Practical Tip: Stream crossing options

There are two possible stream crossing options, in conjunction with riparian fencing that can completely exclude livestock from entering a watercourse and therefore preventing faecal contamination and sediment from entering the watercourse. These are culverts or bridges.

Culverts

Culverts are more appropriate when sediment, bedload and debris movement coupled to the increased risk of flooding is not significant. If a culvert is the preferred option it is worth considering its size, width and location. In general, the bigger the culvert the better as this will help reduce the risk of blockages and any restriction of water flow. Culverts should not alter the natural gradient and bed of the stream. In some instances, poorly installed culverts can affect fish movement.

You should contact your local Environment Agency Development and Control Team on 08708 506 506, for advice on any required consents.
Piped culverts are designed to take water under a track but also enable vehicle or livestock access. Pipes may be either concrete or plastic.
The culvert should be a short section of piped ditch designed to facilitate livestock or machinery access. The culvert must not be used for agricultural drainage unless this is connected with management under an agri-environment scheme.

Pipe Diameter

Pipes should be capable of accommodating anticipated design flows and should always be at least 450 mm in diameter.

Culvert Width

The length of the pipes should provide an adequate, useable width at ground level for normal traffic using the crossing. The minimum useable width for a culvert used by wheeled traffic is 4 m.

Pipe type

Only pipes complying with the appropriate British Standards and having a positive joint to preserve alignment should be used.

Culvert construction

Pipes should be set on a firm bed and in true alignment. The trench bottom (usually the ditch bed) should be recessed where necessary to accommodate pipe joints (normally some form of spigot and socket). The pipe invert (water entry level) at the upstream end should be fractionally below the bottom of the true ditch bed. Where the total depth of cover over the pipes is less than the diameter plus 300 mm, a concrete pad at least 150

mm thick should be used. In all cases, the pipe manufacturer's specifications and warnings should be sought and observed.

Pipe gradient

This should approximate to that of the ditch bed. The ditch bed should be graded downstream to allow for any deepening required to accommodate the culvert.

Prevention of erosion

Protection measures (e.g. stone pitching or slabs) may be needed at the downstream end of the culvert and, if appropriate, on the sides of the ditch.

Backfilling

Stone-free filling should be packed and rammed tight at the sides of the pipe and to a level 300 mm above the crown (top) of the pipe. All filling should be put back in layers not more than 150 mm thick and thoroughly consolidated. The finished backfill surface should be left 'crowned' above surrounding levels, to allow for some settlement and to prevent surface water collecting on the crossing.

Headwalls

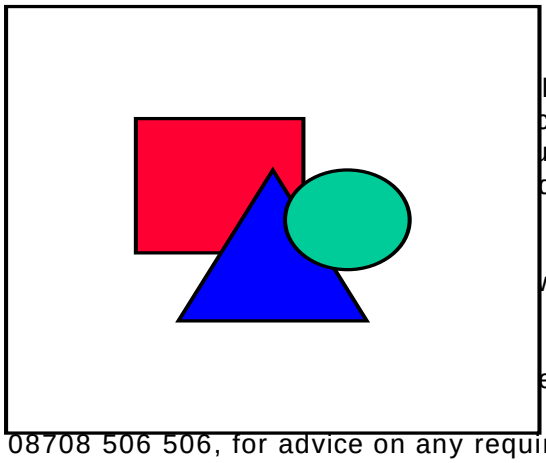
Adequate provision should be made to retain the backfill material against the pressure of traffic using the crossing. Sloping earth ends can be used as headwalls; these should have slopes not steeper than 1.5 horizontal to 1 vertical, and the length of the culvert should be extended by 1 m at each end to give stability to the walls.

Use by Heavy Vehicles

A specialist design is required if the culvert will be used by heavy vehicles. Pipes of specified strength and appropriate bedding and backfilling should be used.

Bridges

In general bridges will have less of an impact on stream beds and water flow than culverts. However, they can be a much more expensive option. Costs can significantly increase with increasing bridge span.



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Source: Environment Agency

Contact a constructional engineer to discuss designs for your particular situation. Standard designs will reduce time and cost of construction. Key issues to take account of are:-

- Bridge use
- Bridge span
- Stream flow rates and in particular flood levels
- Preferred construction materials

Three points to consider are:-

1. Construct the bridge at a height so as not to impede high stream flows
2. To reduce runoff from surrounding land, the bridge should be raised above its approaches.
3. Ideally the bridge should be constructed with raised lips on the edge of the deck to prevent runoff into the watercourse. Channel any runoff away from the bridge on to adjacent land rather than into the stream.

For both culvert and bridge construction, it must be remembered that undertaking constructional activities near and in a watercourse can have impacts upon its water quality. Cement is a highly alkaline material and can result in fish kill. This means that the placing of any concrete and any mixing of construction materials on the adjacent land will have to be carefully managed. No cement or washings from any concrete mixers etc must be allowed to enter the watercourse.
Alternatively you can reduce the impact of livestock crossing watercourses by creating a ford.

Ford

A ford should include a semi-circular, straight or oblique group of toe stones keyed into the river bed on the downstream edge to form a gravel trap. The specific design will depend upon local conditions, but must minimise erosion or the obstruction of fish. The trap allows the natural build up of gravel and cobbles to form a hard crossing point. The stones should be keyed down to a minimum of 600 mm below the existing level of the bed or below the known scour level, whichever is the deeper. Stones that form the trap should not stand clear of the water during low summer flows, and should not form a weir. Fords should usually be 4 m wide to allow stock and farm machinery access.
To protect the bank and immediate area:-

- The approach slope gradient should not be steeper than 1:4.
- The length of the ramp will depend on the slope of the river bank: the steeper the bank the longer the ramp must be.
- The sides of the ford approaches should not be accessible to livestock and should be protected by minor rock revetment on the river side.
- The base of the ramp should be protected to avoid bankside erosion.

The nature of the protection will be site specific but should be of one of the following types:

Rock Armouring: Cobble sized rocks should be positioned to provide as flat a surface as possible, with gaps filled with coarse gravel or hardcore. The gaps should be tightly filled so as that livestock will not be at risk of injury.

Coarse gravel/hardcore with retaining boards: If rock cannot be used as the ramp base, coarse gravel/hardcore can be used with treated retaining boards (50 x 230 mm) along

the ramp (parallel to river flow) spaced 1m apart. The boards should be held in position by treated posts (100 mm x 100 mm), 1m apart, driven into the bank and trimmed at an angle (1:4 parallel to slope), 50 mm below the line of the boards to avoid tripping. The bed of the ramp should be compacted to provide stable footing for livestock.