

Part 700 Public Transportation and Guidelines

Section 701 General

The Oregon Department of Transportation is committed to providing a multi-modal transportation system. As a part of this system, public transportation needs should be examined during all phases of a project. When ODOT sponsored projects are proposed for state highways where transit facilities exist or are proposed, project teams should work with the local transit agency and other local agencies during the planning and preliminary design process to ensure early consideration of transit needs, to ensure an integrated transportation system, and to ensure that design conflicts are resolved early. Likewise, when local transit agency projects are proposed on state highways, the local transit agency design team needs to work with ODOT design personnel to ensure design conflicts are mitigated in an equitable manner to minimize impact to the state highway. Future needs of the state highway system need to be considered in addition to current design conflict mitigations.

Consultation with the local transit agency is critical to ensure appropriate placement and design of transit facilities. Each public transportation provider has unique needs which should be identified and addressed by the project development team working with the Regional Transit Coordinator. The project leader should involve the Region Traffic Engineer and landscape architectural staff when necessary.

This section of the Highway Design Manual provides guidance to designers for integrating good public transportation design practices into projects. This is especially important in urban settings. The best practices outlined in this section are intended to provide consistent guidance for all designers working on ODOT projects, as well as local agency projects and developer projects. The designs provide a basis for designers to develop interaction with local interested parties during project development.

The design criteria are consistent with American Association of State Highway and Transportation Officials (AASHTO) standards. As with all engineering designs, they must be applied using sound engineering judgment. The objective is to ensure efficient, cost-effective facilities that meet the needs of the traveling public, transit agencies, and the community.

Section 702 Design Considerations

Public transportation designs must consider a variety of issues:

1. **Yield to Bus Law** - ORS 811.167 gives a bus the right of way after stopping to receive or discharge passengers if it is displaying a standardized sign that flashes "YIELD." This law influences the decision of the local jurisdiction and ODOT to construct either bus pull-outs or curbside stops.

2. **Bus Priority System** - ORS 184.619 and 810.260, 815.445, and OAR 734-020-0300 through 0330 relate to the use of signal preemption devices and traffic control signal operating devices. These systems can provide arriving buses the capability to alter the timing (but not the sequence) of green intervals. The preemption standards consider the safety and efficiency of emergency, bus, and general traffic operations, and the requirements for traffic signal maintenance. Any signal design in a project area with existing or future transit facilities needs to consider the impacts of these laws. Discussions with the local transit agency will result in identifying the need for bus priority signalization. The installation of a bus priority system must be approved by the State Traffic-Roadway Engineer. Consideration must be given to the impact on intersection operation if bus priority systems are proposed. Future amenities such as bus arrival displays that may require additional design elements such as conduit or pedestal locations should be considered in transit designs.
3. **Americans with Disabilities** - Public transportation provides service to persons with disabilities. Designs need to address the requirements of people who have mobility, vision, or hearing impairments. Designs must comply with the requirements of the Americans with Disabilities Act (ADA) of 1990. See Part 800 for additional requirements.
4. **Safety and Personal Security** - Design considerations include safety elements such as pedestrian access, passenger visibility, and traffic impacts, and personal security elements such as lighting, nearby development, and open areas. Passenger safety and personal security play significant roles in attracting transit ridership.
5. **Local Differences** - Each local jurisdiction or public transit agency has different requirements. All new public transportation facility designs should be coordinated with the local interested parties to ensure they are compatible with the local transportation system and coordinated public transit-human services transportation plans.
6. **Modal Connectivity** - Public transportation designs need to consider connections to other modes. For example, park-and-ride designs should be reviewed for transit accommodations; bus stop locations should consider connections to light rail and intercity facilities; and pedestrians and bicyclists should have safe, accessible routes to bus stops.
7. **Urban vs. Rural Design** - Public transportation facility designs for rural areas will have needs that vary greatly from the urban system needs. Roadway width, design speeds, and bus stops without curbs and/or sidewalks are just a few examples of the issues that may differ between urban and rural settings.
8. **How Do Transit Needs Change Over Time** - Communities change over time and the transit needs of these communities change as well. Transit stops may need to be relocated. Different modes of transit may be installed in the area. Routes may increase or decrease in ridership. New routes may need to be added. Designers need to communicate with the Regional Transit Coordinator, local transit agency and/or review

of local transit planning documents to determine future impacts to both the highway system and the transit system.

Section 703 Transit Stops

703.1 Bus Stops

The spacing, location, and design of bus stops significantly influence transit system performance and ridership. Bus stops should utilize sites which maximize transit efficiency, encourage safe pedestrian crossings, offer proximity to activity centers, satisfy the general spacing requirements, minimize the disruption to other street traffic, including bicycles and provide convenient connections to other modes. Appropriate transit facilities should be incorporated into the design of transportation projects. The following location guidelines and design standards are intended to provide guidance to designers and planners.

703.2 Bus Stop Locations Selection

In general, bus stop spacing affects overall travel time, and therefore, demand for transit. However, bus stops should be spaced to minimize pedestrian walking distances near major passenger generators. Bus stop locations are generally determined by the local transit agency and are based on goals to meet the needs of the passengers and maximize passenger convenience. Table 700-1 lists some typical bus stop spacing that would be expected based on highway segment designations. These spacing distances are not intended to be suggested spacing. They are ranges of spacing distances that have been determined from analysis of information provided by transit agencies throughout Oregon. Generally, the more urban and pedestrian oriented a highway segment designation is, the greater density of transit stops needed.

Table 700-1: Typical Ranges for Bus Stop Spacing Based on Highway Segment Designation

Area	Spacing Range (feet)
CBDs and STAs ¹	330 – 1000
Urban/Developed Areas, CCs, and UBAs ²	650 – 1300
Suburban Areas	740 – 2300
Unincorporated Communities/Rural Lands	As Needed

¹ Central Business Districts (CBDs) and Oregon Highway Plan designated Special Transportation Areas (STAs)

² Commercial Centers (CCs) and Urban Business Areas (UBAs)

Communication between ODOT and the local transit agency is important. The location of the bus stop must address both traffic operation issues and passenger accessibility issues. If possible, the bus stop should be located in an area where typical improvements, such as a bench or shelter, can be placed in the public right of way. Bus stop location should consider potential ridership, traffic and rider safety, and bus operation elements that require site-specific evaluation. Significant emphasis should be placed on factors affecting personal security; well-lit open spaces visible from the street create a safer environment for waiting passengers. Elements to consider in bus stop placement include the following:

1. Use:
 - a) Proximity to major trip generators and/or at major transfer points;
 - b) Presence of or need for addition of sidewalks, crosswalks, and curb ramps;
 - c) Connection to nearby pedestrian circulation system;
 - d) Access for people with disabilities- Minimum 8'x5' landing area
 - e) Accessible sidewalk connections;
 - f) Convenient passenger transfers to other routes; and
 - g) Convenient connections to other transportation modes.
2. Traffic and Rider Safety:
 - a) Conflict between buses and other motor vehicle traffic;
 - b) Passenger protection from passing traffic;
 - c) All weather surface to step to/from the bus;
 - d) Open and lighted spaces for personal security and passenger visibility; and
 - e) Street illumination
3. Bus Operations:
 - a) Adequate curb space for the number of buses expected at the stop at one time;
 - b) On-street automobile parking and truck delivery zones;
 - c) Traffic control devices near the bus stop, such as signals or stop signs;

- d) Volumes and turning movements of other traffic, including bicycles;
- e) Adequate sidewalk width to accommodate expected ridership;
- f) Pedestrian activity through intersections;
- g) Proximity and traffic volumes of nearby driveways;
- h) Street and sidewalk grades;
- i) Ease of re-entering traffic stream; and
- j) Proximity to rail crossings.

Bus stops are generally located at intersections where they may be placed near-side or far-side. They may also be placed mid-block. In general, a near-side stop is preferred for non-signalized intersection on two lane streets when the bus stops in the lane and vehicles will not pass around a stopped bus. In the case of a street with wide shoulders or multiple lanes where vehicular traffic may pass uncontrolled around the bus, a far-side stop is preferred for sight distance issues. In the case of a street with wide shoulders or multiple lanes where vehicular traffic is controlled by a signal, the bus stop may be located either near-side or far-side. Far-side bus stops at signalized intersections should have a pull-out area to minimize vehicle queuing back into the intersection. Stops should be placed to minimize the difficulties associated with bus lane changes and bus weaving maneuvers on the approach to a left turn. Where it is not acceptable to stop the bus in traffic and a bus pullout is warranted, (see following discussion, "Guidelines for Special Treatments"), a far-side or mid-block stop is generally preferred. As with other elements of the roadway, consistency of stop placement lessens the potential for operator and passenger confusion. In order to minimize conflicts and maintain sight distance, bus stops should not be located close to driveways. Table 700-2 presents a comparison of the advantages and disadvantages of each bus stop type.

Table 700-2: Advantages and Disadvantages of Far-side, Near-side and Mid-block Bus Stops

FAR-SIDE STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> Minimizes conflict between buses and right turning vehicles traveling in the same direction Minimizes sight distance problems on approaches to the intersection Encourages pedestrians to cross behind the bus Minimizes area needed for curbside bus zone If placed just beyond a signalized intersection in a bus pullout, buses may more easily reenter the traffic stream If a pullout is provided, vehicle capacity through intersection is unaffected 	<ul style="list-style-type: none"> If bus stops in travel lane, could result in traffic queued into intersection behind the bus (pullout will allow traffic to pass around the stopped bus and should be installed with signalized intersections) If bus stops in travel lane, could result in a high rate of rear-end accidents as motorists fail to anticipate stopped traffic May cause passengers to access buses further from crosswalk May interfere with right turn movement from cross street
NEAR-SIDE STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> Minimizes interference when traffic is heavy on the far side of an intersection Allows passengers to access buses close to crosswalk Driver may use the width of the intersection to pull away from the curb Allows passengers to board and alight when the bus is stopped for a red light Provides the driver with the opportunity to look for oncoming traffic, including other buses with potential passengers when more than one route stop is located at the intersection 	<ul style="list-style-type: none"> Stopped bus may interfere with a dedicated right turn lane May cause sight distance problem for cross-street traffic and pedestrians If located at a signalized intersection, and if the shoulder width at the stop is such that buses will exit the traffic stream, a traffic queue at a signal may make it difficult for buses to re-enter the traffic stream At single lane, signalized intersections with no pullout, prohibits through traffic movement with green light, similar to far-side stop without a bus pullout May cause pedestrians to cross in front of the bus at intersections
MID-BLOCK STOP	
Advantages	Disadvantages
<ul style="list-style-type: none"> Minimizes sight distance problems for vehicles and pedestrians May result in passenger waiting areas experiencing less pedestrian congestion May be closer to passenger origins or destinations on long blocks May result in less interference with traffic flow 	<ul style="list-style-type: none"> Requires additional distance for no-parking restrictions Increases walking distance for patrons crossing at intersection, or requires special features to assist pedestrians with mid-block crossing

Source: Adapted from the Guidelines for Planning, Designing, and Operating Bus-related Street Improvements. Texas Transportation Institute.

703.3 Bus Stop Layout and Delineation

The bus stop must be clearly delineated to ensure that other traffic will not use the stop area and to give bus operators direction on where to stop the bus. Delineation may include appropriate signing and pavement markings at and near to the bus stop location. For curbside stops, the bus stop zones (no parking designation) should be a minimum of 100 feet for near-side stops and 80 feet for far-side stops. Curbside mid-block stop zones should be a minimum of 150 feet. Bus stop zones are lengthened 20 feet for articulated buses. Bus stop zones may be shortened significantly with curb extensions as discussed in the next subsection. Designs should be coordinated with the local jurisdiction and transit agency. Generally, buses and bicycles are able to share available road space. However, stopped buses hinder a bicyclist's progression and slower moving bicycles can hinder buses. On routes heavily traveled by both bicyclists and buses, separation of the two modes can reduce conflict and is the preferred method. Final design of separating bus and bicyclist can take many forms and should be considered on a case by case basis. One method is an adjacent bike lane to delineate the areas. Another method is a completely separated bike path or cycle track behind the bus stop. There may also be other appropriate ways to accomplish bicycle and bus separation specific to a site. Potential right of way needs may be associated with bus stop and bicycle design and should be considered early in the development process.

More than one bus may occupy a stop at a given time. The number of bus-loading positions required at a given location depends on:

1. The rate of bus arrivals, and
2. Passenger service time at the stop.

Curb space for one bus will typically be adequate for up to 30 buses per hour. If passenger service time is more than 30 seconds per bus and bus arrivals exceed 30 buses per hour, then more than one loading/unloading position will likely be required. Bus stop area should be lengthened by 50 feet for each additional single unit bus and 70 feet for each additional articulated bus.

703.4 Bus Stop Guidelines for Special Treatments

703.4.1 Bus Pullout

Bus stops may be designed with a pullout, which allows the transit vehicle to pick up and discharge passengers in an area outside the traveled way. Bus pullouts are provided primarily on high-volume and/or high-speed arterials. Since most ODOT facilities have a roadway classification of arterial, bus pullouts should be considered at all stops on state highways.

Lower vehicle speeds, greater public acceptance of delay, development intensity and limited right of way may make pullouts inappropriate in some urban situations. Bus pullouts are frequently constructed at bus stops with a high number of passenger boardings such as large shopping centers, factories, and office buildings. Bus pullouts reduce potential conflicts between bicyclists and passengers exiting the bus. They also provide a means for bicyclists to pass a stopped bus and continue along the roadway. Providing a bus pullout for bus stop locations is the preferred design option on state highways. However, when a bicycle lane is present, the bus driver must be careful when crossing the bike lane to enter and exit the pullout.

Well placed, carefully designed bus pullouts offer safe passenger loading and unloading with minimal delays to both transit and other roadway traffic. While serving as a bus stop, they may also be used simultaneously as a schedule layover area. Table 700-3 lists the advantages and disadvantages that should be considered in the decision to provide a bus pullout:

Table 700-3: Advantages and Disadvantages of Bus Pullouts

Advantages	Disadvantages
<ul style="list-style-type: none"> • Allows traffic, including bicycles to proceed around bus, reducing delay for other roadway traffic • Assists in maximizing the vehicle capacity of the roadway • Defines bus stop • Passenger loading and unloading may be conducted in a more relaxed manner • Less potential for rear-end accidents 	<ul style="list-style-type: none"> • More difficult to reenter traffic, increasing bus delay and slower average travel time for bus • Bus may need to cross bike lane • Uses additional space, may require additional right of way • May increase rates of sideswipe accidents • Cost • Impacts transit operation times

The Yield to Bus Law, ORS 811.167, gives a bus the right of way when pulling away from a bus stop when it is displaying a standardized sign that flashes “YIELD.” This law should improve the operational problem of buses re-entering the traffic stream.

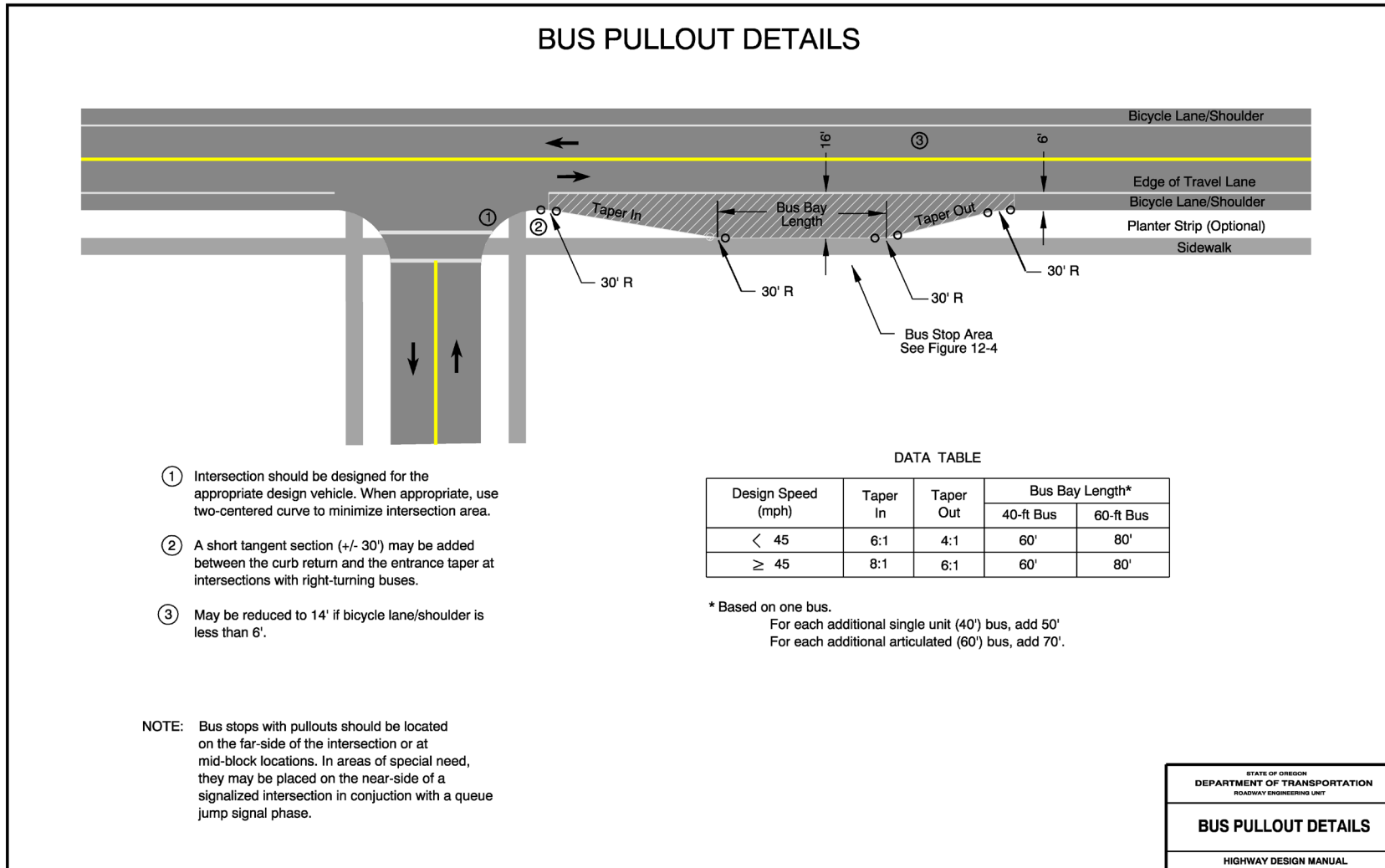
A bus pullout is most appropriate when one or more of the following situations exist:

1. Average vehicle speed exceeds 40 mph;
2. Traffic in the curb lane exceeds 250 vehicles during the peak hour;
3. History of a high rate of accidents, particularly rear-end accidents;
4. More than 5 bus stops per hour;
5. Passenger boardings exceed 30 boardings per hour; or
6. Transit agency desires an area for dwelling time.
7. A bike lane is present or in a high bike use area

Multilane, one-way streets may have sufficient gaps in the traffic stream to allow all other traffic, including bicycles to pass around a stopped bus. Bus pullouts are generally not appropriate on these roadways.

When a bus pullout is justified, it should be placed to allow buses to easily reenter the traffic flow. The design of a bus pullout should allow through vehicle and bicycle traffic to flow freely without the obstruction of stopped buses. They should generally be placed on the far-side of a signalized intersection so that the signal can create gaps in traffic. Due to the highly concentrated wheel loadings on the pavement, bus pullouts should generally be constructed of plain doweled concrete pavement. Typical dimensions for a bus pullout are shown in Figure 700-1. The bay length should be increased by 50 feet for each additional single unit bus expected to concurrently use the pullout. Figure 700-1 and related bus pullout drawings shown are intended to provide design guidance for transit stops to comply with minimum ODOT requirements. Local transit agencies may have their own design criteria that differ from the ODOT minimum. The designer should contact the local transit agency to determine specific transit stop design criteria to comply with the local agency. Collaboration between ODOT and the local transit agency using the state highway is critical to successfully design transit stops.

Figure 700-1: Typical Bus Pullout Details



(Consult Local Transit Agency for Project Specific Details Required)

703.4.2 Curb Extensions

A curb extension may be constructed along streets with on-street parking in areas with high pedestrian use such as downtown shopping districts and central business districts. Curb extensions may be designed in conjunction with bus stops to facilitate bus operations and passenger access. The combination of curb extension and pullout can make design a challenge, particularly the drainage design. The placement of a bus stop on a curb extension should follow the same guidelines as those previously stated (a near-side stop is preferred on two lane streets where vehicles will not pass around a stopped bus. In the case of a street with wide shoulders or multiple lanes where vehicular traffic may pass uncontrolled around the bus, a far-side stop is preferred for sight distance issues). A bus stop on the near-side of a single lane entrance into an uncontrolled intersection should completely obstruct the traffic behind it. Where it is not acceptable to have stopped buses obstruct a lane of traffic, and a bus pullout is justified according to the previously discussed conditions, a bus stop may be placed far-side in the parking strip just beyond the curb extension. It may be appropriate to place a bus stop on a far-side curb extension at an uncontrolled intersection if the warrants for a bus pullout are not met and its placement will not create undue traffic hazards.

Near side curb extensions are usually about the width of the parking lane and of sufficient length to allow passengers to use the front and back doors of a bus. Typical dimensions of curb extensions with near side bus stops are shown in Figure 700-2. Besides reducing the pedestrian crossing distances, curb extensions with near side bus stops can reduce the impact to parking (compared to typical bus zones), mitigate traffic conflicts between autos and buses merging back into the traffic stream, make crossing pedestrians more visible to drivers, and create additional space for passenger amenities such as a shelter and/or a bench.

In areas where curb extensions are desired, but it is not acceptable to have the bus stop in the travel lane, a far side pullout area can be created in the parking strip as shown in Figure 700-3. This location and design, which is generally preferred for low-speed, high volume, four lane roadways, eliminates the safety hazard of vehicles passing the bus prior to entering the intersection.

Figure 700-2: Near-Side Bus Stop with Curb Extensions

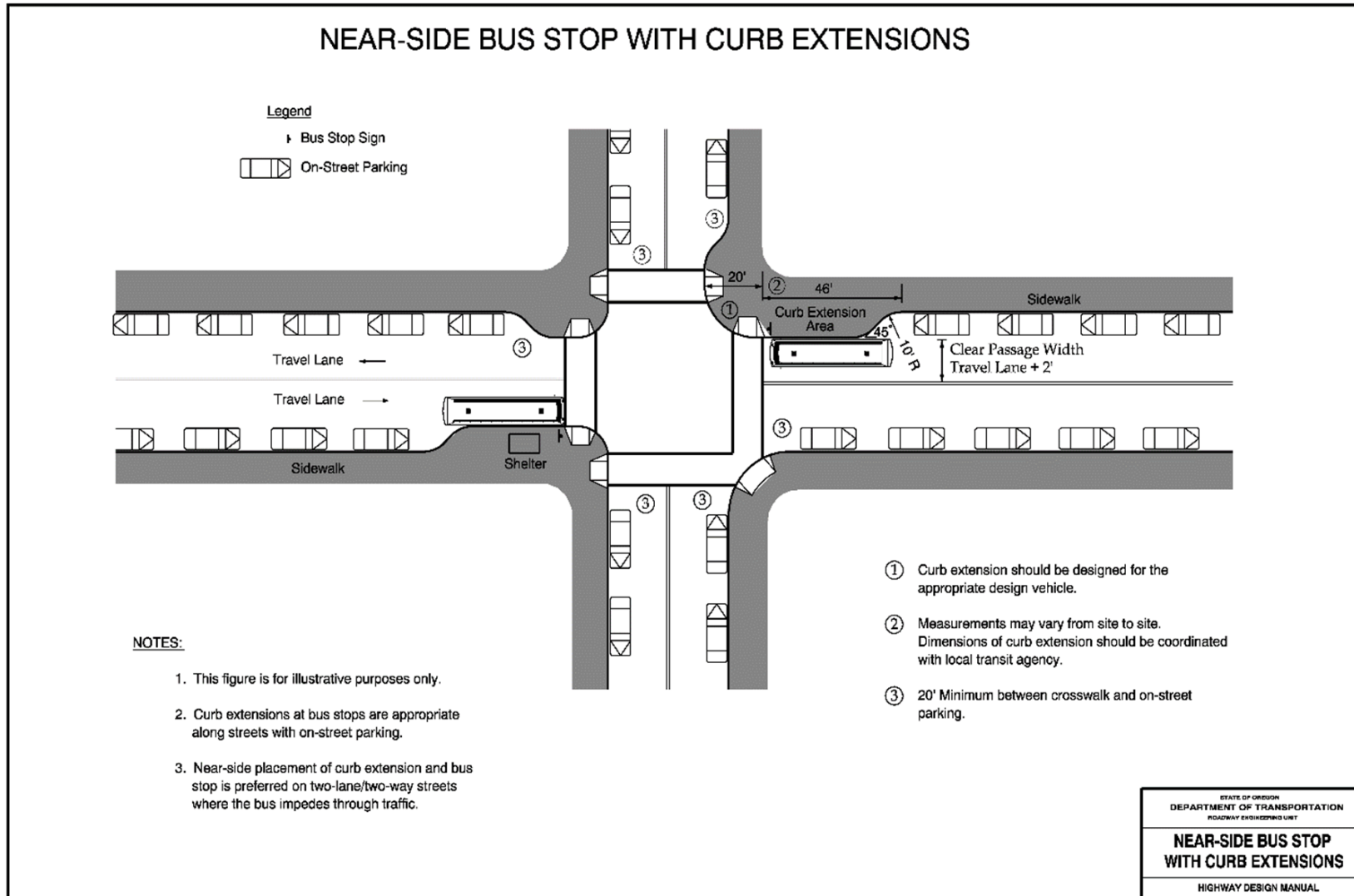
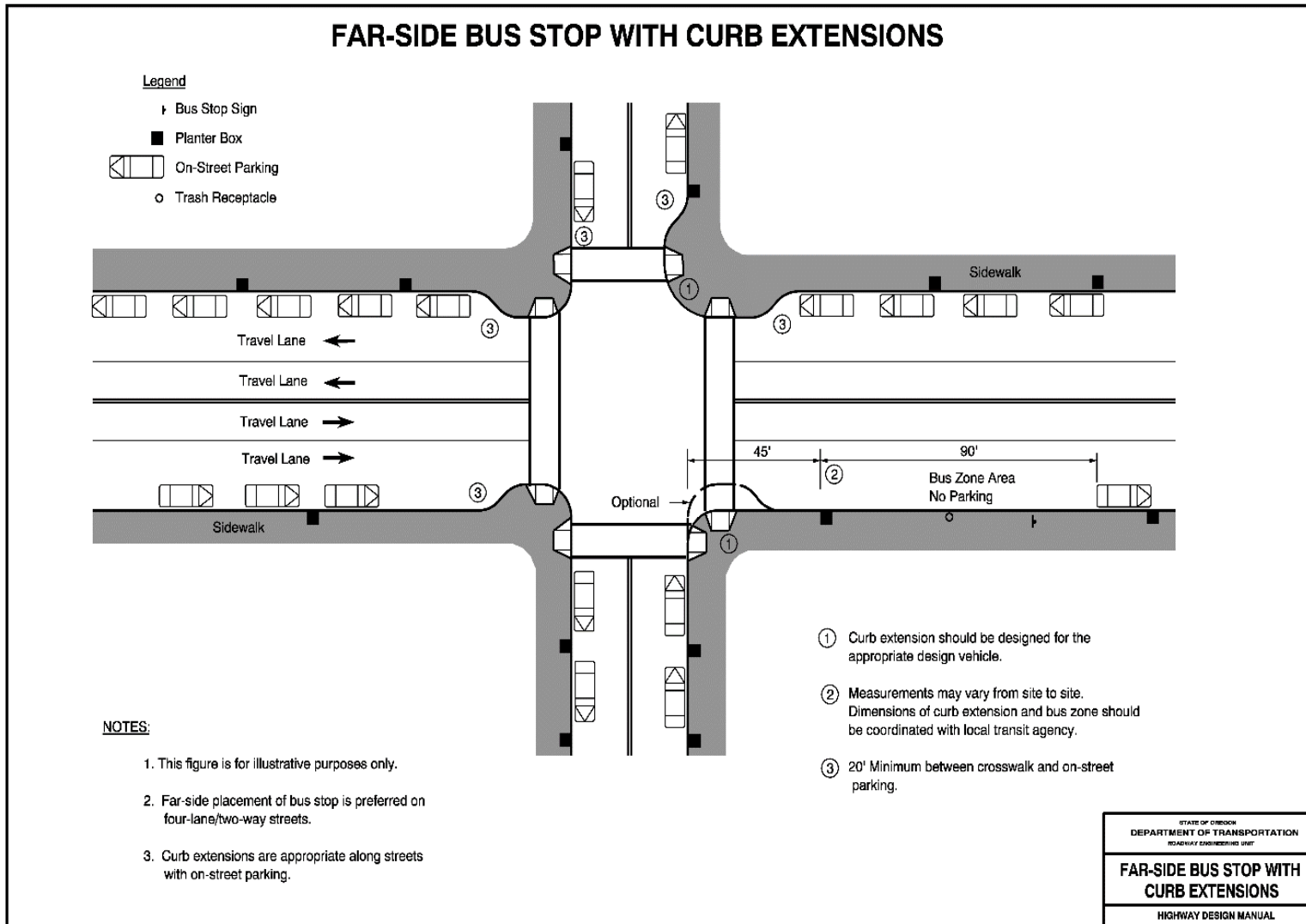


Figure 700-3: Far-Side Bus Stop with Curb



703.4.3 Roundabouts

A roundabout is a form of intersection design and control which accommodates traffic flow in one direction around a central island, operates with yield control at the entry points, and gives priority to vehicles within the roundabout. The placement of bus stops near roundabouts should be consistent with the needs of the users and the desired operations of the roundabout. As with locating bus stops at other types of intersections, pedestrian crossings of the roundabout legs should be minimized. A bus stop is best situated:

On an exit lane, in a pullout just past the crosswalk; or

On an approach leg 65 feet upstream from the crosswalk, in a pullout; or

On an entrance leg, just upstream from the crosswalk where the traffic volume is low and the stopping time is short. This location should not be used on two-lane entrances (a vehicle should not be allowed to pass a stopped bus in the interest of pedestrian crossing safety).

Information on roundabout design can be found in Part 500.

703.5 Light Rail, Bus Rapid Transit and Streetcar Stops

Most of the design principles for bus stops listed previously would also apply to Light Rail Transit (LRT), Bus Rapid Transit (BRT) and Streetcar stop locations. However, there are a few design items that are unique to these modes that may not be found at bus stops. When designing stop locations for LRT, BRT or Streetcars, the following should be considered:

1. Transit stops may need to be on either side of a transit vehicle. These vehicles generally have access on both sides for convenience.
2. Transit stops may be located in a median necessitating safe pedestrian access to the center of the roadway.
3. Rail stops or BRT pathways are more permanent than bus stops, as the route is more difficult to alter.

Section 704 Transit Accessibility and Amenities

704.1 Sidewalk

At transit stops, sidewalks should be provided at a minimum to the nearest intersection or to the nearest section of existing sidewalk. It may also be necessary to wrap a sidewalk around a

corner to join an existing sidewalk on a side street. If a transit route does not have complete sidewalks, it is still important to provide a suitable area for waiting pedestrians and a connection path to the boarding and alighting area. Projects should be considered that provide sidewalks on transit routes, for continuous access to all stops.

704.2 Providing Accessibility

People with disabilities usually ride transit at a higher rate than people without disabilities because many people with disabilities cannot drive. It is therefore critical that all transit stops be fully accessible. The two primary groups for whom this is an issue are individuals with mobility disabilities and individuals with vision disabilities. Both require a continuous, level passage free of obstructions. This passage should be a minimum of 5 feet wide, with at least 7 feet of vertical clearance. A minimum allowable passage of 4 feet wide may be acceptable in constrained areas. See Part 800 for pedestrian access route requirements.

At the transit stops, a minimum 8 foot (measured perpendicular to the curb, street, or highway edge) by 5 foot (measured parallel to the curb, street, or highway edge) landing pad is required at all vehicle entrances and exits. If a transit vehicle has more than one entrance or exit, each access point requires an 8 foot by 5 foot landing area. To avoid the choppy affect this creates at permanent transit stop locations, it may be preferable to construct a continuous sidewalk the length of the transit stop, or at least to the front and rear vehicle doors (see Figure 700-4). The continuous sidewalk should have a minimum width of 8 feet. An accessible route from the bus landing pad to the shelter area is also required.

At stops in uncurbed areas, the shoulder should be 8 feet wide to provide a landing pad and to provide a clear connection path to the street intersection and crosswalk. Transit agencies often have approved bus stop specifications and plans for bus stops in urban and rural areas that may be more extensive with pedestrian amenities. The designer should contact the transit agency early in the design process to ensure appropriate bus stop design, location and infrastructure is constructed.

704.3 Amenities for Waiting Passengers

Transit ridership is enhanced by the provision of safe, pleasant and comfortable places for waiting passengers. Protection from the elements, seating, and personal security are key to a pleasant waiting experience. The following amenities are recommended to be placed where feasible and cost effective. The list is not a complete compilation of amenities available. It is merely a starting point for possible inclusion. The local transit agencies typically have guidelines for amenities and should be contacted to determine which amenities should be included in the project.

704.3.1 Bus Shelter

Type, size, and placement of shelter depends on land use characteristics, transit frequency, and transit capacity. A standard-size bus shelter requires a 6 foot x 10 foot pad. The shelter should be placed at least 2 feet from the curb when the opening faces away from the street and at least 4 feet when the opening faces towards the street. The adjacent sidewalk must still have a 5 foot clear passage for the pedestrian zone. Orientation of the shelter should take into account prevailing winter winds. Sidewalks separated from the roadway with a planter strip offer a unique opportunity to provide a bus shelter out of the path of passing pedestrians. See Part 800 for additional bus shelter site design guidance.

704.3.2 Signing

Appropriate pedestrian scale directional signing (way finding) can help people find major transit stops such as intercity bus stops, transit centers, and park-and-ride lots.

704.3.3 Seating

Benches can make waiting more pleasant for transit passengers. In particular, people with a disability may be unable to stand for long periods while waiting for the bus; seating may increase their ability to use fixed route transit service. Evaluate space for ADA companion seating and clear space requirements when benches are provided.

704.3.4 Shade

The strategic placement of shelters, benches, and bus stops should also account for trees (existing, new) to provide shade for passengers. Deciduous shade trees which cast afternoon shade on the bus stop are generally most effective.

704.3.5 Trash Receptacles and Other Amenities

These improvements can make waiting more pleasant, increasing the likelihood that people will use transit as a mode choice. Ensure a pedestrian access route is available and free of obstructions to all public amenities including the trash receptacle.

704.3.6 Bicycle Parking

Bike racks or storage lockers should be considered at bus stops in urban fringe areas and park-and-ride facilities. Ensure the parking locker or storage does not block or infringe on the pedestrian zone or pedestrian accessible route.

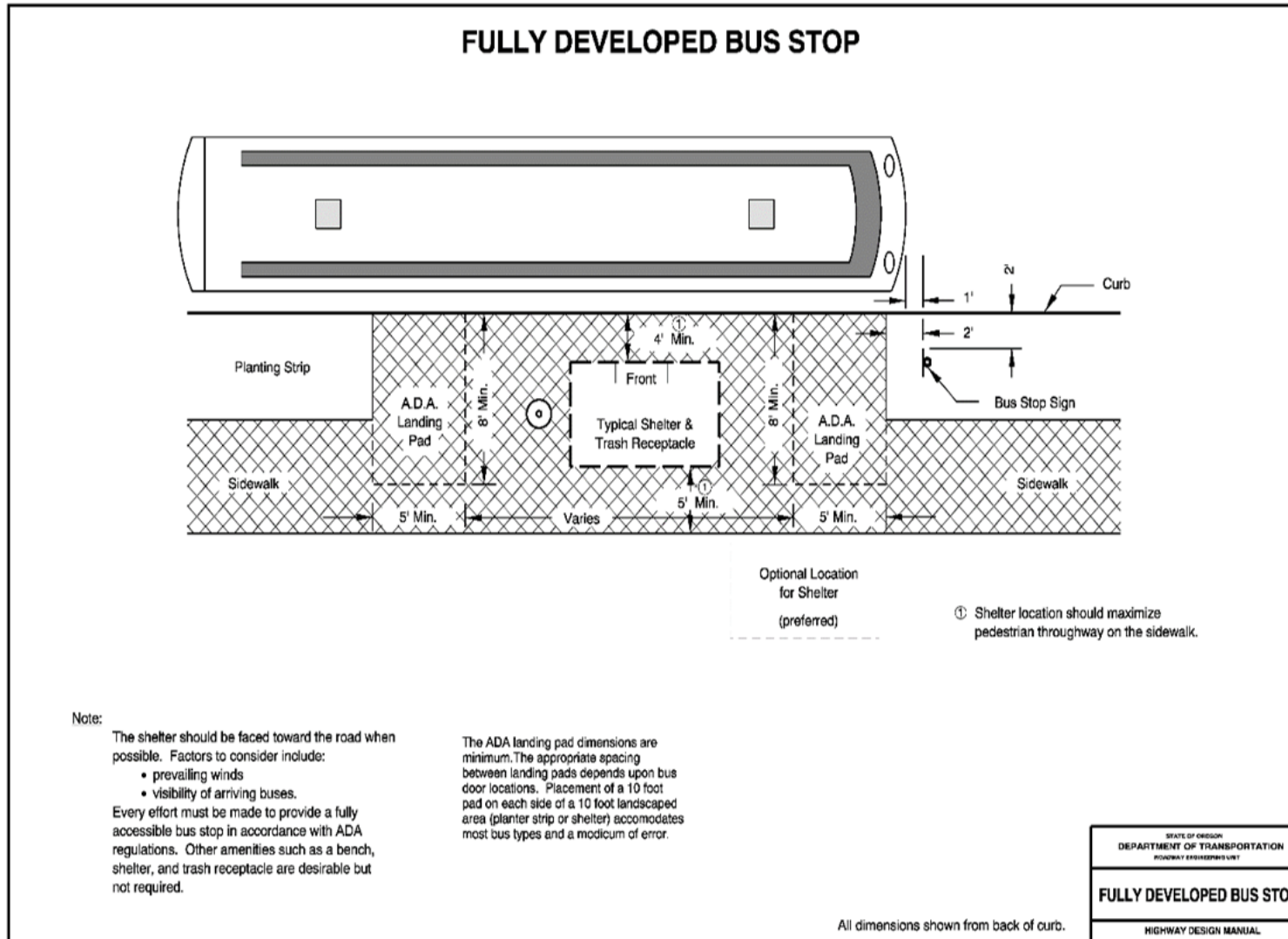
704.3.7 Transit Arrival Information

Electronic transit arrival information in real time is a convenient addition to a transit stop. Coordinate with the transit agency to see if it will be included with the project. At a minimum, facilities should provide hard copy of pertinent transit schedules to be included with transit stops. Ensure the information is not blocked by other amenities and has a clear area that is accessible.

704.3.8 Future Amenities

Work for future amenity items anticipated at a transit stop should be coordinated with the local transit agency. It may be beneficial to install conduit for electrical or communication networks (real time signage, lighting, and other infrastructure) as part of the current project, eliminating the need to remove portions of roadway and sidewalk in the future.

Figure 700-4: Fully Developed Bus Stop



704.4 Security and Safety

Safety is a concern for both the transit user and the operator. Examples of design features that can enhance or degrade personal security include:

1. **Location:** Placement of transit stops should account for access and connectivity to sidewalks, pedestrian crossings, and near activity centers.
2. **Visibility:** Waiting areas should be easily seen by nearby residences, businesses, and passers-by. Transparent shelters and materials further contribute to visibility and security.
3. **Illumination:** Waiting areas should be well-lit; consider pedestrian scale lighting, avoiding creating virtual shadows and free of obstructions.
4. **Soundwalls:** Design features that can dramatically degrade both access and security are soundwalls or other similar structures which can isolate waiting passengers from the neighborhood. In general, there is no reason to locate transit stops adjacent to soundwalls or fences, as these preclude direct access from neighborhoods. Should this situation arise, the structure's design should consider breaks that allow for pedestrian access.
5. **Landscaping:** Street furnishings, trees, and bushes should be designed to provide an open area near the bus stop. Bushes and shrubbery should be smaller near a bus stop. Funding for landscaping and other amenities may need to come from different sources and should be discussed during project development.

Section 705 Roadway and Intersection Design for Transit

The size and operating characteristics of all motorized vehicles regularly using the facility, including transit vehicles are to be considered in the design of roadways and intersections. In addition to motorized vehicles, bicycles and pedestrian needs, movements and interactions must also be included in appropriate intersection design. To begin design, the designer should contact the local roadway jurisdiction and transit agency to determine the appropriate design vehicle for the intersection. Even when transit vehicles are not determined to be the design vehicle, they must be considered in the overall interaction within the intersection. Roadway features such as intersection radii, curb type and height, lane width, and pavement thickness are to be designed to accommodate transit vehicles where necessary. Properly designed intersection features will maximize all vehicle type operations, reduce transit travel times, reduce vehicle conflicts, minimize pedestrian crossing distances, and improve the overall driving/riding experience of the roadway users. When designing transit alignments and layouts

on state highway facilities, transit agencies need to work with ODOT to minimize impacts to future highway projects and future highway needs.

Buses have unique operational characteristics including relatively low power-to-weight ratios, high axle loads, short wheel bases, and long overhangs that may necessitate special treatments.

Bus Rapid Transit (BRT) routes have many of the same design criteria as for regular bus routes. However, the BRT route is usually in a dedicated pathway and may be located in the center of the roadway. The BRT vehicles are often articulated buses. Turning movements and turning radii at intersections can be challenging to fit with other lane configurations in an intersection.

Light Rail Transit (LRT) and streetcars both run on rails. This creates challenges for designers at intersections where these vehicles need to make turns. They may have very limited turning radii and require additional space. Track grades are important design criteria for LRT systems and streetcar systems. Often, where track sections cross each other, the crossing grade needs to be very close to zero percent to allow transition to the other track effectively. Detectable warning surfaces are required at crosswalks, see Part 800.

705.1 Roadway and Intersection Design for Buses

While a roadway may be designed to accommodate large trucks, some design elements may be controlled by the unique needs of public transit. Some of these elements are:

1. **Shoulder width:** On roadways without curbs and sidewalks, the improved shoulder width at the bus stop shall be at least 8 feet for accessibility to provide boarding and alighting areas. At least 4 feet of the improved shoulder surface is provided to connect the boarding and alighting areas to the shoulder, street intersection and crosswalks.
2. **Right of way:** The wheelchair landing pad at a bus stop must extend at least 8 feet beyond the curb line of a typical sidewalk. Additional right of way may also be needed for a bus shelter (see Section 704) or other accessible pedestrian amenities.
3. **Clearance:** Overhead obstructions should be a minimum of 12 feet above the street surface, obstructions should not be located within 2 feet of the edge of the street to avoid being struck by a bus mirror.

Intersections should be designed for use by either a standard bus or an articulated bus. The turning and off-tracking characteristics of the two bus types are slightly different and must be accounted for in the intersection design. (The swept path of an articulated bus is about 1.5 feet wider than that for a standard bus for a right angle turn.) The overhang of buses is considerable and will affect the design corner radii, bus stop location, and placement of bus stop amenities. Street lighting, signals, signs, and other intersection furnishings should be placed clear of the turning paths of buses.

Curb radii design should minimize pedestrian crossing distance, while accommodating the off-tracking characteristics of the bus. Consideration needs to be given not only to buses on the mainline route, but also for buses entering and exiting the mainline roadway from a crossroad. In designing the curb radii for a bus entering a multi-lane road from a signalized crossroad, the design may allow for the bus to initially turn into the inside lane next to the median before returning to the outside lane or entering a bus pullout/stop area. This design will allow for a tighter curb radius or curb extension to be included (if appropriate) which will reduce pedestrian crossing distance while maintaining bus operation. It may be desirable at unsignalized intersections to design the curb radius so that the bus may enter a multilane roadway without encroaching upon the inside lane. At no time should the design encourage the vehicle to turn across opposing lanes. Appropriate curb radii in combination with usable shoulder width and number of cross street lanes are shown in Figure 700-5.

705.1.1 Bus Pads

Very concentrated wheel loading coupled with the dynamic nature of braking place high demands on the pavement at bus stops. Some curbside stop areas may require strengthened pavement sections. On high to moderate speed roadways, these bus pads are generally placed outside of the travel lane. Roadway pavements need to be of sufficient strength to accommodate repetitive bus axle loads of up to 25,000 lbs. Due to the highly concentrated nature of the vehicle paths, consideration should be given to constructing bus pads with reinforced concrete pavement (see Oregon Standard Detail [DET1610](#) for PCC Pavement Details). Pavement designs should be coordinated with ODOT Pavement Services and ODOT Maintenance. The pavement section will depend on anticipated use and site-specific soil conditions. Also, the operating transit agency should be contacted to determine how to include any agency specific needs or requirements concerning bus pads. Some transit agencies have their own standards for construction of bus pullouts and bus pads.

705.2 Roadway and Intersection Design for Bus Rapid Transit

Many of the design concerns for regular bus routes and facilities mentioned in the previous subsections apply to Bus Rapid Transit routes as well. Installation of Bus Rapid Transit (BRT) systems will generally trigger 4R design requirements where they interact with the state highway system. BRT systems are expected to be quick and efficient. Therefore, they have some specific requirements that regular bus routes do not.

1. BRT systems often run in a dedicated pathway separate from the general lanes of traffic. As such, they are expected to run independent of other traffic. At intersections, however, the BRT system must interact with general traffic.
2. BRT vehicles may get pre-emption at signalized intersections.
3. BRT stops may need to be located in the median creating a need for safe pedestrian areas for waiting and boarding activities.
4. The designer may need to provide additional pedestrian crossing locations to accommodate the BRT stop locations.
5. If the BRT route is in the median and then makes a right turn at an intersection to another roadway, provision must be made for the movement across adjacent traffic lanes. This may require a split-phase signal or other means of accommodation.
6. BRT vehicles are often articulated type vehicles that may have specific turning radii that could impact intersection design and interaction with general traffic.
7. BRT routes on dedicated pathways are more permanent than regular bus routes running with general traffic. Therefore, the BRT facility is less likely to change over time.

705.3 Roadway and Intersection Design for Light Rail Transit and Streetcars

Many of the primary design considerations for roadways and intersections relating to bus routes and BRT routes also apply to Light Rail Transit (LRT) and streetcar routes. However, since these vehicles run on rails, they have some unique characteristics that differentiate them from regular bus routes or BRT routes. Coordination with the local transit agency is necessary to establish allowable design criteria specific to LRT and streetcar routes that minimize impacts to the state highway. Adding LRT or Streetcar facilities to the state highway is constructing a new feature that did not exist previously in the roadway. Installation of LRT or Streetcar facilities on the state highway system is a major, permanent impact to highway operations and is considered reconstruction of the highway. Therefore, installation of these facilities will trigger 4R design criteria. The following list assumes the LRT or streetcar route runs on surface streets with general traffic and not on a separate alignment. Where LRT or streetcar routes run along separated alignments, many of these challenges do not pose as great a concern.

1. Vertical grades along the track line are critical to LRT and streetcar routes. These vehicles require flatter grades than regular bus routes or BRT routes.
2. Track cross-slope grades are less forgiving than with other modes. Cross-slope may need to be held at or near zero percent. On heavily superelevated roadways, roadways with excessive cross-slope or excessive crown sections, it can be challenging to establish

adequate transition between roadway cross-slopes and track cross-slopes. As a result, construction challenges can occur, and long term traffic operation can be affected.

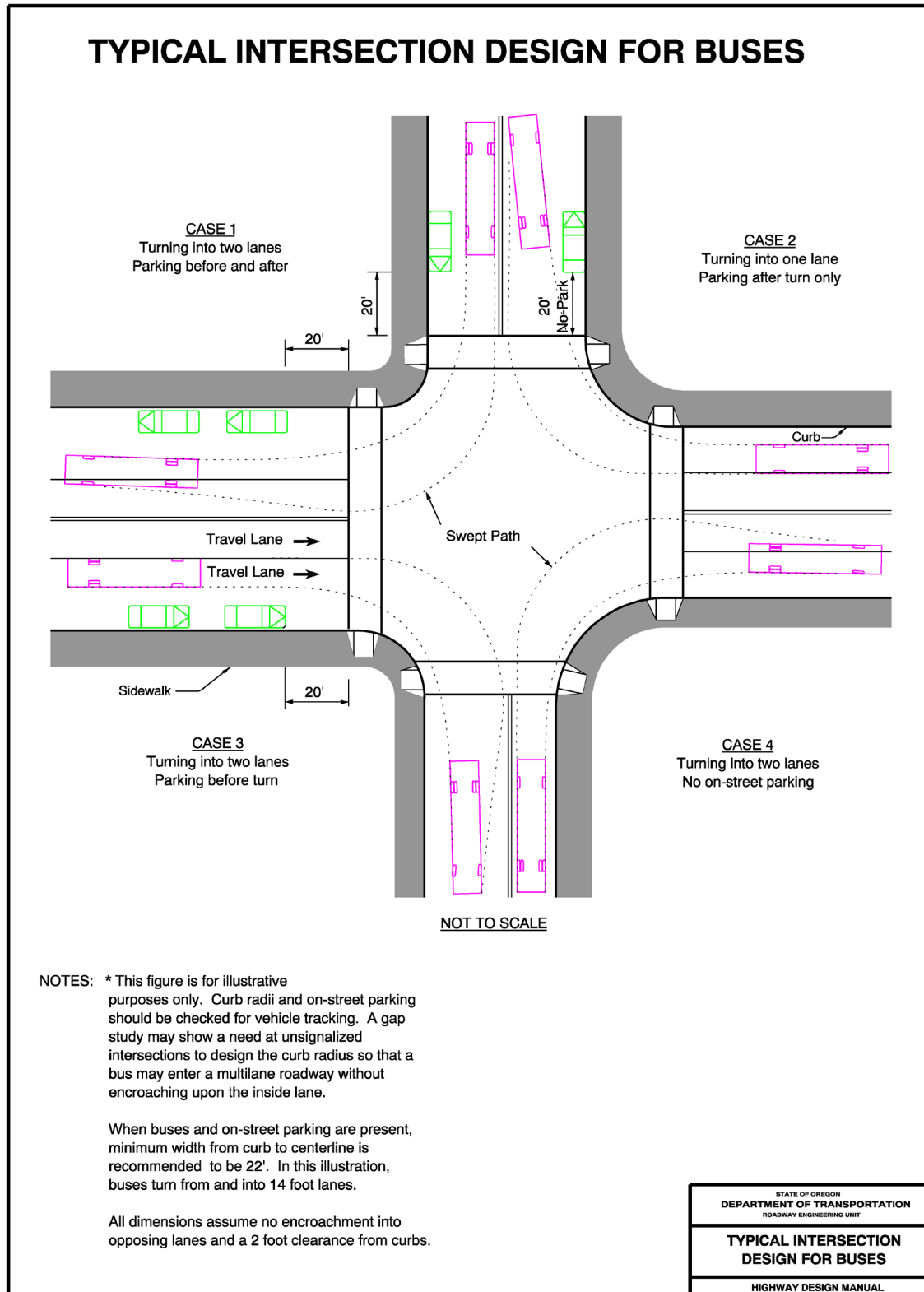
3. Tracks crossing roadway grades perpendicular to the roadway can also create construction challenges and long term operation issues for general traffic due to the introduction of short, steep vertical roadway grades to match required track cross-slope.
4. Potential drainage issues due to the change in cross-slope, vertical alignment or superelevation needed to fit track to roadway.
5. Lane balance may be affected on multi-lane roadways. Drivers may tend to avoid driving in the lane with the tracks.
6. Utility relocations and sloped paving patches to match rail installation can cause rough, uneven surfaces with undesirable cross-slopes for motor vehicles, pedestrians, and bicyclists. The final paving surface should be a completely overlaid surface matching acceptable cross-slope grades.
7. LRT and Streetcar rails are often installed in a concrete pathway. The wide swath of gray concrete in the black asphalt roadway can appear as a separate lane, confusing drivers when the LRT or Streetcar facility deviates from a travel lane. Travel lane delineation and markings need to be understood by drivers to avoid their following the rail facility when it turns from the main line. This is of particular importance at mid-block, off-street stops or at transit terminal facilities.
8. Horizontal curvature may be more limited than other modes due to the LRT or Streetcar vehicle's turning radius and side friction on rails. Wider turning arcs may require use of more than one lane.
9. LRT and streetcar routes are fixed by the rail network and are more permanent than some other modes. LRT and streetcar facilities are less likely to change over time.
10. Steel rails placed in the travel lane may create potential hazards for bicycle traffic. Wet rails may become slippery and bicycle tires can get caught in the rail opening causing a rider to fall.

LRT vehicles and streetcars are usually designed for entrance and egress from either side allowing flexibility along the route. However, this can create special challenges for roadway or intersection design.

1. Stops may need to be located in medians or in the center of roadways.
2. On multi-lane roadways or one-way roadways, the stops may vary from side to side creating the need for the tracks to change from one lane to another resulting in conflicts between transit vehicles and general traffic.
3. Transitioning tracks from one lane to another and holding track grades constant can impact roadway grades and general traffic operations.

4. Transitioning tracks from one lane to another can impact bicycle riders forcing them to cross the track section more frequently increasing the potential for mishap.
5. LRT boarding and alighting areas are required to be accessible and will require detectable warning surfaces.

Figure 700-5: Typical Intersection Design for Bus



Section 706 Park-and-Ride Facilities

Park-and-ride facilities provide parking for people who wish to transfer from their personal vehicle to public transportation or carpools/vanpools. These facilities are one of many Transportation Demand Management (TDM) tools designed to increase highway efficiency, reduce energy demands, increase highway safety by reducing highway congestion, and provide commute options. Park-and-rides are frequently located near freeway interchanges, at train or transitway stations, or on express bus routes.

Oregon Highway Plan, Policy 4E states that it is the Policy of the State of Oregon to encourage the efficient use of the existing transportation system and to seek cost-effective expansion of the highway system's passenger capacity through development and use of park-and-ride facilities at appropriate urban and rural locations adjacent to or within the highway right of way.

Many park-and-ride facilities are located within urban areas and are served by public transportation. Some smaller facilities may have only local transit service. Facilities placed in more rural areas may primarily serve carpools and vanpools. Park-and-ride facilities may be either shared use, such as at a church or shopping center, or exclusive use. Shared use facilities are generally designated and maintained through agreements reached between the local public transit agency or rideshare program operator and nearby businesses or churches. The possibility of meeting the needs of the community with a shared-use lot should be investigated before building an exclusive use park-and-ride lot.

The following guidelines are primarily intended for planning and design of the exclusive park-and-ride facility. If the facility is expected to be served by public transit, the project leader should involve the responsible local agency in the entire project starting with the initial needs assessment and continuing through the planning and design phases of project development. In all cases, the local public transit agency and rideshare program operator should be involved. For areas served by public transit, projects without the support of the local public transit agency should be avoided.

Plans for new park-and-ride facilities should incorporate the design philosophies of this and other generally accepted sources such as AASHTO's Guide for the Design of Park and Ride Facilities. An inappropriately located or designed park-and-ride facility may be counter-productive in terms of visibility, image, and promotion of non-SOV (single occupant vehicle) travel.

706.1 Needs Assessment

The need for a park-and-ride facility may be identified in a region's transportation system plan (TSP), a transportation corridor plan, transit agency development plan or capital improvement plan. The expected demand for parking spaces at a proposed park-and-ride will be related to

the quality of public transportation service, the number of commuters traveling the corridor, accessibility of the facility, the cost and availability of parking at the travelers' destination, and a variety of economic factors and public attitudes. Local experience with park-and-ride facilities is often the most accurate gauge to sizing future facilities.

706.2 Site Selection

Present and future needs are the main considerations in determining the location of a park-and-ride facility. If served by public transit, local transit agency input is critical to ensure that transit service and ridership are optimized with the project. As the necessary size of a park-and-ride facility is difficult to predict, the facility should be sited to allow for a conservative first phase with space available for later expansion. A number of site selection criteria should be considered in the site selection process, most notably:

- Input from local transit and rideshare program operators
- Local transit agency master plan
- Local or regional transportation plan
- Accessibility for transit and motorists
- Local public input
- Traffic impacts
- Commuter distance
- Local government zoning
- Environmental impacts
- Cost effectiveness
- Access by other modes of travel
- Visibility for passing motorist recognition
- Visibility for security
- Maintenance
- Existing right of way
- Shared use
- Future expansion flexibility.

Due to the substantial cost increase associated with buying or leasing property, government-owned right of way should receive prime consideration, assuming the other selection criteria are favorable. Sites with poor access for either transit vehicles or passing motorists should be avoided. It is likely that more users will be attracted by maximizing accessibility for inbound morning traffic than by improving the flow for exiting evening traffic. The selected site should

not jeopardize the present and future integrity of the state highway or local transportation facility.

The alternative of a shared lot with off-peak demand, such as a church, movie theater, or shopping center should be explored. Shared lots can save the expense of building a new parking lot and increase the utilization of existing spaces. The site selection should consider the criteria listed above. If a shared use arrangement is agreeable with the lot owners, good pedestrian connections to the boarding areas should be provided.

ODOT frequently sells excess property, known as surplus property, upon completion of a project. All surplus property parcels should be evaluated for future use as a park-and-ride facility or carpool facility before disposal.

706.3 Site Design

Most facilities outside the Portland metropolitan area will require fewer than 300 spaces, and facilities in rural areas will generally not exceed the need for more than 100 spaces. Lots should be appropriately sized and may be as small as only five spaces.

Some example layouts of park-and-ride facilities are shown in Figure 700-6. Design features must be in compliance with applicable design standards, specifications, operating standards, and any other local requirements that may apply. Design features such as the entrances and exits, internal circulation, shelter location, illumination, landscape preservation and development, and passenger amenities are generally site specific. Below are presented some design principles used to maximize the efficiency and usefulness of the facility.

Transit stop considerations will include those discussed.

706.3.1 Access

A variety of transportation modes are used to arrive at and depart from park-and-ride facilities: private automobile, carpool/vanpool, bus or other transit vehicle, walking, bicycle, and motorcycle. These modes should be safely accommodated.

Often the most efficient access to a park-and-ride facility will be from an intersecting collector or local street. If the intersection is already signalized, excellent access may be available. If the park-and-ride warrants a signal at a later date, the accesses should be located with signal spacing and operations in mind. The Technical Services Traffic Engineering Services Unit should be contacted if signalization is anticipated. Due to cost considerations, sites that do not require signalization may be preferred.

Access to a park-and-ride should not increase congestion on the facility it serves. For this reason, it is not desirable to provide direct freeway access for private automobiles. However,

direct access for transit vehicles may be desirable on freeway entrance ramps, provided that this access does not present safety and operational problems. Appropriate measures should be taken to avoid significant adverse impacts to adjacent neighborhoods and nearby streets. Ease of access, especially for the morning commuters, will encourage use of the facility. The appropriate ODOT access and spacing standards contained in the 1999 Oregon Highway Plan should be followed.

When a facility has more than 300 parking spaces, multiple entrances and exits may be required. With facility sizes greater than 500 parking spaces, exits may warrant a traffic signal. Facilities having more than 1000 spaces may require access to two adjacent streets to avoid congestion.

The transit route from the freeway or arterial to a park-and-ride facility, internal circulation route, and return route should be designed to minimize transit travel time. Automobile traffic should not be in conflict with transit vehicles. It may be desirable to provide an exclusive entrance and exit for transit vehicles.

706.3.2 Internal Circulation

Major circulation routes within a park-and-ride facility should be located along the outside edges of the parking area to minimize vehicle-pedestrian conflicts. The priority sequence for the design of the individual user modes should favor the high occupancy vehicles, namely the transit vehicles and carpool/vanpools. It is critical that facility layout and circulation patterns are coordinated with the local transit agency. Bus circulation routes should be designed to provide for easy movement, with efficient terminal operations and convenient passenger transfers. Personal vehicle traffic should be separated from bus traffic. Curb radii and driveway widths should be designed to accommodate the turning characteristic of the largest expected vehicle. The internal circulation should accommodate the needs of pedestrians and bicycles. Providing secure parking or storage facilities for bicycles in the park and ride layout can promote the combination of bicycle commuting with transit as a viable option for getting to and from work.

The passenger waiting areas should be easily accessed by transit riders. Aisles should be aligned to facilitate convenient pedestrian movement toward the bus loading zone. Large facilities may require a central location for the passenger waiting area with parking for the various user modes surrounding the waiting area. In shared-use type facilities, the passenger waiting area should be placed away from the other activity centers to minimize the impacts of pedestrian, automobile, and bus traffic. Bicycle parking facilities should not conflict with passenger waiting areas.

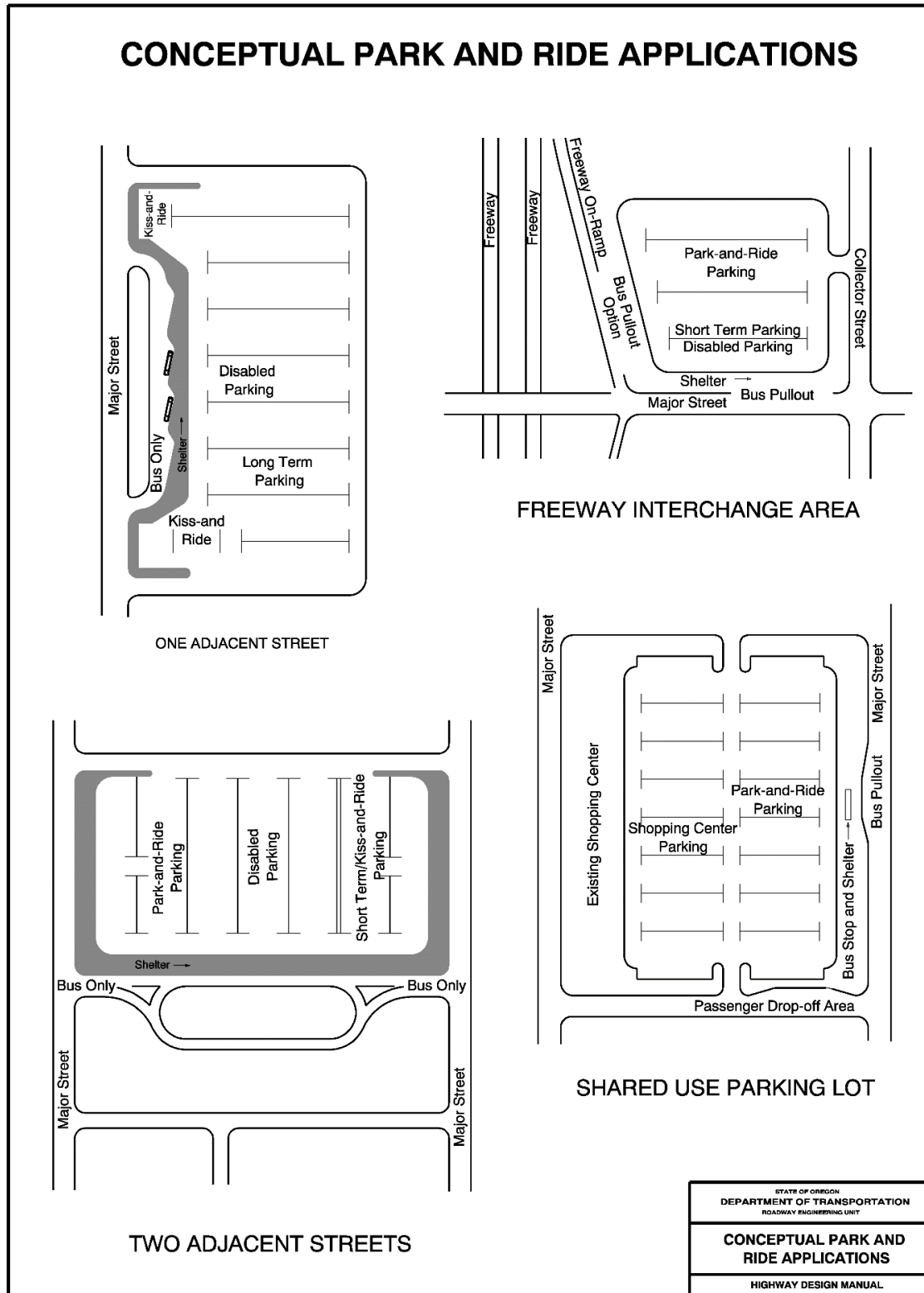
706.3.3 Pavement, Drainage, and Landscaping

Pavement design shall conform to state design specification for each of the functional areas of a facility. The surfacing type shall have the concurrence of the ODOT Pavement Services Unit. Asphalt concrete or portland cement concrete are the ideal surfacing options for all facilities officially designated for park-and-ride. If a facility is to be unpaved, accessibility standards still apply.

Adequate slope should be provided for surface drainage to prevent ponding of water. The recommended grade is 2 percent. Curb, gutter, and surface drains should be installed where needed.

A well-landscaped facility can enhance the appearance of a facility, improve public and neighborhood acceptance, add to the feeling of security, and provide runoff water quality mitigation. Landscaping should be compatible with the surrounding area, and should not interfere with sight distance, vehicle operations, or access for potential users. Selective preservation of existing vegetation is often a cost-effective means to reduce environmental impacts and provide a pleasant environment for facility users. Landscaping should be designed so that security patrols can see into the facility from adjacent streets without entering. Landscape design should keep maintenance requirements to a minimum. Trees should generally be the dominant plant material as they provide shade and visual interest, reduce glare, and are less costly to maintain than shrubs and ground cover. Funding for landscaping and other park and ride amenities will vary and should be discussed early on in project development and the establishment of local agency agreements.

Figure 700-6: Conceptual Park and Ride Applications



706.3.4 Amenities

Passenger amenities will vary depending upon the type of facility (e.g., exclusive or shared use), the anticipated patronage levels, local policies, adjacent land use and available funding. Amenities that are often found at park-and-rides include shelters, benches, trash receptacles, bus route information, vending machines, and sometimes heated waiting areas, telephones, restrooms, and small convenience stores.

706.3.5 Lighting and Security

Adequate lighting is important from a safety standpoint and as a deterrent to criminal activity in both the parking area and the shelters. Illumination should be considered for all park-and-ride facilities. Special emphasis should be given to bus loading and unloading areas, passenger amenities and pedestrian/bike pathways within park and ride facilities. Future expansion plans and nearby development may influence the placement of the luminaire poles.

706.3.6 Signs and Pavement Markings

Control of traffic movements can be greatly improved by proper pavement markings and signing. Reflectorized markings for center lines, lane lines, and lane arrows can guide or separate patron traffic and transit vehicles. Park-and-ride identification signs may be installed. Guide signs may be placed to direct vehicles to parking areas, passenger drop-off and pick-up points, and waiting areas. Signs may also be necessary to designate bus-only lanes, no parking areas, and accessible parking areas.

706.3.7 Bicycle Parking

Almost all facilities will see some bicycle usage. At a minimum, bicycle racks should be provided. The provision of bicycle storage lockers will depend upon usage. Providing convenient and secure bicycle parking or storage is important to encourage the utilization of bicycles in combination with transit as a viable commute option. When a transit rider is comfortable knowing their bicycle is safe from theft during the time they are at work and they do not have to go through the hassle of loading the bike on the transit vehicle, they may be more willing to leave the car at home and ride the few miles to the park and ride. The bicycle parking area should be relatively close to the transit loading area, separated from motor vehicles by a curb or other barrier, and have a direct route from the adjacent streets. The bicycle parking area should not conflict with passenger waiting and loading areas. For additional information on bicycle facilities, see Part 900.

706.3.8 Accessible Parking

The number of accessible parking spaces required for government buildings and publicly maintained or operated parking facilities, are subject to requirements that include ORS 447.233. See the ODOT Traffic Line Manual for detailed guidance on parking area design. Some general guidelines follow. No ramp or obstacle may extend into the accessible parking space or the access aisle. Curb ramps may not be situated in such a way that they could be blocked by a legally parked vehicle. Accessible parking spaces and access aisles shall be level with surface slopes not to exceed 2 percent in all directions.

706.3.9 Environmental Considerations

The design of a park-and-ride facility should consider and address any environmental issues associated with the site. Possible environmental concerns may include stormwater runoff and water quality, wetlands, protected species, noise, visual, traffic impacts and land uses such as public parks and recreation areas. Landscaping and design treatments can help minimize these impacts.