

Stream Crossing Matrix

Crossing Types	Description	Typical specifications	Maintenance requirements	Cost	Users*	Design Req.	Permitting	Constructibility	Volunteer potential
Low Water Crossing or Ford	Crossing of stream on the stream bed itself. Often hardened with rock, gravel or concrete. Not usable in high-water conditions. Can also serve as a grade check in stream bed.	Approach and crossing tread width 5 feet; approach slope <20%; typical materials concrete, rip-rap, gravel, articulated matting, rock	Must be inspected after large storm events. Prone to erosion. Approaches tend to "V" with traffic following a central path.	\$\$\$	P, B, H, ~V	Engineering, hydrology, hydraulics	USACE 404/408 permit, City/County Floodplain permit	Excavation equipment access, but may not need large equipment. Ideally in stable stretches with lower or more gradually sloped banks.	Rarely on smaller crossings- hauling and placing materials
Trail Structures	Structures along the trail alignment which are at-grade or only slightly elevated such as boardwalks, puncheons, turnpikes, and bog bridges. Often used in wet areas that don't necessarily have flow.	Tread width 8 ft; typical materials treated timbers, rock, gravel, sand	Some materials may not weather well and need to be replaced frequently. In areas of flow there is erosion potential. Woody vegetation should be kept away from structure.	\$	P, B, H	Standard Plans, possibly hydrology and hydraulics	USACE 404/408 if impacting channel or wetland, City/County Floodplain Permit if in FP	No heavy equipment required. May be constructed in areas with limited access	Good potential - setting stone and timbers, backfilling, hauling materials, removing woody vegetation
Small Bridges	Bridges which are less than 5 feet above grade. May be used to cross ephemeral streams or wet areas, or as ornamental features.	Minimum width 5 ft, 8 ft desired if horses are to be included; minimum railing height 54 inches;	Maintenance dependent on materials. Need to be inspected at least every 5 years. Woody vegetation needs to be kept back from structure. Regular regrading of approaches.	\$\$	P, B, ~H	Standard Plans or Engineering, possibly hydrology and hydraulics, dependent on site and design	USACE 404/408 if impacting channel or wetland, City/County Floodplain Permit if in FP	Some heavy equipment may be required. May be able to construct in areas with limited access.	Good potential- hauling materials, construction assistance on bridge, painting, deck and railing repair, removing woody vegetation, assist with approach re-grading
Culverts	Concrete, metal or HDPE tubes which allow water to flow under trail. Higher flow events may overtop.	Culvert size dependent on engineering, no less than 12 inches; flared end sections, rip-rap if needed	Susceptible to erosion. May need to have cover material replaced after heavy events. Can collapse if cover is not thick enough (recommend 1 foot).	\$\$	P, B, H, V	Engineering, hydrology, hydraulics	USACE 404/408 permit, City/County Floodplain permit	Excavation equipment likely required, depending on size of culvert.	None
Ped/Bike Bridges	Bridges which are designed for bikes and pedestrians, but not equestrian or maintenance access. Designed to meet hydrology and hydraulic requirements determined through engineering. May be paired with low-water crossings to serve all users.	Minimum width 5 ft; minimum railing height 54 inches; typical materials corten steel, wood, treated timber, cabling	Maintenance dependent on materials. Need to be inspected at least every 5 years. Woody vegetation needs to be kept back from structure. Regular regrading of approaches.	\$\$\$\$	P, B	Engineering, hydrology and hydraulics, may be able to use standard plans	USACE 404/408 if impacting channel or wetland, City/County Floodplain Permit if in FP	Moderately heavy equipment required. Stream morphology is important in location selection.	Limited - removing woody vegetation, assist with approach re-grading
Multi-Use Bridges	Bridges which have surface and load capacity to allow all trail users, as well as maintenance and emergency vehicles, to cross. Designed to meet hydrology and hydraulic requirements determined through engineering. Only choice when crossing Salt Creek.	Minimum width 10 ft; minimum railing height 54 inches; typical materials concrete, corten steel, wood may be used on decking and rub-rails	Maintenance dependent on materials. Need to be inspected at least every 5 years. Woody vegetation needs to be kept back from structure. Regular regrading of approaches.	\$\$\$\$\$	P, B, H, V	Engineering, hydrology, hydraulics	USACE 404/408 if impacting channel or wetland, City/County Floodplain Permit if in FP	Heavy equipment (crane) required. Stream morphology and site access major factors in location selection.	Limited - removing woody vegetation, assist with approach re-grading

*Users - P = Pedestrian, B = Bicycle, H = Horse, V = Vehicle, ~ = potentially, dependent on design