IMPROVEMENT OF ORDINARY COUNTRY ROADS.*

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N a subject of this kind the first question to determine is the exact meaning of the title. What is light volume mixed traffic? How many vehicles are to pass over a given piece of highway and still be classed as light volume? What is their relative proportion as to motorpropelled and horse-drawn? The right interpretation of these terms is not clear. There are sections of the country where presumably the mixed traffic would consist almost entirely of horse-drawn vehicles, while in others a very large per cent. would be motor traffic.

The treatment of the surface of these two subdivisions would vary to a considerable extent. The writer is inclined to consider the subject as being the treatment of subsidiary roads which have only the horse-drawn traffic originating upon the road, together with motor traffic of the pleasure class and little or no freight traffic which is motor-driven.

With the immense mileage of roads, it would seem that a large proportion of the roads will never be improved under the types of construction which are now considered necessary for their improvement and that 90 per cent. of the entire mileage will be unimproved if it is necessary to improve them with the higher types of construction.

There must be a revulsion of feeling which will compel more mileage and lesser cost. Given, then, a country highway as it now exists and the proposition that for 10 miles of this road there is only available the sum of \$25,000, what can we do to render this really an improved road which, under proper maintenance, will take care of the traffic upon it? A preliminary survey may show that a portion of the road is in a low-lying level section without proper ditches where at present the natural tendency of the road is to act as a sort of drainage canal for lands adjacent to it. The soil itself consisting partially of leaf mold containing a large amount of humus and which if used as a cultivated field would produce good crops.

The next portion may consist of a sand and gravel formation, containing boulders and on a grade of from 5 to 8 per cent., rolling over elevations and into hollows and gullies and eventually working out into clear deep sand. Succeeding this may be a hollow from which you rise upon a side hill cut through a clay bank. Here you face the proposition that the clay is of such a nature as to practically absorb all the water and where your drainage condition is most difficult to handle. Your last section may be through ledge of native rock or large boulders, the soil slightly covered with either hard-pan or sand and upon grades which easily wash under the annual rainfalls.

On almost all country roads several of these conditions will ordinarily appear, while, of course, it is an exaggeration that they will all occur within the 10-mile stretch.

Confronted with these conditions, it seems to be absurd to attempt a standardization of such a highway in order to economically work out the problem. The material which is comparatively local must be used and the treatment of each section will be different. The width of the present highway must first be taken up and, in general, standardized for the ordinary traffic, probably a width of 21 feet between ditches is the most satisfactory standard and considering that this should be accepted as the width of the road, you are next confronted with the alignment and drainage.

In all probability the alignment will be comparatively easy over the level, fertile section, but the drainage on this section will be a problem. Here, in general, you must first provide by deep ditching for reducing the water level of the surrounding land and by deep ditching is not meant the ordinary ditch from which the crown of the road rises, but in many instances a ditch which acts to a considerable extent as a drainage canal.

Culverts must be provided at all points where the drainage may be taken away from the road at every accessible point, and however level the plain or plateau may be as a whole, you will doubtless find a large number of places by which the water will be conveyed entirely away from the road.

In most instances the grading material obtained from the ditches, though seemingly of very inferior quality, may be used to raise the general grade of the road and, if kept dry by the side ditches, will compact and make a fair subgrade.

The next essential is to obtain upon such raised grade a sufficient quantity of metal of some kind to prevent the cutting through of the road surface from water which falls upon the road or in flood seasons cannot be entirely carried away by the ditches. This may be obtained either from fields, stone fences or even drawn from section two, which has an entirely different soil. In some places it would be necessary to practically lay this stone as telford. In other places it is enough to simply dump it in the road and only partially place it by hand labor. In many places where a roller is available this may be the method and the stone simply forced into the soft material excavated from the ditches and not as yet thoroughly dried out from the service rendered by the ditches.

As for surface material, in many places it will be found that along or adjacent to the road there are hills or hummocks which contain soil not properly either hardpan or clay, but in many places a combination of each containing considerable metal in the shape of either pebbles or fractured stone. Having obtained the bottom through drainage and the addition of stone so that the sub-base will be practically dry, you may apply 10 inches of the material containing a small amount of metal and by the use of road drags and road hones bring this first into section and next into a smooth, hard surfacing, which will prove satisfactory in all weather for traffic, provided it has constant attendance and is repeated after every rain dragged with the ordinary road drag. The drag removes every slight rut which may be started and does not allow the water to settle through the weak upper surfacing. The maintenance must be not intermittent, but constant. A somewhat slippery upper surface may still be found, in which case it will be necessary to add an inch or two of gravel or sand from section two. This may only require from 3 to 6 yards of gravel surfacing per 100 feet, and while it may be at a considerable distance from the improvement, it will not add materially to the cost.

The surfacing upon such a type of road will require practically 2,000 yards per mile, and if the material is from different banks along the roads the cost will not exceed 20 cents per yard. It is then perfectly feasible over this section to build such a highway, including the raising of the grade from 1 to 2 feet at a cost of not more than the estimated limit of \$2,500 per mile.

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