

But tonight we are assembled not for detailed instruction, but to enjoy a rest from schooling.

“The wisest men that e’er you ken
have never deemed it treason
To rest a bit, to jest a bit,
And balance up their reason,
To laugh a bit, and chaff a bit
And joke a bit in season.”

PATCHING AND RESURFACING CITY PAVEMENTS

By D. B. Davis,
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City pavements are structures which are subjected to very great abuse. Consequently they must receive considerable attention and repairs to keep them in a serviceable condition. The causes which contribute most largely to their deterioration can be defined as those due to foundation defects, surface defects, presence of street car tracks therein and utility cuts.

The cuts in pavements made by utility companies cause greater distress and inconvenience to the official and the traveling public than any other. Although efforts are made to get a sufficient number of service pipes laid prior to laying of the pavement, the growth of cities and business constantly necessitates the laying of additional mains and service connections. This is a temporary inconvenience and should not be discouraged, but rather it should be so regulated that repairs can be made quickly and efficiently.

For the city to properly maintain its pavements, it is necessary that it have complete control over all excavations and replacements. If complete responsibility is centered on the city authorities, they may then receive the censure for negligence or likewise may receive the credit for strict attention.

In Richmond, Indiana, such responsibility is placed upon the city by ordinance, the city refilling all trenches and replacing the surface with its own forces.

In this connection, it is essential to good business that costs be kept of all repair work. This may be done effectively by means of the usual work-order system. In this way relative

costs can be obtained for repairing cuts in the various types of pavements.

The efficient repair of pavement requires adequate equipment and tools. Considerable saving may be effected by using modern methods and modern equipment.

For patching, the Richmond street department has an outfit consisting of a Fordson Tractor pulling a two-wheel trailer wagon, having a capacity of $2\frac{1}{2}$ cubic yards. This wagon was constructed in the city work shop. The body is of wood, resting upon a low wheel trailer support with the sides of the bed hinged at the third point, to better facilitate the removal of material when the bed is partially empty. Attached behind the trailer is a tar heating kettle. It has a warming rack under the hood for an extra barrel of tar. Two men, the driver and a helper, constitute the working force for each patching outfit.

Methods

When an excavation has been made in any pavement and the trench ready for refilling, the city is notified by the party making the service cut. The filling is then replaced in layers and thoroughly tamped. If it is in saturated clay or other soft material, it is replaced by gravel. This is essential if a firm sub-base is to be secured in any reasonable length of time.

In gravel and macadam pavements, after the earth is replaced, the old surfacing material is used on top. Care being used to leave it level with the surface of the surrounding pavement and not heaping it up to allow for future settlement. The trench will no doubt settle somewhat, in which case it should be refilled until it is ready for the placement of the permanent surface patch. To leave a trench heaped high, without adequate red lights, is negligence in this motor age.

In case of trenches in the business district, where there are plate glass show windows, no temporary surfacing material should be used which contains particles which can be thrown through the glass by passing autos. We have found that a layer of asphalt is most effective for this purpose. Its cohesive character tends to prevent the dislodgment of any loose particles and gives a smooth riding surface while the trench is adjusting itself for its permanent patch.

In placing the permanent patch on trenches in a surface treated gravel or macadam pavement, certain requirements should be met. The top material should be removed to the required thickness of three inches. If there is a lack of sufficient foundation material beneath this thickness, it is pro-

vided in the usual way. For permanent patch, coarse stone is thoroughly tamped into the trench over which $1\frac{1}{2}$ gallons per square yard of Tarvia X is uniformly poured. Over this is then spread a sufficient amount of $\frac{3}{4}$ inch stone chips to completely fill the voids and leave a slight excess. When these chips are tamped into the coarse stone, $\frac{1}{2}$ gallon per square yard of Tarvia X is again uniformly poured over the stone and especially along the edges of the patch. Over this second pouring, a light layer of coarse sand is spread. Particular care is used to keep the patch level with or slightly below the surrounding pavement.

In patching small depressions in surface treated gravel or macadam streets, a somewhat different method is followed. After the depression is thoroughly swept free of all dust and foreign substance, by a steel or stiff fibre broom, a light coat of Tarvia X is sprinkled around the edges of the patch and clean $\frac{3}{4}$ inch stone chips are spread, leveled and tamped smooth. A light weight straight edge is useful in testing the finished tamping to determine if it is above the surrounding surface before the tar is poured over it. For a finish, a light sprinkling of sand is applied.

Gravel or macadam pavements which have not been surface treated should not be patched with bituminous materials, as these bituminous patches will after a short while stand up like islands in the street, due to the surrounding pavement wearing faster than the patch.

Patching Pavements

Rock asphalt is a material, which we have found, lends itself readily to patching various types of pavements. It is a material composed of fine sand intimately mixed by nature with from 7 to 9 per cent of bitumen. This material has the advantage of being easily stored for future or constant use, without losing any of its inherent qualities or without the need of mixing other materials with it. We have used it for patching concrete, sheet asphalt and brick pavements.

Depressions in concrete or brick are first swept clean, the surface painted with asphaltic cement and the rock asphalt tamped or rolled into them. The level of the rock asphalt should be left at least three-sixteenths of an inch high to provide for the compression which traffic will ultimately give it.

To patch sheet asphalt, the old surface material is cut out completely as in repairing with sheet asphalt. The sides of the patch are made rectangular in shape with the thickness of the old surface cut vertical. After cleaning out all foreign matter, the edges of the old pavement are painted with liquid

asphalt and the rock asphalt spread and compacted as for repairing concrete or brick.

To secure a smooth job, it is essential that the rock asphalt be pulverized into as small particles as is possible by means of raking and no lumps should be left on the surface. In cool weather this pulverizing can be materially expedited by warming the material before spreading. Our heater, which was designed by the street commissioner, is a double sheet iron pan with sides, mounted on low iron wheels, with a stack at one end. A small fire is maintained under the heating surface, upon which is deposited the lumpy rock asphalt. An attendant keeps the material stirred with a rake until the lumps are all broken when it is wheeled or shoveled into place in the patch. The warmed material resembles sheet asphalt surface mix, crawling and full of life. Constant stirring will prevent burning while warming.

Cuts made in brick pavements are replaced with brick. A substantial foundation composed of 8 inches of Portland cement concrete reinforced with wire mesh or rods is laid 3 inches wider than the trench. This is to furnish support for the slab. Upon this is placed the sand bed and the brick in the usual manner. The joints being filled with asphalt or tar.

Cuts made in concrete pavements are likewise replaced with concrete. Formerly this was considered impossible, but now is done very successfully if but a few details are observed. The edges of the old concrete are thoroughly cleaned with water, using a wire brush. This cleaning should not be slighted in any respect. A thin paste of rich mortar is then brushed over the cleaned surface with an old broom. Before the surface of the edges have dried, the concrete for the bulk of the patch is poured, tamped and finished as for concrete pavements. The important item is to trowel the edge of the patch where it meets the old pavement, in such a way that there will be little chance of raveling. The patch should be cured to prevent rapid, excessive shrinkage. The use of quick hardening cement is fast coming into use for street repairs and is especially suited for patchwork such as this.

Cracks in concrete pavements should be repaired immediately after they become of such width that liquid asphalt or tar can be poured into them. When cracks in concrete pavements are not properly filled, traffic soon ravel out the edges until they become unsightly. Concrete pavements should be thoroughly inspected in the fall of the year and the repair work finished before cold weather.

Our experience in patching pavements has taught us the following fundamentals which we endeavor to have the workmen follow:

Bituminous patches on unsurfaced treated gravel or macadam have proven unsatisfactory.

It is better practice to replace pavements over service cuts, using same type materials as the original pavement.

In pouring a bituminous patch, to use sufficient material to coat the particles without making it "fat."

Paint-coat the surface of old concrete or brick where rock asphalt is used in resurfacing.

Observe the little details of construction which have been evolved from the experience and experiments of others. Do not treat them as being inconsequential or unnecessary. They are the result of the failure and success of others before you. Profit by their mistakes.

Resurfacing City Pavements

Most modern city pavements consist of a foundation and a surface course; either constructed separately as with sheet asphalt or brick on a rigid or flexible base or constructed simultaneously as a concrete pavement.

For any type of pavement to give continued service it is essential that there exist a well drained sub-soil, a stable foundation and a wear resisting surface. In years past many such wonderful pavements of various types and designs were constructed, returning to the taxpayers every dollar's worth of investment in real service. But as time progresses and traffic increases, the surface of these pavements wear down, some evenly and some so unevenly that they become unfit for travel. Whence, complying with a popular demand for a new, smooth pavement, the authorities proceed to replace them. In many of these cases, all that is needed is a renewal of the surface course. The foundation may be in perfect condition, having received the compaction of years of traffic, which is so much more effective than can be secured in any other way.

Inasmuch as economy is the aim of good engineering, it behooves the one in charge to make all necessary investigations to determine the adequacy of the existing foundation, to the end that it may be preserved. If this can be accomplished, a saving of approximately \$1.20 per square yard will be made.

When all information is at hand, the design of the surface for each particular job can then be determined on its merits and becomes purely a matter of the engineer's judgment.

In Richmond we have effected a considerable saving by using bituminous surface over old worn pavements. This re-surface work has come under two heads; that which is done without removing the old pavement surface and that which does remove it.

In our experience we have resurfaced with the following types:

Bituminous macadam over old gravel and old macadam pavements.

Sheet asphalt over old gravel and old macadam pavements.

Rock asphalt over old macadam and old brick pavements.

Preparation of the Surface

Where a bituminous top is to be laid over an old gravel or macadam street from which a portion of the old surfacing is to be removed, great care is exercised in making the excavation. The scarifier teeth are adjusted so that only part of the required depth is loosened at a time, leaving the surface firm and compact after the removal of the loosened material.

Where the depth of the gutter may be reduced, the present surface is first cleaned and when using sheet or rock asphalt for the surfacing, the pavement is brought to profile by the use of black base. When using bituminous macadam for the surfacing, the small irregularities can be adjusted by an excess of stone.

Soft places in the foundation and service cuts are reinforced by a six-inch Portland cement concrete or black base slab.

Rock asphalt is a material which is well adapted for re-surface work. It has been used successfully in many cities in this state and others. It is a material comparatively simple to handle and requires a minimum of contractor's equipment.

In the resurfacing of old macadam, it is essential that the rough aggregate in the old surface be exposed by thorough sweeping. This provides a bond for the surfacing asphalt. If a firm, clean surface cannot be obtained, it is often advisable to excavate and replace with a layer of new stone $2\frac{1}{2}$ inches in thickness, constructed and water-bound as in macadam base construction.

Guide strips are laid four to five feet apart between which the asphalt is raked and smoothed. The strips are of such depth as to provide for one-third compaction.

Care is exercised in thoroughly raking the material and leaving the top of the finished surface free of all lumps.

Rolling is done in the customary way with a ten-ton roller, until the surface is smooth and compact.

In resurfacing over brick or concrete the surface is thoroughly washed and swept clean, then brought to profile with black base, after which the cleansed surface is uniformly painted with asphaltic cement by means of an ordinary white-wash spray.

If desired, the rock asphalt may be feather edged 5 to 6 feet from the gutter and also at the car tracks, if any exist.

One inch thickness has proven suitable for this surfacing.

Sheet asphalt has been and is now being used quite extensively as a resurfacing over old pavements of all types.

This material is laid in resurface work similar to constructing it on a prepared foundation.

Sheet asphalt cannot be successfully feather edged. It requires a shoulder.

Bituminous macadam has been used successfully over old gravel and macadam pavements and is doing a large service on the state roads.

The same methods of construction are followed in resurfacing as in new construction.

There are other types of resurfacing materials which have given service in many cities of the country. I have only mentioned those we have used in Richmond.

GREATER SAFETY AT RAILROAD HIGHWAY CROSSINGS

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In discussing safety regulations at railroad highway crossings we must do so from a broad standpoint, having in mind not only the problems with which we are confronted today but we must also take into consideration the conditions we may reasonably expect to exist in the future. This subject is a vital one and is of tremendous importance in any plan we may adopt in our efforts to reduce accidents at railroad highway crossings.

During the seven-year period from 1917 to 1923, inclusive, as a result of crossing accidents in the United States there was a yearly average of 1,882 deaths and 5,100 injuries, and during 1924 there were 2,149 persons killed and 6,525 injured in this manner, an average of 24 casualties per day, as