fir. The remainder of the work from "merchantable" timber of various kinds.

Crib Piers and Abutments.

Fig. 23 illustrates the manner in which crib piers and abutments for Howe truss, pony truss, and wooden lattice spans are constructed. The courses are dovetailed at all intersections, and drift-bolted together with drift bolts long enough to penetrate 2½ courses of timber. Oak trenails are used at all other points except where the timbers intersect. All intersections at cutwaters are dovetailed at the proper angle, and drift-bolted in the same manner. The nosing of cut waters is protected as a rule with a covering of sheet iron. The timber used is cedar, pine or tamarac.

Crib Retaining Walls.

Crib retaining walls are frequently introduced as a protection at the foot of slopes running out into water where

Cattle Guards and Open Culverts.

Timber in place per 1,000 ft. B.M..... \$20 00 Superstructure, stringers, ties, etc. 30 00 Piling per lin. ft. left in work 30

Wrought and cast iron included in above prices.

Box Culverts.

Box	culverts,	2	ft.	by	2	ft.	per	lin.	ft.			•		•				\$2.5
	66	3	ft.	by	3	ft.					•	•	•	•	•	•	•	3.0
"		4	ft.	by	4	ft.		"				•						4.0

Framed Trestle Work.

Ironwork included in price of framing above. Trestle work about 20 feet in height costs about \$6.25 or say 25 shillings per lineal foot.



there is danger of erosion from currents, also at various points where otherwise masonry retaining walls would be necessary. They are constructed from rough logs, laid in the manner indicated by Fig. 24. The timbers are notched at all intersections and drift-bolted together. The timber used is chiefly cedar, spruce, and tamarac.

Approximate Cost of Structures.

The cost of the various structures referred to varies so much over so vast a territory that it is scarcely possible to give more than approximate figures. The following prices, however, may be considered a fair average, when timber can be procured at a reasonable figure, and the work done by experienced workmen, under the superintendence of men familiar with this class of work.

Crib piers and abutments cost per cub. yard, including stone filling complete \$3.50. Open cribwork for retaining walls with stone filling costs per cubic yard \$2.

The author had in view the idea of introducing in the present paper a few examples of the permanent work by which the temporary work is being rapidly replaced. There are many features of the construction of masonry arch culverts, piers and abutments, on Canadian railways which might be of interest by way of comparison, but in order to attain this purpose it will be necessary to deal with this division of the work apart from the present paper.

The principal object the writer had in view in preparing this paper, was to deal with the subject in a manner to be of interest to the younger members of the profession who, per-