

RELATIVE EFFICIENCY IN METHODS OF REPAIRS TO BITUMINOUS MACADAM AND BITUMINOUS CONCRETE PAVEMENTS*

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IN recent years there has been marked development in the methods of repairing and rehabilitating bituminous pavements. There are innumerable instances where pavements had apparently arrived at a stage of such failure that their entire reconstruction seemed justifiable, but by scientific, efficient and economic methods of the highway engineer they have been repaired at a great saving in cost, which in the end is one of the most essential factors in all construction work.

Bituminous macadam is represented principally by the penetration method types of pavement. Naturally, in the analysis of this subject, the first thought is directed to the causes of the various forms of disintegration or failure in pavements of this type, and whereas it is extremely difficult in all cases to arrive at definite conclusions, observation, experiment and laboratory analyses of samples taken from the pavements furnish invaluable data from which fair judgment can be made. Before taking up the efficiency of the actual methods of repair, some of the failures and causes of disintegration common to these types of pavement will be described briefly.

The bituminous penetration method road in its various stages of disrepair or disintegration furnishes a fertile field of opportunity for study and experiment. The most common deficiency in this type of work is found in the non-uniformity of the surface. As an example, we have, first, a section of road where the surface is composed of spots of excess bituminous material, and bare or lean areas, where the binder is lacking in quantity, which condition results in a short time in a raveling or breaking up of the road surface. This condition is usually caused by improper distribution or by incorporating the bituminous material when the stone is not thoroughly dry.

Second.—A rough surface is presented where the stone is loosened or ravelled, the binder showing rapid deterioration, generally causing a series of pot-holes. This may be occasioned by improper or overheated bituminous material, unsatisfactory aggregate or faulty sub-drainage.

Third.—At times we have apparently a lifeless surface in so far as the bitumen is concerned, but upon further examination it is found to contain bituminous binder with considerable life a slight depth below the surface. This condition is due in many cases to an insufficiency of bituminous material.

Fourth.—A pavement may present a wavy and uneven appearance, and this is usually due to an excess of bituminous material, or is caused by the bituminous material being too soft to withstand the action of traffic.

Fifth.—There are surfaces which consist of ridges of material which are the result of irregular or improper pouring—in most cases, careless hand-pouring. A surface of this kind suffers quickly from the impact of traffic and the attack of the elements, and early disintegration is the result.

Sixth.—We have a fairly well-shaped, uniform surface becoming porous. This condition is true of all bituminous

highways in time, as it represents the beginning of the deterioration of the bituminous material.

It will be seen that before repairs are taken up on bituminous macadam roads, careful study and examination are necessary in order to select the most effective method. Taking the several conditions in order as hereinbefore mentioned, the first case, if taken in time, can be repaired by sealing the dry or lean spots in the surface with a light, heated application of bituminous cement of the binder grade, or the cold bituminous surface treatment materials in quantities ranging from one-tenth of a gallon to three-tenths of a gallon to the square yard of surface, covered with chips or pea gravel, using between fifteen and twenty pounds to the square yard. Unless the surface is badly worn, repairs of this character will even up the surface to a true cross-section, giving added life to the pavement.

The second condition calls for heroic treatment if of any great extent, and a complete scarifying and harrowing of the surface becomes necessary. All disintegrated material must be removed and sufficient new stone added to give the required depth before the surface can be repenetrated and sealed as in the original construction. If, however, the affected portions are only occasional and do not represent the greater area, they may be cut out, cleaned thoroughly and filled with new stone, making due allowance for compression, then penetrated, etc., in the manner hereinbefore mentioned. If drainage conditions are responsible for the failure, they must be corrected before any surface repairs are taken up.

The condition described in the third example may be treated in two ways. The most economical, so far as first cost is concerned, would be to give the pavement a treatment, in sufficient quantity to fill the surface voids, with a material that will penetrate and enliven the old material, followed by a covering of good, hard stone chips, using about twenty pounds to the square yard. The alternative would be to scarify and harrow the whole surface, supplying additional new stone in quantities as the rolling would indicate to be required to give the proper cross-section, and penetrating the surface with a bituminous binder, sealing again as in the original construction. In the latter method the surface must first be thoroughly cleaned, and in scarifying and harrowing the remaining bituminous material in the road must be distributed as evenly as possible. If the material found in the pavement, however, does not possess life, this method is a hazard.

In the wavy, corrugated surface, where there is found to be an excess of bituminous material, it is generally more economical and satisfactory to scarify and reshape the surface, adding new stone in order to take up the excess bitumen, and again sealing the surface. This same method should be followed where waves have been caused by the bituminous material being too soft, only, perhaps, more stone would be required in the reconstruction, and it would be essential to incorporate a harder bituminous binder than was used in the original construction.

Occasional waves in the surface may be taken out in the due course of ordinary repairs by cutting off the high places and resealing if the conditions are very pronounced, or by cutting out the depressions and replacing with new material.

A surface full of ridges, due to improper pouring, if not too pronounced, may be evened up by painting between the ridges with bituminous cement and covering with stone chips or gravel. This method may be continued from time to time until the surface is entirely evened up. This condition may also be corrected by scarifying the

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