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**Use of Cattleguard Superstructures for Low Water
Crossings on Secondary Forest Roads**

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USE OF CATTLEGUARD SUPERSTRUCTURES FOR LOW WATER CROSSINGS ON SECONDARY FOREST ROADS

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Low water crossings have become increasingly popular in recent years on the Eldorado National Forest because of their diversity of application to different stream-crossing situations and low initial cost. Recently a stream crossing was encountered on our Forest that presented a real challenge to determining the best type of structure that could be used.

The following are some facts and physical conditions which had to be considered in selecting the structure:

- Existing 16-foot road fords a relatively flat stream bed—180 feet between high water marks.
- Good trout spawning gravels exist both upstream and downstream of the proposed crossing site.
- Dispersed recreation exists in the form of hunting, camping, and fishing.
- Thirty MMBF of timber will be removed from the area in the next 20 years.
- Flow fluctuates from 15 feet wide and 1 foot deep to 180 feet wide and 5 feet deep.

The environmental analysis established the following criteria to be adhered to in the design of the structure:

- Provide for minimal stream disturbance during the construction phase.
- Provide for free passage of fish during periods of low flow.
- Avoid any damming of the stream that would cause channeling during peak flows.

Within these limitations, many structures were evaluated: gabion low water crossing, concrete box culverts, concrete fords, and treated timber, concrete, and composite bridges. After careful consideration of each of these structures, we found that all had some definite drawbacks, varying from environmental or aesthetic impacts to high cost. Then someone

suggested expanding a concept we had used before, that of a concrete ford with a single cattleguard over the low flow opening, to a “low-water bridge” structure with concrete piers and a cattleguard running surface (see fig. 1).

The structure consisted of the approach slabs, ten concrete piers, twenty 8- by 16-foot cattleguards, and two 8- by 8-foot cattleguards. All elements were designed for H20-S-44 loading. The concrete pier footings were designed with a soil bearing pressure of 1 ton/sq ft and were placed 5 feet below streambed to prevent scouring. The understructure of the cattleguards was designed so as to distribute the weight over three I-beams and two channel beams. To provide a smoother running surface, the cross-rail section of the cattleguards was fabricated with two more rails per cattleguard than normal. The concrete approach slabs placed on each end of the structure were designed with cutoff walls 5 feet below the streambed and were heavily rip-rapped, both upstream and downstream, to protect the roadway during high water.

The structure was designed to carry approximately 80 percent of the stream flow (5000 c.f.s. for a 100-year storm) under the cattleguards. This required an end area of 336 square feet.

The low bid for the structure, \$53,000, was about half the estimated cost of the cheapest acceptable alternative.

The structure was topped by an extremely heavy spring runoff the first winter after its completion and showed no apparent effect from it. No maintenance of the structure has been needed in the first year of its life.

The Forest will erect detachable wheel guards this spring to provide an additional safety precaution as 160 feet of continuous cattleguard running surface could become slippery when wet or icy. These wheel guards will be removed each fall to allow the structure to function properly during high runoff periods. In addition, a 3-foot-wide, metal-mesh walkway will be permanently installed on the structure to accommodate foot traffic and 2-wheel vehicles.

All in all, the Eldorado has been pleased with the aesthetic appearance, low initial cost, expected cost of maintenance, and the minimal environmental impact of this structure.



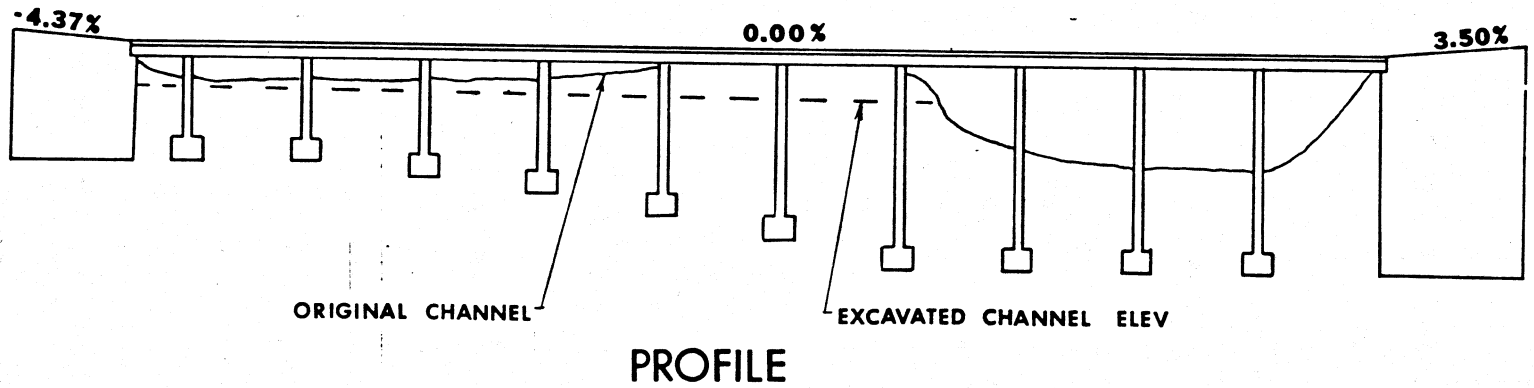
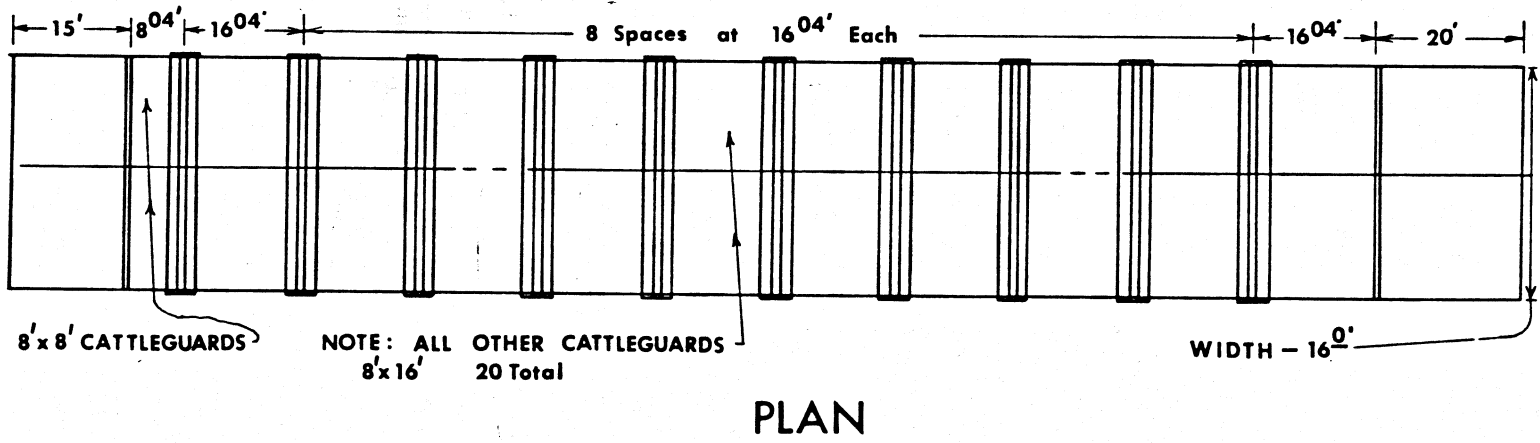


Figure 1. - Plan and Profile