PLACING, SPREADING, AND FINISHING STABILIZED ROAD MATERIALS

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SYNOPSIS

The blade grader is the most commonly used equipment for grading and spreading, and most road mix operations can be performed with this machine The amount of manipulation depends on the design of the mix and the ease with which water is incorporated in it Spreader boxes, high type asphaltic pavers, and even dumping trucks have been utilized Compaction was superior with the sheepsfoot roller, but since this is a tamping roller, flat wheeled rollers or truck rollers are required for finishing In placing materials for maintenance operations plant mixes are gaining in popularity, a 3 to 4-inch layer being placed on the old roadway Scarification of the base proves satisfactory in certain instances Finishing methods depend to some extent on the type of compaction, and proper moisture content is also necessary for the success of this operation An important factor in this stage of the construction is the provision of an adequate A type crown which slopes uniformly from center to side, and without which excessive potholing is likely to develop If the stabilized course is intended as a base for bituminous surface, the seasoning period should extend until a mosaic of aggregate appears at the surface, but if the material is retained as a surface, operations need be less exacting and finishing can be considered as maintenance

Construction methods for soil stabilization lie somewhere between ordinary earthwork and macadam base and they also have a basic similarity to other types of road work Because of these similarities standard equipment has served fairly well and very little specialized equipment has yet been developed It is evident, however, that new and improved methods to handle this particular type of construction are being devised

Trend On New Construction

The trend is toward the development of equipment which will place material to the correct thickness and cross section in as few operations as possible If grade stakes are set, as they should be on new construction, modern grading equipment can cut the grade accurately to the desired elevation Long base levelling devices and maintainers are very effective in securing a level, smooth riding subbase One of the most important preliminary requisites is the construction of a firm, solid subgrade Some engineers have felt that it was possible to place stabilized material on a spongy soft subgrade and build up a good base or surface Such is not the case Undesirable subgrade soil will work up into the stabilized material and result in ridges, thin spots, waves, and a generally unsatisfactory condition The addition of stabilized material to a poor soil will, of course, improve that soil, but such a so-called stabilization cannot be expected to act satisfactorily either as a base for bituminous surface or as a stabilized surface

Placing and Compacting Materials

Engineers have utilized, for this work, practically every kind of grading and spreading equipment designed for the various types of road construction Perhaps the most common piece of equipment used is the blade grader Most road mix operations may be performed with this machine The windrow method of placement requires that the material be turned over from 3 to 5 times before a satisfactory mix is obtained This means from 15 to 20 passes with the grading

unit. Of course the design of the mix, that is, the percentage of soil fines and the coarseness of the aggregate, will have some bearing on the action of the material. The ease with which water can be incorporated in the mix also determines to a great extent the amount of manipulation needed. When plant mixed material is used, spreader boxes, high type asphaltic pavers and even end dump trucks have been utilized. Here again the design of the mix plays an important function in the placing of materials. If gravel or stone up to $1\frac{1}{2}$ in. in size is used, there is danger of segregation even with the best type of equipment available. By keeping the material moist, segregation will be reduced to a minimum. Within the past year there has been some very commendable progress in the development of spreader boxes. Several of the new designs place the material smoothly and accurately to the desired grade with a minimum of segregation. High type asphaltic pavers have been most successful in applying plant mixed material. However, unless the yardage would justify this particular type of equipment, cheaper methods would probably have to be utilized.

When new material is supplied, there seems to be little reason why the soil binder should not be added at the producing site. It is my belief, especially on base work, that the trend will continue to be toward the use of sandy clay or loam as binder. These materials can be easily pulverized and when added to the production line of an aggregate plant the result will be equally as good, if not better than that obtained by road mix methods. At least this has been our experience in Indiana. While it is not the intent of this paper to discuss plant mixes, all of the Indiana projects constructed in 1935 and 1936 were plant mixed. On three of these projects concrete mixers were used and the material mixed in a dry or damp condition. For the remaining projects the soil binder was added to the production line at the aggregate plant as the material was being processed. As long as the soil binder is fairly well pulverized, this type of mixing is very satisfactory. Of course if the volume of work justifies the erection of an all-weather mixing plant of the pugmill type, better results can be expected.

There is a definite trend toward the placing of thicker layers. On some of the earlier Indiana projects in 1934, the material was windrowed on the side of the road, then bladed toward the center,

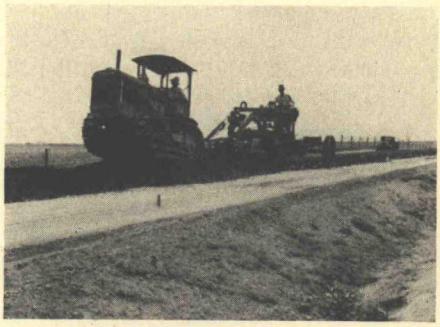

Figure 1. End dumping of plant mixed stabilized material which is moved into position by means of a blade grader. While this is not the most desirable way to place stabilized material it does show that available equipment can usually be used.

moistened, and compacted, in one inch layers. It was found necessary to do this because of the large amount of through No. 40 and No. 270 material which was used. Water did not penetrate readily; therefore the thin layers were required. The present Indiana design carries about 18 per cent of material passing the No. 40 sieve and about 9 per cent passing the No. 270. This mixture absorbs water readily when in a loose state. All stabilization in Indiana is designed as base for future bituminous surfacing.

It has been commonly found that 3 to

4 in. of loose material can be satisfactorily moistened and rolled. A roller which provides a kneading and compacting action is most desirable. Flat wheeled rollers of 10 ton capacity work satisfactorily with this thickness of material, truck and multiple pneumatic wheeled rollers are preferable since they impart the necessary kneading action. The wheeled roller with its wheels spaced much more closely than on a truck is superior to ordinary truck rollers as there is not as great a tendency to squeeze the subgrade up between the tires. Much has been written about the use of the sheepsfoot roller on earthwork. However, little has been mentioned about its use in stabilized gravel. While Indiana experience with this type of roller has

Figure 2. Sheepsfoot Roller

been somewhat limited, the results were superior to those obtained with other types. We have found that 8 in. of loose gravel stabilized mix can be satisfactorily compacted provide it is uniformly moistened. Again, a high percentage of soil fines makes uniform moistening and rolling more difficult when the water is applied to the surface by tank, wagon, or truck. On plant mixes where the water is incorporated in the mix, this problem is much simpler. In cement stabilization it appears that the tamping roller is a necessity as it is specified in the Portland Cement Association's specification. Under certain conditions the tamping roller should work satisfactorily in bituminous stabilization. It would probably be necessary to have a friable mix for this type of equipment to work to advantage. If the material shows a tendency to ball up, the multiple wheeled roller should be used. On gravel stabilization we have found that 15 to 20 passes of the sheepsfoot roller are necessary for proper compaction. It must be understood that the sheepsfoot roller is a tamping roller and cannot be utilized as a finishing roller. After the course has been compacted, flat wheeled rollers or truck rollers will be required for the finishing operation.

Placing Materials as a Maintenance Operation.

Conditions are very similar to those outlined for new construction. Road mix methods are still most popular, but plant mixing is gaining ground rapidly. Usually from 3 to 4 in. of stabilization materials are placed on the old roadway as a surface or base strengthening operation.

Engineers are divided on the advisability of scarifying old gravel bases which have been compacted over a period of years. One school believes in scarifying the metal, adding a binder and chemical, and recompacting. The other school believes in giving the old base a light levelling and adding new material for surfacing, in which case the stabilized material has hard subbase against which it can be easily compacted. The scarification method is satisfactory only when it is definitely known that there is more than enough material to provide the desired thickness. Wayne and Oakland Counties in Michigan follow the practice of placing about four inches of stabilized material on old gravel roads, utilizing them as surfaces over one winter and then applying a bituminous surface treatment.

In the case of old worn out bituminous roads with little, or nonuniform thickness of material, scarification with the addition

of salt, calcium chloride, or bituminous materials has proved satisfactory in a number of instances. Usually the old base is scarified and thoroughly broken up. The chemical or bitumen is then added and thoroughly mixed with the old material. Indiana has tried one section of road where the base was thoroughly pulverized and 1.2 gal. per sq. yd. of a priming emulsion applied. After mixing back and forth, the base was compacted and a surface treatment applied. About five inches of the old road were treated. This particular section has not gone through the winter, although at the present time it is in good condition.

Figure 3. A view of stabilized road after being compacted with the sheepsfoot roller. Eight and one-half inches of material were compacted to a 5 inch thickness. The course is then brought to the proper cross section and finish rolled.

It seems that scarification of old bases and the use of bituminous materials would result in the soil particles being waterproofed and, therefore, not as susceptible to the absorption of water as would be the case with clay-aggregate stabilization.

Finishing.

The finishing operations are dependent to some extent on the methods used in compaction. It is desirable to fill all depressions which may have formed during the compacting process. When a tamping roller is used it is necessary to do the finish rolling with a rubber-tired wheeled roller or a flat-wheeled roller. If no flat-wheeled roller is available, the course can be satisfactorily ironed out with the truck type roller. The road is usually maintained, either before or after the final rolling, while the moisture is still present in the material. If major

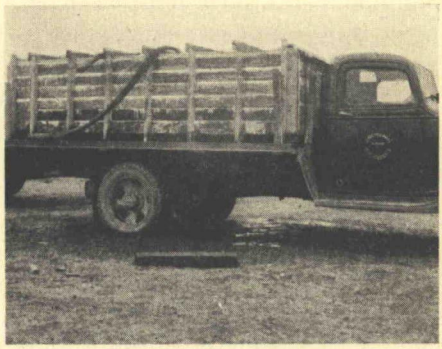

Figure 4. A water tank which was made of 2 x 6 tongue and groove boards with white lead between the joints. The cost of this tank was approximately $50.00.

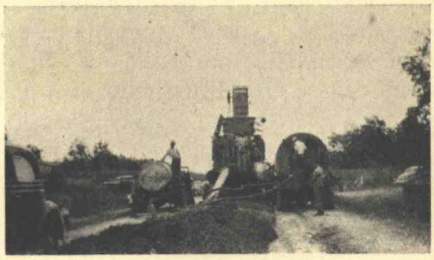

Figure 5. Traveling plant of the pug mill type used in mixing asphalt emulsion and gravel. The aggregate was picked up from a windrow and run through a pug mill at which time the emulsion was added. The mix was allowed to dry for about four days. It was then spread and compacted.

levelling is necessary, the stabilized course should be maintained before the final rolling. If the course has retained its proper cross section during the compaction process, maintaining may be accomplished after it is well rolled but before it is dried.

If the material is placed at the proper

moisture content and well compacted at the time of construction, the finishing operations can be completed within a short time after the material is placed Weather conditions however have an effect upon finishing operations If the stabilized material has become too wet it has a tendency to ball up under the maintainer If too dry, little can be done in the way of proper maintenance as the blade will only tear the surface

For economy's sake, it is sometimes advisable to wait for rain to provide moisture, both for the compacting and the finishing operations In my opinion the construction of a stabilized road should be such that there is an adequate time interval during which the surface may season under natural weather conditions The final polishing or finishing then becomes a maintenance operation

It is very important during the final stage of stabilized soil construction to provide an adequate A type crown which slopes uniformly from center to side A crown of this type is much more satisfactory than a parabolic or circular crown Any areas without crown are likely to show excessive potholing It is recommended that a crown of $\frac{1}{2}$ in per foot of width be provided for clay-aggregate stabilization When an insoluble binder is used the crown can, of course be decreased It does not seem necessary or advisable to use less than a 2-in crown on a low or intermediate type surface

When it is intended that the stabilized course shall act as a base for a bituminous surface, the seasoning period should progress to such an extent that a mosaic of aggregate appears at the surface If a layer of what we may call laitance (in this case soil fines) is present, the priming material will not adhere properly to the base When the proper mosaic is exposed and a bituminous prime applied, excellent results have been obtained On one Indiana road a $\frac{1}{4}$ gal per sq yd application of light cold tar carried heavy truck traffic for several months before there were signs of potholing If the stabilized material is to be retained as a surface, the finishing operations need not be so exacting at the time of construction Finishing then can be considered as maintenance