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BATTERY CULVERT CROSSINGS FOR LOGGING ROADS

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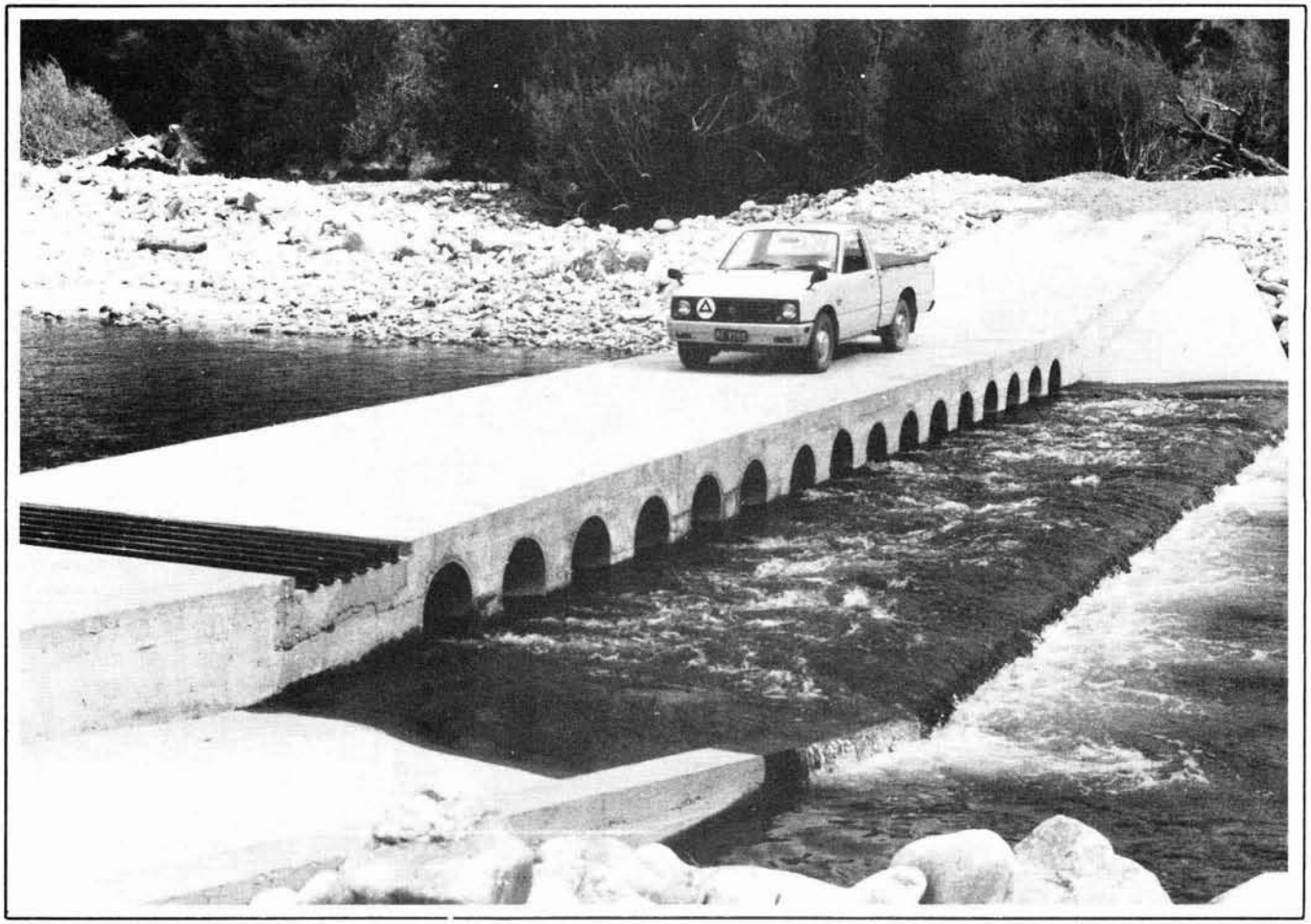


Fig. 1 - Battery culvert over the Dart River in the Nelson Conservancy

INTRODUCTION

Battery culverts and other types of low-level stream crossings have been used in low-cost roading operations in various parts of the world for many years. They are suited to the steeper catchments prone to flash flooding during storms. As many of New Zealand's exotic forests have been established on this type of terrain, this type of crossing can provide low-cost access.

Battery culverts are basically a hollow multipipe structure filled with selected ballast, and encased in concrete. Extensive foundation works are not required, as the stability of the structure is assured by building to the lowest practical profile providing an adequate anti-scour apron.

DESIGN PROCEDURES

When evaluating this river crossing option, heed must be taken of the following basic design considerations :

(a) The "debris deflecting buttresses" increase structure stability as they improve the flow of the floodwaters over the structure, as well as deflecting floating debris.

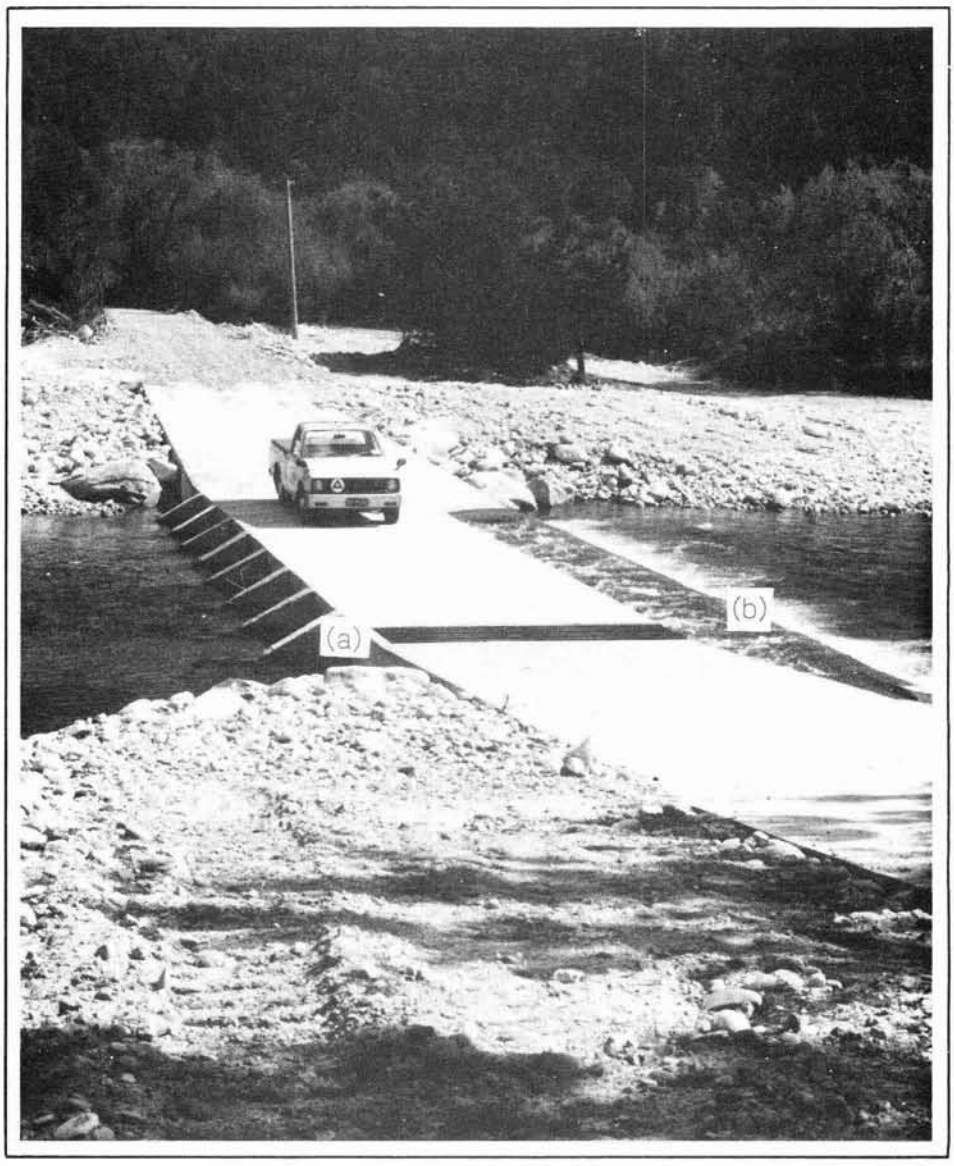
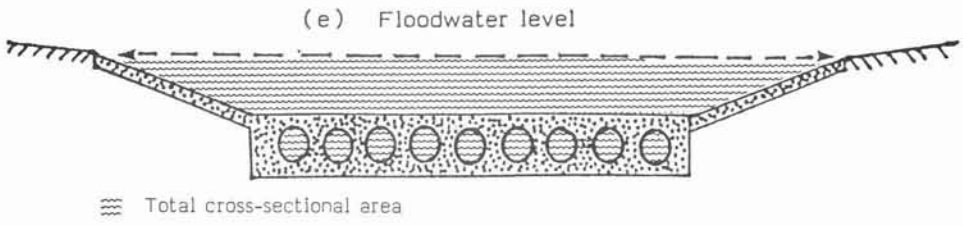


Fig. 2 - Culvert with normal river flow

(b) The "flow stabilising block" on the downstream edge of the anti-scour apron minimises the scouring effect whilst maintaining a sufficient depth of water across the apron and through the pipes to allow the passage of migrating fish.

(c) Select a site downstream of a fairly stable and straight section of stream channel and plan to cross the stream at right angles if possible. This will minimise future maintenance costs by reducing the tendency for the structure to become choked with gravel.

(d) Design for the finished height of the structure to be as low as possible. Multiple smaller diameter pipes are preferable to fewer larger ones. The criteria for pipe diameter selection is "ease of maintenance". In most cases, the 450 mm diameter pipe would be the most appropriate.



(e) The cross-sectional area of the paved profile, plus the sum of the cross-sectional areas of the piped waterway, must be sufficient to carry the anticipated floodwaters to prevent scour of the road approaches.

(f) A "finished height" datum peg must be established well clear of the construction zone before commencing work. This is vital, as the height of the structure must correspond to the natural undisturbed river channel, to avoid scouring.

(g) Owing to the abrasive effect of rocks and gravels passing over the structure during floods, concrete of no less than 30 MPa strength should be used on all upper surfaces, including the apron and the block. Concrete hardening additives such as "FEBEXEL" are recommended.

(h) The pipes and anti-scour apron should conform to the natural gradient of the river channel.

(i) Smaller crossings can usually be built completely with the stream diverted, but larger ones often have to be built in stages.

(j) The design proposal should be referred to the local Catchment Authority for their approval prior to installation.

ADVANTAGES

(a) Low cost - approximately 20-25% of the cost of an equivalent high-level bridge. In Nelson, costs are running at $450-$550 per lineal metre, including ramps.

(b) No particular loading restrictions, making them suitable for forestry and logging traffic.

(c) Heavy vehicles can negotiate these crossings with 400 mm or more of floodwater flowing across the pavement.

DISADVANTAGES

(a) Generally impassable for part of the time. This is influenced by the skill and experience of the designer. The chosen combination of; pavement, length and gradient of ramps, and area of piped waterway should be sufficient to accommodate the floodwaters without an excessive depth of water flowing across the pavement.

(b) Regular inspections are required, especially following storms, when pipes can become blocked by debris.

CONCLUSIONS

These low-cost crossings can produce substantial savings in roading costs and warrant consideration.

Construction is relatively straightforward but the design requires consultation with civil engineering personnel.

Local knowledge of river behaviour and information on flood flows is vital.

It is often possible to cater for minor flooding without an excessive depth of water over the pavement, thus providing almost unrestricted access.

Care is needed when contemplating crossing during flood flows.

For further information on design specifications, contact :

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