“Standardizing” Highway Construction

A Plea for Rational Road Building

By Charles E. Foote

DURING the last half dozen years, in which highway building has progressed from the commonplace to the scientific stage, much has been ascertained about establishing “standards” of construction. Leading civil engineers have written books and delivered scientific addresses before learned societies with a view to the education of those whose business it is to build roads, that they may be able to follow “standards” and to construct first-class highways.

On a six-mile stretch of a New York State highway, now under construction, the specifications call for a six-inch lower course of field stone, no stone to be more than eight inches in its largest dimension, and the stone to be broken with a sledge until it will roll evenly to a firm mass with a ten-ton roller. This foundation course is placed on a thoroughly rolled subgrade. On top of the six-inch course of field stone is placed three inches of surfacing material, consisting of broken stone with a bituminous binder.

For the most part of the stretch that type of road will, or ought to, last for years; permanently, if kept properly surfaced. The subgrade is sand and gravel, and neither heaves with frost nor breaks in a thaw. The foundation course will settle into the gravelly sand and become as solid as the earth itself. And that kind of soil drains itself.

But at frequent intervals there juts out from the adjacent hills projections of different formations. One may be of hardpan; another of clay; still another of alluvial deposits; and some ledges of loose rock, probably semi-disintegrated limestone. These juttings may be anywhere from fifty to five hundred feet wide where they cross the right of way. Sometimes on account of the narrowness of the valley or the passage of the river close to the hill, it is necessary to excavate the hillside, possibly building a retaining wall to establish such a roadway as is required under the New York law, with fifteen feet of metaling and four and a half feet of shoulder and a three-foot ditch on each side.

While a New York road is taken as an illustration, because of the vast amount of construction under way at the present time, the same principle prevails in nearly every other State where road building is going on. New York has no monopoly of the idea of “standardization” in making roads.

Why does it not occur to the engineers who make the cross-sections and prepare the plans, to except from the general foundation plan those stretches which require different treatment? The veriest tyro in the road-building business should know that the standard, as applied to the sand and gravel subgrade, will not be successful when applied to other soils. There must be carefully studied systems of underdrainage, to lower the level of the bench-water to a point below the frost line; or back drainage, to prevent seepage of moisture into the road foundation; or such other treatment as the condition may require, even if the stretch of road be not more than two rods in length. Besides, under any such conditions the field stone foundation course should give place to a solid course of evenly broken stone, rolled down, sanded or filled with stone dust, flushed, and rolled some more, so as to make a foundation worthy a good road.

The one thing that may be standardized is the surface. Under present conditions of traffic the standards of to-day are likely to be obsolete to-morrow, even as the waterbound macadam road, the standard for a century or more, has virtually passed out of consideration in new construction.

A road in Madison County, Tennessee. A two-horse team has difficulty in hauling one bale (500 pounds) of cotton. Before improvement.

The same road in Madison County, Tennessee. Two horses easily draw twelve bales (6,000 pounds) of cotton. After improvement.

Excavating for a side-hill road in New York. On this subgrade will be placed a foundation of six inches of field stone, with a three-inch surface of broken stone with bituminous binder.

An Illinois road constructed with a surface of tar macadam.

About the only materials available for road surfacing under present conditions are vitrified brick, broken stone with a binder of bitumen of some sort, and Portland cement concrete. By reason of the limited deposits of clay, which will make good road brick, and the expense of freights, the use of vitrified brick is confined to limited areas. Wherever it can be used economically brick makes a most excellent road surface. It is dustless, smooth, and when properly laid, durable. It costs, according to the figures prepared by the National Paving Brick Manufacturers' Association, approximately one thousand dollars per mile per foot of width, where the expense of grading is normal and the freight not excessive. This cost includes the grade and a five-inch concrete foundation.

Different surfaces, made of broken stone and bituminous material, are as plentiful as are makers of surfacing specifications. Numerous preparations add variety to the collection. Most of them, patented and otherwise, make serviceable roads within the limits of their availability.

Concrete of Portland cement with sand and either broken stone or carefully selected gravel as a mineral aggregate, is attracting much attention. Wayne County, Michigan, has put down a large mileage of concrete roads during the past four years, and the officials express themselves as entirely pleased and satisfied with the results. Recently a plan of putting on the concrete a surfacing, or mat, of bituminous material mixed with coarse sand or fine gravel has been adopted. This method has become sufficiently recognized so that it has been adopted for a large portion of the California State highway system.

But these are merely the surfacings. The roadbed itself is the road. The surface can be repaired and replaced whenever necessary, as part of the upkeep. It can be standardized to-day, and the standards readily changed to-morrow if found necessary.

In the same absurd ratio that the soil, climate, etc., must be standardized to enable a standard foundation to be made, must the traffic be standardized to permit surfacing standards to be established. Otherwise all standards must fail.

Ten years ago there were approximately 50,000 automobiles in the United States. To-day, according to the estimates of the manufacturers, there are about one million. Then there were no motor trucks to speak of. Now trucks carrying weights of six or eight or even ten tons are not uncommon.

Ten years ago the horse-drawn traffic on our country roads was limited, practically, by what a two-horse team could pull over the worst places. A ton was considered a big load. Over the improved roads two or three tons are not uncommon. Besides, the light or pleasure-driving travel with horses has been multiplied many-fold by reason of improvement in the roads.

Therefore, while standards may be made for road surfaces which will meet present travel conditions, what certainty is there that the same standards will be available ten years, five years, or even one year hence? With the stresses on the roadway at least twenty-five times greater than they were ten years ago, what right have we to assume that ten years hence, either by changes and development in vehicular construction, or some new application of power, or the augmentation of traffic in some other direction, the stresses placed on the highways will not be twenty-five times greater than they are now?