

Salvaging Rigid Pavement in Georgia

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This paper describes the methods of salvaging rigid pavements in Georgia. The use of the pavement breakers for seating rocking slabs and removal of extremely broken-up pavement and replacing with premixed soil-bound macadam portland cement-stabilized base course mixture are described. The methods of salvaging old pavements have been used on many miles and in several contracts. The results of these methods as found by inspection after some service are also included.

• THIS PAPER presents an alternate method to that of seating old rigid pavements with heavy pneumatic-tired rollers. The alternative method is being used by the State of Georgia and is presented for comparative purposes to the use of the heavy pneumatic-tired rollers.

The problem of rehabilitating old pavements is one that all Highway Departments face sooner or later. It is a problem that requires intricate study of each project as to its condition. Further, it requires the determination of the best methods and design to give a long and satisfactory life in accommodating the anticipated traffic in the future as well as accomplishing the rehabilitation in the most economical manner possible.

Georgia has many old rigid pavements that through the last few years have become so broken and rough as to require some type of rehabilitation (Fig. 1). These old pavements are faulted at the joints, with considerable breakage of the slabs along the joints and cracks, rocking panels or slabs and warped panels. In many instances, study of the projects for the purpose, of choosing the type of rehabilitation showed cavities existed under the slabs of broken pavement allowing them to rock in seesaw fashion as traffic passed over them. In other instances, where the pavement had become broken into small pieces of about 6 to 12 in. across, they were loose and moved with the passing of the traffic.

One such rigid pavement over an 8-mi project became so rough in 1949 that it required rehabilitation, and a study was made as to what method should be chosen for rehabilitating it. Because the project showed a considerable number of rocking slabs and numerous places where the pavement was broken into small pieces which were loose and moving under the traffic, it was decided to require the use of a pavement breaker in preparing the places where the old pavement showed rocking slabs and broken sections.

This was set up in the contract as breaking and reseating concrete into the subgrade. The special provisions to accomplish this required that the breaking of the concrete should be done with a drop hammer (steam, gasoline, or electric power), pneumatic hammer and other equipment suitable to perform the work required. After the pavement had been broken to the specified dimensions of an area not to exceed 1 sq ft with the maximum length of any one side not greater than 18 in., the pieces were required to be compacted and seated by rolling or by the use of mechanical tamps or other approved methods. The roller, if used, was to be rated at not less than 10 tons. The compaction and seating was to be continued until the entire area of broken pavement had been firmly bedded and there was no perceptible disturbances of the broken pieces



Figure 1. Old, broken, and rough rigid pavement.

TABLE 1
GRADATION OF FINE AGGREGATE

Sieve Size	Percent Passing
No. 3	100
No. 4	80 - 100
No. 50	10 - 40
No. 100	0 - 10

ahead of the roller or under the mechanical tamps and there should be no rocking of the pieces or evidence of further settlement.

During the rolling or tamping of the broken pavement, sand or screenings of

the gradation (Table 1) were to be applied gradually to the surface and swept into the crevices ahead of the compaction equipment.

The compaction and application of the sand or screenings was to be continued until all cracks and voids had been filled and the entire course was thoroughly compacted and uniform. The low bid on this item of breaking and reseating concrete into the subgrade was \$0.25 per sq yd.

During the breaking and reseating of the pavement, the results did not turn out as had been planned. The subgrade was so well compacted and firm that in trying to seat the small pieces into the subgrade, they became further broken causing such a swell in the thickness of the course that part of the broken pavement had to be removed to hold to the pre-established finished grade.

With this experience on two or three sections of the project, the operation was changed whereby the rocking pavement slabs were broken just enough to seat the slabs on the subgrade reasonably well. This method appeared to be a more satisfactory way than the pounding of the pieces of pavement and trying to make a base course of the pieces and sand or screenings.

After the old pavement had been prepared by this latter method and made stable, and after the base widening had been placed, a leveling course of hot asphaltic concrete mixture was placed and then followed by 2½ in. of penetration macadam, and 1½ in. of hot asphaltic concrete binder and 1-in. surface mixture.

Within a few months this project showed reflection cracks in the resurfacing along the joints and larger cracks. After 12 years of service, the reflection cracks had further developed along the cracks formed by the small broken pieces.

Since this experience, it is very seldom that the large pavement breaker is used. However, occasionally when a rocking slab is found and it is not broken into small pieces, a 2-ton pile-driving hammer operated from a small portable crane is used before resurfacing. The hammer is dropped only 4 to 5 ft and with a minimum of blows to seat the slab on the subgrade. Although this is not considered as producing a perfect job, it is an economical way of using old rocking slabs for an extended period.

The general practice for the last few years is to remove the broken pieces of a foot or two in area and replace for the full depth with either asphaltic concrete or a soil-stone mixture stabilized with portland cement. This latter mixture is a very satisfactory and economical material for both a full-width base and for widening old rigid pavements. The mixture produces a semi-rigid slab which after hardening seldom becomes distorted along the joint between the old and new. Many of the mixtures never produce shrinkage cracks; however, others do and they are usually reflected through the overlay surfacing.

The design of the mixture and the construction procedure of placing the mixture is a relatively simple one. When a project is set up for rehabilitation, a survey is made as to the availability of local soils suitable for cement stabilization, and when found, an option is secured on the deposit and information concerning the size, quantity of ma-

terial, clearing and grubbing, royalty, price, and other features are furnished to the contractors for bidding purposes. The design is simply a requirement that the final mixture contain a minimum of 60 percent by weight of aggregate retained on the No. 10 sieve and passing the $1\frac{1}{2}$ -in. sieve. The remaining 40 percent or less must be a suitable, friable type of binder material that can be easily pulverized and mixed with portland cement and that will become hardened or set after the cement is added. The binder may be produced with screenings, sand, and clay or sand clay or topsoil, whichever may be available. If economical, a straight soil-cement mixture is sometimes used.

The method of arriving at the percent of cement is to predetermine a strength of 300 psi at 28 days or 225 at 7 days by triaxial testing with 20-lb lateral pressure. This strength requirement results in cement content of around 2 to 3 percent by volume with the stone mixture and 6 to 11 percent with the soil-cement.

The construction procedure is that the broken pavement is taken out for the full depth, the subgrade prepared by shaping and rolling or pneumatic tamping on the surface and if the project is widened, the shoulders are excavated to a depth of about 8 in. and a special flat steel-wheel roller (Fig. 2) is employed to compact the shoulder or trench subgrade on each side of the pavement.

The cement-stabilized stone mixture is prepared in a portable mixing plant set up at a suitable location on the project; all ingredients consisting of coarse aggregate, binder, cement, and water are mixed, transported to the project, and spread by specially constructed spreaders (Fig. 3) for the widening and the ordinary type of spreader for the full section after which the mixture is compacted by rolling (Fig. 4) to 100 percent maximum density (AASHTO Method T 99). After compaction, the surface is finely graded and rerolled to the finished grade (Fig. 5). These operations are followed



Figure 2. Compacting trench subgrade.



Figure 3. Specially constructed spreader for widening.



Figure 4. Compacting mixture.



Figure 5. Rerolling surface to finished grade.



Figure 6. Bituminous prime coat.



Figure 7. Placing hot asphaltic binder.

very closely back of the spreading. The average prices for the soil-bound macadam, cement-stabilized mixture, in place, is \$2.25 per ton with the cement having a price of \$4.90 a barrel.

After the material has been placed, on the following day a bituminous prime coat is applied (Fig. 6) at the rate of 0.15 to 0.20 gal per sq yd. The bituminous prime coat acts as both a curing agent and a prime coat. After about 7 days of curing, the surface wearing course is then placed over the entire pavement.

This wearing course usually consists of a leveling course of hot asphaltic concrete, followed by hot asphaltic binder (Fig. 7) and surface course mixture. The penetration macadam used in the older project has been found to be somewhat unstable under present-day heavy traffic in that movement apparently takes place within the course causing reflection cracks in the surface courses which soon begin to show deteriorating crack patterns. However, on the old project already mentioned, the displacement of the penetration macadam, under the heavy traffic could not be differentiated between that and the movement of the old broken-up rigid pavement. But, experience on other projects has shown the penetration macadam is not as stable as asphaltic concrete; therefore, the later procedure has used asphaltic concrete overlays on rigid pavements with the thought in mind that there might possibly be some movement within the penetration itself.

In rehabilitating rigid pavements it is concluded from the work done in Georgia; (a) that a pavement breaker is only suitable for use in very few instances; (b) that if the pavement is broken too badly, then it should be removed for the full depth and replaced; and (c) that the cement-stabilized stone mixture has proven to be an economical material for use in replacing and widening rigid pavement.