Temporary Watercourse Crossing: Bridges

DRAINAGE CONTROL TECHNIQUE

Low Gradient		Velocity Control		Short Term	✓
Steep Gradient		Channel Lining		Medium-Long Term	✓
Outlet Control		Soil Treatment		Permanent	

Symbol

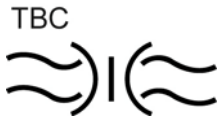

Photo 1 – Temporary bridge crossings formed with a 'culvert bridging slab'

Photo 2 – A barge used for the temporary crossing of tidal watercourse

Key Principles

1. Significant bank damage can occur during the installation and removal of these temporary watercourse crossings; therefore, extreme care must to be taken to minimise such damage.
2. It is important to minimise the risk of sediment-laden runoff from the approach roads being allowed to discharge directly into the watercourse without passing through an appropriate sediment trap or vegetative filter.
3. Critical design parameters are the flood immunity of the bridge deck and the structural integrity of the bridge during overtopping flood flows.
4. Critical operational issue is the minimisation of harm to the watercourse, including any sediment releases.

Design Information

Bridge crossings require both structural and hydraulic design. Their design requires input from both structural and hydraulic specialists.

Design parameters include expected traffic loads, required flood immunity, and expected hydraulic and debris loadings. The following information is supplied for general reference purposes only.

Bridge Structure:

Consideration should be given to the potential damage caused to the watercourse if the bridge structure washes away during a flood event. In critical locations it may be necessary to tether the structure to the watercourse banks using cables or chains to prevent individual components of the bridge being washed down the watercourse during severe floods.

Sizing:

Where practicable, the hydraulic capacity of the bridge should be equivalent to the in-bank hydraulic capacity of the watercourse, or at least equal to the hydraulic capacity of the watercourse below the level of the deck. The purpose of this requirement is to minimise the water level difference across the bridge at the point when the bridge deck is first overtopped. This reduces the risk of bank erosion caused when flood waters re-entering the downstream channel.

The use of earth or soil as *fill material* placed within the waterway channel during construction of the temporary bridge crossing should be avoided wherever possible.

Approach roads:

The approach roads should be stabilised (e.g. gravelled) and where practical, should have appropriate flow diversions installed to prevent sediment-laden runoff from the roads discharging directly into the stream. Ideally the approach roads should be straight for at least 10m each side of the crossing, and should align perpendicular to waterway channel.

In locations where sediment-laden runoff from the approach ramps cannot be suitably treated to avoid harm to the watercourse, then these ramps should be stabilised (e.g. gravel, aggregate, or rock) depending of expected channel flow conditions.

Photo 3 – Temporary steel deck bridge on a construction access road

Legislative Requirements:

Legislative requirements, permits and approvals vary from state to state, and region to region. Typical permit and approval requirements include:

- Approval for works within a watercourse (typically a department of water resources or natural resources).
- Approval for disturbance to bed, banks, or riparian vegetation.
- Approval for importing materials into a watercourse to form the bridge abutments.
- Approval for works that may interfere with fish passage (typically a fisheries authority).

Description

A temporary bridge crossing consisting of suspended beck or floating pontoon (Photo 2).

The bridge deck can be formed from steel framing and mesh, or from precast culvert bridging slabs (Photo 1).

Purpose

Used to provide all weather access across a watercourse or drainage channel, or to provide a trafficable bypass route during the replacement of an existing watercourse crossing.

Limitations

The capabilities of temporary bridge crossings are generally limited only by the extent of the budget.

Advantages

A well-designed and operated bridge crossing can minimise sediment releases to streams during a variety of weather conditions.

A suitably sized bridge crossing can minimise disruptions to traffic flow as well as disruptions to aquatic and terrestrial movement along the watercourse.

Bridge crossing are generally preferred by Fisheries authorities.

Bridge crossings have the potential to cause much less disturbance to both the watercourse and stream flow compared to a temporary culvert, causeway, or ford crossing.

Disadvantages

Temporary bridge crossings can be relatively expensive given their expected short design life, unless the components are re-useable.

Failure of a stream crossing or approach road can result in significant sediment loss.

Debris blockage of small bridges can aggravate upstream flood levels.

Special Requirements

Following removal of the temporary bridge crossing, the watercourse must be restored to its original condition and cross section.

Special attention will need to be paid to maintaining fish passage if the crossing is in place during a known fish migration period. Seek advice from local Fisheries officers.

Location

Ideally, temporary bridge crossings should be located on a straight section of a watercourse, well downstream of a sharp bend.

In any case, all crossings should be located in a position that will cause the least overall disturbance to the watercourse and associated riparian vegetation, especially to those areas that are required to remain in a 'natural' state.

Site Inspection

Temporary stream crossings should be inspected with great care because these structures can contribute to the discharge of sediment directly into a stream causing significant environmental harm. Such harm can occur during their construction, flood events, and during their decommissioning.

Check any overflow or bypass flow paths to make ensure the banks are stable.

Check for erosion cause by stormwater runoff passing down the approach roads.

Check for appropriate erosion controls and flow diversions on the approach roads.

Check for debris blockages.

Check the stability of the approach roads.

Installation

1. Prior to commencing any works, obtain all necessary approvals and permits required to construct the temporary watercourse crossing, including permits for the disturbance of bank vegetation, aquatic vegetation (e.g. mangroves) and any temporary instream flow diversion barriers or sediment control measures.
2. Refer to approved plans for location and construction details. If there are questions or problems with the location or method of installation, contact the engineer or responsible on-site officer for assistance.
3. Ensure that the location of the crossing will not interfere with future construction works.
4. Prior to significant land clearing or construction of the approach ramps and bridge abutments, establish all necessary sediment control measures and flow diversion works (instream and off-stream as required), clearing only those areas necessary for installation of these measures.

5. To the maximum degree practicable, construction activities and equipment must not operate within open flowing waters.
6. Maintain clearing and excavation of the watercourse bed and banks to a minimum. Initially clear only the area necessary to allow access for construction. Clear the remainder of the approach ramps only when adequate drainage and sediment controls are in place.
7. If flow diversion systems cannot be installed, then conduct bank excavations by pulling the soil away from the channel.
8. Where practicable, construct the watercourse crossing perpendicular to the channel.
9. Where practicable, the approach ramps should be straight for at least 10 metres and should be aligned with the crossing.
10. Where practicable, direct stormwater runoff from the approach ramps into stable drains, adjacent vegetation, or appropriate sediment traps to minimise the release of sediment into the watercourse.
11. Take all reasonable measures to prevent debris and construction material from entering the watercourse, especially any still or flowing water.
12. If highly erosive soils are detected, then appropriately stabilise such soils as soon as practicable.
13. Appropriately stabilise all disturbed watercourse banks.
14. Appropriately stabilise the approach roads including the approach ramps each side of the bridge crossing.
15. If it is not practicable to stabilise the access ramps against erosion, then install flow diversion banks across the width of each access ramp adjacent the top of the channel bank, and at regular intervals down the ramps (as required) to prevent or minimise sediment-laden runoff flowing directly into the watercourse.
16. Stabilise all disturbed areas that are likely to be subjected to flowing water, including bypass and overflow areas, with rock or other suitable materials.

Maintenance

1. Temporary watercourse crossings should be inspected weekly and after any significant change in stream flow.
2. Debris trapped on or upstream of the crossing should be removed.
3. Repair any damage caused by construction traffic. If traffic has exposed bare soil, stabilised as appropriate.
4. Check for erosion of abutments, channel scour, or rock displacement.
5. Make all necessary repairs immediately.
6. Check the bypass floodway making sure the banks are stable.
7. Check for excessive erosion on the approach roads.
8. Check the conditions of any flow diversion channels/banks and the operating conditions of associated sediment traps.

Removal

1. Temporary watercourse crossings should be removed as soon as possible after alternative access is achieved or the bridge is no longer needed.
2. Remove all specified materials and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
3. Restore the watercourse channel to its original cross-section, and smooth and appropriately stabilise and revegetate all disturbed areas.