

3.6.2 Ford Design & Construction on Non-Fish Streams

A ford is a dip in a road constructed to facilitate crossing a stream. The objective of a ford is to maintain drainage and provide a safe, erosion-free, and storm-proof crossing that requires little or no maintenance. In the past, inappropriate location and design of fords, and uncontrolled use, has led to a number of negative environmental impacts. These include increased sediment delivery, and degraded water quality downstream.

In isolated locations where maintenance equipment may not be available on a continuing basis, properly designed and constructed fords require little maintenance, and can be effective in reducing adverse impacts in drainage systems that are prone to debris flows or debris floods (Figure 3-16). Consider the use of fords for areas of low traffic and intermittent use. Consider them as alternatives to bridges or culverts only where the crossings would not result in negative environmental impacts and where traffic use is confined to low-flow periods. Do not consider using a ford if the crossing is expected to be subjected to extensive or year-round traffic.

Figure 3-16 Road profile (stream crossing)

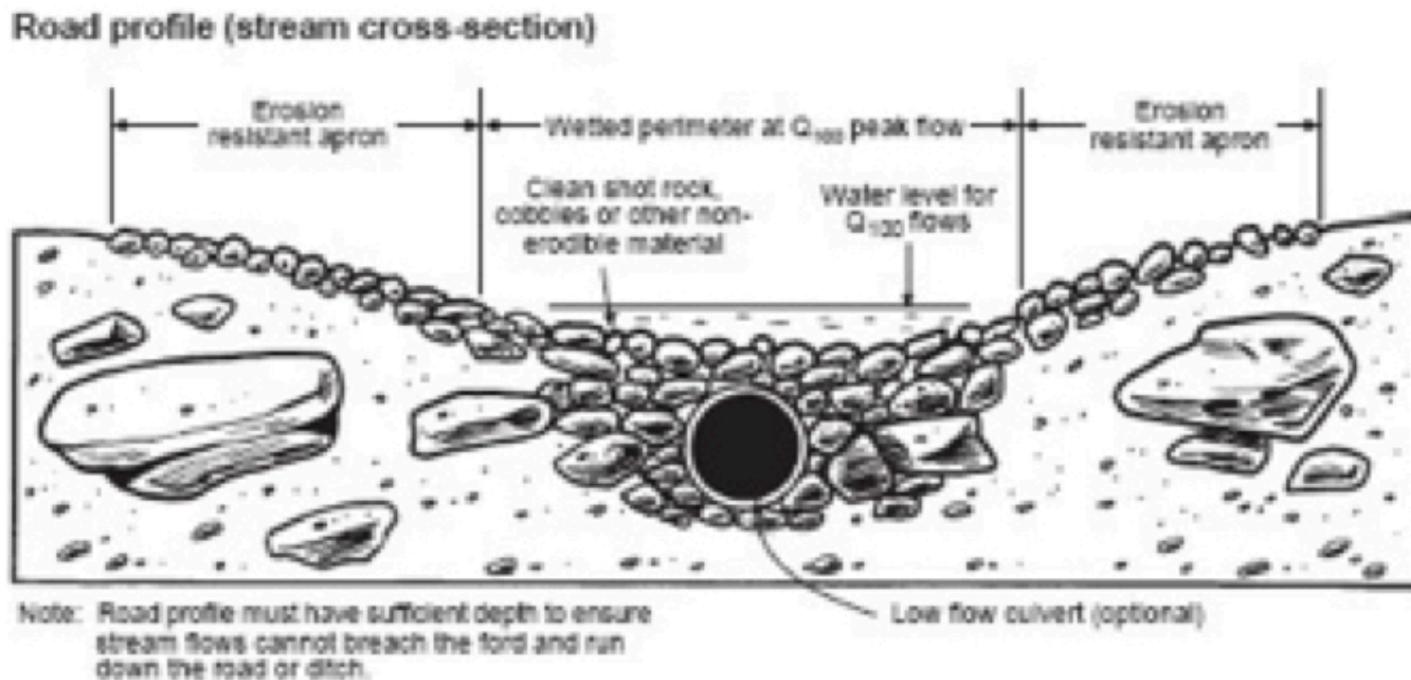
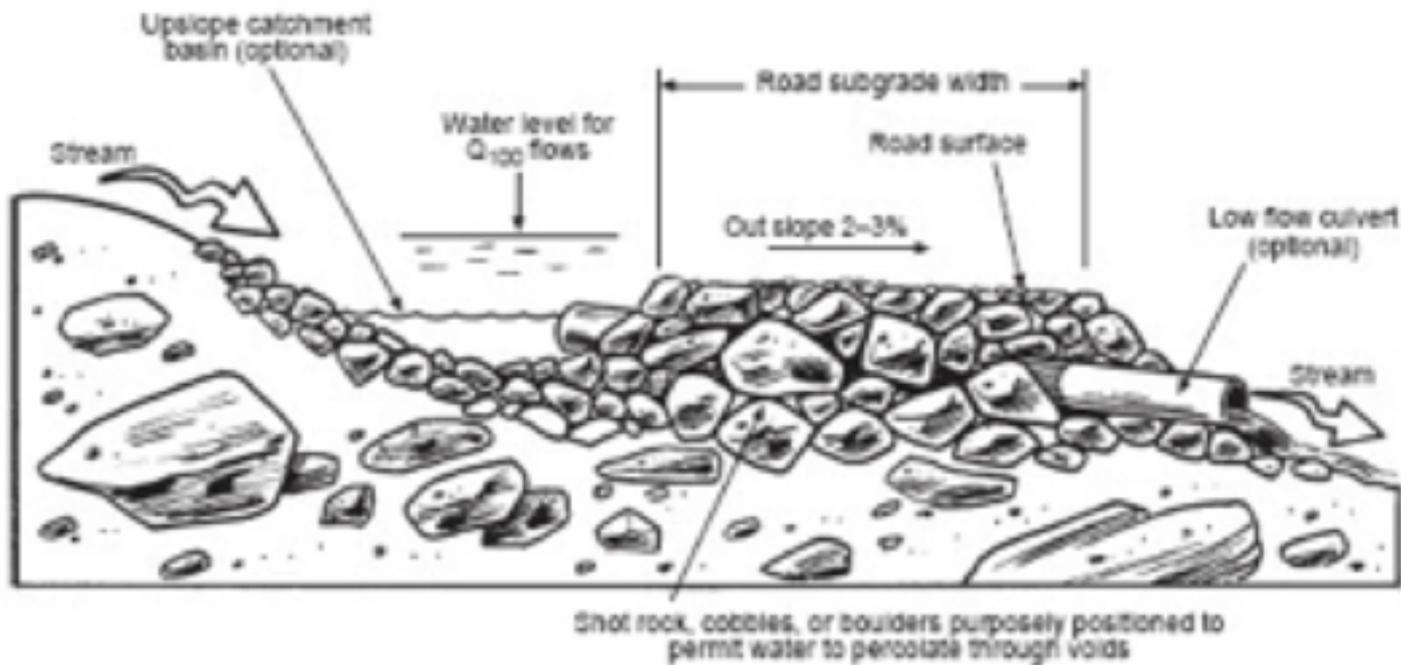


Figure 3-17 Road cross-section (stream profile)

Road cross-section (stream profile)



Ford Planning

Identify fords in the planning stage of road development to ensure that the required design and measures include appropriate road grades leading into and out of the stream crossing.

Prior to planning a ford, evaluate the stream to ensure that it is not a fish stream. Refer to the [Fish-Stream Crossing Guidebook \(PDF, 4.2MB\)](#) for limitations on the use of fords on fish streams.

When planning a ford, and establishing design criteria, determine if any of the following possible user safety restrictions (or combination of restrictions) will apply to the stream crossing:

- the design vehicle will only be able to cross the ford during certain months of the year;
- the design vehicle will not be able to cross the ford during periods of specific maximum stream flows;
- only certain types of vehicles will be able to cross the ford; and
- only certain specific road uses will be considered for ford applications (such as industrial use).

Each proposed ford design is unique, but the objectives of any design are to:

- pass the design peak flow;
- minimize downstream erosion of the stream;
- prevent sediment input into the stream from the approaches and associated ditches;
- provide a suitable road profile to accommodate safe passage of the design vehicle;
- ensure that the stream remains in its channel and cannot be diverted down the road or ditches; and
- ensure that the ford will either pass channel debris-the preferable option-or trap it.

Ford Design

For a ford, the road profile dips into and out of the stream, creating a concave shape sufficient to ensure that the stream cannot be diverted away from its natural channel and down the road.

Ensure that the anticipated design vehicle can negotiate vertical and horizontal curves at the proposed ford. Where it is practical to do so, design the approaches to be at right angles to the stream.

Check the debris flow history of the stream channel:

- on air photos;
- on terrain stability maps or terrain stability field assessments; and
- in the field and considering local knowledge.

For further information, refer to the [Gully Assessment Procedures Guidebook \(PDF, 1.8MB\)](#).

If there is a debris flow hazard, decide whether the ford should be designed to:

- trap the debris, or
- allow the debris to pass over the ford (the preferred option).

The size and shape of the largest cobbles or boulders in the stream channel indicates the minimum size of rock required to resist movement when the stream is in flood, and thus provides a guide to the minimum size of rock to be used to construct the ford. The more angular the rock (such as shot rock), the more resistant it will be to moving.

In some situations, the use of a ford may be restricted to low-flow periods when the flow is subsurface. Design a low-flow culvert to pass the anticipated low flow. With this design, peak flows and debris flow over the top of the ford, resulting in some increased annual maintenance. Use a sufficient size of running surface material to resist erosion.

Design methods are available for determining flow rates through voids in rock fills. Such voids may plug up with sediment and debris, so design the dip in the road profile to accommodate the peak flow discharge based on considerations similar to those applied to the design of a bridge or culvert.

Design Approval Requirements

Prepare sketches of the ford design, showing:

- the road profile, extending at least 50 m at each end beyond the wetted perimeter at the design peak flow discharge;
- the width and depth of the wetted surface during;
- those months when use of the road is anticipated;
- design peak flow level and an estimate of debris volumes to be passed or trapped;
- annual low-flow level, or the flow levels for the periods of anticipated use;
- the range and average size of the material in the stream channel and its shape (angular, semi-angular, or rounded);
- the minimum width of the road running surface required to accommodate anticipated traffic;
- the requirements for any erosion-resistant materials for the road running surface, such as shot rock and concrete cross-ties, including use of any geosynthetics, to help separate different types and gradations of road fill materials;
- the rock source, size, and volume requirements;

- the length, width, and depth of the upstream catchment basin if one is proposed;
- the type and dimensions of the low-flow culvert, if one is proposed; and
- the length of apron to be surfaced with erosion resistant material.