SUB-DRAINAGE OF WET CUTS WITH VITRIFIED TILE.*

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BETWEEN years 1905 and 1911 extensive use was made of vitrified tile for draining water pockets and wet cuts on the Missouri Pacific System. During this period approximately 714 locations were worked in the following States: Kansas, 417; Missouri, 180; Arkansas, 80; Colorado, 21; Oklahoma, 10; Nebraska, 4; Louisiana, 2.

Of this total about 79 locations or 11 per cent. were reported as failing to give benefits, with but two causes of failure assigned: (1) Tile not placed to sufficient depth; (2) tile not placed in proper location.

On this account and to determine the value of tile drainage for roadbed, an investigation was made of all the territory which had been previously worked.

In the conduct of the investigation locations were selected for examination where grade, soil, rainfall and other conditions widely varied. At seventy locations the drains were uncovered at two or more points and examined for line, grade and signs of clogging. In the stretches of track inspected the drains varied from 100 to 3,000 feet in length and were at depths of from three to seven feet below base of rail.

The investigation showed a remarkable benefit to have been derived through the strengthening of roadbed where drains had been properly installed and estimates made from most reliable information obtainable indicate a return of from 50 per cent. to 200 per cent. per year in the decreased cost of maintaining line and surface on the short pieces of track which were drained.

The failures reported were found to be due principally to improper installation, particularly with reference to depth of drain to the moving material in the roadbed. In these locations many of the drains were forced to the surface and completely filled. In those locations examined where proper methods of installation had been followed, the line and grade of tile was intact and entirely free of sediment or evidences of clogging.

The data gathered in the investigation dispels much of the doubt previously existing both as to the permanency of the drains and the benefit derived from them.

Generally speaking, the writer does not believe it can be found that tile drains will produce a direct saving in dollars and cents in track maintenance, but the benefit would seem to lie in the development of more efficient track in locations where it was formerly found to be impossible to maintain good track. The benefit comes from the removal of slow orders and a more even distribution of the time of the section forces over their territory. In some cases it has resulted in an actual decrease of section forces, but this is an exception rather than a rule.

The necessity for tiling cuts comes from neglect to provide and maintain adequate surface drainage. The change is gradual and is not always noticeable until we are confronted with the result. Just as efficient if not better track could be developed if cuts were projected by intercepting and side ditches properly constructed and maintained, but tile seems to afford the only practical relief where the roadbed has become water soaked and too soft to sustain the loads.

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Conclusions drawn from our experience indicate if tiling be installed in accord with the following requirements, the greatest permanency and benefit will be assured:—

Drains should be laid with bell-end, vitrified salt-glazed sewer pipe of minimum diameter of 6 ins., with unsealed joints.

The top of tile should be placed one foot below frost line and a minimum distance of one foot below unstable or moving material. Depth in each case should be carefully determined by test holes or inspecting excavation.

Tile should be laid to grade established by level and with all fall obtainable.

Location of centre line of tile should be parallel to and from 4 ft. 6 ins. to 7 ft. from centre line of track.

Tile should be placed directly on bottom of trench. After it is laid to line and grade, and before backfilling, it should be covered with straw, grass or some such material to prevent loose particles in backfilling from entering the joints.

Trenches should be backfilled with cinders, with coarse material placed directly around and over the tile. Where walls of trench show signs of distortion from passing loads, sufficient quantity of riprap or coarse stone should be mixed with the cinders to brace the walls.

Pockets under track should be tapped with cinder-filled lateral trenches, and connected into tile drain trench, but without connection with tile drain except through the unsealed joints.

Remove all surface water from cuts by intercepting and side ditches, otherwise tile drain may be overtaxed and eventually fail entirely.

After drains have been installed it is essential to maintain free outlets to prevent backing water into tile.

The ends of drains should be surrounded and supported by concrete or dry masonry to guard against underwash.

To prevent small animals from entering tile, the outlet should be protected by rods or grating.

Failures of drains come from the following causes:—

Insufficient depth below moving material.

Shifting grade or alignment causing joints to open.

Insufficient grade to provide proper flow.

Location of drain in impervious material without providing adequate means for tapping saturated material with lateral drains or cross-trenches.

Distortion of walls of trenches.

Tile drainage is not a panacea for all wet cuts and its use is not recommended without a complete knowledge of the conditions to be corrected. When these are known and proper methods of installation are applied, much benefit is reasonably sure to follow.

COBALT ORE SHIPMENTS.

The following are the shipments of ore, in pounds, from Cobalt Station for the week ended November 24th:—

Temiskiming Mining Company, 78,677; La Rose Mine, 87,345; Dominion Reduction Company, 174,000; McKinley-Darragh-Savage Mines, 162,332; Nipissing Mining Company, 302,135. Total, 804,489 pounds, or 402.2 tons.

The total shipments since January 1st, 1916, now amount to 29,262,568 pounds, or 14,631.2 tons.