

SECTION 14: TRAILS

1. SCOPE:

- a. This article establishes the minimum requirements for the design of Multi-Use Paths within the City of Payson. Multi-use paths shall be placed where so indicated on the City of Payson Future and Existing Trails and Parks plan in the Payson Master Transportation Plan as well as all other Payson area-specific plans.

2. DEFINITIONS:

- a. Trails and Separated Shared-use Paths: The terms shared use paths, multiple-use paths, and trails are interchangeable within Payson City. A trail or shared use path shall refer to a City owned right-of-way (or permanent easement) that allows non-motorized travel with, or without access to the adjacent properties.
- b. Bicycle Lanes: Shall refer to on-street lanes, a minimum of four feet (4') wide, designated by paint or barriers, dedicated for the use of people on bicycles.
- c. Sidewalks – Shall refer to a hard-surfaced path adjacent to a street, a minimum of ~~four feet (4')~~five feet (5') wide, dedicated for the use of people walking.
- d. Neighborhood Pathways: Shall refer to short links between neighborhoods, adjacent businesses, parks, and other points of interest. In cul-de-sacs, strategically placed paths (between two lots) can link bicyclists and pedestrians to local destinations without requiring long, indirect routes that tend to inhibit walking or bike riding.
- e. Non-standard or Temporary Pathways – Shall refer to the use of existing improvements such as sidewalks or roadway shoulders for trail routes and may be used only after all other options have been exhausted. Such solutions are temporary expedients.

3. DESIGN AND CONSTRUCTION STANDARDS

- a. These standards are based on recommendations of the American Association of State Highway and Transportation Officials (AASHTO), as set forth in the AASHTO Guide for the Development of Bicycle Facilities, 1999; and the Manual on Uniform Traffic Control Devices, 2009 Edition (MUTCD 2009), and other sources. Should any of these design standards come into conflict with published national standards, follow those in the current AASHTO Guide and MUTCD.
- b. Separation of Facilities
 - i. When two-way shared-use paths are located adjacent to a roadway, wide separation between the two facilities demonstrates to both the bicyclist and the motorist that the path functions as an independent facility. Safety and comfort of the trail user are both critical considerations – a trail located next to high speed traffic diminishes safety and creates discomfort for the patron that reduces trail use.
 - ii. A minimum horizontal separation of ~~five feet (5')~~six feet (6') between the trail edge of pavement and roadway edge of pavement is required. Ideally,

this buffer area will be lined with shade trees or other vertical and native and/or drought-tolerant landscaping that acts as a barrier. Where the trail runs parallel to a high-speed facility (greater than or equal to 40 mph), wider separation is recommended.

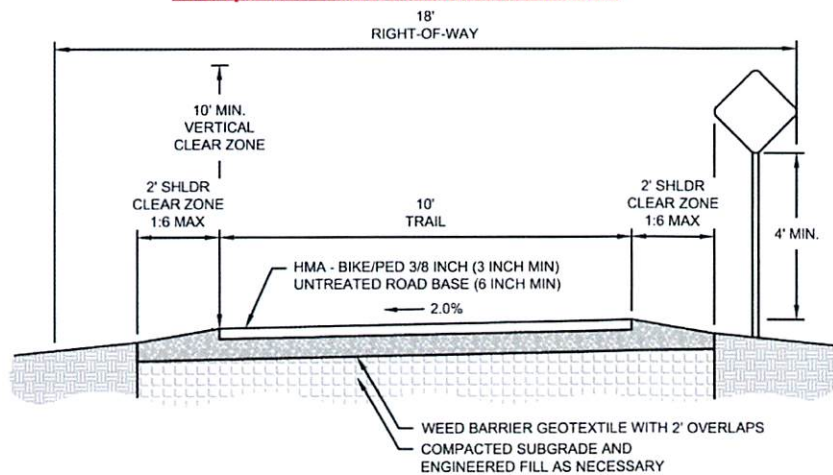
- iii. When this is not possible, a suitable physical barrier is required. Such barriers serve both to prevent path users from making unwanted movements between the path and the highway shoulder and to reinforce the concept that the path is an independent facility. Where used, the barrier should be a minimum of forty-two inches (42") high, to prevent bicyclists from toppling over it. A barrier between a shared-use path and adjacent roadway should not impair sight distances at intersections, and not be a hazard to trail users or errant motorists.
- iv. Trails should not be located along roadsides where sidewalks are typically provided. Typically, sidewalks are not good candidates for use as trails since they tend to be too narrow to accommodate multiple services and are also frequently interrupted. Where good trail design is not possible due to frequent interruptions or lack of suitable separation from roadways, a combination of bicycle lanes and sidewalks may be more appropriate.

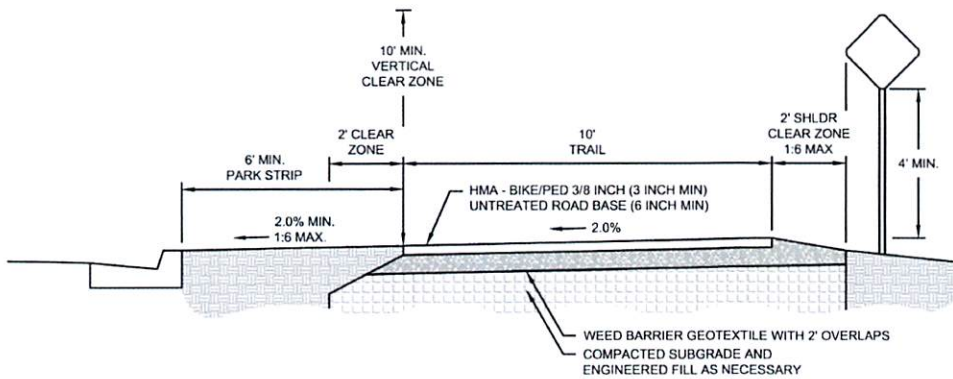
c. Trail Widths

- i. Right of Way - A minimum right of way width of eighteen feet (18') wide shall to be deeded to the City to accommodate the trail, shoulders, and signage. The trail right-of-way is meant to always provide public access along the trail. If the right-of-way cannot be deeded to the City based on extenuating circumstances, then a permanent easement needs to be granted that runs with the property to maintain public access in perpetuity. Neighborhood trail connectors should also follow the same cross section, widths, and standards outlined in this document even if part of a private development connection to the trail system.
- ii. Paved Shared-Use Trails - Minimum useable surface width shall be ten feet (10') for two-way, shared-use trails in most instances. Constrictions to eight feet (8') may be designed in certain situations, such as restricted physical space between a roadway and building or vertical drop-off. All such constrictions should be less than one hundred feet (100') in length, and have smooth rather than abrupt transitions. Appropriate signage shall be installed to warn users of changes in trail width.
- iii. Natural surface paths - Such paths in backcountry or rural settings shall be a minimum of two feet (2') wide where only pedestrian use is anticipated. A minimum width of four feet (4') is recommended where multiple uses are anticipated, or where the path is adjacent to a paved urban trail. Where path usage levels are anticipated to be similar to paved trails, natural surface paths shall be a minimum of ten feet (10') wide.

iv. Neighborhood Pathways – Short connecting paths of five hundred feet (500') or less, minimum six feet (6') in width.

v. Shoulders and clear zones – At a minimum, a two-foot (2') wide horizontal clear zone, from which all lateral obstructions such as trees, signs, fences, etc. are to be removed shall be provided on either side of the path. Within this clear zone, a two-foot (2') wide graded area on either side of the trail with a cross-slope no greater than a 1V:6H shall be provided. A vertical clear zone of ten feet (10') is also required, free of obstructions such as tree limbs, overhangs, etc. The horizontal and vertical clear zones together create a trail envelope free of obstructions and other hazards.





4. TRAIL SURFACES:

- a. Asphalt surfacing shall be preferred for trails in the City. If circumstances dictate that a concrete trail would be preferable, then it must be approved by the City Engineer or their appointee.
- b. Design Loads—While loads will be substantially less than highway loads, trails shall be designed to sustain, without damage, occasional wheel loads from emergency and maintenance vehicles.
- c. Subgrade Identification – Trail projects shall be required to identify the existing subgrades along the proposed trail route prior to construction. A geotechnical report completed by a licensed, professional geotechnical engineer must be completed for all trail projects to analyze soil conditions and recommend a pavement design unless waived by the City Engineer or designee. Naturally occurring clay soils, peat, and high silt content sandy soils have been identified as having typically insufficient strength for proper pavement construction at minimum thickness.
- d. Asphalt Surface Trail - Asphalt surface trails shall be built with a minimum three (3) inches bituminous surface course of PG 64-34, DM-1/2, 50 blow (APWA 32.12.05) on top of six inches (6") of untreated roadbase--minus 3/4-inch aggregate size. Subgrade soil should be compacted to a minimum of ninety-five percent (95%) maximum density at optimum moisture (AASHTO T 99 standard) and base course must be compacted to ninety-five percent (95%) of maximum density at optimum moisture as determined by the AASHTO T180 or ASTM D 1557 or as determined by a licensed, professional geotechnical engineer and approved by the City Engineer or designee.

i. General Specifications for Asphalt Work

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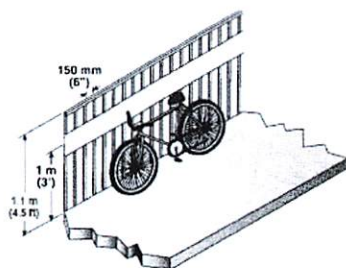
1. Ensure that asphalt paving machines and handwork must be able to form the smooth curves, width changes, surface pitch, and superelevation required.
 2. Ensure that both the subgrade and the base must be dry and free of frost and ice when asphalt work is done.
 3. Scarify the surface of the subgrade to a minimum depth of six inches (6"), adjust the moisture condition as needed, then compact the soil.
 4. Apply a root inhibitor or lay geotextile beneath the asphalt to prevent roots from heaving the surface.
 5. Extend base course a minimum of two feet (2') beyond the minimum paved surface width. Compact the shoulder and slope it away from the asphalt at a maximum 1V:6H slope.
 6. Ensure that the finished asphalt surface is smooth and free of obvious imperfections. Where asphalt meets concrete or other hard surfaces, the joint must be smooth and even across both surfaces. Asphalt joints are to be butt rather than taper.
 7. Feather the edge of pavement with base course or native soil to avoid any sharp drops from the trail edge.
- e. Concrete Surface Trail - Concrete Surface Trails shall be constructed with a minimum four-inch (4") slab thickness on four-inch (4") base course, with transverse saw-cut joints every ten feet (10') and a medium transverse broom finish. Finished slabs shall be flush with ground surface.
- i. General Specifications for Concrete Work
 1. Cross-slope, superelevation, grade and weed barrier geotextile fabric requirements for concrete trails are the same as for asphalt trails.
 - ii. Materials
 1. Concrete – 4000 psi at twenty-eight (28) days, 6±1% entrained air. Aggregate shall be both coarse and fine with maximum coarse aggregate size of one and one-half (1-1/2) inch, conforming to the Standard Specification for Concrete Aggregate, ASTM C33. Air entraining agents shall conform to ASTM C260.
 2. Cement – Cement shall conform to standard specification for Portland Cement, ASTM C150, Type I or II, or ASTM 175 for Air-Entraining Portland Cement, Type IA or IIA.
 3. Water – Water used for mixing shall be clean and free from injurious amounts of oil, acids, alkali, salt, or organic substances harmful to concrete.

- 4. Curing Compounds – Liquid membrane curing compounds shall conform to ASTM C309.
- 5. Preformed Filler – Expansion joint material shall be non-extruding preformed joint filler conforming to ASTM D1751.
- 6. Joint Sealer – Joint sealer shall conform to ASTM D3405.
- f. Natural Surface Trail – Trails using natural surfacing materials should be designed to provide facilities for as many users as possible. Surface type shall be provided as indicated in the Payson City *Non-Motorized Trails System Plan*. Compacted dirt, crushed stone and crusher fines are acceptable in appropriate aggregates and size.
 - i. Large rocks, roots or stumps, and other obstacles to users shall be removed and all organic material scarified within the path envelope unless the trail is planned specifically for singletrack mountain bike use.
 - ii. Crushed stone paths shall have a minimum compacted depth of four inches (4") of crushed stone--limestone, sandstone, or crushed rock--with an aggregate mix and passing a screen of no more than three-fourths inch (3/4"). No rounded aggregate shall be used. Path surfaces of untreated base course are discouraged, due to the typical inclusion of soils in base course materials that render them prone to rutting and displacement in wet conditions.

5. STRUCTURES:

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- a. All overpasses, underpasses, and bridges shall have a minimum clear width the same as that of the approach trail, plus the minimum two-foot (2') wide horizontal clear zone. Bridge or underpass approaches shall be aligned along the path to allow clear sight lines across or through the entire structure, and to avoid forcing trail users to make abrupt turns, climbs, or descents to access the structure.
- b. Widths and clearances—The minimum clear width of the bridge surface shall be no narrower than the approach path. A preferred width of fourteen feet (14') provides an additional clear width of two feet (2') on each side of a ten-foot (10') traveled portion of a bridge that is to be used by both cyclists and pedestrians. A vertical clearance of ten feet (10') shall be maintained.
- c. Design loads—When a bridge is wide enough to permit access by emergency vehicles, the design live load of the bridge shall accommodate such vehicles.
- d. Railings—Railings on both sides of a multi-use path structure shall be a minimum of forty-two inches (42") high. Additional height tends to obstruct the view of path users and should be avoided if appropriate. Smooth ten-inch (10") wide horizontal rub rails shall be attached to the inside of the railings at a handlebar height of three feet (3') above the bridge deck surface. Openings in the handrail shall be no wider than six inches (6") to prevent young children from falling through the handrail.



i. Railing with "rub-rail"

Adapted from Oregon Bicycle and Pedestrian Plan (1995)

- e. Bridge entrances—At each entrance to the bridge, the handrails as described above shall extend a minimum of eight feet (8') beyond the end of the bridge and splayed outward at fifteen-degree (15) angles to the pathway.
- f. Decking—If decking that does not provide a smooth and continuous surface is to be used (such as wood decking) it shall be laid at no less than forty-five degrees (45) to the direction of travel along the bridge to prevent gaps that may develop in the decking from trapping bicycle wheels. Where possible, decking shall be laid ninety degrees (90) to the direction of travel. On all bridge decks, bicycle-safe expansion joints shall be used. Decking materials that become slippery when wet shall be avoided. All screws or bolts shall be countersunk flush with the deck surface.
- g. All structures, including underpasses, shall maintain the minimum clear zone or envelope throughout.

6. DRAINAGE:

- a. Trails shall have continuous cross slopes of two percent (2%) to provide for proper drainage, and be accessible to wheelchairs where wheelchair use is possible. Crowned surfaces are not usually wheelchair-friendly.
- b. Ditches, swales, interceptor swales, and/or closed drain systems shall properly drain water away from the trail surface and clear zones. Open drainage features shall be located outside the trail envelope.
- c. Drainage grates shall be located outside of the trail envelope. However, if placement inside the envelope is necessary, the grate shall be of bicycle safe design and emplaced flush with the trail pavement surface.

7. DESIGN SPEED:

- a. Paved trail design speed shall be to twenty-five (25) miles per hour to safely accommodate bicycle use; higher design speeds for multi-use paths are discouraged. Unpaved trails may be designed to a fifteen (15) miles per hour speed.

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8. MINIMUM CURVE RADII FOR PAVED TRAILS:

Design Speed	Minimum Radius
12mph	36 feet
20mph	100 feet
25mph	156 feet
30mph	225 feet

- a. Where reduced curve radii must be used because of limited right-of-way, topographical, or other considerations, standard curve warning signs and supplemental pavement markings shall be installed as per the *MUTCD 2009* or the most current edition. Wider pavement can also be used to offset the effects of reduced curve radii.
- b. Superelevation—Superelevation or pavement banking on curves may be required. Refer to *AASHTO Guide for the Development of Bicycle Facilities*, 1999, pp 37-46 for design recommendations.

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9. GRADES:

Grade	Maximum Length
6%	800 feet
7%	400 feet
8%	300 feet
9%	200 feet
10%	100 feet

- a. Grades on trails shall be kept to a minimum, under five percent (5%), in order to best serve all non-motorized users. Steeper grades may be used only over short distances.
- b. Grades shall not exceed ten percent (10%) on straight sections, or five percent (5%) on curves. Where a path must curve on a grade, provide longer than normal sight lines and a transition zone at both top and bottom of the grade.
- c. Grades shall not exceed three percent (3%) with crushed stone or other unpaved surfaces for bicycle handling, drainage, and erosion reasons. If this is not feasible, appropriate drainage and erosion mitigation measures should be utilized. Refer to International Mountain Bicycling Association's publication *Building Better Trails* for design guidelines.

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- d. Signs warning of steep grades must be provided at the top of sections with grades higher than five percent (5%), or where users cannot see the bottom of the grade.



W7-5
18"x18"

10. SIGHT DISTANCE:

- a. Adequate sight distances shall be maintained for the higher speed users, usually considered to be bicyclists. Use the guidelines provided in the *AASHTO Guide for the Development of Bicycle Facilities*, 1999, pp 40-46.

11. TRAIL-ROADWAY INTERSECTIONS:

- a. Long sections of trail without road crossings or driveways are most desirable. At a bare minimum, 1320 feet (1/4 mile) between such interruptions should be planned and maintained throughout.
- b. Intersections between trails and roadways shall be carefully designed to maintain the safety of users and motorists. Refer to *AASHTO Guide for the Development of Bicycle Facilities*, 1999 for design recommendations.
- c. Controlling motorized vehicle access may be required at trail/roadway intersections. All such intersections shall be signed with the MUTCD standard sign R5-3.



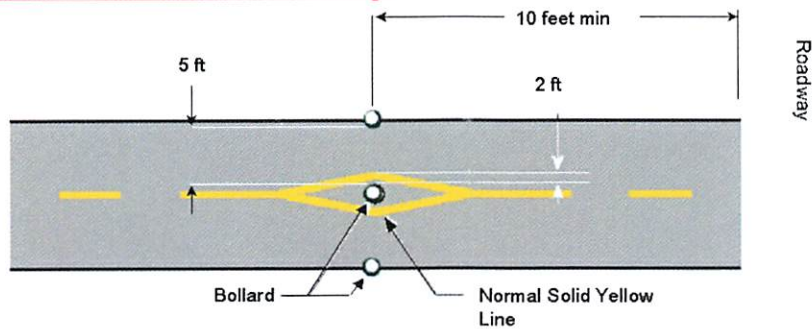
i. R5-3

- d. Lockable, removable bollards shall be used if more aggressive measures are needed. Posts or bollards shall be set back beyond the clear zone on the crossing roadway or be of a breakaway design. The post shall be permanently retro-reflectorized for nighttime visibility and painted a bright color for improved daytime visibility. Striping an envelope around any post within the travel way of a paved trail is recommended. See *MUTCD 2009, Part 9, Traffic Controls for Bicycle Facilities*, page 9C-3.



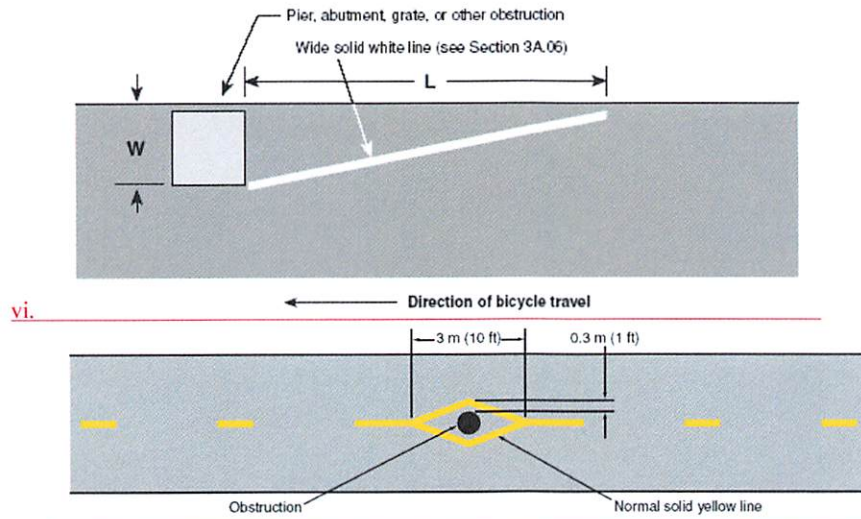
- i. Bollard Design—Three and one-half-inch (3½") diameter galvanized steel, rounded top, painted traffic yellow with retro-retro-reflectorized obstruction marking. Top of bollard should be between three feet (3') and four feet (4') above paved surface

ii. Bollard Placement and Pavement Markings



- iii. An appropriate number of bollards shall be placed across the trail to inhibit motorized access. Placement should be such that "travel lanes" on the trail are unobstructed and do not force users to detour out of the normal line of travel. Separation between bollards shall be five feet (5') to allow trail user access while not allowing automobiles.
- iv. Where the desire for ATV use of the trail can be reasonably anticipated, the separation between bollards may be reduced to a maximum of forty-eight inches (48") to discourage such vehicular access. Appropriate obstruction marking and signing should be placed as needed when bollards intrude into the pathway surface.
- v. _____

Figure 9C-8. Example of Obstruction Pavement Marking



12. SIGNAGE AND PAVEMENT MARKINGS:

- a. All appropriate and necessary signage and pavement markings are to be provided according to the MUTCD 2009 or the most current edition. See Part 9, Traffic Controls for Bicycle Facilities.
- b. Sign placements shall follow MUTCD regulations. Signs should be placed no closer than two feet (2') from the trail edge of pavement, and no farther than six feet (6'). The bottom edges of signs shall be between four feet (4') and five feet (5') vertically from the trail surface. These requirements facilitate access by users while maintaining the envelope. Signs for a trail shall be scaled down to recommended sizes.
- c. Striping of bicycle lanes on the roadway in tandem with sidewalks for pedestrians can be provided to link two sections of separated pathway or to extend a route where needed. Proper signage should also be provided. Multiple or frequent transitions from trail to bike lanes/sidewalks are not recommended due to safety and usability problems. Refer to the AASHTO Guide for Developing Bicycle Facilities, 1999.



d. Sample Signage

13. ACCESSIBILITY:

- a. Title II and Title III of The Americans with Disabilities Act (ADA) of 1990 require all new construction and alterations to be accessible to all Americans, including those with disabilities. The US Access Board publishes *ADA Accessibility Guidelines (ADAAG)* that must lawfully be applied to new construction in both the private and public sectors. While these guidelines do not yet specifically address trails, the following provisions can and should be applied:
 - i. Accessible Routes (ADAAG 4.3)
 - ii. Parking (ADAAG 4.6) - will usually apply to trailheads
 - iii. Curb Ramps (ADAAG 4.7)
 - iv. Ramps (ADAAG 4.8)