

ENGINEERING DEPARTMENT.

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Municipal Engineering.

The province of a municipal engineer is as broad as the profession itself. When we consider the different branches of civil engineering—sanitary, hydraulic, mining, mechanical, railway, military, naval and municipal engineering, the breadth of the field embraced in this department will be observed.

THE MUNICIPAL WORLD will be devoted to municipal work and it will be my duty to discuss only such questions as relate to sanitary, hydraulic and municipal engineering, unless at the request of subscribers who find it necessary to consider other branches of the profession as incidental thereto.

The construction and maintenance of roads and streets, the quality and description of material to be used for road covering and pavements, the cost of good roads and the expense of bad ones, the drainage of lands for agricultural purposes and assessments therefor, the sewerage of towns and cities, sanitation in urban and rural communities, heating and ventilation of public buildings, water supply for towns and cities, the different systems of waterworks, direct pressure, gravitation, mechanical filtration, aeration, etc., will receive special consideration.

Roads and Road Making.

The construction and maintenance of highways must form at all times a most important work to municipal authorities, not only because of the increased comfort of the community of well-kept roads, but because of the increased cost of locomotion and the discomfort of badly maintained roads. The construction and maintenance of highways is a subject that the municipal authorities of to-day are devoting much attention to; it is a question that comes very near the public heart for the reason that it draws very heavily upon the public purse.

If the best results are to be obtained there must be intelligent designs, careful supervision of construction and properly organized forces for the maintenance of the same; with a few exceptions, these requirements are not found combined either in city, county or township, nor can they be until both the construction and maintenance of highways is placed under the care and direction of men whose training and experience especially fits them to have charge of and control in a large measure this department of public work.

The construction of a street or road involves something more than filling up holes and covering mud; the question of grades, width of roadway to be improved, cross-section of completed road, drainage of both surface and sub-grade, the kind and amount of material to be used requires careful and skilful consideration and investigation.

Country roads, as distinguished from paved streets in cities and town, may be classified with respect to their covering as follows:—

1. Earth roads.
2. Corduroy roads.
3. Plank roads.
4. Gravel roads.
5. All broken stones.
6. Stone sub-pavement, dressed with broken stones.

Earth Roads.

Earth roads necessarily possess so many defects of surface that whatever amelioration their condition is susceptible of, by a careful attention to good surface drainage and sub-drainage, should be secured; the grades should be easy, not exceeding one foot in twenty-five, and the road surface should slope not less than one foot in twenty from the centre towards the side. The side ditches should be deep and capacious, with a fall of not less than one inch in one hundred feet, and where the land on the borders of the road is timbered, the trees should be cleared away at last four rods from the lines of the road to admit the wind and sun. In soils composed of a mixture of sand, gravel and clay the road is formed of this material and requires only that the ditches should be kept open and free, and that the ruts and hollows be filled up as fast as they form in the surface in order to render the road a good one of its kind. The material used in filling up ruts and hollows should be composed largely of gravel and coarse sand, free from sod, muck or mould; it should not contain cobble-stone or large fragments of rock, which would form large and mouldering lumps on one side of the wagon track, soon resulting in corresponding ruts and hollows on the other. All ruts should be filled in with good material as soon as formed.

A pernicious custom prevails of repairing country roads only at a certain season of the year, the cost of maintenance would be greatly reduced by frequent repairs, and especially by keeping the said ditches clear and open to their full depth and width, by promptly filling in the ruts, and by maintaining the required slopes from the centre towards the sides. It is seldom found that the material obtained by cleaning out the side ditches is fit to put upon the roadway.

Corduroy Roads.

Straight logs of timber, either round or split, cut to suitable lengths, and laid down side by side across the roadway, scarcely deserves the name of a road; nevertheless, they are vastly superior to a soft marsh or swamp, which in some seasons of the year would be absolutely impassible for the wheeled vehicles of any description. They are commonly known as corduroy roads, from their ribbed character. In heavily timbered districts nearly all the logs for such a construction would be procured in clearing off the usual width—four rods—prescribed for country roads. The width of the road covering itself on the corduroy being restricted to about fifteen or sixteen feet, so that two vehicles can pass each other upon it without interference. The logs are all generally cut to the same length, and in laying them down such care in selection should be exercised as will give the smallest joints or opening between them. In order to reduce as much as possible the draught and the violence of the repeated shocks to which vehicles are subjected upon these roads, and also to render its surface practicable for draught animals, it is customary to level up between the logs with smaller pieces of the same length, but split to a triangular cross section, these are inserted with edges downwards in the open joints so as to bring their top surface even with the upper sides of the large logs, or as nearly as practicable. Upon the bed thus prepared a layer of brushwood is put, with a few inches in thickness of soil or turf on top to keep it in place. This completes the road.

Plank Roads.

Plank roads were much in vogue twenty-five or thirty years ago and are still used in localities where lumber is cheap and stone and gravel scarce and expensive. They should be at least eight feet wide and occupy one side of an ordinary well-drained and properly graded earth road, the other side being used to turn out upon and for travel during the dry season. The method of construction most commonly followed is to lay down, lengthwise, with the road, two parallel rows of stringers about five feet apart, between centres, and upon these to lay cross plank of from three to four inches in thickness and eight feet long, so adjusted that their ends shall not be in a line, but form short offsets at intervals of three or four feet to prevent the formation of long ruts at the edges of the road and aid vehicles in regaining the covering from the earth turnout. New plank roads possess many advantages for heavy haulage as well as light travel when the earth road is muddy and soft, but in a short time the planks become so worn and warped and so many of them get displaced that they are very disagreeable roads to travel upon. They are so deficient in durability that a common gravel road, which I will hereinafter describe, will in the end be found more profitable in most localities, the ease and rapidity with which they can be constructed render them a popular and even a desirable make-shift in newly-settled districts and towns where lumber can be procured at low cost, but they lack the essential features of permanence and durability which all important highways should possess.

Gravel Roads.

A great deal must be taken into consideration before attempting to construct gravel roads. A capital distinction must be made between gravel that will pack under travel and clean rounded gravel which will not, due to a small proportion of clayey or earthy matter contained in the former which unites and combines the material together. Seaside and riverside gravel consisting almost entirely of waterworn and rounded pebbles of all sizes, which easily move and slide upon each other, is unsuitable for a road covering unless other materials be mixed with it, while pit gravel usually contains too much earthy matter. The gravel for the top layer, at least, must be hard and tough, so that the wear will not pulverize it and convert it into dust and mud. It should be coarse, varying size, from one-half to one and one-half inches in largest dimensions, it should not be water worn and should contain enough sandy or clayey loam to bind it together firmly. Pit gravel usually contains so much earthy material that it should be screened to render it entirely suitable for the surface layer for this purpose. Two wire screens will be necessary, one with the wires from one and one-half to one and three-fourth inches apart, while in the other they should not be more than one-half to three-fourth inches apart. The pebbles which do not pass the large screen are to be rejected, or if used should be broken up into small fragments, while the earth, small gravel and sand that pass the smaller one, although not suitable for the road surface, will answer for a bed for the road material to rest upon. If the bed of the road is rock a layer of earth should be interspersed to prevent the too rapid wear of the latter. In ordinary soils an excavation to the depth of ten or twelve inches and of the required width is made for the reception of the gravel. The surface of this excavated form, called the sub-grade, may be made level, or, preferably, it may be arranged parallel to the finished road surface by sloping it from the centre to the sides. A layer, four inches thick, of good, unscreened gravel, in its natural state, is first spread upon the roadbed, which is then thrown open to travel until it becomes tolerably well consolidated. The work may be hastened by