Stormwater Best Management Practice

Temporary Stream Crossings

Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Erosion Control

Description

A temporary steam crossing can provide a safe, stable way for construction vehicle traffic to cross a watercourse. Temporary stream crossings provide streambank stabilization, reduce the risk of damage to the streambed or channel, and minimize sediment loading from construction traffic. The crossing may be a bridge, culvert or ford. Stream crossings in most cases require a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

Applicability

Temporary stream crossings are appropriate where heavy construction equipment needs to move from one side of a stream channel to the other. They are also appropriate where lighter construction vehicles will cross the stream repeatedly during construction. Table 1 provides conditions for when each type of stream crossing is appropriate.

A bridge or culvert is the best choice for most temporary stream crossings because each can support heavy loads and regular traffic, as well as cause minimal disturbance. Bridges require the highest level of engineering and generally are the most expensive option; however, they provide the most functionality and protection to the stream that vehicles cross. Construction staff can salvage bridge and culvert construction materials after they remove the structures. A ford is a shallow area in a stream that vehicles can cross safely, and it generally has no load limits. However, fords can result in significant stream disturbances. Fords are only appropriate where stream crossings are infrequent and culverts or bridges are infeasible. When used, fords are appropriate where normal flow is shallow or intermittent and the channel is wide.

Table 1. Conditions affecting suitability of stream crossing type.

Crossing Type	Applicability
Bridge	■ Streams with high flow velocities, steep gradients and/or areas where regulations do not allow temporary restrictions in the channel. ■ Streams that do not have time-of-year restrictions.
Culvert	■ Perennial or intermittent streams. ■ Most common type of temporary stream crossing. ■ Creates less disturbance than a ford.
Ford	■ Dry washes, ephemeral streams or low-flow perennial streams in arid climates during the dry season. ■ Areas where stream banks are less than 4 feet high or construction of a culvert or bridge is impractical. ■ Most appropriate for short-term use.

Sources: IDT, 2014; MPCA, 2019

Siting and Design Considerations

Because of the potential for stream degradation, flooding and safety hazards, construction staff should avoid stream crossings whenever possible. Construction staff should consider alternative routes to accessing a site before planning to erect a temporary stream crossing. If a stream crossing is necessary, they should select an area where the potential for erosion is low and, if possible, construct the stream crossing during a dry period. In all cases, after removal of the temporary stream crossing, construction staff should return impacted banks and streambeds to their original condition and grade (USACE, 2015). Construction staff

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should minimize the disturbance or removal of vegetation to facilitate rapid regrowth after removing the temporary structure.

Bridges

If over-stream bridges are necessary, construction crews should only construct them under the supervision and approval of a qualified engineer.

Culverts

Culverts should be of an appropriate size for the site hydrology and drainage area. A qualified engineer may need to perform the hydrologic analysis and design. Construction staff should use filter cloth to cover the streambed, stream banks and approach to reduce settlement and make the culvert structure more stable. The filter cloth should extend at least 6 inches and no more than 1 foot beyond the end of the culvert and bedding material. The culvert piping should be of sufficient diameter to allow flow to pass completely during peak flow periods and to pass debris (USACE, 2015). Aggregate should cover pipes by at least 1 foot or one-half the pipe diameter, whichever is greater (MPCA, 2019). If necessary, construction staff should install energy-dissipating devices downstream of the culvert to prevent scour. Regional time-of-year restrictions may exist and should be a consideration (USACE, 2015).

Fords

Fords may be appropriate when a bridge or culvert is not feasible; the natural streambed and banks consist of a ledge, rock, or sand that help minimize erosion; and a stable gradual approach exists (USACE, 2015). Construction staff should construct fords using stabilizing material such as large rocks or clean, native gravel. Some streams, such as salmonid streams or streams and rivers below reservoirs, may even benefit from an influx of gravel (IDT, 2014). Cellular confinement systems or prefabricated mats may also be appropriate where the addition of gravel may be problematic (MECA, 2010). Ford construction should ideally occur during periods of little to no flow to minimize erosion. If construction has to occur during periods of flow, construction staff should use a temporary stream diversion. They should also use appropriate erosion and sediment controls along the stream banks and approach to the ford until stabilization occurs (MPCA, 2019).

Limitations

Bridges can be expensive to design and install, and sites should avoid them if less obtrusive measures are possible.

Culvert construction and removal usually disturbs the surrounding area, leading to erosion and sediment export. Therefore, some localities may prohibit the practice in sensitive streams. Culverts can also obstruct flow in a stream and get in the way of migrating fish. Depending on the culvert's size, large debris in a stream can block the culvert, and culverts are vulnerable to frequent washout (IDT, 2014).

Approaches to fords are likely to erode without sufficient stabilization. In addition, excavating the streambed and approach to lay riprap or other stabilization material causes major streambed and bank disturbances that construction staff should repair. The crossing can transport mud and other debris directly into the stream unless construction staff use it only during periods of low flow or use a temporary stream diversion (USACE, 2015).

Developers should be cautious when considering stream crossing measures that require disturbing area below the stream's high-water mark. A Section 401 State Certification of Water Quality, Section 404 dredge and fill permit or state permit may be a requirement for a temporary stream crossing (IDT, 2014). Additionally, a permit with the U.S. Fish and Wildlife Service may be a requirement if authorities know endangered or threatened species or critical habitat to be present in the work area (MPCA, 2019). For any project, developers should contact local authorities to ensure they have obtained all required permits.

Maintenance Considerations

Construction staff should inspect temporary stream crossings and maintain them in compliance with all applicable federal, state and local permit requirements. Inspections should occur at least once a week and after all significant rainfall events for staff to remove debris, repair areas of erosion or replace eroded material. If inspectors report any structural damage to a bridge or culvert, construction staff should not use the structure until they repair it. Following completion of the construction project, construction staff should promptly

remove temporary stream crossings and stabilize disturbed areas (IDT, 2014).

Effectiveness

The effectiveness of a temporary stream crossing depends on the applicability of the crossing type, proper design and installation, siting, and adherence to long-term maintenance plans (MPCA, 2019). In an experiment that reviewed the effectiveness of stream crossings during and after construction of the crossing, Morris et al. (2016) found that the construction of fords and culverts results in nearly 10 times more sediment transport than the construction of bridges. They also found that, for any crossing type, protecting slopes with rock or gravel could reduce regular sediment export by about half compared to bare slopes, and they found that incorporating a geotextile could reduce sediment export further compared to rock alone.

Cost Considerations[1]

Implementation costs vary widely for a temporary stream crossing depending on the site needs, crossing type, maintenance needs and other site-specific factors. Typically, temporary bridges are more expensive to design and construct than culverts. Bridges also have higher maintenance and repair costs if they fail. Table 2 shows cost ranges of temporary stream crossings based on a survey of actual construction costs, including materials and installation, from 70 Virginia logging contractors (McKee et al., 2012).

[1] Prices are in 2019 dollars. Inflation data is from the Bureau of Labor Statistics CPI Inflation Calculator.

Table 2. Average total construction costs for stream crossings.

Crossing Type	Cost
Ford	$1,200
Culvert	$900–$1,900
Wooden bridge	$3,300–$3,500
Steel bridge	$11,000–$13,700

Source: McKee et al., 2012

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

Idaho Department of Transportation (IDT). (2014). NS-4: Temporary stream crossing. In *Best management practices manual*.

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