3. DESIGN GUIDELINES

Plan Concept

The Plan proposes the development of a pathway system that identifies a core system of pathways based on the existing canal system within the City of Meridian. This core system of pathways is enhanced by the developer-implemented residential pathways that will provide connections to and through many residential areas while creating a larger citywide loop. In addition, the pathways system will be enhanced by the use of the utility and railroad rights-of-way for pathway corridors (Figure 3-1). This system of pathways gives community members a wide variety of options for exercise and recreation, leisure and nature viewing, commuting, and running errands.

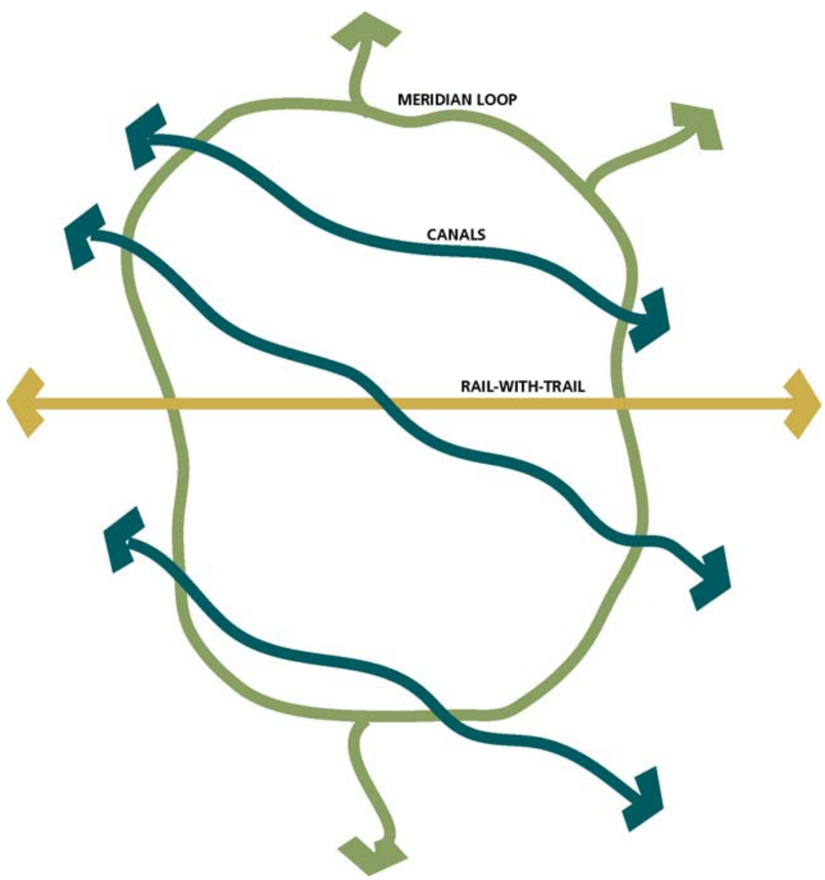


Figure 3-1. The Meridian Pathways System

Definitions of Proposed Design Types

Canal Pathway

A 10-foot-wide paved pathway physically separated from the roadway that follows a canal or other type of waterway through the City of Meridian. Designed for use by pedestrians, bicyclists, skaters, wheelchair users, joggers, and other nonmotorized users.

Residential Pathway

A 10-foot-wide paved pathway that parallels the roadway and is separated from the roadway by a 6-8-foot-wide planting buffer. Designed for use by pedestrians, bicyclists, skaters, wheelchair users, joggers, and other nonmotorized users.

Rail-with-Trail Pathway

A 10-14-foot-wide paved pathway physically separated from any street or highway that is located within the existing Union Pacific rail corridor right-of-way from Nampa to Boise.

Micro Pathway (Accessway)

A narrow, paved pathway that provides access to important destinations such as schools or provides access through a residential development to connect with the existing pathway system.

Unpaved or Soft Surface Path

A 3-8-foot-wide path with a surface consisting of gravel, crushed limestone, dirt, or other semi-pervious material. Developed dirt and gravel pathways are used primarily by pedestrians but may also serve bicyclists. They provide access in natural areas or open space. They are found in the same types of facilities as hiking paths.

Sidewalk

A paved concrete walkway along the side of a street separated from the street by a raised curb. Sidewalks are generally 4-8 feet wide and cross multiple driveways and intersections. A planting strip may separate the sidewalk from the roadway. Sidewalks intend to serve pedestrians and wheelchair users. Sidewalks are by law the responsibility of the property owner. Sidewalks located within the road right-of-way are under the jurisdiction of the Ada County Highway District (ACHD) or the Idaho Transportation Department (ITD).

Bicycle Lane

These are defined as a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. Bicycle lanes are generally found on major arterial and collector roadways and are 4–6 feet wide. Bike lanes are under the jurisdiction of ACHD.

Pathway Designs

The following cross-sections illustrate standard treatments for the primary pathway design opportunities in Meridian. There are also a few innovative designs, like swales (shallow, wide depressions adjacent to roadways and pathways that collect stormwater runoff) and other "green street" concepts, which can be used in some situations. This section should be supplemented with other pathway design documents, including American Association of State Highway and Transportation Officials (AASHTO) and the Manual on Uniform Traffic Control Devices (MUTCD).

Typical Meridian Pathway Cross-Section Detail

The typical pathway in Meridian is a 10-foot-wide paved surface of either concrete or asphalt, as shown in the cross-sections below. The potential uses for the pathways dictate their structural design. These potential uses include routine maintenance by City staff and use by fire and police emergency vehicles. The Meridian Police and Fire Departments use existing pathways as access points to neighborhoods to provide improved service and safety to residents. As such, the pathway system must be built to a higher standard to continue providing for all uses.

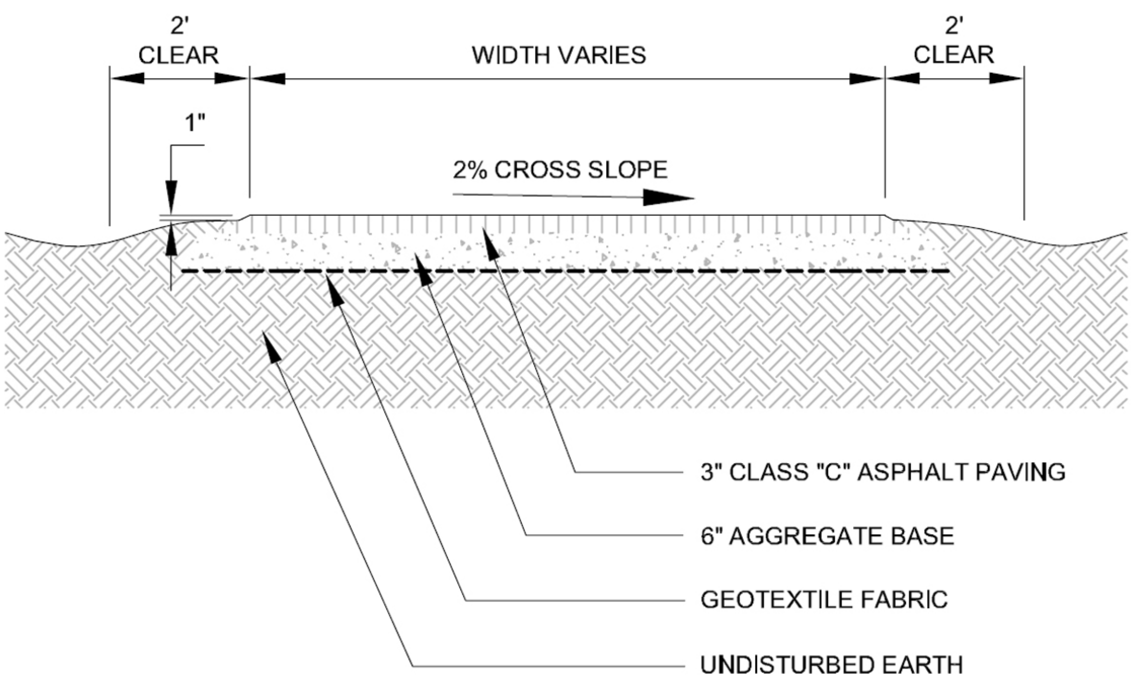


Figure 3-2. Asphalt Pathway Cross-Section Detail

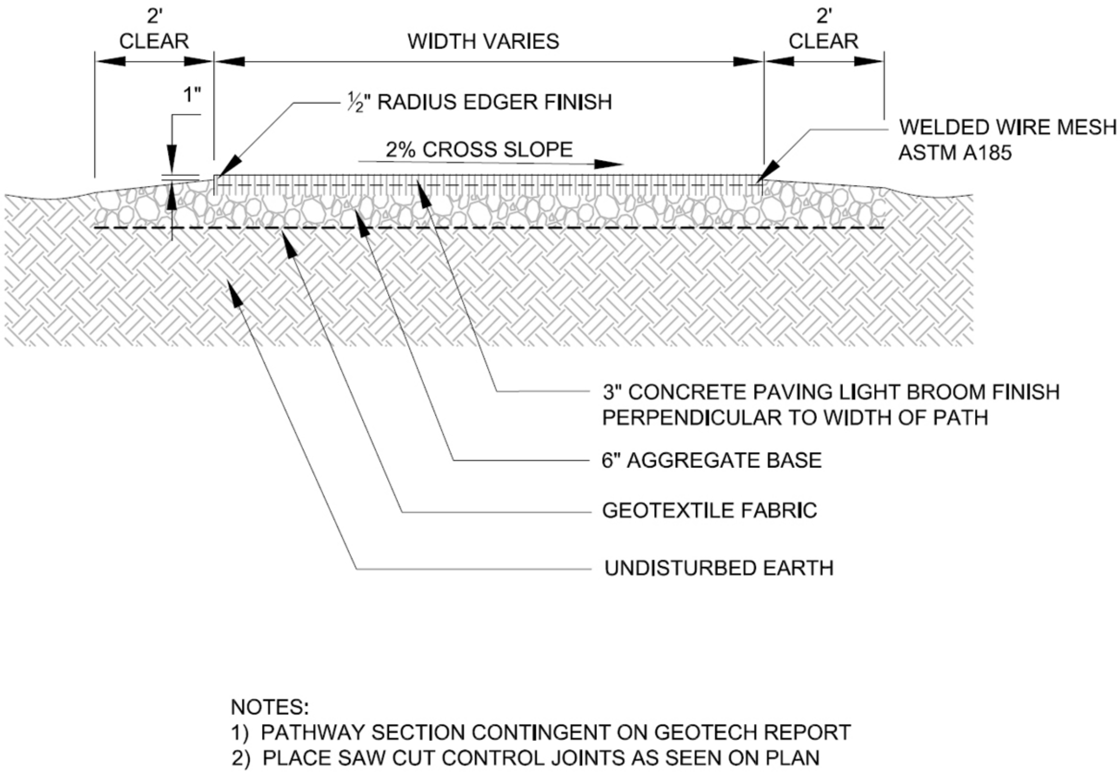


Figure 3-3. Concrete Pathway Cross-Section Detail

Canal Pathways

There are two primary designs for pathways along canals, depending on the classification of the waterway by the irrigation district.

Canals and Laterals

Figures 3-4 and 3-5 illustrate a typical shared use pathway design that is appropriate for pathways along laterals and canals. This pathway is designed to accommodate two-way bicycle and pedestrian traffic, typically has its own right-of-way, and can accommodate maintenance and emergency vehicles, either along the pathway itself or along the irrigation district maintenance road. This type of pathway is typically paved (asphalt or concrete) to meet Americans with Disability Act (ADA) requirements (see "Universal Access" beginning on page 3-21 for a discussion of ADA guidelines). Wider soft shoulders should be provided for runners and joggers if space allows. If using federal funds for construction, two-foot-wide shoulders will be required for the pathway. The existing design for pathways along canals and laterals is dictated by the current maintenance practices of the irrigation districts. While the irrigation districts do not access the canal corridors frequently, they do periodically clear silt and other debris from the canal and dump it onto the maintenance road for later collection. This would interfere with any pathway uses if located in the same right-of-way. As the Meridian Pathway system continues to mature, the City should strive to work with the irrigation districts to minimize any impacts on the pathways.

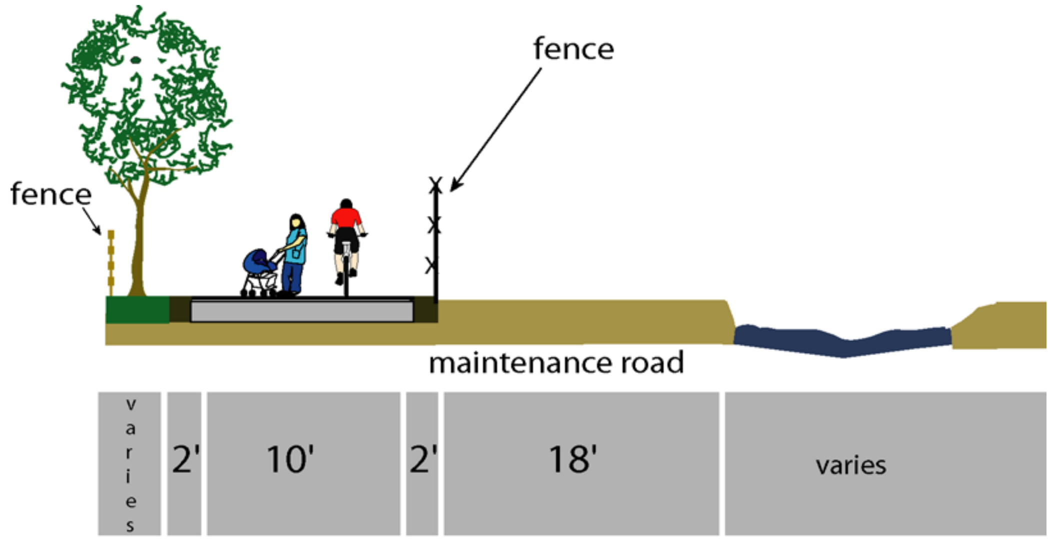


Figure 3-4. Shared-Use Pathway along Lateral or Canal

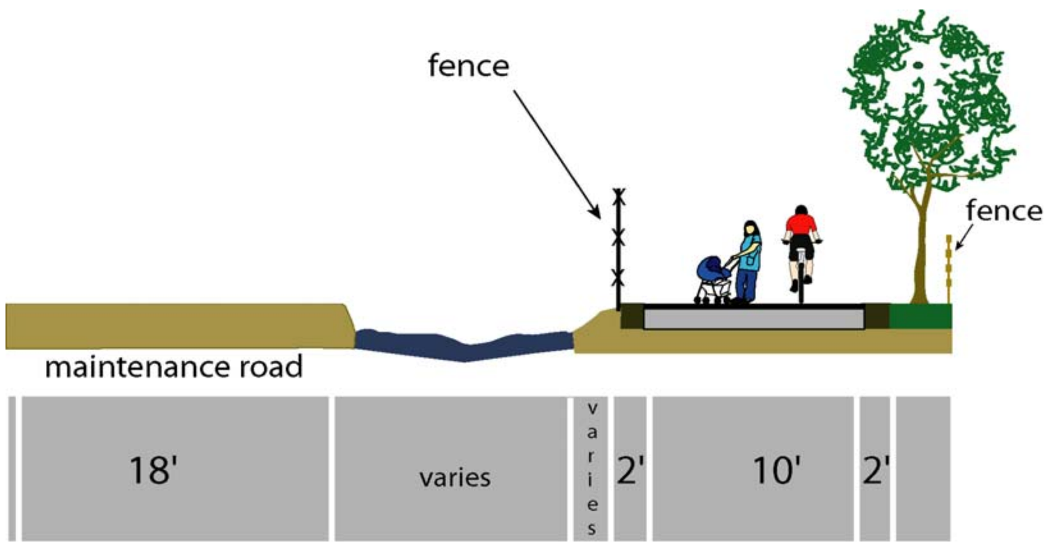


Figure 3-5. Shared-Use Pathway along Lateral or Canal

Other Waterways

Figure 3-6 illustrates a typical shared-use pathway design that is appropriate for pathways along other designated waterways such as drainages and ditches. This pathway is designed to accommodate the same type of non-motorized traffic as a canal pathway. The design for this type of waterway pathway (a ditch, drainage, creek, etc) is different from the canal and lateral pathway design based on the volume of water being transported, the destination of the water, and a reduced need for access to the corridor by the irrigation districts.

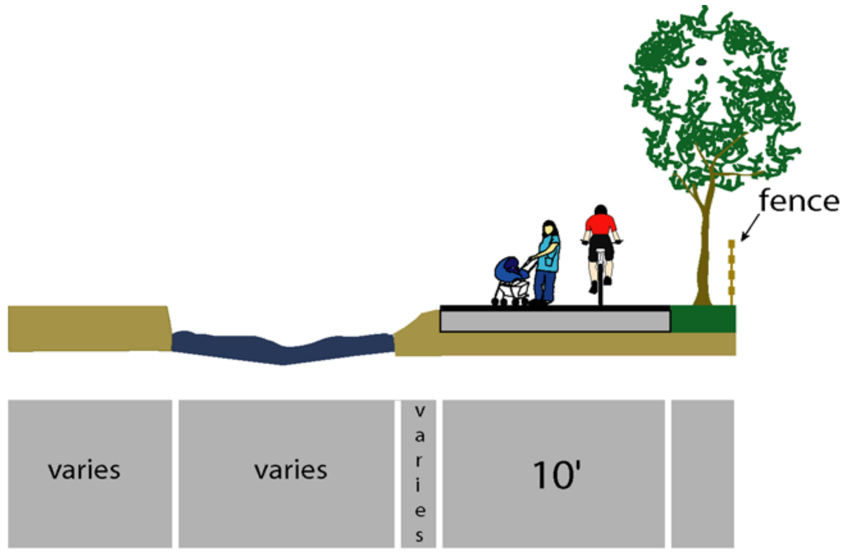


Figure 3-6. Shared-Use Pathway along Other Designated Waterways

Residential Pathway

Figure 3-7 illustrates a typical shared-use pathway design that is appropriate for pathways through new residential developments where there is no feasible natural feature (such as a canal) to locate the pathway. The pathway is designed to accommodate two-way bicycle and pedestrian traffic. The pathway is typically located within the road right-of-way and parallels the roadway through the residential development. It is located on one side of the road and separated by a planting buffer 6-8 feet wide. The pathway is paved (asphalt or concrete) to meet ADA requirements.

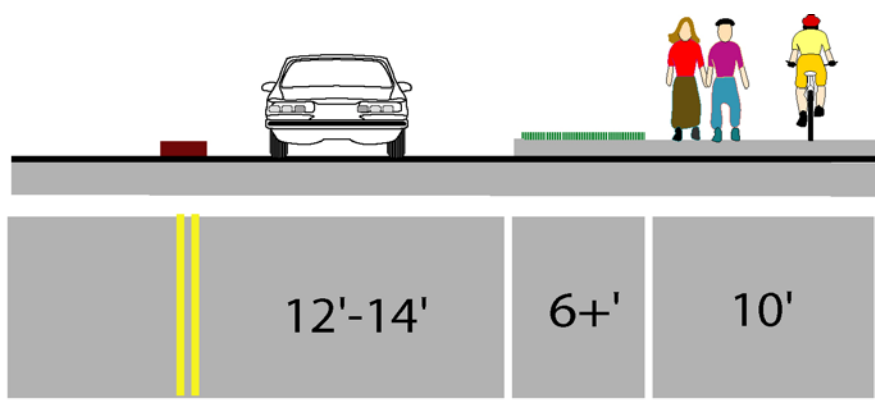


Figure 3-7. Shared-Use Pathway through Residential Developments in Road Right-of-Way

Treasure Valley Rail-with-Trail Pathway

Figure 3-8 illustrates a typical shared-use pathway design for a rail-with-trail pathway through Meridian. As noted earlier, rail service includes two to three trains daily that travel 20-25 mph through the city with active spur lines as well. The railway generally has a 200-foot easement. This pathway is designed to accommodate two-way bicycle and pedestrian traffic, typically has its own right-of-way, and can accommodate maintenance and emergency vehicles. The pathway layout must consider the existing and future operational footprint of the railroad – i.e., double tracking, spur line, commuter rail, etc.

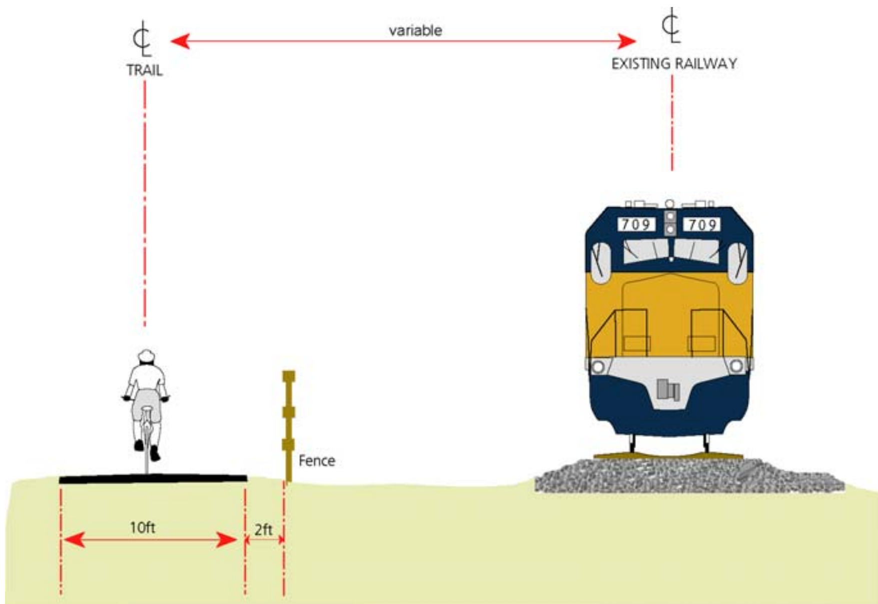


Figure 3-8. Rail-with-Trail Pathway

Figure 3-9 illustrates the corridor with the existing railroad line, a high-speed commuter transit line, and the pathway all located within the existing easement.

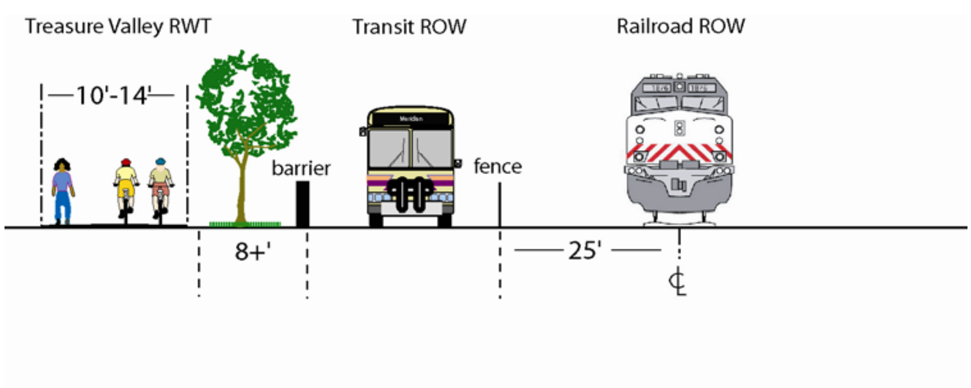


Figure 3-9. Rail-with-Trail Pathway

Urban Pathways

In some cases, the Meridian pathway system may utilize on-street routes to provide connections between pathways or to important destinations that cannot be made outside of the street right-of-way. Urban pathways will mainly utilize low traffic/low speed residential and neighborhood streets and consist of on-street segments, with pedestrians using the existing sidewalk and bicyclists sharing the road with motor vehicles (Figure 3-10). Where a collector road is identified as an urban pathway, the typical design will include a bike lane for bicyclists and a sidewalk for pedestrians (Figure 3-11).

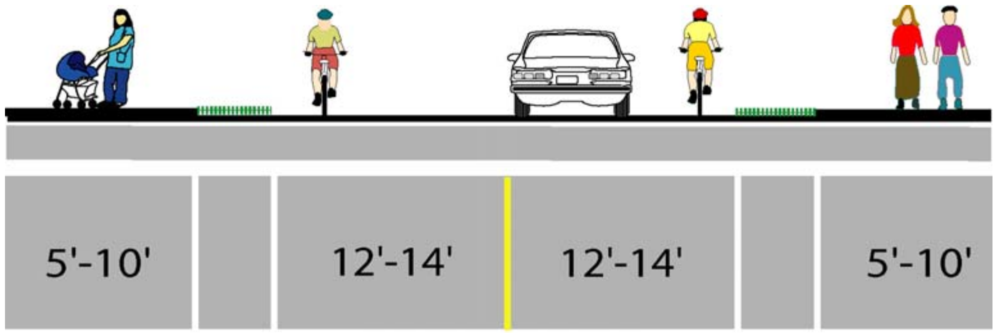


Figure 3-10. Urban Pathway on Low-Volume Neighborhood Street

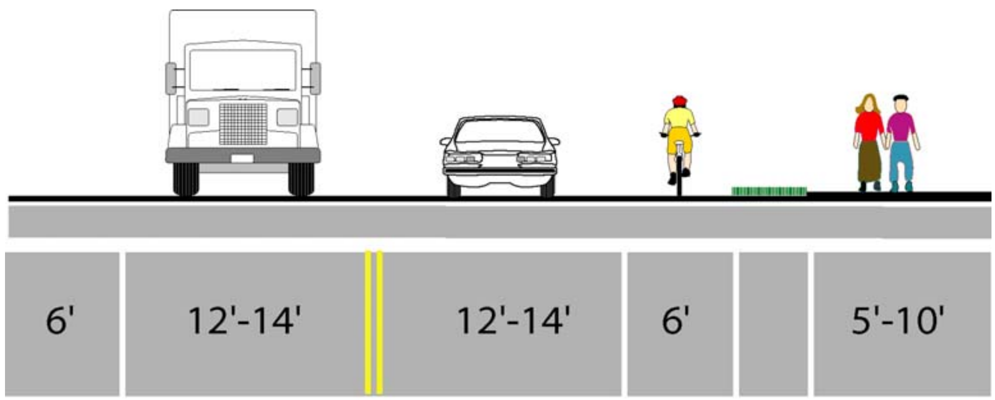


Figure 3-11. Urban Pathway on Collector Road

Micro Pathway (Accessway)

Accessways and micro paths have paved surfaces and are typically 5-8 feet wide (Figure 3-12). Where they provide a direct connection to a park, school, or other neighborhood attraction, micro paths will generally have their own right-of-way, separated from the street system.

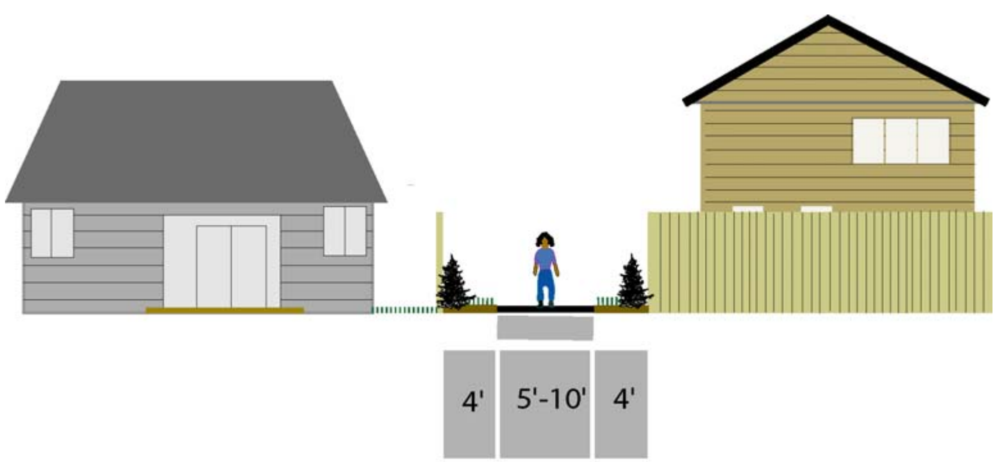


Figure 3-12. Micro Pathway (Accessway)

Innovative Pathway Features

There are also other innovative ways to provide direct access, particularly in topographically constrained areas (i.e., on steep hills, over waterways, etc.) Stairs, alleyways, and bridges can provide quick and direct connections throughout the district and can be designed so they are safe, inviting, and accessible to most pathway users. For example, stairways can have wheel gutters so that bicyclists can easily roll their bicycles up and down the incline and boardwalks can provide access through sensitive wet areas and across small waterways (Figure 3-13). The irrigation districts will not allow bridges over larger waterways such as canals and laterals due to safety and operational concerns.

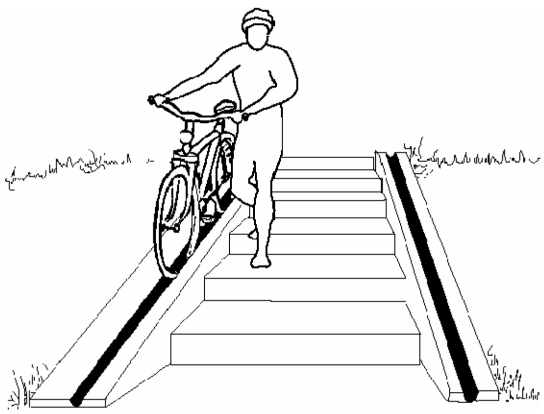


Figure 3-13. Stairways with Wheel Gutters (left) and Boardwalk (right)

Innovative Roadside Pathway Treatments

Filter strips and bio-swales are innovative ways to retain and treat stormwater from impervious surfaces and work well with residential pathways. The design guidelines for filter strips and swales are similar; both methods use grassy vegetation or aggregate to remove sediment from stormwater runoff. Use of filter strips and swales can be limited in retrofit situations due to slope, soil, and right-of-way conditions. Existing underground utility conflicts may increase cost and complexity.

Filter Strips

Filter strips (Figure 3-14) are gently sloped grassy and aggregate areas that are used to treat small quantities of sheet flow runoff. They are often used to pre-treat stormwater flow of minimal depth (.5 inches) as it passes from an impervious area, like a parking lot or roadway, into a swale or infiltration area. Sidewalk width illustrated is a minimum.

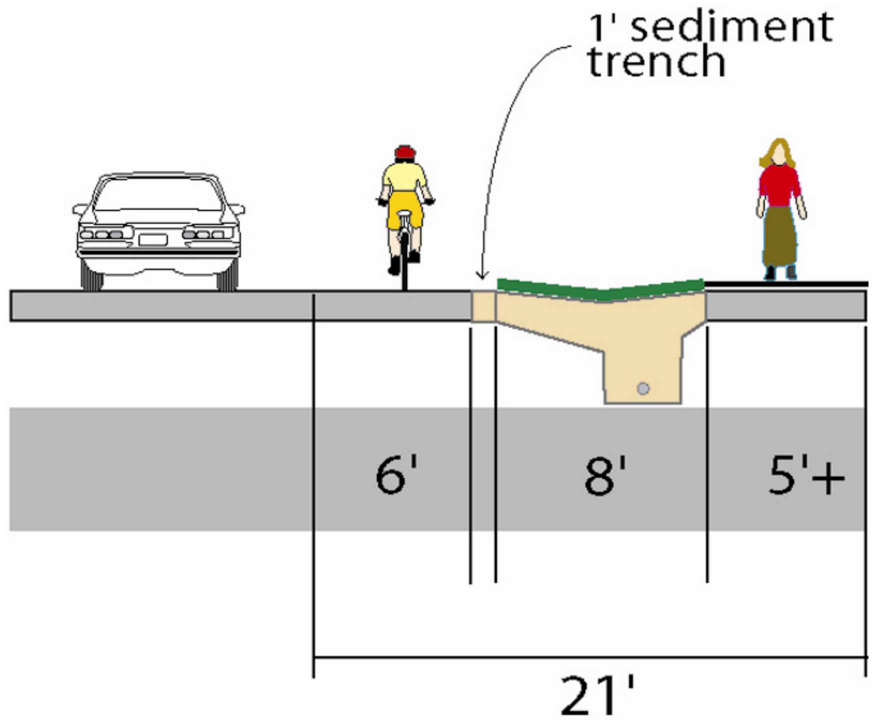


Figure 3-14. Filter Strip with Sediment Trench

Swales

Swales (Figure 3-15) are shallow, wide depressions adjacent to roadways and pathways that collect stormwater runoff over vegetation to slowly settle sediments and particulate matter. The pollutants are filtered out, settled, or removed by plants, causing fewer pollutants to enter ecologically sensitive water bodies.

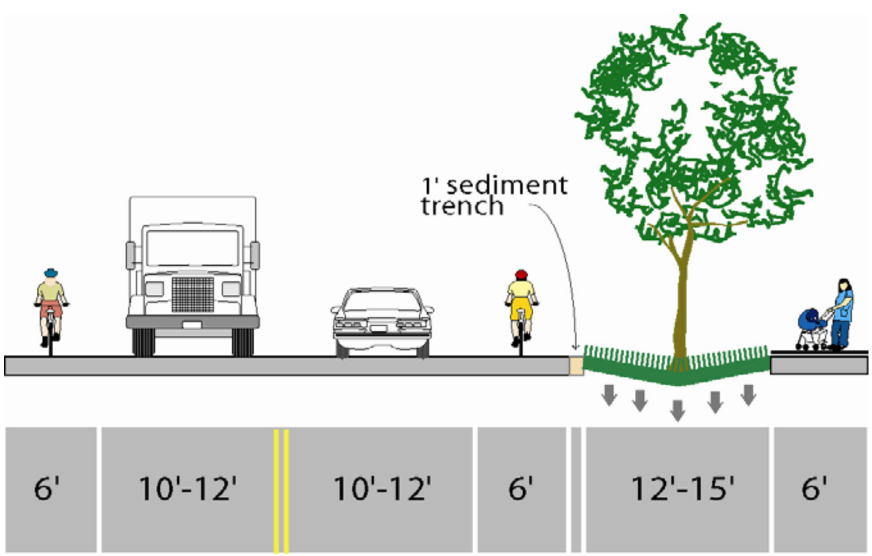


Figure 3-15. Bio-Swale

Table 3-1. Bio-swale Guidelines

Optimal Length	200 – 250 ft
Slope of sides (optimal)	1 – 2%
Slope of sides (minimum, maximum)	1 %, 6%
Optimal water depth	3 inches
Optimal width	12 ft

Signage

The Meridian Pathway System should use a comprehensive signage system that includes three types of signs: directional, regulatory, and interpretive. Signage style and imagery should be consistent throughout the system to provide the pathway user with a sense of continuity, orientation, and safety. As a general rule, caution should be exercised to not "over sign" the pathways. Incorporation of signage into planned vertical elements such as bollards should be encouraged. This will avoid "visual pollution" of too many signs along the pathways and an excessive number of sign poles.

Directional Signage

Directional signage provides orientation to the pathway user and emphasizes the continuity of the pathway. Street names, mileage markers, and place names are key elements that should be called out along the pathway. Street names should be called out at all pathway intersections with roadways. Mileage markers should be located with mileage call outs at quarter-mile increments. In addition to providing a distance reference, mileage markers are an attraction to joggers and walkers that target exercise for set distances. Directional signage (Figure 3-16) should be used to call out key destinations along the pathway route.

Regulatory Signage

The Manual of Uniform Traffic Control Devices clearly delineates how regulatory signage should be incorporated into trails and pathways.

Pathway Access Signage

Informational signage should be provided that includes a "You Are Here" map and pathway etiquette signs (Figure 3-17) at major pathway access points. These should be placed on an information kiosk (Figure 3-18), designed to be reflective of the Treasure Valley heritage. Kiosks must be ADA compliant.

Pathway Etiquette Sign: Utilize at Key Access Points

The pathway etiquette sign will clearly list proper rules and customs for pathway users. This will be based on national standards and accepted pathway practices. A sample sign is shown in Figure 3-17.

Figure 3-16. Directional Signage

Figure 3-17. Pathway Etiquette Sign

Interpretive Signage

Interpretive signage provides enrichment to the pathway user experience, focuses attention on the unique attributes of Meridian and the Treasure Valley, and provides educational opportunities. The natural and cultural resources in the surrounding Treasure Valley provide opportunities for interpretation related to the agricultural and commercial history of the area.

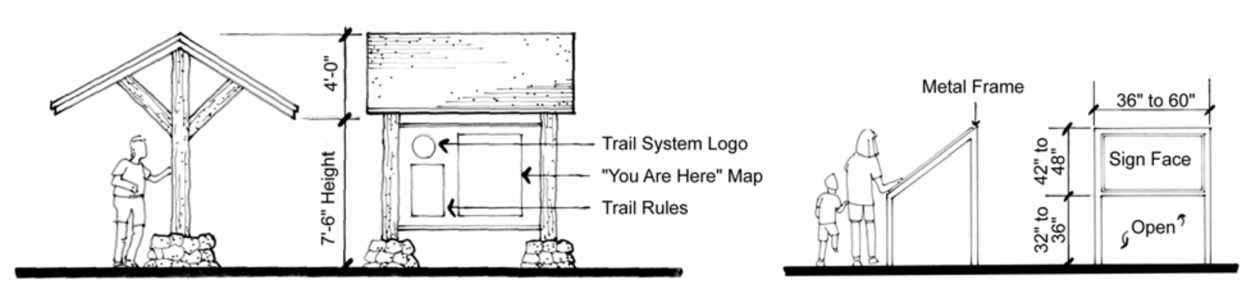


Figure 3-18. Interpretive Signing and Information Kiosk

Bollards

Posts or bollards at roadway/trail intersections and trail entrances will be necessary to keep vehicles from entering the pathway system. Posts will be designed to be visible to bicyclists and others, especially at nighttime, with reflective materials and appropriate striping. Posts will be designed to be removable by emergency vehicles. Details for both permanent and removable bollards can be found later in this chapter.

- **Fixed bollards**: Should be used at roadway/trail intersections. Bollards should be heavy structures and spaced at 5' 0" on center.
- **Removable bollards**: Install center removable bollards at intersections that can be keyed and locked to allow maintenance and emergency service vehicle access to the trail. Recommend use of plastic wood.

Landscaping

Vegetative Buffers

When possible, landscaping is the first choice for creating separation between a pathway and adjacent properties. Vegetative buffers have the dual purpose of creating a natural privacy screen and providing habitat for some of the wildlife that live near a pathway (i.e. birds, small mammals). Landscaping can also be an effective barrier to unwanted access where needed

Invasive Plant Removal

Implementation of new pathway projects will likely require the removal of some non-native and native vegetation along the existing corridor. The majority of vegetation will likely be non-native and invasive species. This should be followed up with planting efforts (possibly through volunteer effort) that will ultimately shade out the nuisance plants. Manual removal is a relatively low impact method of controlling invasive plants, but some species may require spot application of a state-approved herbicide.

Recommended Plants

Use of native plant materials that can establish in one or two growing seasons should be encouraged.

Areas cleared of invasive/non-native vegetation should be planted with native shrubs and groundcover. Riparian plantings along the canals should also be encouraged.

Fencing

As a general policy, fencing will be the responsibility of the adjacent resident. Although the public often perceives fencing as a means of assuring safety by prevention of unwanted access, too much fencing can have the opposite effect by impairing informal trail surveillance. Inappropriate fencing can also degrade the experience of trail users, obscuring views and creating a "tunnel" effect that make users feel trapped.

Should adjacent property owners choose to build fences, a variety of fencing applications can be considered (Figure 3-19). Solid fencing that does not allow any visual access to the trail should be discouraged. Fencing that allows a balance between adjacent residents' privacy and allowing for informal surveillance of the trail should be encouraged.

A fencing height of six feet is typically sufficient to provide security along the canals. Lower fencing of approximately four feet can also provide a barrier sufficient to denote private property or deter most access for adjacent residences.

Figure 3-19. Residential Fencing along Trails

Amenities

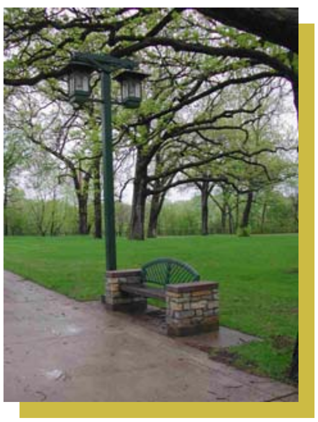
There are a number of amenities that make a pathway system inviting. Below are some common amenities that make systems stand out.

Interpretive Installations

Interpretive installations and signs can enhance the users experience by providing information about the history of Meridian and the surrounding area. Installations can also discuss local ecology, environmental concerns, and other educational information.

Water Fountains and Bicycle Parking

Water fountains provide water for people (and pets, in some cases) and bicycle racks allow recreational users to safely park their bikes if they wish to stop along the way, particularly at parks and other desirable destinations.



Pedestrian-Scale Lighting and Furniture

Pedestrian-scale lighting improves safety and enables the facility to be used year-round. It also enhances the aesthetic of the pathway. Lighting fixtures should be consistent with other light fixtures in the city, possibly emulating a historic theme.

Providing benches at key rest areas and viewpoints encourages people of all ages to use the pathway by ensuring that they have a place to rest along the way. Benches can be simple (e.g., wood slates) or more ornate (e.g., stone, wrought iron, concrete).

Maps and Signage

A comprehensive signing system makes a bicycle and pedestrian system stand out. Informational kiosks with maps at trailheads and other pedestrian generators can provide enough information for someone to use the network with little introduction – perfect for areas with high out-of-area visitation rates as well as the local citizens.

Art Installations

Local artists can be commissioned to provide art for the pathway system, making it uniquely distinct. Many pathway art installations are functional as well as aesthetic, as they may provide places to sit and play on.

Pathway Amenity Specifications

Trash cans should be located at primary pathway access points along with other amenities such as benches and information kiosks. Care must be taken to locate trash receptacles far enough from the surrounding homes to ensure that residential garbage does not appear in the Parks Department's trash receptacles.

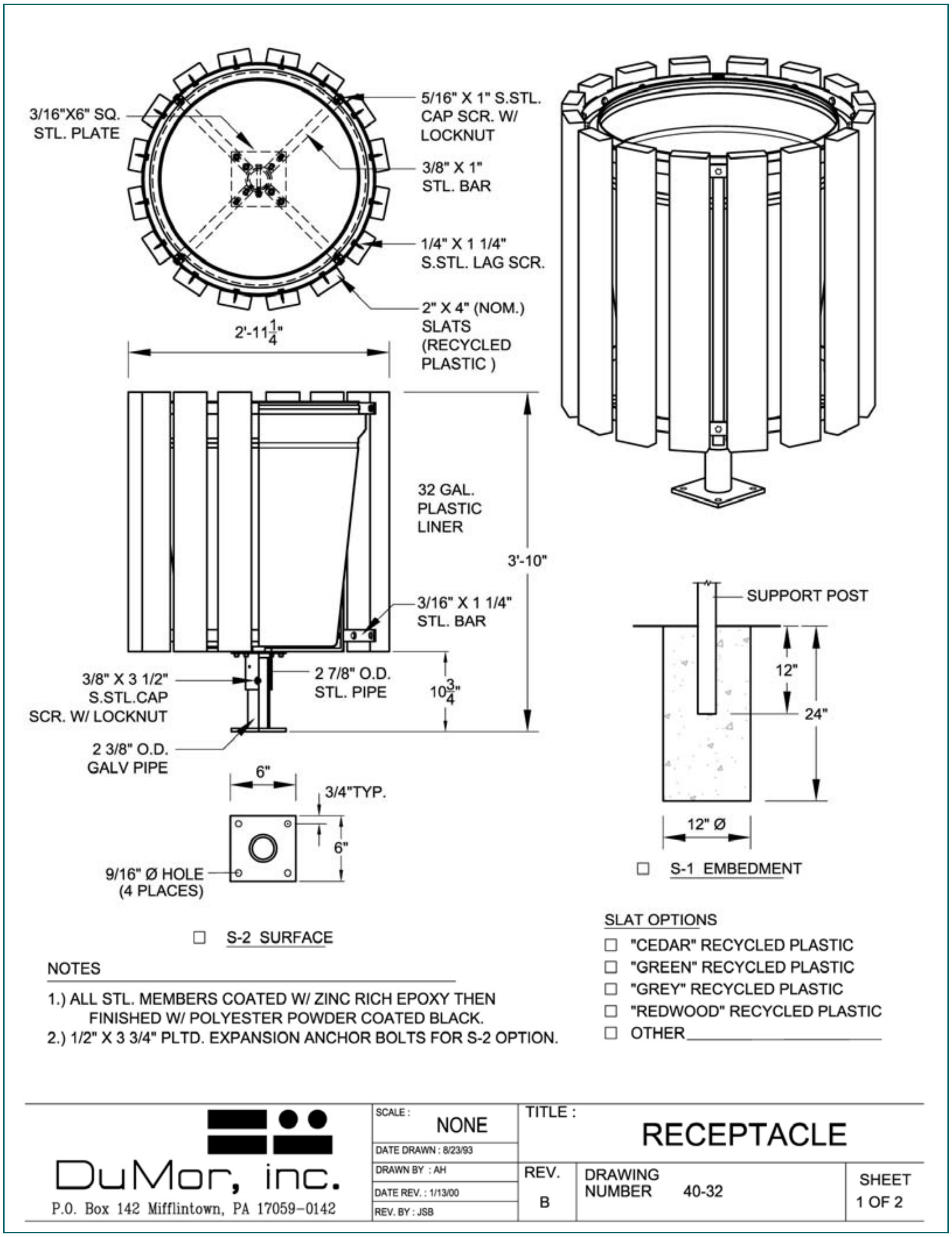


Figure 3-20. DuMor Trash Receptacle

Benches should be located at primary pathway access points and other well-lit, highly trafficked areas with other amenities to ensure proper use.

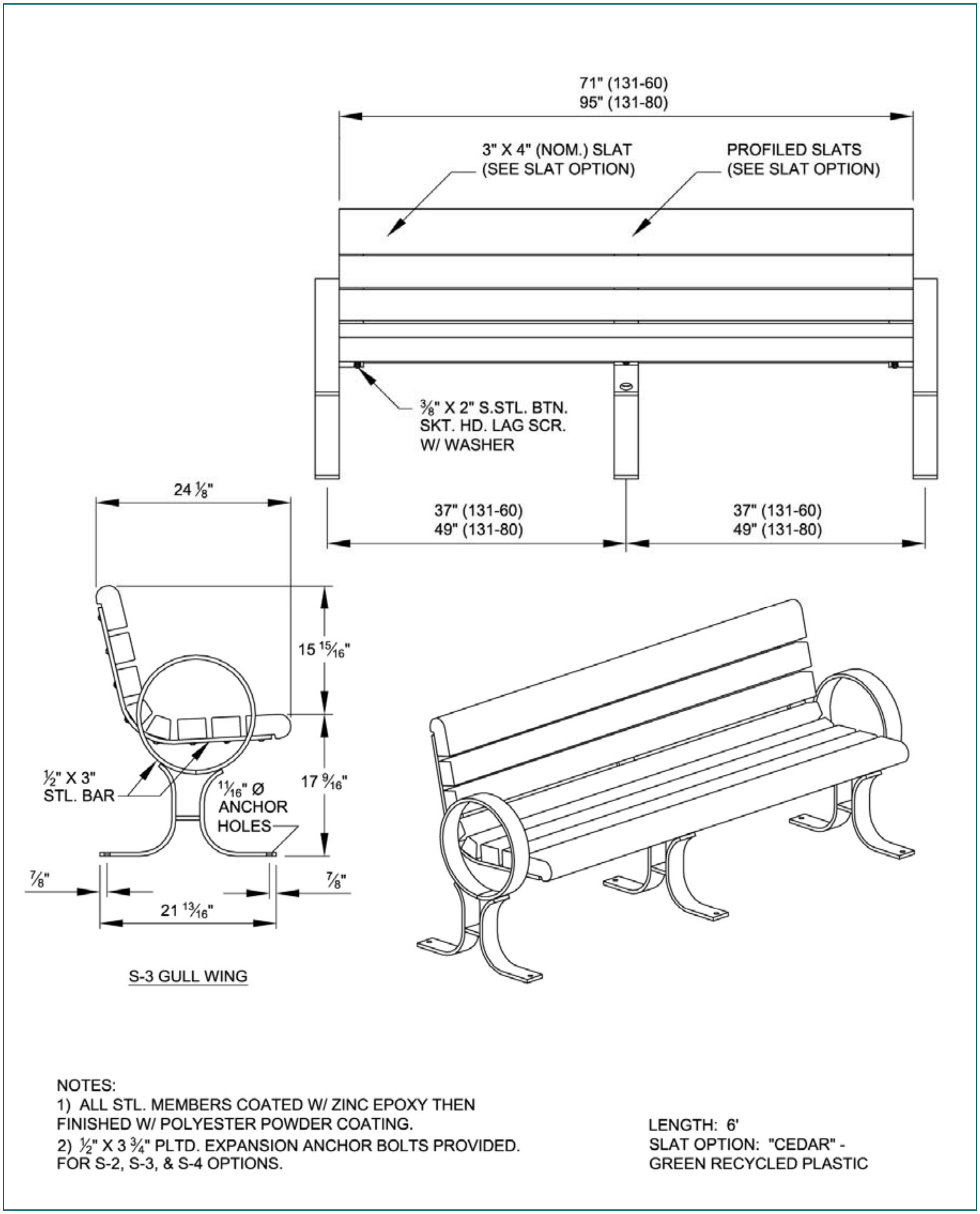


Figure 3-21. DuMor Bench

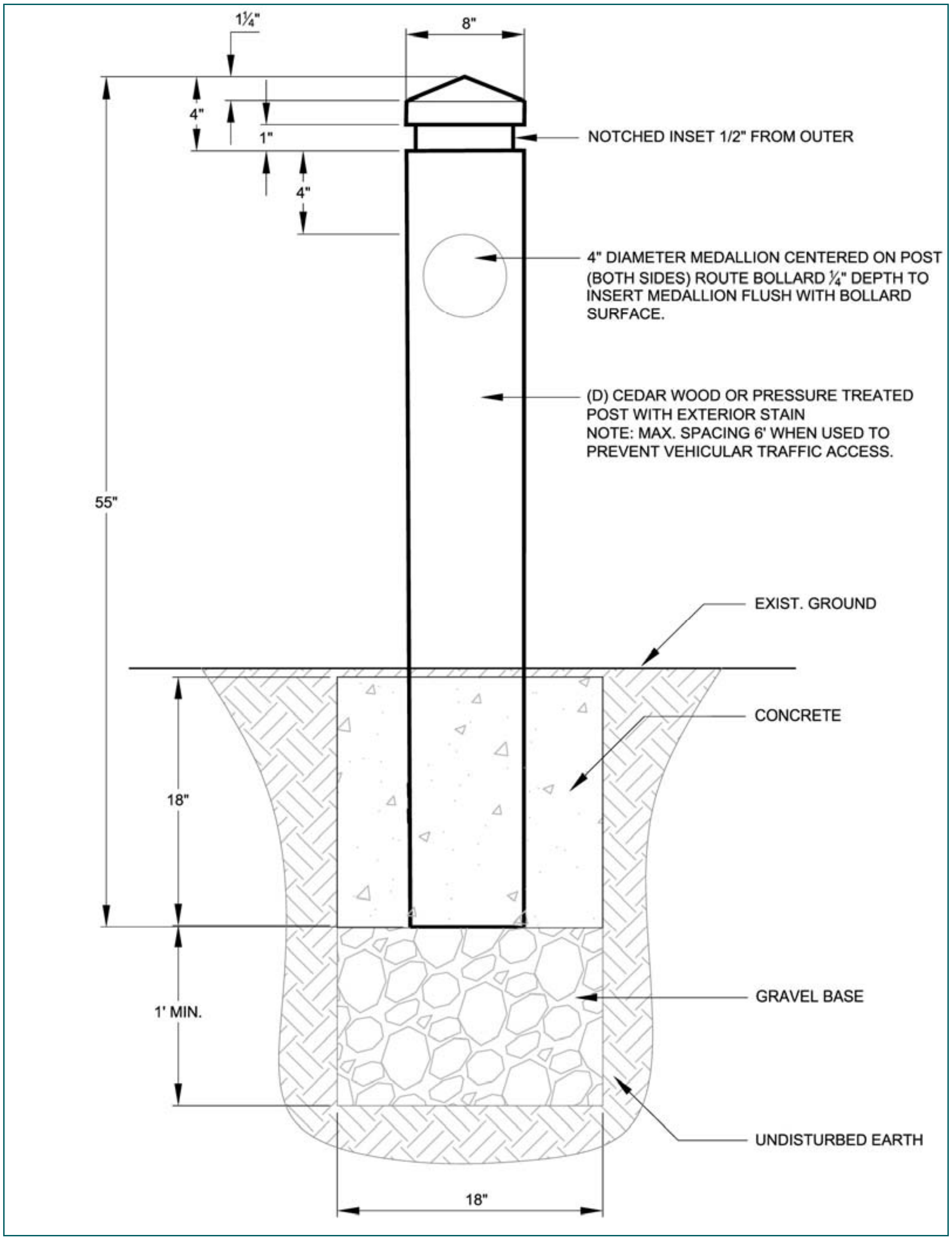


Figure 3-22. Permanent Bollard

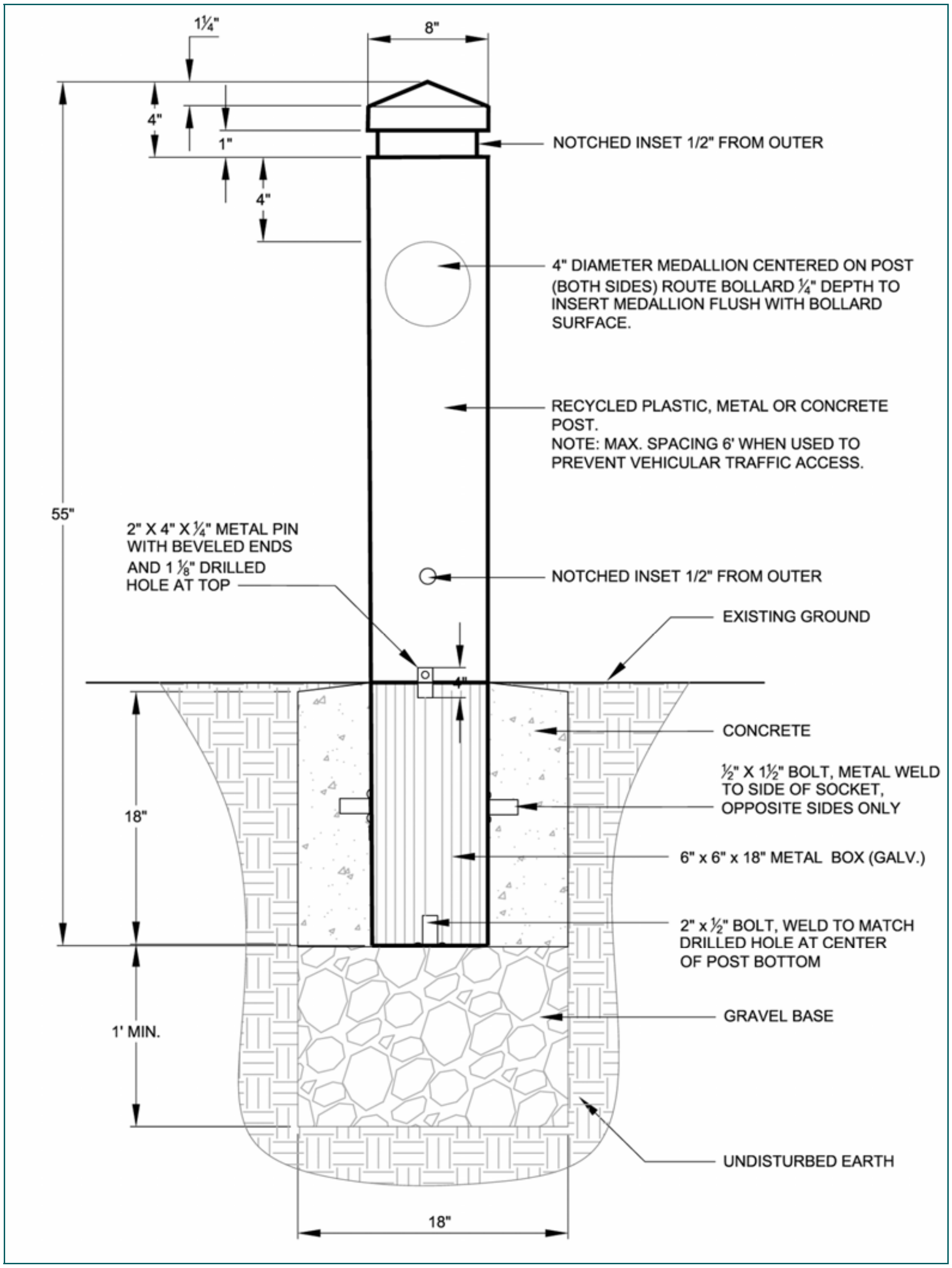


Figure 3-23. Removable Bollard

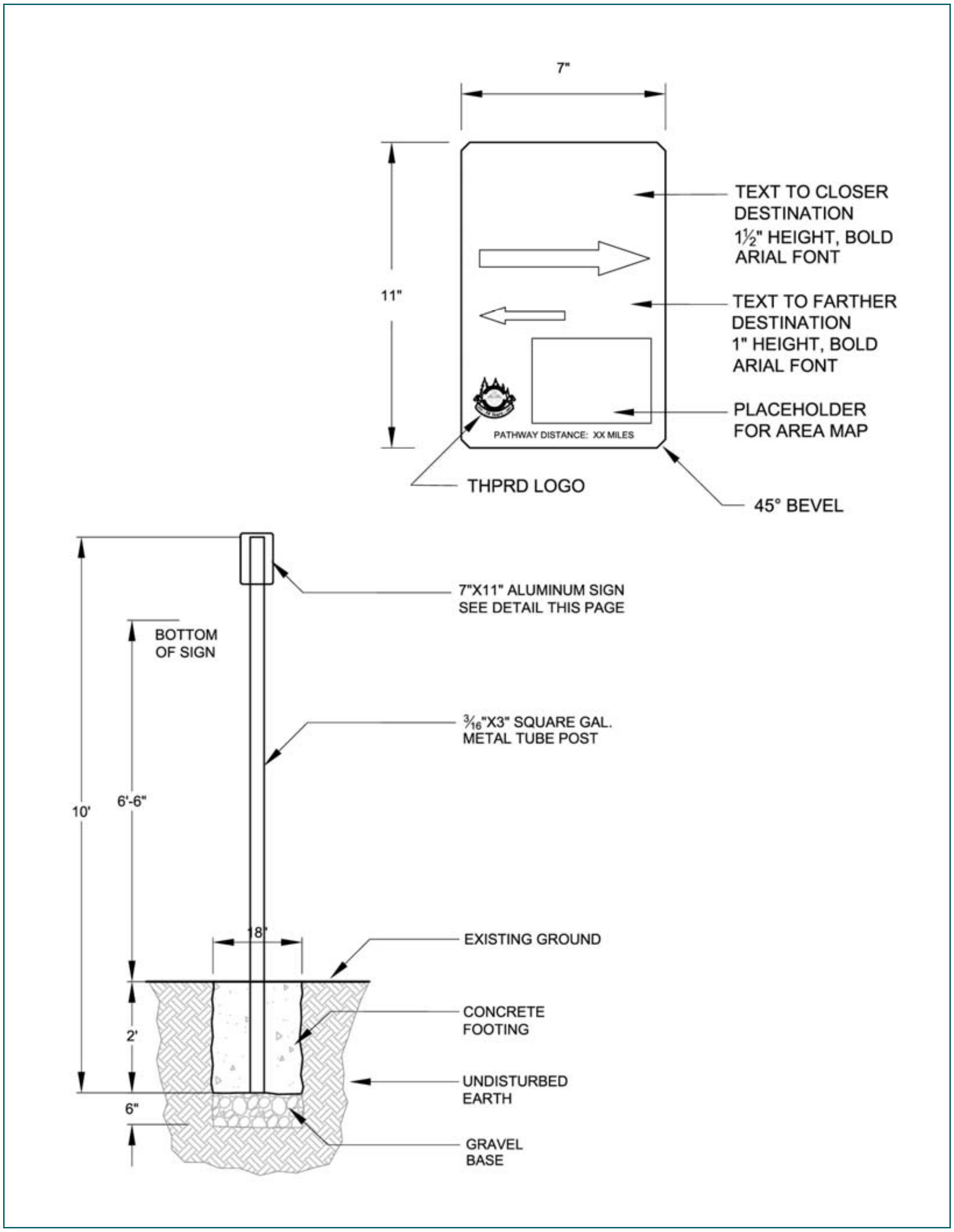


Figure 3-24. Directional Sign

Universal Access

All public facilities must be built to meet the requirements of the American's With Disabilities Act (ADA). The act was established to prohibit discrimination based on disability by public accommodations and requires places of public accommodation and commercial facilities to be designed, constructed, and altered in compliance with the accessibility standards established by the ADA. (http://www.usdoj.gov/crt/ada/stdspdf.htm).

ADA design standards establish criteria to support universal access. All paths and ramps are to be designed with the least possible slope. The maximum slope allowed by ADA design standard for a walkway in new construction shall be 1:12 or 8.33% of rise, over 30 feet of run (http://www.access-board.gov/adaag/html/adaag.htm#4.8). When designing for the maximum slope, landings are needed every 30 inches of rise along with handrails. Paths will have a continuous clear width of 5 feet minimum so that two wheelchairs can pass each other. In order to provide extra traction, decking should be set perpendicular to the walking direction. Standard code requirements state that where the walkway/ boardwalk will be 30 inches or more from the ground plain, guardrails will be added to the design. In areas 30 inches or lower, curbing stops will be constructed to edge the walkway.

It is recognized that constructing pathways outdoors may have limitations that make meeting ADA standards difficult and sometimes prohibitive. Prohibitive impacts include harm to significant cultural or natural resources, a significant change in the intended purpose of the pathway, requirements of construction methods that are against federal, state or local regulations, or presence of terrain characteristics that prevent compliance. Table 3-2 provides guidelines for development of accessible pathways.

Simple details to be considered in the planning and design process can greatly enhance accessibility to and within the planned system. Breaks in long grades, consideration of the user's eye level, minimizing grades at drainage crossings, providing areas to get off the pathway, and appropriately designed seating walls are examples of simple accessible improvements. Consultation with the physically challenged on specific design issues prior to the planning and design of pathways or trailhead facilities can be very beneficial and is encouraged for every accessible project.

Table 3-2. ADA Pathway Development Guidelines

Item	Recommended Treatment	Purpose
Pathway Surface	Hard surface such as, asphalt, concrete, wood, compacted gravel	Provide a smooth surface that accommodates wheelchairs
Pathway Gradient	Maximum of 5%	Greater than 5% is too strenuous
Pathway Cross Slope	2% maximum	Provide positive pathway drainage, but avoid excessive gravitational to side of pathway
Pathway Width	5' Minimum	Accommodate a wide variety of users

Item	Recommended Treatment	Purpose
Pathway Amenities, phones, drinking fountains, pedestrian actuated buttons	Place no higher than 4' off ground	Provide access within reach of wheelchair users
Detectable pavement changes at curb ramp approaches	Place at top of ramp before entering roadways	Provide visual cues for visually impaired
Trailhead Signage	Accessibility information such as pathway gradient/profile, distances, tread conditions, location of drinking fountains and rest stops	User convenience and safety
Parking	Provide at least one accessible parking area at each pathway head	User convenience and safety
Rest Areas	On pathways specifically designated as accessible, provide rest areas/widened areas on the pathway	User convenience and safety

Pathway-Roadway Crossings

General Crossing Design Treatment

Like most pathways in built urban areas, the City of Meridian pathways must cross roadways at certain points. While at-grade crossings create a potentially high level of conflict between pathway users and motorists, well-designed crossings have not historically posed a safety problem, as evidenced by the thousands of successful pathways around the United States with at-grade crossings.

The current practice in Meridian is an unmarked, unsignalized crossing, at which a pathway user would wait for a gap in traffic to cross. The lack of markings or signals at most crossings can be very intimidating for pathway users, and may be challenging enough to suppress potential pathway usage. However, in most cases, pathway crossings can be properly designed at-grade to a reasonable degree of safety and meet existing traffic and safety standards.

Grade separated crossings are recommended in certain situations, which are discussed later in this section. The conversion of existing at-grade pathway crossings to grade-separated crossings is a difficult and expensive undertaking and should be considered where other traffic control measures have failed, where the natural topography lends itself to a grade-separated crossing, or where persistent safety issues exist.

Pathway-roadway crossings should comply with the Association of American State Highway and Transportation Officials (AASHTO) Guide for the Development of Bikeway Facilities, Idaho Transportation Department (ITD), the Ada County Highway District (ACHD), and Manual of Uniform Traffic Control Devices (MUTCD) standards.

Crossings of arterial roadways should be placed at locations that have or likely to have signalization in the future. This will typically occur at the intersection of another road, either existing or planned, with the arterial. On roadways of lesser functional classification, pathway crossings are allowed outside of planned or existing taper or storage areas.

There is a need for the City of Meridian and ACHD to collaboratively assess the appropriate treatment of any roadway crossing during the development review process and the construction of either pathways or roadway projects to ensure a safe crossing environment. Evaluation of pathway crossings involves analysis of vehicular and pathway user traffic patterns, including speeds, street width, traffic volumes (average daily traffic, peak hour traffic), line of sight, and pathway user profile (age distribution, destinations). This study identifies the most appropriate crossing options given available information, which must be verified and/or refined through the actual engineering and construction document stage.

At-Grade Crossing Prototypes

The proposed intersection approach that follows is based on established standards, [1] published technical reports,[2] and the experiences from cities around the country.[3] At-grade pathway-roadway crossings will fit into one of four basic categories:

- Type 1: Marked/Unsignalized, Type 1+: Marked/Enhanced
- Type 2: Route Users to Existing Intersection
- Type 3: Signalized/Controlled
- Type 4: Grade-separated crossings

Type 1: Marked/Unsignalized Crossings

A marked/unsignalized crossing (Type 1) consists of a crosswalk, signing, and often no other devices to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, pathway traffic, use patterns, vehicle speed, road type and width, and other safety issues such as the proximity of schools. The following thresholds recommend where unsignalized crossings may be acceptable:

Type 1 Crossing

Maximum traffic volumes:

- ≤ 9,000-12,000 ADT
- Up to 15,000 ADT on two-lane roads, preferably with a median.
- Up to 12,000 ADT on four-lane roads with median.

[1] MUTCD, AASHTO Guide for the Development of Bicycle Facilities, Oregon Pedestrian and Bicycle Guide.

[2] Federal Highway Administration (FHWA) Report, "Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations."

[3] In particular, the recommendations in this report are based in part on experiences in cities like Portland (OR), Seattle (WA), Tucson (AZ), and Sacramento (CA), among others.

Maximum travel speed:

- 35 mi/h

Minimum line of sight:

- 25 mi/h zone: 155 feet
- 35 mi/h zone: 250 feet
- 45 mi/h zone: 360 feet

If well designed, crossings of multi-lane higher volume arterials over 15,000 ADT may be unsignalized with features such as a combination of some or all of the following: excellent sight distance, sufficient crossing gaps (more than 60 per hour), median refuges, and/or active warning devices like flashing beacons or in-pavement flashers. These are referred to as Type 1 Enhanced (Type 1+). Furthermore, both existing and potential future pathway usage volume should be taken into consideration.

On two-lane residential and collector roads below 15,000 ADT with average vehicle speeds of 35 mi/h or less, crosswalks and warning signs ("Pathway Xing") should be provided to warn motorists, and stop signs and slowing techniques (bollards/geometry) should be used on the pathway approach. Curves in pathways that cause the pathway user to face oncoming traffic are helpful in slowing pathway users and making them aware of oncoming vehicles. Care should be taken to keep vegetation and other obstacles out of the sight line for motorists and pathway users. Engineering judgment should be used to determine the appropriate level of traffic control and design.

On roadways with low to moderate volumes of traffic (< 12,000 ADT) and a need to control traffic speeds, a raised crosswalk may be the most appropriate crossing design to improve pedestrian visibility and safety.

The crosswalks are raised at least 75 mm above the roadway pavement, similar to speed humps, to an elevation that matches the adjacent sidewalk. The top of the crosswalk is flat and is typically made of asphalt, patterned concrete, or brick pavers. Brick or unit pavers should be discouraged because of potential problems related to pedestrians, bicycles, and ADA requirements for a continuous, smooth, vibration-free surface. Tactile treatments are needed at the sidewalk/street boundary so that visually impaired pedestrians can identify the edge of the street. Costs can range from $5,000 to $20,000 per crosswalk, depending on the width of the street, the drainage improvements affected, and the materials used for construction.

Raised Crosswalk

On roadways with higher traffic volumes, a flashing yellow beacon may be used, preferably one that is activated by the pathway user rather than operating continuously. The costs will range between $5,000 and $15,000 depending on the need for poles with arms and overhead mounted signals. These can be activated by pathway users tripping video or motion detectors on the pathway. This equipment, while slightly more expensive, helps keep motorists alert.

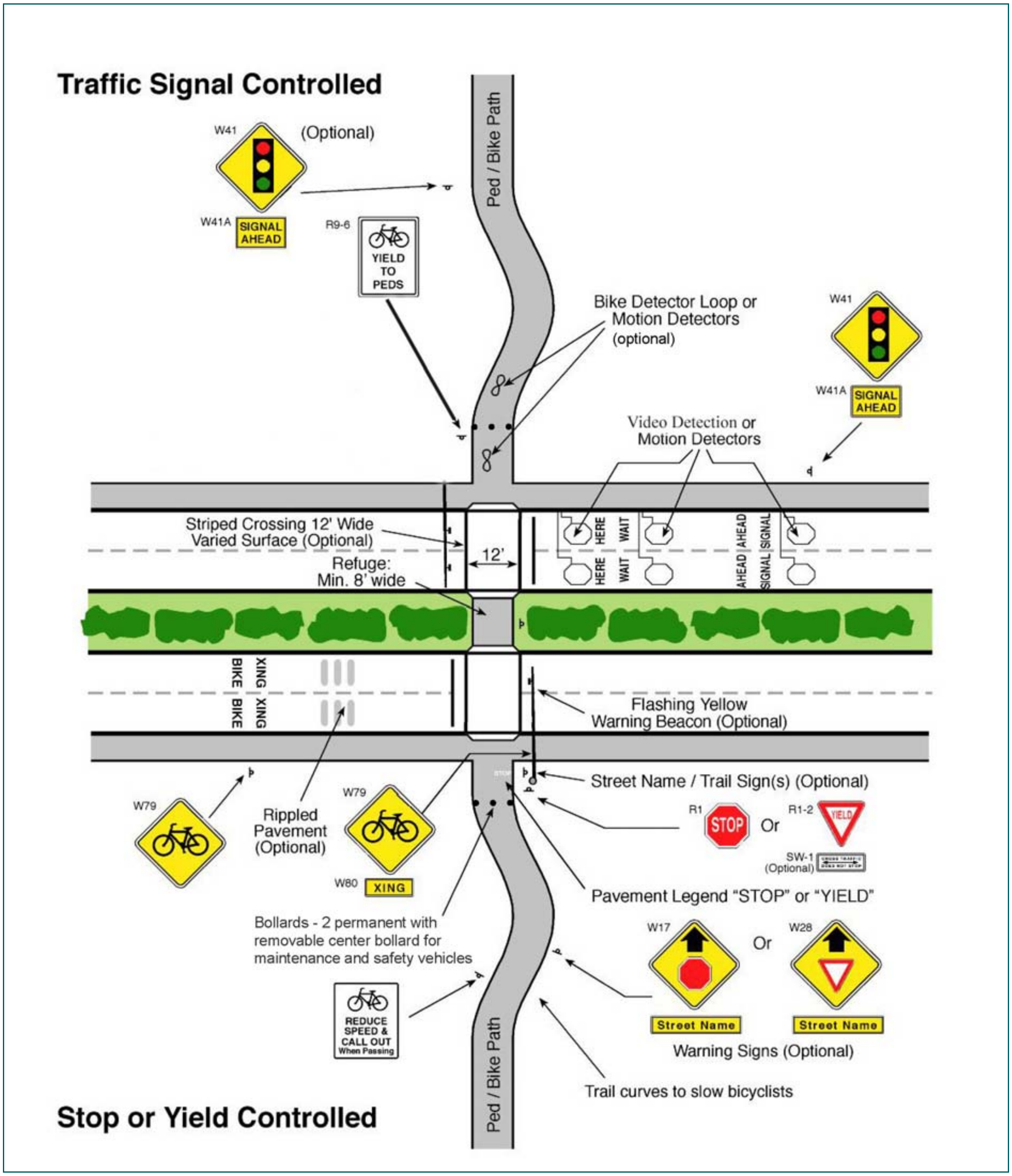


Figure 3-25. Type 1+ Without Signal or Type 3 with Signal Crossing Treatment

Type 2: Route Users to Existing Intersection

Crossings within 250 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection for safety purposes. For this option to be effective, barriers and signing may be needed to direct pathway users to the signalized crossings. In most cases, signal modifications would be made to add pedestrian detection and to comply with the ADA. If the pathway is greater than 250' from the intersection, an alternative crossing type needs to be considered or the pathway alignment needs adjustment to ensure a safe crossing for all users.

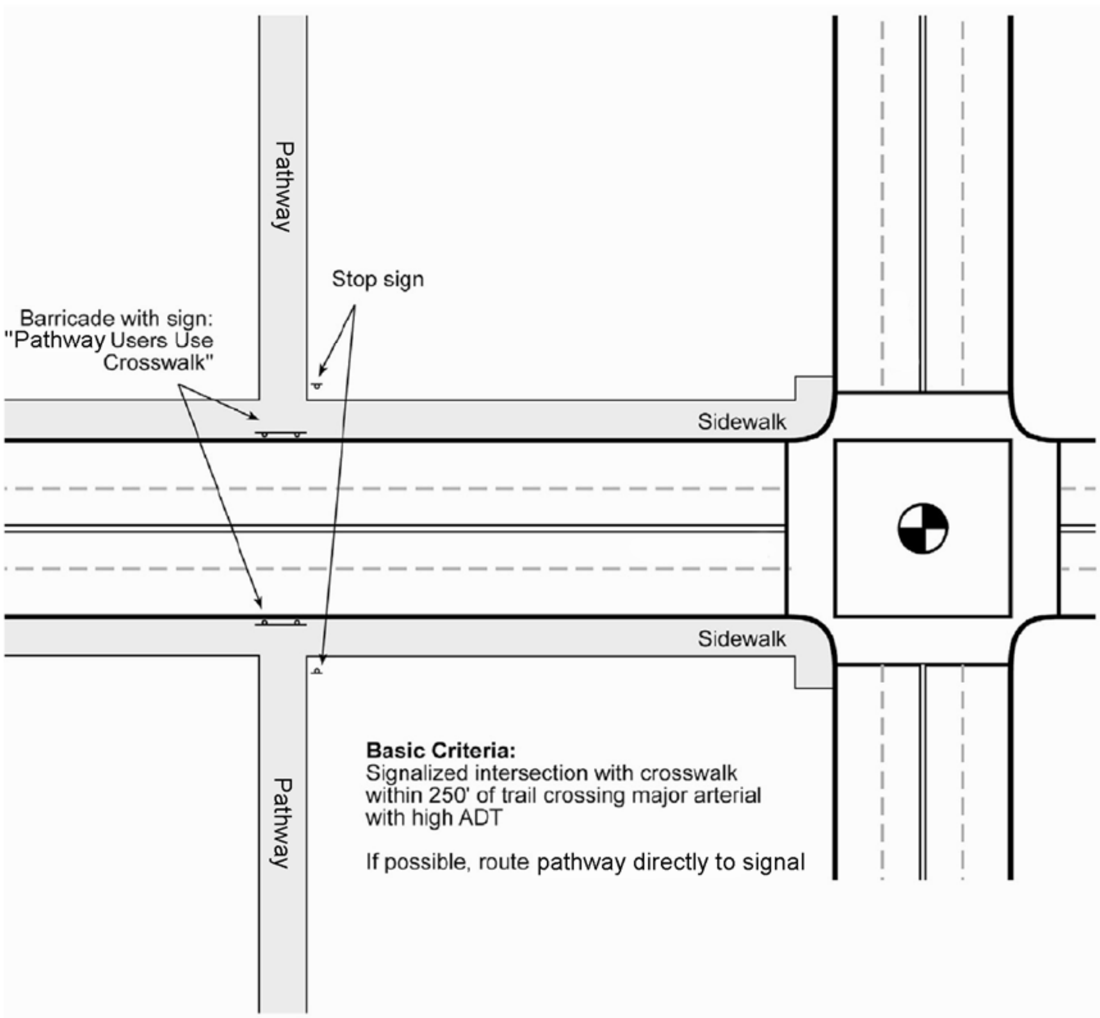


Figure 3-26. Type 2 Roadway Crossing Treatment

Type 3: Signalized/Controlled Crossings

New signalized crossings may be recommended for crossings that meet pedestrian, school, or modified warrants (see pp. 3-28 to 3-32), are located more than 250 feet from an existing signalized intersection and where 85th percentile travel speeds are 40 mi/h and above and/or ADT exceeds 15,000 vehicles. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

Type 3 Crossing

Pathway signals are normally activated by push buttons, but also may be triggered by motion detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street. The signals may rest on flashing yellow or green for motorists when not activated, and should be supplemented by standard advanced warning signs. Typical costs for a signalized crossing range from $150,000 to $250,000. However, there are additional signal choices, such as "half-signals," that are discussed on page 3-32.

Type 4: Grade-separated Crossings

Grade-separated crossings may be needed where ADT exceeds 25,000 vehicles, and 85th percentile speeds exceed 45 mi/h. Safety is a major concern with both overcrossings and undercrossings. In both cases, pathway users may be temporarily out of sight from public view and may have poor visibility themselves. Undercrossings, like parking garages, have the reputation of being places where crimes occur. Most crime on pathways, however, appears to have more in common with the general crime rate of the community and the overall usage of the pathway than any specific design feature.

Type 4 Grade-Separated Undercrossing

Type 4 Grade-Separated Overcrossing

Design and operation measures are available that can address pathway user concerns. For example, an undercrossing can be designed to be spacious, well lit, equipped with emergency cell phones at each end and completely visible for its entire length prior to entering.

Other potential problems with undercrossings include conflicts with utilities, drainage, flood control, and maintenance requirements. Overcrossings pose potential concerns about visual impact and functional appeal, as well as space requirements necessary to meet ADA guidelines for slope.

Signals and Signal Warrants

Full Signalized Crossings

The federal government has provided guidance to determine where traffic control signals should be considered for installation. The Pedestrian Volume signal warrant is intended for the application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. Section 4C.05 of the Manual on Uniform Traffic Control Devices details Warrant 4, Pedestrian Volume. For signal warrant analysis, a location with a wide median, even if the median width is greater than 9 m (30 ft), should be considered as one intersection.

In most of Meridian, it will be unlikely that pathway crossings will meet this warrant for criterion A, because pathway usage has not increased to this point. However, this may be attributed in some part to the lack of intersection protection, among other issues.

Some jurisdictions, such as Portland (OR), have found success in installing traffic signals at pathway/roadway crossings by identifying the pathway as a minor roadway - since it serves as a major non-motorized transportation corridor - and applying Warrant 2, Four-Hour Vehicular Volume of the MUTCD. Portland's Springwater Corridor, for example, crosses three major roadways, at which signals were installed after a Warrant 2 Analysis/Projection.

Warrant 4, Pedestrian Volume

Support:

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

The need for a traffic control signal at an intersection or mid-block crossing shall be considered if an engineering study finds that both of the following criteria are met:

A. The pedestrian volume crossing the major street at an intersection or mid-block location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour;

B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular travel.

At non-intersection crossings, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings if a traffic control signal is justified by both this signal warrant and a traffic engineering study.

Warrant 2, Four-Hour Vehicular Volume

Support:

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic[4] is the principal reason to consider installing a traffic control signal.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 3-27 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mi/h or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 3-28 may be used in place of Figure 3-27.

There are four locations: SE 82nd Ave, SE Foster Road, SE 122nd Ave, and Eastman Parkway along the Springwater Corridor where the pathway crosses a major roadway of above 15,000 ADT. In all four cases, the crossing width was greater than 60 feet, the nearest intersection more than 350 feet away, and all had anticipated pathway user volumes of greater than 100 per hour. Trail designers felt that new signalized crossings would be necessary to facilitate safe travel, and thus developed a signal warrant analysis that projected use through pathway user numbers from the Burke-Gilman Trail in Seattle (WA), and user counts on a one-mile built portion of the Springwater Corridor in Gresham (OR). Each location was also analyzed for sight lines, impacts on traffic progression, timing with adjacent signals, capacity, and safety.

Signalized crossing at 82nd Ave and 122nd Ave in Portland (OR) includes: two marked crosswalks (one for each movement); landscaped median with signal activation; pedestrian and equestrian push button activation; bicyclist loop detector signal activation; good sight lines; and advance warning signs for motorists.

Pathway users activate the signal as follows:

- Pedestrians: push button
- Cyclists: loop detector in pavement
- Equestrians: push button mounted on pole at 8 ft height

[4] According to the MUTCD, "Traffic shall be defined as pedestrians, bicyclists, ridden or herded animals, vehicles, streetcars, and other conveyances either singularly or together while using any highway for purposes of travel."

At SE 82nd, SE Foster Road, and SE 122nd Avenue in Portland (OR), the crossing includes a median island to reduce the crossing distance, signal activation in the median for those unable to cross the entire roadway in one movement, and advance warning signs for motorists. Other crossing features follow the guidelines provided for diverting users to an existing signal as described earlier.

Results

The signalized crossings have been effective and functional. Since their installation in 1995, there have been no reported collisions, with an estimated 500,000 annual users. Pathway users note that although they must activate the signal and wait for a green light, motorists have gotten used to the signal and frequently stop before they get the red light. Traffic engineers report minimal interference with nearby signals, given the relatively distant spacing from the nearest signalized intersections. They also report no problems.

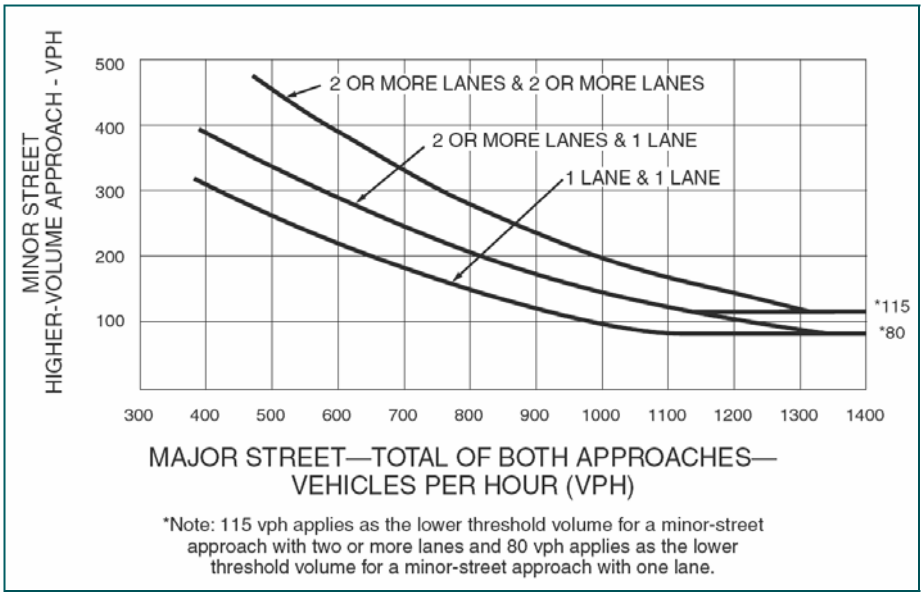


Figure 3-27. Warrant 2, Four Hour Vehicular Volume

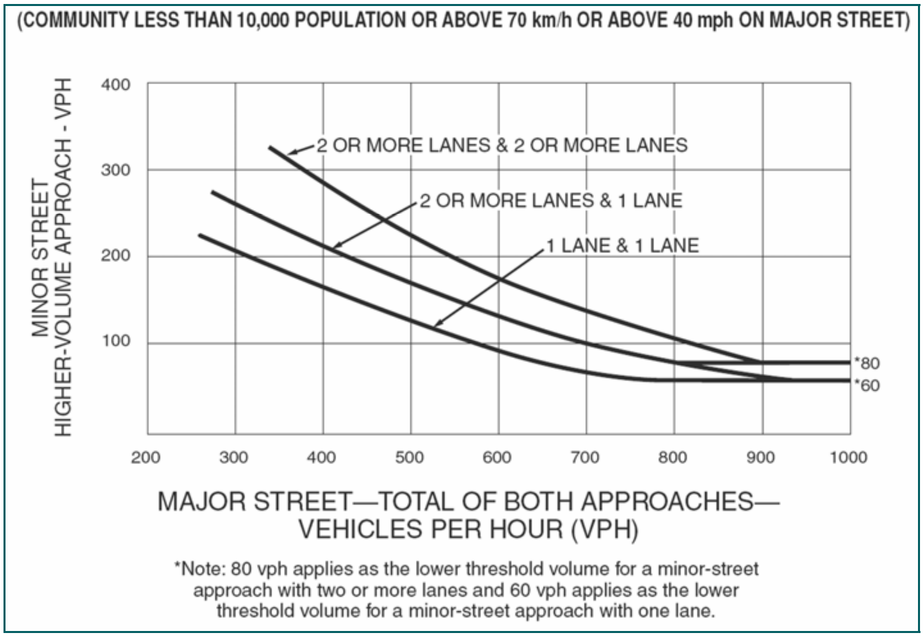


Figure 3-28. Warrant 2, Four Hour Vehicular Volume (70% Factor)

Warrants for the application of Traffic Control Devices (TCD) are a series of guidelines – not absolute values – that should be used in evaluating a situation. The satisfaction of a warrant is not proof that a TCD is needed, and failure to fully satisfy any specific warrant does not guarantee that the device could not serve a useful purpose. The application of warrants is effective only when combined with sound engineering judgment.

For many of the pathway-roadway crossings in Meridian, utilization of Warrant 2 would allow application of Figure 3-28, as many of the roadways have posted or 85th percentile speeds greater than 40 mi/h. In those situations, only 60 vehicles (a combination of pedestrians and bicyclists) per hour for a four-hour period would be required to trigger the installation of a traffic signal if the location is determined appropriate by local engineers.

Warrant 5, School Crossing, is a third signal warrant that has applications in Meridian. Cities like Sacramento (CA) have modified their usage projections by upwardly accounting for youth, disabled, and elderly populations through the Equivalent Adult Units factors (see the chart at right):

- 40 pedestrians cross during a one-hour period or 25 cross per hour for four consecutive hours using the Equivalent Adult Units system.[5]

Equivalent Adult Units

Type	Factor
Child	2
Senior	1.5
Disabled	2

[5] Use of a system of Equivalent Adult Units is recommended in order to recognize intersections that require special attention due to the presence of seniors or children, even if they don't meet the volume requirement. These two groups are disproportionately represented in collision and fatality statistics.

Warrant 5, School Crossing

Support:

The School Crossing signal warrant is intended for the application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal.

Standard:

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (see Section 7A.03[7]) and there are a minimum of 20 students during the highest crossing hour.

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

The School Crossing signal shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

Guidance:

If this warrant is met and a traffic control signal is justified by an engineering study, then:

A. If at an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors.

B. If at a nonintersection crossing, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (110 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if installed within a signal system, the traffic control signal should be coordinated.

- Fewer than five gaps in traffic during the peak five-minute period.[6]

Half Signalized Crossings

In situations where there are few "crossable" gaps and where vehicles do not stop for pedestrians waiting to cross (or because of multiple lanes, it is unsafe to cross in front of a stopped vehicle), there are a number of innovative pedestrian traffic signals that do not operate as full signals that might be installed. Many of these models have been used successfully for years overseas, and their use in the United States has increased dramatically over the last decade.

[6] Average number of gaps per five-minute period = total usable gap time in seconds divided by pedestrian crossing rate at four feet per second, multiplied by 12.

[7] "Alternate gaps and blockades are inherent in the traffic stream and are different at each crossing location. For safety, students need to wait for a gap in traffic that is of sufficient duration to permit reasonably safe crossing. When the delay between the occurrence of adequate gaps becomes excessive, students might become impatient and endanger themselves by attempting to cross the street during an inadequate gap."

Pelican

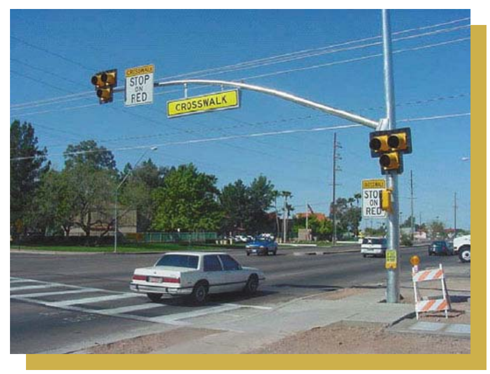
A Pelican (Pedestrian Light Control Activated crossing) signal incorporates a standard red-yellow-green signal light that rests in green for vehicular traffic until a pedestrian wishes to cross and presses the button. The signal then changes to yellow, then red, while Walk is shown to the pedestrian. The signal can be installed as either a one-stage or a two-stage signal, depending on the characteristics of the street. In a two-stage crossing, the pedestrian crosses first to a median island and is then channelized along the median to a second signalized crossing point. At that point, the pedestrian then activates a second crossing button and another crossing signal changes to red for the traffic while the pedestrian is given a Walk signal. The two crossings only delay the pedestrian minimally and allow the signal operation to fit into the arterial synchronization, thus reducing the potential for stops, delays, accidents, and air quality environmental issues. A Pelican crossing is quite effective in providing a pedestrian crossing at mid-block locations when the technique can be accommodated into the roadway design.

Pelican signal in Tucson, AZ

Puffin signal in Tucson, AZ

Puffin

A Puffin (Pedestrian User Friendly Intelligent) crossing signal is an updated version of a Pelican crossing. The signal consists of traffic and pedestrian signals with push-button signals and infrared or pressure mat detectors. After a pedestrian pushes the button, a detector verifies the presence of the pedestrian at the curbside. This helps eliminate false signal calls associated with people who push the button and then decide not to cross. When the pedestrian is given the Walk signal, a separate motion detector extends the Walk interval (if needed) to ensure that slower pedestrians have time to cross safely. Conversely, the signal can also detect when the intersection is clear of pedestrians and return the green signal to vehicles, reducing vehicle delay at the light. Puffin signals are designed to be crossed in a single movement by the pedestrian, unlike the Pelican signal, which can be designed to cross in either one or two stages.



Hawk signal in Tucson, AZ

Hawk

A Hawk (High-Intensity Activated Crosswalk) signal is a combination of a beacon flasher and traffic control signaling technique for marked crossings. The beacon signal consists of a traffic signal head with a red-yellow-red lens. The unit is normally off until activated by a pedestrian. When pedestrians wish to cross the street, they press a button and the signal begins with a flashing yellow indication to warn approaching drivers. A solid yellow, advising the drivers to prepare to stop, then follows the flashing yellow. The signal then changes to a solid red, at which time the pedestrian is shown a Walk indicator. The beacon signal then converts to an alternating flashing red, allowing the drivers to proceed after stopping at the crosswalk, while the pedestrian is shown the flashing Don't Walk signal.

Summary of At-Grade Recommendations

In summary, Table 3-3 provides guidance on how to implement at-grade pathway-roadway crossings in the City of Meridian.

Table 3-3. Summary of At-Grade Pathway-Roadway Intersection Recommendations[8]

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicle ADT > 15,000		
	Speed Limit **											
	30 mi/h	35 mi/h	40 mi/h	30 mi/h	35 mi/h	40 mi/h	30 mi/h	35 mi/h	40 mi/h	30 mi/h	35 mi/h	40 mi/h
2 Lanes	1	1	1/1+	1	1	1/1+	1	1	1+/3	1	1/1+	1+/3
3 Lanes	1	1	1/1+	1	1/1+	1/1+	1/1+	1/1+	1+/3	1/1+	1+/3	1+/3
Multi-Lane (4 or more lanes) with raised median ***	1	1	1/1+	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3
Multi-Lane (4 or more lanes) without raised median	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3

* General Notes: Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.

For each pathway-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

** Where the speed limit exceeds 40 mi/h (64.4 km/h), marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.

1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.

1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

1+/3 = Carefully analyze signal warrants using a combination of Warrant 2 or 5 (depending on school presence) and EAU factoring. Make sure to project pathway usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

[8] This table is based on information contained in the U.S. Department of Transportation Federal Highway Administration Study, " Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations," February 2002.