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FOR THE CANADIAN ENGINEER.

RAILWAY ENGINEERING.*

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PART II.

CHAP. I.—TRACK.

ARTICLE 1.—FORM OF ROADBED.

The first essential of a good track is proper drainage; there can hardly be good track without it, from which it naturally follows that too much care cannot be taken in forming a roadbed at the completion of its construction, which will have good drainage in itself; even with abundant and good ballast, drainage is necessary, while it may be the saving feature of a track surfaced with inferior or scanty ballast. Plate XXII. shows types of roadbeds in use in America, and it will be seen that most of them have a slight slope each way from the centre, forming a rounded surface onto which the ballast is laid; the crown at sub-grade should be 3 to 4 inches for a single track in cutting, but may be partially omitted on embankments, as future settlement tends to round off the corners and aid drainage. Should low spots exist in the centre of the roadbed beneath the ballast, water will lodge there and soften up the earth so that the ties will sink under the churning action of car and engine wheels. Although not essential or always done, it is an advantage and an economy of ballast to elevate the roadbed on curves parallel to the expected plane of the ties and rails; this practice also gives an elevated track before ballasting is commenced. Widths of roadbed vary with the climate and materials. Embankments vary from 10 feet for cheaply built roads in the Southern U.S.A. to an ordinary standard of 16 feet for Canadian and Northern U S.A. first-class roads; cuttings vary similarly, but are usually about 6 feet wider than the embankments for making ditches; for purposes of handling snow it is not found advisable to make cuttings less than 22 feet in Canada, although rock cuts with narrow ditches are sometimes made 20 feet. To all of these, 12 to 14 feet are added for each additional track, and in case of very wet cuttings extra width may be needed for proper drainage (see Fig. 8, Plate XXII.), or a tile may be laid beneath the cut ditches to drain the sub-soil (see Fig. 5, Plate XXII.). Ordinary cut ditches are about three feet wide and one foot deep, and may be wedge-shaped (Fig. 7) or trough-shaped (Fig. 8), but although the latter is often dug in the first place, the weight of evidence is in favor of the former, which is formed by a flat slope of from 2 to 1 to 6 to 1, starting from near the edge of the ballast and meeting the cut slope at an angle. The tendency of such a ditch is to direct the water well away from the track and thus prevent undermining of the ballast. Cut ditches should be led well away from the mouth of the cuttings to avoid scouring the foot of the adjacent bank, indeed, the cut ditch on the upper side should join the catchwater ditch and continue down to the entrance of the nearest culvert as a berme ditch placed five or six feet away from the foot of the bank. By a thorough system of ditching at the conclusion of construction much trouble and expense can be avoided and the energies of the track gangs during early maintenance may then be devoted to other things. To make the ditching system complete, catchwater ditches should be dug along the upper side of every cut, placed six or eight feet back from the top of the slope, the earth from them being placed inside; these ditches should collect all those small trickling streams and general hillside wash that would otherwise run down the cut slopes, carrying sediment into the cut ditches. These cut ditches are often soon neglected during early maintenance, and extra ties, heaps of unused ballast and stray boulders block the drainage, while in later years rotten ties and weeds need watching. Too great stress cannot be laid on having clean straight cut ditches with a uniform fall.

Of late years construction has been usually very rapid, and embankments, if made of earth, will rarely have completed more than half of their shrinkage; this will vary in amount with the method used in building the bank, being greatest when built with wheelbarrows or machine graders from side ditches, and least when flat or wheel-scraper work has trampled it in thin layers by the horses' feet, etc. For these reasons all banks made of earth ought to be left full width and a certain per cent. of height at each point above the theoretical grade line. Of course, abrupt changes in track surface are not desirable, even for a short time, and such allowance for shrinkage should be made with judgment according to the merits of the case in hand

* This series of papers will be issued in book form as soon as they have appeared in THE CANADIAN ENGINEER.