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Roads and Roadmaking.

In the construction of a good road it will be necessary to take into consideration the following: Climatic influence, geological formation, material, drainage, traffic, location, elasticity, cost and maintenance.

It is well known that many roads which have been laid with really sound materials and apparently fairly constructed have signally failed in their purposes owing to the negligence of their constructors in not taking into consideration the climatic influences of the district in which such roads are laid. Severe storms, intense frosts, low humid atmosphere, sudden hot droughts with occasional heavy washouts, entail severe strain upon the best constructed roads, by removing the lighter surface material and converting it into mud, breaking up or disintegrating the cohesiveness of the heavier material and so displacing the sectional divisions of the road strata. For want of immediate attention to its repair a road is left in a weak condition, consequently its usefulness is gone necessitating a heavy expenditure to restore it to its original state.

The often serious results of these climatic influences can be materially lessened and their damaging propensities modified. Against severe storms and washouts there should be provided properly constructed water outlets, clear open drains and gutters and a well made grade falling from the crown of the road. These protections will reduce the force of the surface washings. Severe frosts are often injurious in their effects on roads, especially in the spring season. Care therefore is necessary to see at once to the water outlets, relevelling places, upheaved ruts in roads which are subject to frequent traffic on them of heavy vehicles, raked back, and the keeping of the surface to the original grade. From an economical point of view a few dollars spent at the right time may save hundreds of dollars at some future period in restoring the road to its proper condition. The full action of the sun and wind upon the road surface is another important factor, it being one of the means of keeping it dry and hard. Trees should also be kept well trimmed, fences maintained at a low height and thus encourage these beneficial helpers.

Geological formation is an important factor and roads should not be constructed until a well drained and solid foundation has been secured. Many roads have been made without much thought or care having been bestowed upon the strata and beds upon which their foundation materials are laid and which is shown by the surface of such roads losing entirely all uniform appearance and causing constant outlay for their maintenance.

Outside of certain districts and of rocky places, the strata upon which such roads are constructed in the majority of cases will come under the following classes of soils and subsoils, viz.: Silicious, calcareous, clays (both light and heavy), marls and loams.

Silicious soils of a flinty nature and calcareous soils having properties of lime, present no great difficulty in securing a firm, dry and solid foundation for the construction of roads. On soils of a clayey nature, either light or heavy, it is absolutely necessary to secure perfect dryness of such beds which can only be obtained by a perfect system of draining both at bottom and surface.

Soils that vary considerably in their natural properties classed as rich and poor earths in many places are intermixed with a large proportion of flint and other hard materials, the component parts of which are generally small. Other marls are softer and hold moisture tenaciously, requiring a through system of drainage to enable the roadbed to be perfectly made. Swamps and morasses being of a soft and spongey nature, better known as low wet grounds under the name of marshes and bogs, present the greatest difficulty in road construction and in several places have entailed heavy charges for their proper Such localities demand maintenance. perfect drainage.

In the construction of a good road it is absolutely necessary to have material in each of the sectional divisions of good, sound and durable qualities. The sectional divisions are now commonly placed under three heads, viz .: Upper, middle, lower vertical sections. It is necessary that each separate section of its construction should be laid in the gradient form of the proposed formation of the road from the fact that the traffic is more upon the centre than on either of its sides, and helps to keep the cohesiveness and component parts in more compact form and elastic shape preventing displacement of materials. The materials of which the several sections are formed may be described as follows :

Lower section—Solid broken rock rough cobbles, iron slag, slate refuse, shale and similar heavy substances from the various quarties. As such materials can be obtained in almost any district in which roads are required to be made in more or less quantity, constructors should be guided of course in the selection of the material by the facility with which it can be procured.

Middle section—Materials of porous and yet durable nature. These qualities are found in burnt clays, stones taken from silicious soils, broken rocks, or similar hard and durable substances, which should be broken to a size that would pass through a two and a half inch ring and of either cubic or angular shape. Here again contractors should be enturely guided by localities.

Upper section-Lighter and smaller materials of a strong, dry and durable na-

ture not easily disintegrated which will retain their solidity after severe tests of sun and frost or sudden changes to either high or low temperature. These qualities are found in small broken rocks, crushed *stone from out of silicious soil, stone from sand or gravel pits; cinders also are at times used where the traffic is light and in such cases are useful, but on roads over which there is a large amount of heavy traffic cannot be recommended. The size of material should not be larger than would pass through a one inch screen. The immediate surface of this section should have smaller material, such as gravel or heavy sand, that would pass through a half inch screen.

It may be well to define what is meant by the term "burnt clay," as its introduction for use in road construction is of comparatively recent origin and as yet has not been extensively used, but may ultimately come into general use. The use of burnt clays or ballast is limited to districts that are known to have subsoils of white or blue clay and as a matter of economy in the construction of roads through such it is found to be as cheap and as desirable material as can be obtained. The modus operandi is as follows :

Take a road that has been constructed through a heavy clay district, such as parts of the counties of Essex, Kent and Lambton, where gravel is scarce, one of a medium width, say a local road twenty feet wide. In summer weather or during the hot season. the soil in the proposed road should be cut out to a depth of two feet into large spits and laid roughly one upon the other and left in that condition for about ten days. By that time the sun's rays will have evaporated the moisture held by soils of this nature. So soon as the spits are dry they are submitted to the action of fire in the following manner: A circle is formed twenty feet in diameter surrounded by a wall made of the roughest and largest spits two feet high ; in the enclosure thus formed straw or other light combustible material is laid ; small pieces of wood are placed on these, and over them are placed other spits so as to form a cone or pyramid, the whole structure to be about eight feet high. Fire is then applied to the several parts at once, due care being taken to see that the spfts sink evenly until the whole mass is well alight. After being well banked the mass is left for a day or two and as soon as it attains a good red appearance is drawn down, the wall broken, the spits are thrown on top and others added as required from day to day until all the earth dug has been submitted to the same process. In a length of one hundred yards of road thus served it would take about s x fires to burn the 12,000 cubic feet contained therein ; the cost of labor would prebably be twentyfive cents per cubic yard. The burnt clay is then, after cooling, relaid upon the road and forms the middle section, and will last for years.