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CULVERTS—THEIR LOCATION AND CONSTRUCTION

SOME PRACTICAL SUGGESTIONS ON THE DESIGN, CONSTRUCTION AND PROPER LOCATION OF VARIOUS TYPES OF CULVERTS.

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To determine the proper size opening required to take care of the maximum amount of water that may be expected, is sometimes a difficult matter.

There are various formulæ that take into consideration the drainage area, the slope of the ground, and the permeability of the soil; but on railway and trunk road construction, the engineer is generally a stranger to the district, unacquainted with local conditions; there is seldom a map of the surrounding country of a scale large enough to be of any use and, above all, he is always pressed for time.

In a settled country, the highway bridges, both up and down stream are the best guide, and local records will show whether any previous bridges have been washed away. In cases where the road crosses the valley on a low fill, there is always the likelihood that the stream may flow over the embankment in times of flood. Such a happening, while not very serious in the case of a highway, would be fatal to a railway. It should always be remembered that local construction is often built with a narrow margin of safety; in fact, many structures seem to defy all natural laws, and to hold up by special act of providence.

The high-water mark should always be looked for, and in the bush that is about the only information that can be found, but there it is much better defined than elsewhere. A rough estimate of the area of the cross-section of the stream in flood, together with the velocity of the water, and the shape of the soil in the banks, will usually give sufficient information to determine the size of opening required.

If possible, the elevation of high water in the spring and after every flood should be taken; the severest floods often occurring in the late summer, and not at the "break-

up". A good way to get the high-water level during freshets, is to nail up a board under cover, and on it mark a vertical line with indelible pencil; this line will be blurred as far as the water reaches. At high water, the direction of the current should also be noticed, as the course may then be very different from what it was at low water, and indicate the necessity of rip-rap.

In some districts, provision must be made for the accumulation of ice in the invert of the culvert, as in many cases this will reduce the effective size of the opening at least 50 per cent., just at the time when the full opening is most needed. This accumulation of ice occurs most frequently where the winters are not very severe, and where

there are many changes in temperature above and below freezing point. It is also worse in open country than in the bush.

All opportunities of stream diversions should be looked for, and the cost compared with that of an extra culvert. In a settled country they need special consideration, as it is usually unlawful to divert surface water from one piece of property to another, and even where the stream will flow over the same parcel of land, it is best to get the written consent of the owner.

Type of Structure.

—The type of structure will depend to a great extent upon the available funds, local conditions, and the facilities for handling material. For small openings, pipe is the best; cast iron, corrugated iron, vitrified tile, or concrete, but in no case should a smaller size than 18 inches be used, on account of the difficulty of cleaning. For openings larger than 7 or 8 square feet, a built-in structure is the best, either of

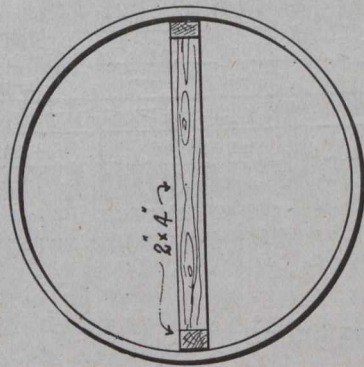


Fig. 1.—Showing Method of Bracing Large Sizes of Corrugated Iron Culvert.

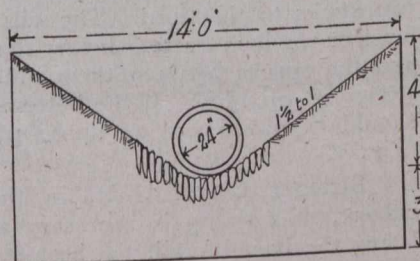
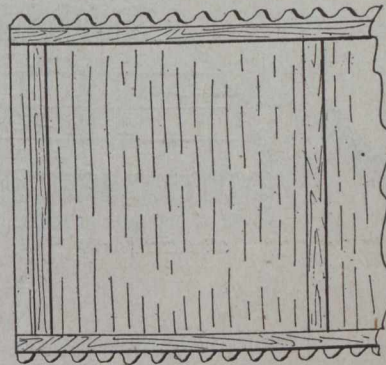


Fig. 2.—Type of Concrete End Wall and Paving Used with Culvert Pipe.

