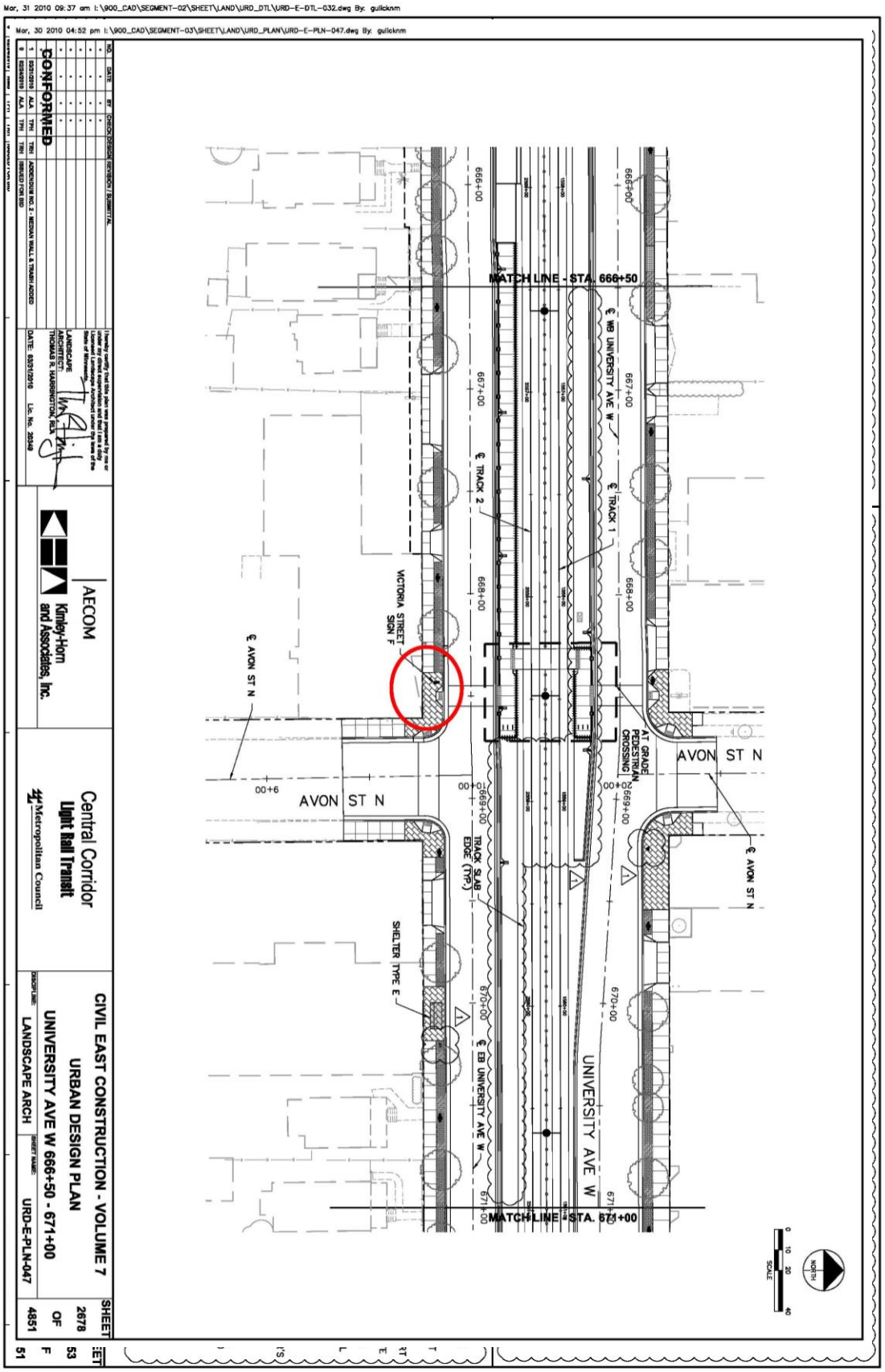
Station areas should include both route and service time information for transit customers. Route identification, route and system maps, schedule information, and rider alerts should be provided within weather-proof kiosks or protected but visible portions of shelters. Schedule information may be static or real-time. Real-time information should be provided at high-volume stations wherever site conditions allow. Station areas may also include information regarding prohibited behaviors.

Station areas should include wayfinding information within the station area to platform entrances and exits, bicycle parking areas, bus drop off, short-term pick-up/drop- off, and, where provided, park-and-ride facilities. Station areas may also include wayfinding signs directing passengers to nearby public facilities that are permanent, major civic attractions in proximity to the station. Examples include City Hall, the State Capitol, museums, and other nearby transit facilities. Where budget permits, wayfinding signs may also include other major civic attractions such as nearby parks, recreational trails, stadiums, and public event centers close to the station. Wayfinding within the station area to businesses or other types of attractions nearby may be included as a local betterment as defined in Guideline 4.11. Wayfinding information may also be provided outside station areas to direct transit customers to nearby transitway stations.

The number and placement of LRT, Commuter Rail, and Highway BRT station signage should be consistent with provisions described in the project *Design Criteria* (available from Metro Transit on request). As an example, the Central Corridor LRT project budget provided for a minimum average of six wayfinding signs per station. The majority (generally four) are focused on station access at the nearest signalized intersection, with the remaining two signs on either side of the station access at an unsignalized intersection.

The figures which follow illustrate several wayfinding sign details from the Central Corridor LRT design documents.

At Arterial BRT stations, passenger signage should be distinctive to the Arterial BRT service. Arterial BRT station signage should be positioned to both signal the location of access to the service, and to identify the boarding location(s) at the station within the sidewalk area, extension or bulb-out serving as the station platform. Station signage should be closely coordinated with the local jurisdiction for clarity within neighborhood-scale commercial Arterial BRT corridors, which typically have multiple visible elements.


MATCH LINE - STA. 666+50
MATCH LINE - STA. 671+00
WB UNIVERSITY AVE W
EB UNIVERSITY AVE W
UNIVERSITY AVE W
TRACK 1
TRACK 2
AVON ST N
VICTORIA STREET SIGN F
AT GRADE PEDESTRIAN CROSSING
TRACK SLAB EDGE (TYP.)
SHELTER TYPE E
666+00
667+00
668+00
669+00
670+00
671+00
SCALE
NORTH
CONFORMED
AECOM
Kimley-Horn and Associates, Inc.
Central Corridor
Light Rail Transit
Metropolitan Council
CIVIL EAST CONSTRUCTION - VOLUME 7
URBAN DESIGN PLAN
UNIVERSITY AVE W 666+50 - 671+00
LANDSCAPE ARCH
URD-E-PLN-047
SHEET 2678 OF 4851

2.9. Pedestrian/Bicycle Overpass/Underpass

Special attention should be given to providing convenient and safe access to transitway stations for customers on foot, in wheelchairs, or traveling by bicycle. Grade-separated bicycle/pedestrian crossings may be considered where there is no technically feasible at-grade crossing option, where benefits to the broader transportation system are shown to be significant, or where required by the runningway's owning entity (e.g., railroad). Evaluation criteria that should be considered when assessing the need for grade-separated crossings include (*source: Design and Safety of Pedestrian Facilities: A Proposed Recommended Practice of the ITE, Chapter 10, "Grade Separated Crossings", Dec. 1998):*

- High pedestrian volumes
- High numbers of pedestrian or bicycle crashes
- Long pedestrian crossing distances
- Presence of poor sight distance to see crossing transit customers
- Roadway average daily traffic volumes of more than 35,000 and 80th percentile speeds documented at more than 40 mph
- Distance of greater than 600 feet to the nearest alternative safe crossing (i.e., controlled intersection or existing over-/underpass)
- Potential to coordinate with adjacent facilities such as a bike trail or sidewalk system

If an at-grade crossing is feasible, provision of a grade-separated bicycle/pedestrian crossing may be included as a local betterment as defined in Guideline 4.11.

Where required, a pedestrian/bicycle overpass or underpass structure should meet national, state and local clearance requirements of the affected highway, intersection, or rail line. Any over-/underpass should also be on the normal path of travel whenever possible, and if not possible, use of fences, median barriers, railings, or other barriers may be needed to prevent transit customers from crossing tracks or roadways at locations they believe to be more direct.

The FHWA also provides a *Pedestrian Safety Guide and Countermeasure Selection System* (http://www.walkinginfo.org/pedsafe/pedsafe_selection.cfm). Countermeasures recommended in that FHWA tool include narrowing the roadway, reducing the number of lanes, adding curb extensions, adding pedestrian crossing medians, and providing pedestrian crossing signals.

Pedestrian/bicycle over-/underpasses should be open only during transitway service hours unless the over-/underpass is part of a multiuse facility (e.g., trail, sidewalk system, or building). Special conditions will apply when an over-/underpass connects to a building. Buildings may be locked during non-business hours, which may restrict the availability of any over-/underpass for transit customers. Over-/underpass hours of availability should be considered early in the transitway design process.

2.9.1. Sizing and Visibility

Pedestrian/bicycle overpasses should be sized in consideration of factors including roadway authority or railroad requirements, ADA requirements, projected peak-period patronage, direction of customer access, relationship to park-and-ride facilities, and other relevant factors. A minimum overpass

walkway width of ten feet should be considered to accommodate concurrent pedestrian traffic in both directions. Underpass width should consider the same factors, but an increased width and higher level of lighting should be provided for customer comfort and security.

2.9.2. Enclosure

Pedestrian/bicycle overpasses should be constructed with protective guardrails and fencing. In determining whether an overpass should be covered or enclosed, factors to consider include the following:

- Volume of pedestrian and bicycle transit customer usage
- Snow removal requirements and constraints (e.g., requirements to carry snow off an overpass rather than plow it off)
- Length and climate conditions of the facility to be overpassed (e.g., wind shear over a river or freeway)

Where functional and maintenance needs do not indicate a cover or enclosure is necessary, a community may opt to cover or enclose a pedestrian overpass and the enhancement would be considered a local betterment as defined in Guideline 4.11.

2.9.3. Climate Control

Non-waiting spaces in transitway stations such as pedestrian/bicycle overpasses and underpasses should be vented but not heated or cooled.

2.9.4. Lighting

Lighting should be provided in pedestrian/bicycle overpasses and underpasses to achieve required illumination levels for the safety and comfort of station users. Lighting components should be selected for ease of maintenance and cost-effectiveness. LED lighting should be considered.

3. Station Engineering

3.1. Coordination with Property Owners

Stations should be constructed on property owned by a public entity wherever possible. The lead agency should proactively communicate and coordinate with the property owner and directly adjacent property owners. Property owners may be residents, businesses, roadway authorities, institutions, public jurisdictions or agencies, or railroads.

The coordination process should be structured, transparent, and continuous throughout the station planning, design, and construction process.

3.2. Right-of-way Requirements

Right-of-way requirements for transitway stations should be identified during the facility planning process and no later than the conclusion of preliminary engineering. In determining right-of-way requirements, the lead agency should consider:

- Station functions to be provided

- Minimum and desired spacing for each station function
- Access paths/drives from roadways and trails
- Utility relocation requirements
- Drainage requirements, which may include holding ponds
- Other factors as appropriate

Property acquisition and disposal is discussed in Section 0.

3.3. Station Access from Local Street Network

Station access from the local street network should be a primary consideration in transitway station design to maximize convenience for transit customers and minimize adverse impacts on the neighborhood street, sidewalk, and bikeway network. Regardless of the presence of transit transfer and/or park-and-ride functions, drive access will be necessary for shuttles, taxis, short-term auto drop off, and station maintenance functions. Drive access should be designed to maintain the station's internal circulation hierarchy.

Where the drive access for either autos or buses is limited to drop-off along an adjacent roadway, space should be identified along that roadway to accommodate those functions. Special attention should be paid to avoid inhibiting access to adjacent property access points such as driveways and loading areas.

3.4. Bus Turning Radius, Staging Requirements

At minimum, transitway stations which provide a bus transfer or layover functions should be designed with spatial requirements and turning radii to accommodate both standard and articulated buses. Wherever feasible, stations with layover facilities should also be designed to allow over the road coaches.

3.5. Utility Relocation

Procedures and criteria governing design for the provision, consolidation, relocation, adjustment, protection, or other work related to public and private utilities necessary to accommodate transitway stations are provided in the project and state and local roadway design documents.

In addition to following the criteria in those documents, as recommended by APTA, the lead agency should demonstrate environmental stewardship by pursuing partnerships with local utilities to:

- Assess opportunities to reduce the total carbon footprint of the station
- Partner on projects that result in utility investment in alternative technologies that reduce station energy consumption
- Seek opportunities to consume and store energy during off-peak periods
- Optimize public investment in shared infrastructure

3.6. Roadway/Street Reconstruction Standards

Roadways which require reconstruction to implement a transitway station shall be reconstructed to the required standards of the owning roadway entity. Special attention should be given to providing convenient and safe at-grade accommodations for transit customers crossing roadways on foot, in wheelchairs, or on bicycle.

3.7. Pedestrian Control

Consistent with the station circulation priorities noted previously, pedestrians should be provided with the closest, most convenient boarding area access. Pedestrian paths should avoid crossing or passing through transitway runningways, vehicular access drives, and parking areas wherever possible. Where such crossings are necessary, best design practices for pedestrian hazard notification and crossing design should be followed. Pedestrian refuge areas should be provided where appropriate.

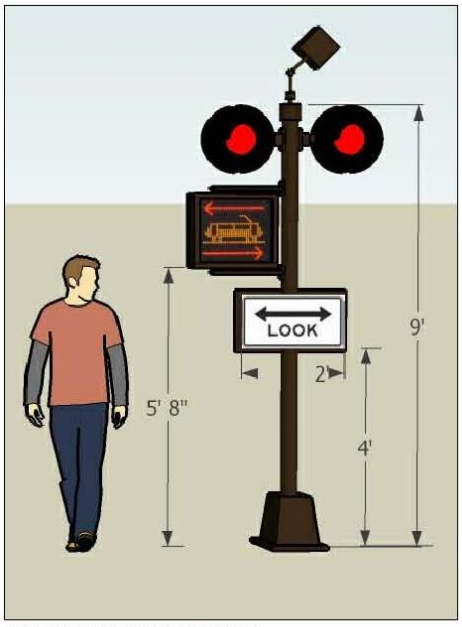
3.7.1. Gate Infrastructure

Pedestrian crossing gates should be provided at transitway stations based on an evaluation of specific conditions at individual stations. As a rule, pedestrian crossing gates separate from full roadway intersection control gates should not be considered standard.

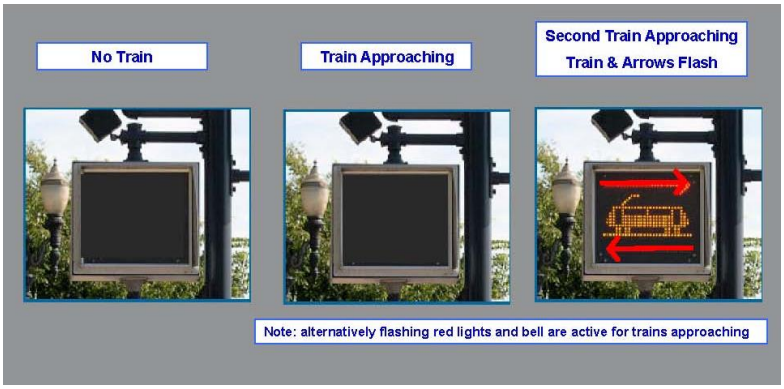
3.7.2. Active Warning Systems

Active warning systems for pedestrians should be provided at transitway stations based on an evaluation of specific conditions at individual stations. As a rule, systems separate from full roadway warning systems should not be considered standard.

The figures below illustrate active warning devices for pedestrian and bicycle crossings at stations.



ACTIVE WARNING DEVICE



Train Warning Sign with Second Train Warning

3.8. Signal System

Traffic and pedestrian crossing signals should follow MnMUTCD standards and be coordinated during the design phase with the jurisdictional authority, to give transit customers safe, clearly indicated, and convenient access to transitway stations.

3.9. Station Fencing

Arterial BRT stations should not include fencing, as this type of transitway is intended to provide ready access from adjacent pedestrian facilities such as sidewalks. LRT, Commuter Rail and Highway BRT station platforms should be fenced on the side not used to access the transitway at median stations, and where significant grade changes exist at side platforms. For these types of transitways, median and split side station areas should also include fencing to guide pedestrian crossings to authorized areas only. Fencing at Commuter Rail stations is required between tracks to prohibit uncontrolled crossings.

3.10. Energy Conservation

Station design should incorporate features and materials which conserve energy, are low-maintenance, and cost-effective to construct and repair. Such features may include materials compatible with the climate, LED lighting, passive solar lighting and heating, or comparable advances in these technologies.

3.11. Parts Standardization

Transitway station materials should be standardized as much as possible for cost-effective repair and replacement. The “family of parts” approach is recommended to use low maintenance materials and minimize life-cycle costs. Coordination between transit operators to standardize station parts is recommended.

4. Station Operation and Maintenance

The upkeep, repair and replacement of all station elements should be considered in designing station components, include landscaping, pavement, signage, structures, etc.

4.1. Opportunities for Shared Facilities

Where stations can be incorporated into existing facilities, such as commercial or public building frontages, operating and maintenance agreements should be developed with affected property owners.

4.2. Power Source and Backup Power

For LRT, Commuter Rail, and Highway BRT, each station should have its own power service, as stipulated in the *Northstar Design Criteria*. Arterial BRT stations may be powered via an adjacent electrical service, should be coordinated with the utility owner, and provided in accordance with the owner's standards.

Power should be sufficient to provide well-lit entrance and exit points for pedestrian access and egress to the station. Back-up or alternative power should be provided at stations to preserve safe lighting, communication operation and other safety-sensitive equipment such as gate crossing arms. Stations should be designed for power source redundancy, such that if power goes out at one station, those on either side provide enough to cover the outage.

4.3. Snow Clearance/Removal

Each circulation system (pedestrian, bicycle, auto, and bus paths and drives) within a transitway station should be designed to accommodate snow clearance and removal equipment. This factor should be considered in designing pavement treatments for pedestrian and bicycle paths, in particular, which do not require the pavement strength of driving surfaces.

4.4. Signage Maintenance

Directional, route information cases, and wayfinding signage should be designed following MnMUTCD and local jurisdictional guidance using the "family of materials" approach and efficient installation techniques for cost-effective maintenance and low life-cycle costs. Sign fixtures and poles should be no more than 40 feet high to permit servicing by a bucket truck. *(source: CCLRT Design Criteria).*

4.5. Litter Removal

Litter removal is a function of the transit agency for Commuter Rail, light rail, and Highway BRT where access to stations is restricted. Litter removal at Arterial BRT stations should be provided by interagency agreement.

4.6. Route Information Updates

Kiosks and other signage for route information should be designed to allow a single maintenance employee to change out information alone, including in harsh weather conditions (*source: CCLRT Design Criteria).*

4.7. Cleaning Standards

Cleaning should be facilitated and cleaning costs reduced by selecting the types of materials noted in Section 2.4. Surfaces should be selected for easy cleaning in a single operation with the use of standard equipment and cleaning agents.

Where custodial facilities are provided, such as in maintenance and layover facilities and/or terminal stations with operator restrooms, the custodial facility should have one mop sink with hot and cold running water, one hose bib, and a floor drain.

Environmentally-friendly cleaning products are recommended.

5. Station Safety and Security

Transitway stations should be designed to promote a safe, secure, and comfortable environment for patrons. This includes consideration of the application of the principles of crime prevention through environmental design, the performance of Design Reviews and Hazard, Threat, and Vulnerability Analyses, and provision of station based communications and preparation for emergencies.

5.1. Design Review Process

In addition to implementing the principles of crime prevention through environmental design, an evaluation should be conducted during the station design process to identify any elements which might a) inadvertently compromise the overall safety and security of the station area, and b) result in less than optimal long-term operating and/or maintenance requirements.

Sustainable options for station elements should be considered as technology improves the cost-effectiveness of more environmentally friendly materials and construction techniques.

Elements to be evaluated during station design review include:

- Sight lines for safety
- Unconstrained, unblocked access to platforms, entrances and exits
- Signage legibility
- ADA accessibility to all station elements
- Appropriate lighting
- Appropriate pavement markings
- Adequate vehicular turning radii
- Appropriate crossing locations, signage and surfaces
- Adequate roadway, pedestrian and bicycle access. Special attention should be given to providing convenient and safe at-grade crossing accommodations for transit customers on foot, wheelchair, or bicycle.

5.2. Hazard, Threat and Vulnerability Analysis

Consistent with the requirements of both FTA and FRA, the transit operator should conduct a detailed risk assessment to pinpoint the possibility of hazards and potential areas of vulnerability within the station. The methodology should identify potential hazards related to persons (employees, passengers, pedestrians, and members of the general public), trains, buses, equipment, autos, and first responder vehicles which may use as station.

A detailed risk assessment assigns a level-of-risk (frequent, probable, occasional, remote, and improbable) and a level-of-hazard (negligible, marginal, critical, or catastrophic**)** to each identified hazard. Each of the risks identified should then be assessed to determine the potential for damage to property, personnel, and operations. Based on the level-of-risk and the estimated probability of the identified hazard occurring, priorities should be set to mitigate hazards. Recommendations to eliminate or control hazards should be identified and documented.

5.3. Crime Prevention through Environmental Design

The principles of crime prevention through environmental design should be used in the design of all stations, bus stops, park-and-ride lots, and other passenger facilities. Physical features and activities should be organized and placed in a manner that maximizes visibility and positive social interaction. Examples include using windows and open, transparent design to increase natural surveillance of spaces; avoiding blind spots and proving well-lit pathways, stairs, entrances/exits and parking areas; and keeping lighting, landscaping and fencing at appropriate heights and designs to maintain visibility. Access points should be limited and clearly identifiable, and design elements should be used to control the flow of people through the space. Design elements can also be used to naturally define public, semi-public and private space. Proper maintenance (both cleaning and repair) is a very important tool for minimizing vandalism and maintaining a sense of security. A good source of information is the International CPTED Association (www.cpted.net).

5.4. Station Based Communication

Transitway stations should include public address systems, closed circuit television, and emergency telephones.

5.4.1. Audio

LRT, Commuter Rail, Highway BRT stations, and whenever feasible Arterial BRT stations, should include a public address system, including both speakers and signs, to convey information to persons with disabilities in compliance with ADA requirements. Speakers and signs should be positioned to be clearly audible/visible, but not readily accessible to the public.

5.4.2. Video

LRT, Commuter Rail, Highway BRT stations, and whenever feasible Arterial BRT stations, should be equipped with closed circuit television to record activity, at a minimum, at ticket vending areas and platforms. Camera locations should be coordinated with the locations of other equipment such as lighting, audio equipment and signage. Cameras should be visible to the public, but not readily accessible.

Closed circuit television coverage will be operated and maintained in central control facilities.

5.4.3. Telephone

LRT, Commuter Rail, Highway BRT stations, and whenever feasible Arterial BRT stations, should incorporate an emergency telephone on or near the platforms for communication with the central operations center for that mode and emergency services. An emergency telephone is also recommended on every level of structured park-and-ride facilities, located near elevators.

Public telephones should not be provided at any station.

5.5. Training and Emergency Preparedness

Access to transitway stations in an emergency should be a design consideration. Coordination with emergency responders should be established and maintained via a documented plan developed with the concurrence of all agencies with jurisdiction over facilities adjacent to or connecting with transitway stations. Coordination should include ensuring access to transitway stations in emergency situations.

6. Station Costs

6.1. Capital

Capital costs should be estimated based on the one-time cost to build the stations. However, capital cost elements should take into consideration the life-cycle costs to operate and maintain each element before finalizing the station's elements.

Capital cost estimates should be developed consistent with the FTA's Standard Capital Cost (SCC) organization, unless the organization with governance over the funding of the system establishes another approved methodology. FTA SCC estimates address the following station elements:

- Platforms
- Shelters
- Canopies
- Fixtures
- Elevators/escalators/stairs
- Auto parking lots/structures
- Bicycle parking facilities
- Access drives/paths
- Sitework and special conditions (eg. demolition, clearing, earthwork; soil and water remediation, environmental mitigation, roadway/intersection/sidewalk reconstruction, landscaping, fencing, and lighting)
- Communication systems
- Fare collection systems
- Traffic signals
- Right of way acquisition
- Property relocation
- Professional services (eg. Engineering, project management for design and construction, insurance, legal, permit fees, surveys, and soil testing)
- Finance charges

Capital costs should include contingency estimates for each item, appropriate to the level of design development and precision.

6.2. Operating and Maintenance

Operating and maintenance costs for stations should be incorporated into overall corridor operating or service plans. To identify those costs applicable to the operation and maintenance of stations themselves, the following should be considered:

- Labor costs for cleaning, and snow clearance personnel
- Labor costs for updated service/route information
- Utility costs for lighting, signage, communication, plumbing where restrooms are provided, and refuse removal
- Replacement parts, materials, and cleaning supplies
- Insurance

7. Transitway Support Facilities

The need for transitway support facilities should be identified during transitway planning and design to ensure that adequate facilities are provided for these functions. Transitway support facilities should address daily vehicle storage and cleaning, major vehicle maintenance, central system control, and/or rail systems maintenance. Other elements of runningways, including power substations and traffic signals, are discussed in the Chapter 5: Runningways.

7.1. Support Facility Requirements

Transitway support facility design should comply with all laws, rules and regulations cited earlier in this document, and local ordinances governing support facility locations.

All transitway support facilities should fit in with and enhance the neighborhoods surrounding them today and in the future. Transitway support facilities should be functional, attractive, cost-effective, and generally consistent by transitway mode across the region. The requirements within support facilities should be based on the specific program identified for each facility. For a stand-alone support facility, planners and designers should consider the following:

- Exterior - materials should be selected based on attractiveness, durability, and low-maintenance needs
- Interior - materials should be durable and low-maintenance
- Structural – materials should be approved for fire-resistant construction, snow build up/loads, floor loads, wind loads, and seismic forces
- Lighting – appropriate to the functional needs to be lit within and surrounding the support facility

- Acoustics – noise-generating equipment should be located away from office areas and should be insulated to reduce noise transmission. Acoustics should be a major consideration when buffering the facility from non-industrial land uses such as residential and commercial uses

Major maintenance facilities for LRT and Commuter Rail should include a drop table to provide the ability to remove and replace wheels on a train (source: Northstar Maintenance Superintendent).

Support facilities should be enclosed by a perimeter security fence. The fence should be a minimum of six feet high and of chain-link or other approved material and type (*source: Portland TriMet Design Standards, Jan 2010*).

7.2. Layover and Turnaround

Sufficient space should be provided at vehicle storage and maintenance facilities to accommodate the bus or rail fleet planned to use the facility. Both internal and external space requirement should be considered in identifying the layover and turnaround facility needs. Planners and designers should consider the following:

- Level rail car storage areas – including paved access aisles between the tracks to allow safe movement of workers around trains
- Rail run-around loop (track) – to allow railcars multiple access points to the functions of the facility
- Parking – for employees and visitors
- Storage building(s)
- Outside storage areas
- Fire protection systems
- Yard lighting
- Security
- Refuse/recycling collection
- Landscaping
- Vehicle wash facility
- Administrative area

7.3. Control Center Expansion Needs

As additional transitway corridors come on-line, the capacity of the central control center(s) to accommodate staffing, communication equipment, and other administrative space needs should be evaluated.

7.4. Redundancy

Transit support facilities should be equipped with backup systems for electricity, water, and communications.