

BETTERMENT OF OUR PUBLIC HIGHWAYS.*

BY CHARLES R. KEYES.

No better illustration is afforded of how purely scientific investigations may be easily turned to great practical account than the Good Roads problem in the Mississippi valley. Iowa presents many peculiar geological features. Among these none are so noteworthy as those relating to her surface deposits. Covered nearly everywhere by glacial clays, sands and gravels and their derivatives, exceptional and refined methods of inquiry have been brought to bear upon the solution of the riddles of their existence and distribution.

The geological surveys of Iowa and Missouri, especially, have had in hand for several years past a series of investigations regarding the occurrence, distribution, geological positions, properties and possible uses of the clays of these states. In the present connection, only one of the many interesting and highly useful results thus arrived at may have attention called to it. This refers to the singular properties of what are commonly known as the "gumbo soils," or "gumbo clays." The wide possible utilization of these universally despised deposits is a discovery the economic importance of which can hardly be overestimated. When fully availed of millions and millions of dollars will be saved each year to the farming communities of our State. A new epoch in our industrial development then begins.

Economic problems rarely afford maximum results directly from minimum efforts. It is paradoxical to derive from the worst of anything the best. It is manifestly illogical to regard two extremes as occupying at once one and the same place. Yet these very conditions are the strange anomalies actually presented by many of our public highways.

* This article is extracted from a paper by the same author, who is an Iowa man, that appeared in a recent number of the American Monthly Review of Reviews, published in New York City, and entitled "Burnt Clays for Roads in the West."—EDITOR.

In the permanent improvement of rural roads, the usual method of macadamizing with stone rubble is the most widely adopted method. This is the plan followed in France, England, and other European countries, where the good roads are the wonderment of all Americans. The same plan is also carried out in many of the older parts of our own country. In all localities where natural rock exposures occur it is possible to obtain the same sort of road-metal at a cost that is regarded as comparatively low.

There are, however, many places where practically no suitable ledges of durable rock are found. The vast coastal plains and much of the broad Mississippi valley are such regions, largely devoid of hard rock for road-metal. Throughout much of this extensive territory the country roads, during certain portions of every year, are certainly the very worst imaginable. Every low place in a road, every swale between hills, becomes in wet weather a mire without bottom, often impassable to vehicles and even the beasts of the field. As a chain is no stronger than its weakest link, so a highway is no better than its worst stretch.

Now, when we come to examine into the composition of the mire, we find that it is made up of the stickiest of sticky muds. The mud adheres with a tenacity of many pounds to everything that it touches. Strange as it may seem, this highly developed property, which is technically called plasticity, is the very property that makes this very mud a very superior material for road-metal. The "worse" the mud, the better the quality of road-metal it is possible to obtain from it. It only has to be simply and properly treated. The magic change is accomplished by thoroughly baking, or "burning" the mud.

Of late years, burnt mud, or burnt gumbo as it is more widely called, has been extensively used in the central west for railroad ballast. In Illinois, Missouri, Iowa, and the neighboring states; the trunk lines of railroads are largely

ballasted with this burnt gumbo. Its use is, therefore, beyond the experimental stage.

While at first it was intended that the burnt gumbo should take the place of natural rock ballast in those localities where the latter could not be readily and cheaply obtained; its superiority over stone was soon proven to be so great that it is now widely used even where there are good rock ledges. A brief account of its use by the railroads will demonstrate its advantages for highway road-metal.

As burnt gumbo appears as ballast for the railroad track it is a red, gravelly material, in which the fragments are sharply angular in shape, very porous, and very hard. On the whole, it is not unlike coal cinders in appearance, except that the color is red. On account of the high amount of shrinkage while being burned, and the great strength when in the state of mud before burning, the muds, or very impure clays which compose them, easily fall into small pieces. At the same time, being so very impure, these clays require only a very low temperature to be readily burned very hard.

The economic and engineering points of merit which burnt gumbo possesses as railroad ballast are many. Among them may be especially mentioned economy in handling, ease of bringing the roadbed up to a high degree of perfection, readiness with which repairs may be made, elasticity of roadbed, general absence of weeds along the track, remarkable freedom from ice and snow in winter, and, more important than all, low first cost.

The railroads handle the clay and carry on all operations connected with its burning by machinery. The burnt gumbo, ready for use, can be delivered on board the cars at a cost of 25 to 35 cents a cubic yard. When burned by hand, as would usually have to be done in highway improvement, the cost would be, perhaps, 10 to 15 cents more. The railroad gumbo pits are often a mile or two long and hundreds of feet wide. In the case of the highways, the mud would merely have to be shoveled out of the roadway, burned, and shoveled back.

While for macadamizing purposes on country roads burnt gumbo is not quite so durable as some of the best grades of rock, it has many advantages to offset this one shortcoming, slight as it is. The process of producing burnt gumbo requires practically no capital or great skill to carry on. The most ordinary labor and a little common sense on the part of one person, as overseer, can produce the best of results. Of course, the road should be properly graded and crowned before putting on the gumbo road-metal. A surface of burnt clay, six to eight inches in thickness, is commonly sufficient for good results; or ten inches in particular places, where unusual conditions exist or traffic is especially heavy.

By selecting for improvement the heaviest parts of the road first, since the worst stretches are often caused by the very material that makes the best grade of road-metal, and systematically working under intelligent guidance, five years would find every principal highway in a county as passable the year around as a paved city street, and at very little more cost than is now usually squandered on "working the roads." The county surveyor could easily superintend the whole work for his district; and, with local overseers as head burners, he could soon produce as good a system of highways as any one could wish for. Once properly prepared, two men could easily keep the roads of a whole county always in good repair.

With no more expenditure of money and effort than is now put on the country roads, ballasting with burnt clay would produce in a dozen years a system of highways equal to any of those for which France has so long been famous.

A burnt gumbo road is never muddy, for that property is lost in the burning. The surface of the road is hard and smooth. As a speedway for bicycles and automobiles it is ideal. For carriages and heavy wagons it has no superior. No vegetation can grow on it. It is practically free from dust, after the highway system has been well developed, so that mud is not brought in from the tributary roads. More-

over, the warm red highways contrast pleasantly against the green landscape at those seasons of the year when country drives are most enjoyable.

The process of burning clay is quite simple. Along the roadside, cordwood is piled to form a low pyramid or ridge 8 to 10 feet wide. On this is thrown 3 to 4 inches of coal slack, and 12 to 20 inches of gumbo mud, which is cut from the roadway, or a pit, as the case may be. On firing the wood, enough air enters the pile to enable slow combustion to be carried on without the generation of too much heat, which would vitrify the clay.

When a "pit" is made, as often is necessary when burnt gumbo has to be hauled some distance, or, as is the usual way with the railroads, new additions of slack and mud are added each day on one side of the pyramid, while on the other side the burnt gumbo is allowed to cool and is then carted away. In this way the pit advances sideways a few feet a day until it has become several hundreds of yards across.

The gumbo clays have many notable qualities, besides being excessively sticky in wet weather, enabling them to be readily distinguished. They usually form what the farmer calls cold, sour soils. These soils cannot be tilled to advantage. The land occupied by them is almost worthless, except, perhaps, for scant pasturage at certain seasons of the year. The clays absorb and are capable of retaining an immense amount of water, often so much as twenty-five gallons to a cubic yard.

Permission to locate a railroad ballast pit on some farmer's gumbo land is usually readily obtained. He not only gives his consent and the use of the land free, but he is secretly delighted at the idea of having the railroad excavate without cost to him a big pond for his stock.

The best clays for making burnt ballast are distinguished by certain physical properties. They are very plastic, quite impure, very fine-grained, and tenacious. Their tensile

strength is enormous, often as high as 400 pounds to the square inch. The shrinkage is very great—10 to 12 per cent in the drying and burning process. These are the technical tests for recognizing these clays. A ready, practical test is to find the very worst stretch of a muddy country highway.

WE are pleased to see in the last *Iowa News*, that Du Buque is improving rapidly this season, and that the village is also healthy. We rejoice in the prosperity of Iowa, of the whole of Iowa, and we cannot cherish one sectional feeling which might operate to the injury of any part of our flourishing territory. In Iowa City, the seat of territorial government, located by the last legislature, lots have been sold by the commissioners to the amount of many thousand dollars, several buildings already being erected. Those who have visited the location will agree in the opinion that it is the best that could have been made, in the heart of a fine farming country, with an extensive quarry of elegant marble on the bank of the Iowa, only a short distance from the point on which the public buildings are to be erected. The Iowa river to this point is not navigable for boats of any kind, but it is said to be a fine mill stream.—*Iowa Sun, September 11, 1839.*

THE STATE BOARD OF EDUCATION will assemble in Des Moines tomorrow, Monday, the 6th inst., to continue in session twenty days. This is a most important body, and its deliberations are second only to those of the legislature, in their consequences in the State. The entire educational system of Iowa is subject to its supervision.—*Dubuque Express and Herald, Dec. 5, 1858.*

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