BMP-24

BMP: TEMPORARY VEHICULAR STREAM CROSSING

Definition

A temporary structural span installed across a flowing watercourse for use by construction traffic. Structures may include bridges, round pipes, pipe arches, or oval pipes.

Purposes

1. To provide a means for construction traffic to cross flowing streams without damaging the channel or banks.

2. To keep sediment generated by construction traffic out of the stream.

Conditions Where Practice Applies

Generally applicable to flowing streams with drainage areas less than 260 hectares (1 square mile). Structures which must handle flow from larger drainage areas should be designed by methods which more accurately define the actual hydrologic and hydraulic parameters which will affect the functioning of the structure.

Planning Considerations

Temporary stream crossings are necessary to prevent construction vehicles from damaging streambanks and continually tracking sediment and other pollutants into the flow regime. These structures are, however, also undesirable in that they represent a channel constriction which can cause flow backups or washouts during periods of high flow. For this reason, the temporary nature of stream crossings is stressed. They should be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

The specifications contained in this section pertain primarily to flow capacity and resistance to washout of the structure. From a safety and utility standpoint, the designer must also be sure that the span is capable of withstanding the expected loads from heavy construction equipment which will cross the structure. The designer must also be aware that such structures are subject to the rules and regulations of the U. S. Army Corps of Engineers for in-stream modifications (404 permits).

A temporary bridge crossing is a structure made of wood, metal, or other materials which provides access across a stream or waterway. It is the preferred method for temporary waterway crossings. Normally, bridge construction causes the least amount of disturbance to the stream bed and banks when compared to the other types of crossings. They can also be quickly removed and reused. In addition, temporary bridges pose the least chance for interference with fish migration when compared to the other temporary access waterway crossings. A temporary culvert crossing is a structure consisting of stone and a section(s) of circular pipe, pipe arches, or oval pipes of reinforced concrete, corrugated metal, or structural plate, which is used to convey flowing water through the crossings. Temporary culverts are used where the channel is too wide for normal bridge construction or the anticipated loading of construction vehicles may prove unsafe for single span bridges. There is some disturbance within the stream during construction and removal of the temporary culvert crossing. The stone, along with the temporary culverts, can be salvaged and reused.

Design Criteria

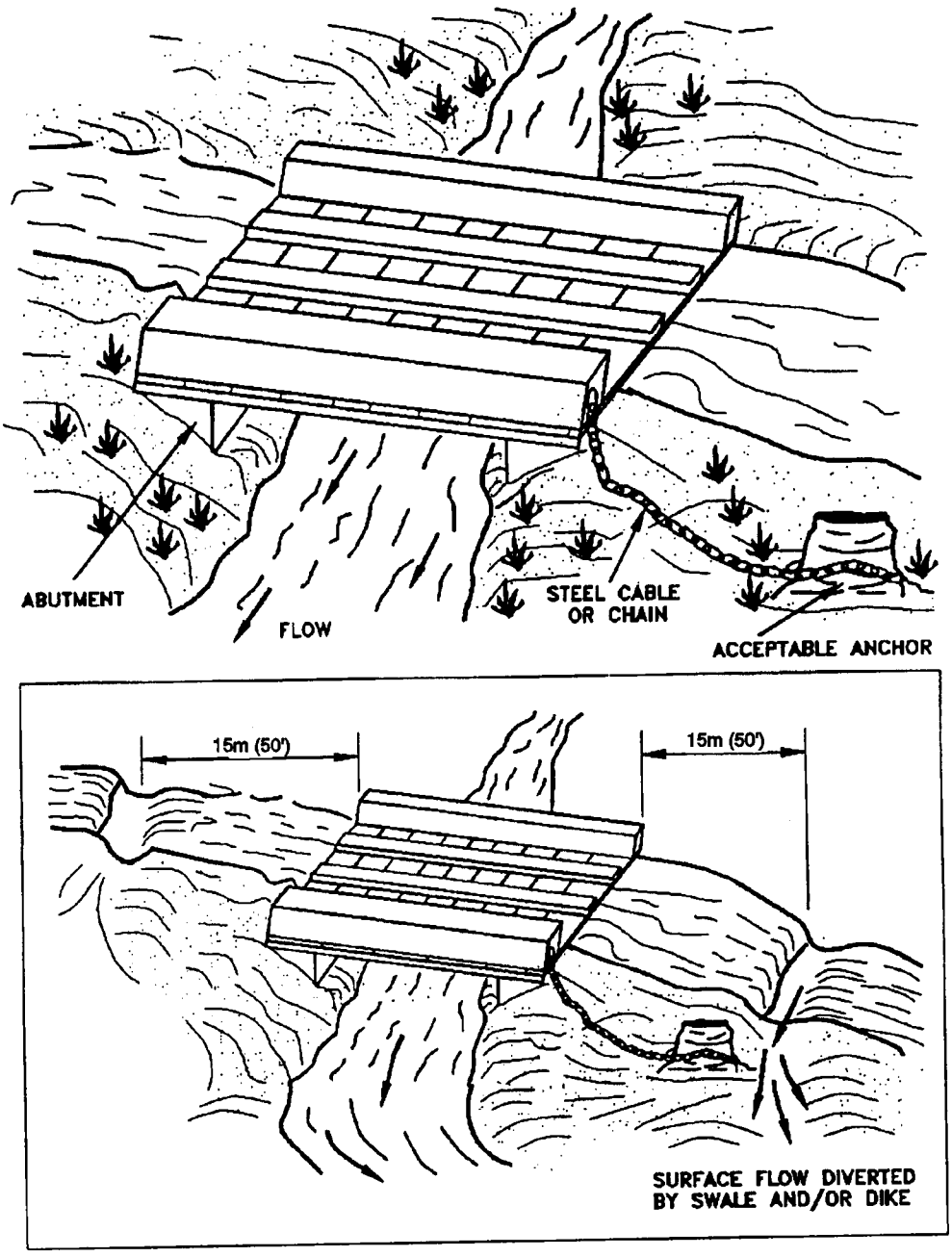
1. Temporary Bridge Crossing

   a. Structures may be designed in various configurations. However, the materials used to construct the bridge must be able to withstand loading of the construction traffic. Figure 24-1 shows on example of such a crossing.

   b. Crossing Alignment - The temporary waterway crossing shall be at right angles to the stream. Where approach conditions dictate, the crossing may vary 15degrees from a line drawn perpendicular to the center line of the stream at the intended crossing location.

   c. The centerline of both roadway approaches shall coincide with the crossing alignment centerline for a minimum distance of 15 meters (50 feet) from each bank of the waterway being crossed. If physical or right-of-way restraints preclude the 15 meter minimum, a shorter distance may be provided. All fill materials associated with the roadway approach shall be limited to a maximum height of 0.6 meters (2 feet) above the existing flood plain elevation.

FIGURE 24-1: TEMPORARY BRIDGE CROSSING



d. A water diverting structure such as a dike or swale shall be constructed (across the roadway on both roadway approaches) 15 meters (50 feet) (maximum) on either side of the waterway crossing. This will prevent roadway surface runoff from directly entering the waterway. The 15 meter distance is measured from the top of the waterway bank. Design criteria for this diverting structure shall be in accordance with BMP-11, TEMPORARY RIGHT OF WAY DIVERSION or BMP-9, TEMPORARY DIVERSION DIKE. If the roadway approach is constructed with a reverse grade away from the waterway, a separate diverting structure is not required.

e. Appropriate perimeter controls such as SILT FENCE (BMP-5) or TURBIDITY CURTAIN (BMP-27) must be employed when necessary along banks of stream parallel to the same.

f. All crossings shall have one traffic lane. The minimum width shall be 3.7 meters (12 feet) with a maximum width of 6 meters (20 feet).

9. Further design/construction recommendations for temporary bridge construction may be found in Construction Specifications.

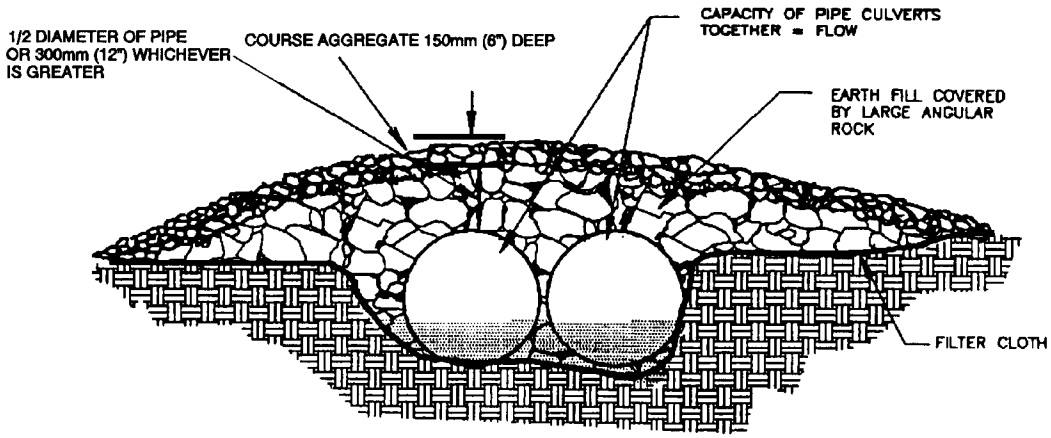
2. Temporary Culvert Crossing

a. Where culverts are installed, Coarse Aggregate or larger will be used to form the crossing. The depth of stone cover over the culvert shall be equal to one-half the diameter of the culvert or 300 millimeters (12 inches), whichever is greater. To protect the sides of the stone from erosion, riprap shall be used and designed in accordance with BMP-19, RIPRAP (see Figure 242).

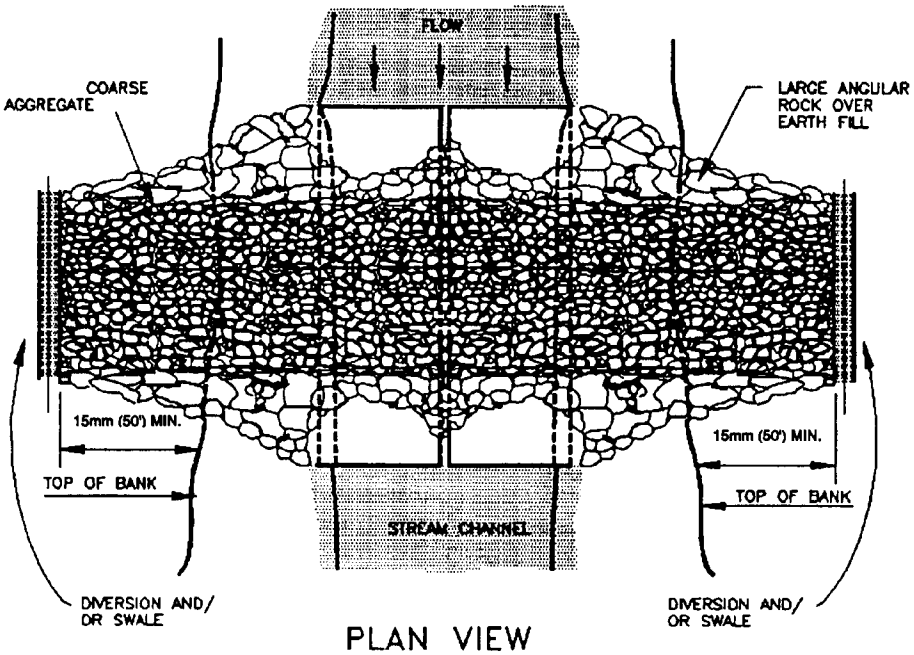
b. If the structure will remain in place for up to 14 days, the culvert shall be large enough to convey the flow from a 2-year frequency storm without appreciably altering the stream flow characteristics. See Table 24-1 for aid in selecting an appropriate culvert size (note all assumptions). If the structure will remain in place 14 days to 1 year, the culvert shall be large enough to convey the flow from a 10-year frequency storm. In this case, the hydrologic calculation and subsequent culvert size must be done for the specific watershed characteristics. If the structure must remain in place over 1 year, it must be designed as a permanent measure by a qualified professional.

c. Multiple culverts may be used in place of one large culvert if they have the equivalent capacity of the larger one. The minimum-sized culvert that may be used is 458 millimeters (18 inches).

FIGURE 24-2: TEMPORARY CULVERT CROSSING



ELEVATION



PLAN VIEW

TABLE 24-1:
PIPE DIAMETER FOR STREAM CROSSING [a]

Drainage Area, hectares (Acres)	Average Slope of Watershed			
	1%	4%	8%	16%
1-10 (1-25)	610 (24)	610 (24)	760 (30)	760 (30)
11-20 (26-50)	610 (24)	760 (30)	915 (36)	915 (36)
21-40 (51-100)	760 (30)	915 (36)	1068 (42)	1220 (48)
41-60 (101-150)	760 (30)	1068 (42)	1220 (48)	1220 (48)
61-80 (151-200)	915 (36)	1068 (42)	1220 (48)	1372 (54)
120-140 (301-350)	1068 (42)	1220 (48)	1524 (60)	1524 (60)
141-160 (351-400)	1068 (42)	1372 (54)	1524 (60)	1524 (60)
161-200 (451-500)	1068 (42)	1372 (54)	1524 (60)	1830 (72)
201-220 (501-550)	1220 (48)	1524 (60)	1524 (60)	1830 (72)
221-240 (551-600)	1220 (48)	1524 (60)	1524 (60)	1830 (72)
241-260 (601-640)	1220 (48)	1524 (60)	1830 (72)	1830 (72)

[a] Note: Table is based on Graphical Peak Discharge Method for 2-year frequency storm event, CN = 65; Rainfall depth = 9 millimeters (3.5) inches. Drainage areas listed are in hectares and (acres). Pipe diameters listed are in millimeters, mm and (inches).

d. All culverts shall be strong enough to support their cross-sectioned area under maximum expected loads.

e. The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes.

f. The slope of the culvert shall be at least 20 millimeters per meter (0.25 inches per foot).

g. Crossing Alignment - The temporary waterway crossing shall be at right angles to the stream. Where approach conditions dictate, the crossing may vary 15 degrees from a line drawn perpendicular to the centerline of the stream at the intended crossing location.

h. The centerline of both roadway approaches shall coincide with the crossing alignment centerline for a minimum distance of 15 meters (50 feet) from each bank of the waterway being crossed. If physical or

right-of-way restraints preclude the 15 meter minimum, a shorter distance may be provided. All fill materials associated with the roadway approach shall be limited to a maximum height of 0.6 meters (2 feet) above the existing flood plain elevation.

i. The approaches to the structure shall consist of stone pads meeting the following specifications:

   1) Minimum thickness: 150 millimeters (6 inches).
   2) Minimum width: equal to the width of the structure.

j. A water diverting structure such as a swale shall be constructed across the roadway on both roadway approaches, 15 meters (50 feet) maximum on either side of the waterway crossing. This will prevent roadway surface runoff from directly entering the waterway. The 15 meter distance is measured from the top of the waterway bank. Design criteria for this diverting structure shall be in accordance with BMP-11, TEMPORARY Right OF WAY DIVERSION or BMP-9, TEMPORARY DIVERSION DIKE. If the roadway approach is constructed with a reverse grade away from the waterway, a separate diverting structure is not required.

Construction Specifications

Temporary Bridge Crossing (see Figure 24-1)

a. Clearing and excavation of the stream bed and banks shall be kept to a minimum.

b. The temporary bridge structure shall be constructed at or above bank elevation to prevent the entrapment of floating materials and debris.

c. Abutments shall be placed parallel to and on stable banks.

d. Bridges shall be constructed to span the entire channel. If the channel width exceeds 2.5 meters (8 feet), as measured from top-of-bank to top-of-bank, then a footing, pier or bridge support may be constructed within the waterway. One additional footing, pier or bridge support will be permitted for each additional 2.5 meter width of the channel. No footing, pier or bridge support will be permitted within the channel for waterways which are less than 2.5 meters wide.

e. Stringers shall either be logs, sawn timber, prestressed concrete beams, metal beams, or other approved materials.

f. Decking materials shall be of sufficient strength to support the anticipated load. All decking members shall be placed perpendicular to the stringers, butted tightly, and securely fastened to the stringers. Decking materials must be butted tightly to prevent any soil material tracked onto the bridge from falling into the waterway below.

g. Run planking (optional) shall be securely fastened to the length of the span. One run plank shall be provided for each track of the equipment wheels. Although run planks are optional, they may be necessary to properly distribute loads.

h. Curbs or fenders may be installed along the outer sides of the deck. Curbs or fenders are an option which will provide additional safety.

i. Bridges shall be securely anchored at only one end using steel cable or chain. Anchoring at only one end will prevent channel obstruction in the event that floodwaters float the bridge. Acceptable anchors are large trees, large boulders, or driven steel anchors. Anchoring shall be sufficient to prevent the bridge from floating downstream and possibly causing an obstruction to the flow.

j. All areas disturbed during installation shall be stabilized within 7 calendar days of that disturbance.

k. When the temporary bridge is no longer needed, all structures including abutments and other bridging materials should be removed immediately.

l. Final clean-up shall consist of removal of the temporary bridge from the waterway, protection of banks from erosion, and removal of all construction materials. All removed materials shall be stored outside flood plain of the stream. Removal of the bridge and clean-up of the area shall be accomplished without construction equipment working in the waterway channel.

2. Temporary Culvert Crossings

   a. Clearing and excavation of the stream bed and banks shall be kept to a minimum.

   b. The invert elevation of the culvert shall be installed on the natural streambed grade to minimize interference with fish migration.

   c. Filter cloth shall be placed on the streambed and streambanks prior to placement of the pipe culvert(s) and aggregate. The filter cloth shall cover the streambed and extend a minimum of 150 millimeters (6 inches) and a maximum of one 300 millimeters (1 foot) beyond the end of the culvert and bedding material. Filter cloth reduces settlement and improves crossing stability. See BMP-19, RIPRAP, for required physical qualities of the filter cloth.

   d. The culvert(s) shall extend a minimum of 300 millimeters (1 foot) beyond the upstream and downstream toe of the aggregate placed around the culvert. In no case shall the culvert exceed 12 meters (40 feet) in length.

   e. The culvert(s) shall be covered with a minimum of 0.3 meters (1 foot) of aggregate. If multiple culverts are used, they shall be separated by at least 300 millimeters (12 inches) of compacted aggregate fill. At a minimum, the bedding and fill material used in the construction of the temporary access culvert crossings shall conform with the aggregate requirements cited in part "i" under "Temporary Culvert Crossing."

   f. When the crossing has served its purpose, all structures including culverts, bedding and filter cloth materials shall be removed. Removal of the structure and clean-up of the area shall be accomplished without construction equipment working in the waterway channel.

   g. Upon removal of the structure, the stream shall immediately be shaped to its original cross-section and properly stabilized.

Maintenance

Both structures shall be inspected after every rainfall and at least once a week, whether it has rained or not, and all damages repaired immediately.