

SAND CLAY ROADS

Their Construction and the Characteristics Which Distinguish Them From Common Earth Roads.

By W. L. Spoon, Road Engineer.

What characteristics distinguish a sand-clay road from a common earth road? The question is pertinent and to the point. The earth road is either all clay, all sand, or part clay and part sand. If it is all clay it will be a good road when moderately dry but very dusty when quite dry, and very muddy when soaked with water and well nigh impassable if much used while in this wet state. If the road is all sand it will be best when fully wet and bad in proportion to the absence of moisture. If the road has a mixture of sand and clay it is to that extent a sand-clay road, no matter whether an effort was made to effect the mixture or not. As every one knows, nearly all clays have some sand in them and nearly all sand has a percentage of clay or other foreign substance in it. Seldom do we find either in a pure state but in proportion to their separation, or purity, do we find their bad qualities prominent when tested on the road, and in proportion to the perfection of the mixture in a certain ratio do we find the good qualities appearing as a road material. What is this ratio? It is the relation of the voids in a mass of sand to the solid parts. In order to form some notion of this let a measured quantity of sand which is clear of all clay or vegetable matter and fully dry be just covered with water. To do this take a measured quantity of such sand and pour from a measured quantity of water on to the sand until the water rises to the surface of the sand. Note the amount of water consumed in this test and you have the measure of the voids in the sand ocularly demonstrated. If a like volume of clay has been added and it could be rendered liquid as water it would at once fill all the voids as the water did, but by common experience we know that it is impossible to render clay liquid. The nearest approach we can come to it is when it is fully pulverized, as cement, yet all are aware that clay in this state is positively non-cohesive and will not bind anything. Water must be added before cohesion can set up between the particles of clay. Intense heat might vitrify and solidify a mass of sand and clay dust, but the process would be impracticable

because of the cost, if for no other reason; hence the only practicable plan is to add water in order to effect the proper cohesion necessary to a firm roadway.

Water has ever been the most potent factor in the distribution and mixing of terestital substances. The more the subject is studied, the more amazing does this ceaseless activity of surface changing without any agency of man whatever appear. In view of this activity it is to be expected that we shall find everywhere in the natural state every grade of composition and its great variety, and the expectation is fully realized in the mixing of sand and clay. As a result of this we have grades of sand roads, clay roads, and sand-clay roads naturally constructed, and this significant fact should have long since awakened the curiosity of the observant man and caused him to make an effort to reproduce by artificial methods the successful process carried on naturally in the mixing of sand and clay. Notwithstanding the simplicity of this process, it was not utilized until a comparatively recent date. The matter is now in the lime-light and the great cry all over the country is for information relative to the construction of the sand-clay road: what it is; what kind of clay to use; and how does it differ from a common earth road. The best answer that any man can give his question comes from a critical study of places that are naturally always good and also places always bad, and notethe differences and try to arrive at the cause of the wide variation in the two places. See whether it is on account of drainage or the lack of drainage, whether it is shade or the lack of sunshine on the road. In a word, find out all the whys in the matter. Find out Nature's secret.

From what has been said it is apparent that the common earth road may be and often is a perfect sand-clay road. Indeed it will be found that nearly all good roads are sand-clay or clay-gravel roads, in composition as defined above; in substance,--sand with the voids filled with clay and no more. This specifically is the sand-clay road. The common earth road may be a sand-clay road or it may not be. As stated just above and here repeated, the earth road will be good in proportion to the accuracy with which the composition confirms to the definition.

So far, the discussion has not made any distinction as to the clay or sand but has classed all kinds of sand as sand and clay as clay. There is a wide difference, however, in each, and some study of these differences is of the utmost importance to the road builder. Here again, the careful study of natural manifestations is the most fruitful source of practical knowledge in this particular. The student was directed to study critically the good places and the bad as well and from a com-

parative study it will be found that some clays have good binding power and others little or none. Some clays have little tendency to absorb water, and others act like a sponge. Some clays will stand for a long time in water and preserve their shape, while other clays will melt down immediately. All these peculiarities should be studied and the different results manifested on the road carefully noted. It will be found that the clay that has greatest binding power and the greatest water-resisting power is usually best when fully incorporated with the sand according to our definition of the sand-clay road. On the other hand clay such as the schistose clays in the Appalachian mountain and piedmont slopes have very low binding powers because of the mica they contain. Occasionally there will be found in this section a deposit of clay bordering on what is commonly known as pipe clay, and this will be found to have better bond than the micaceous clay, which is practically worthless in the construction of a sand-clay road. A most carefully study of the situation is necessary to determine with certainty what will be resulting road. Do not lose sight of the fact that clay is only for a binder and the firmness of the road will depend upon the efficiency of the binding clay. If the clay is very absorbent and quickly takes in water it cannot make a good road because the expanding effect of the water will separate sand grains and leave the road more helpless than if there were only sand and water, the clay acting more as a lubricant than a binder. It is obvious then, that the clay is the most vital thing in the composition, and more depends upon its binding power and ability to resist the washing action of water than upon the character of the sand. It is a good plan to study the character of the clay as it appears in the ditches and washes in the vicinity. Any clay that has the power to withstand weather action until moss forms on the almost precipitous wall may, as a rule be relied upon to give good results. If the clay is poor, use little of it. That is, have an excess of sand in the composition,--but in all cases rely upon the road's actual manifestations under use, as this is the only criterion given us for a safe guide. Ofttimes in the mountains of Western North Carolina there are found excellent section of perfect sand-clay roads naturally mixed. These roads have been used from time immemorial, and are always good. They are simply called sand roads, and this is perhaps the better name for them for they are nearly 90 per cent sand and usually quite flat. This suggestion of a flat road may be considered with profit in the building of a sand-clay road, as the natural roads are always nearly level and

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LOCATION OF GOOD ROADS

As one travels over a great portion of the public roads in any of the Southern States, the question is often raised as to how the majority of these roads came to be located as they are, especially, when in many cases it is very apparent that a much better location could have readily been obtained without any increase in distance or extra cost of construction.

In most cases the public roads were not located according to any definite rule, and, in many instances, were simply the widening of previous trails or paths connecting one point with another. Some were located by persons who had various and sundry purposes in view; others were located by committees or juries; a very few by engineers; and a great many were located by accident. The majority of the roads in the South were laid out fifty to a hundred, or more, years ago, and have been in nearly constant use since then. Each generation of those who use the road constantly have asked the same question: How did the road come to be located as it is? Even those who use the road constantly have asked the same question, but have never taken sufficient interest in the question to count up the cost of climbing the hills on the steep grades so that they would realize how much it would save them if the road were relocated.

The question of good roads is becoming such a vital one at the present time that there are but very few communities but what are really interested in the improvement of their public roads; and the cry is for a permanently improved road. On account of this widespread interest and desire of our people for improved roads, I have felt that particular attention should be called to the fact that the only part of a road that is really permanent is the location. Therefore, the greatest care should be taken that when the road is located it is located for good, and that there will be no question as to its re-location. In order that this should be so, it is absolutely necessary that the road that is to be built between two points should have its location very carefully worked out by a practical and impartial road engineer.

Questions that must be considered in regard to location are grade, distance, cost of construction, and the number of people it will benefit. If it is not possible in a location that is being considered, to build the road so that no portion of it will have a grade that exceeds 4 1-3 per cent, then, another location should be investigated; for, in permanently locating a road, no grade on that road should be over 4 1-3 per cent, as that is the maximum grade that a road can have over which a horse can haul the same load for a certain distance that he can on a level. And it is also the maximum grade that a road can have without it being necessary to construct some form of "thank-you-ma'ms" to turn the surface water into the ditches, to prevent the cutting out of the road's surface. In some instances, it will of course be found that it will cost a great deal to maintain such a limit for the grade, yet it will be found in the end by far the cheapest road to construct, as there will be a great saving in maintenance of the road, and also much saving to everyone using the road, on account of the increased load that can be hauled.

In locating a road, the shortest distance is desired, but very often this is impossible on account of it being necessary to make too steep grades. The shortest distance, however, should be maintained, provided, that the grades can be kept down to the minimum--otherwise, the longer distances should be used. In no case, however, should the distance of the road be increased to any considerable amount in order to go by somebody's house or farm. This is one of the reasons why, in the location of a public road, the best results can be obtained from the services of a road engineer who has no personal relations whatever with the people living in the vicinity of the proposed road.

Sometimes it will be found much cheaper to construct a road by increasing the distance, by reason of which certain cuts and fills are avoided, and in this case a longer distance is very often preferable.

The people who will be benefitted by the road are not only those who happen to live along the road, but also those who come into this road and use it as the principal thoroughfare from country to town, and, for this reason, any increase in distance means an increase in the cost of their hauling from country to market, and, in considering benefits to be derived by a particular location for a road, all the people who will use the road must be considered.--By Joseph Hyde Pratt, State Geologist.



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