Conditioning an Existing Concrete Pavement For Bituminous Resurfacing

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● FOR more than a decade Ohio has found it necessary to salvage many existing pavements by resurfacing or by widening and resurfacing with hot-mix asphaltic-concrete in order that its highway system be kept open to accommodate the ever-increasing volume of traffic. Pavements that have been so salvaged are of many types, being principally bituminous surface treated, brick wearing course with either flexible or rigid base, and portland-cement concrete.

In this type of work varying degrees of preparation of the existing pavement have been practiced. Such preparation as has been practiced, being influenced by either the thinking of the designer or the length of time between the decision to salvage and the completed work is desired. However, considerable thought has been given to the best way to resurface old portland-cement-concrete pavements to prevent the reflection of transverse and longitudinal joints and cracks, stop pumping, and stabilize moving slabs.

Such approaches as bituminous surface treatments, compacted granular courses, thickened resurfacings and subsealing with both heavy tars and low-penetration asphaltic cement, have been tried with varying degrees of success. A compacted granular course over the existing pavement or subsealing, or a combination of both, have probably given the best results where no removal and replacement have been done.

As more experience was gained, it was found that the piling on of thickened courses of resurfacing would not correct conditions of bad or weakened pavements. This has been demonstrated where existing pavements with cracked, broken, and pumping slabs were resurfaced with as much as 5 inches of compacted, hot-mixed asphaltic concrete. In some cases, in less than a year, the cracks and joints reflected through and the rocking slabs continued to pump. These pavements being salvaged had been laid on earth subgrade and the subgrade soils were clay or clayey materials.

Money for rebuilding highways has not been available to meet the demands of increasing traffic volume. This lack of money has also influenced salvage programs, and pavements have not always been salvaged at the point just before rapid disintegration sets in. Consequently, those pavements being salvaged show marked or extreme distress before those persons responsible feel that such salvage work can justifiably be programmed.

Under such conditions of operation, it becomes apparent that preparation of the pavements being salvaged for resurfacing is necessary to assure a reasonable service life of the resurfacings. In locations where there is a large volume of heavy truck traffic, some preparation is necessary, or the seriously distressed areas soon reflect through the resurfacing. Regardless of the location of the pavement and the character of the traffic, where an old portland-cement-concrete pavement reaches a certain stage of disintegration, preparation for resurfacing appears to be a justifiable and economic procedure.

During the years of 1942-43, the Ohio Department of Highways constructed a new portland-cement-concrete pavement on US 42, between the towns of Ashland and West Salem. This new pavement was built parallel to the existing pavement, forming the north-bound lanes of a divided highway. The plans provided that the new lanes be built 24 feet wide with a 9-7-7-9 section, transverse joints be spaced at 60 feet, alternate joints being expansion and contraction. Reinforcing was included, with dowels at transverse joints and tie bars along the longitudinal joint.

Due to conditions then existing, resulting from a state of war, the contractor was unable to obtain reinforcing mesh as required by the plan under the priority rating assigned to the project. Because of this reason, the pavement was built without reinforcing mesh and the section was deepened to 9-8-8-9. The transverse-joint spacing was rearranged to intervals of 20 feet, with expansion joints at intervals of 120 feet. Of the resulting five contraction joints between expansion joints, four were built without dowels and one with dowels. Dowels were used in this manner because they had been supplied for the original joint spacing and none further could be obtained. The longitudinal joint remained as originally planned. The holding devices on hand placed the dowels ½ inch below the horizontal transverse centerline of the slab, but this was not considered to be critical or detrimental to the slab. Side forms 8 inches deep were used with 1-inch hardwood lifts.

This pavement was placed on earth subgrade, which was built under a specification requiring a minimum of 95 percent of standard Proctor density for soils having a maxi-

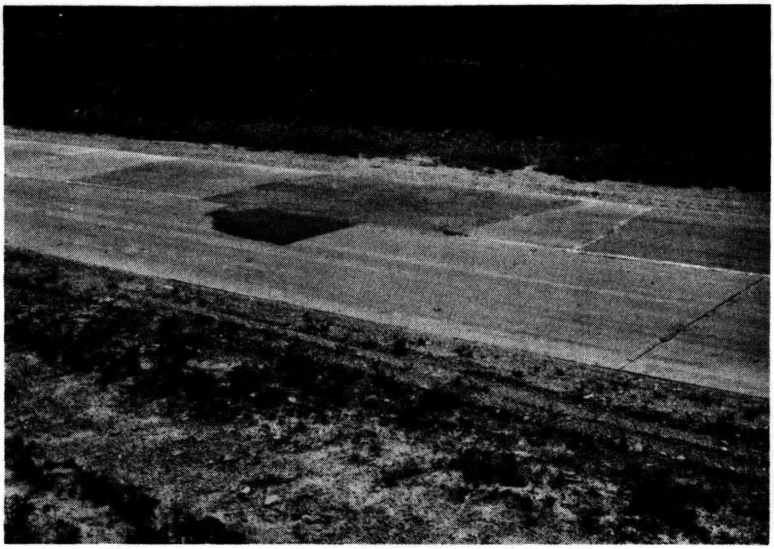

Figure 1. Condition of old pavement prior to resurfacing. Foreground is passing lane.

Figure 2. Condition of old pavement prior to resurfacing. Foreground example of extensive bituminous patching. Background example of numerous corner breaks.

mum dry weight of 95 to 120 pcf. and 90 percent for soils having a maximum dry weight in excess of 120 pcf.

By the fall of 1949, this pavement was requiring more than ordinary maintenance, and it was programmed for resurfacing in 1950. A plan was prepared and a contract was let early in 1950 for the work. The resurfacing was for a minimum of 1¾ inches of leveling course and 1¼ inches of surface course. Both courses were of the same mix and involved a ¾-inch aggregate maximum. The plan provided for the removal and replacement of 600 sq. yd. of the existing pavement and the installation of 300 linear feet of porous backfilled underdrains. The total project was 4.521 miles long.

Before the resurfacing work could start in the spring of 1950, the condition of the pavement became steadily worse, because of alternate periods of frost and extremely

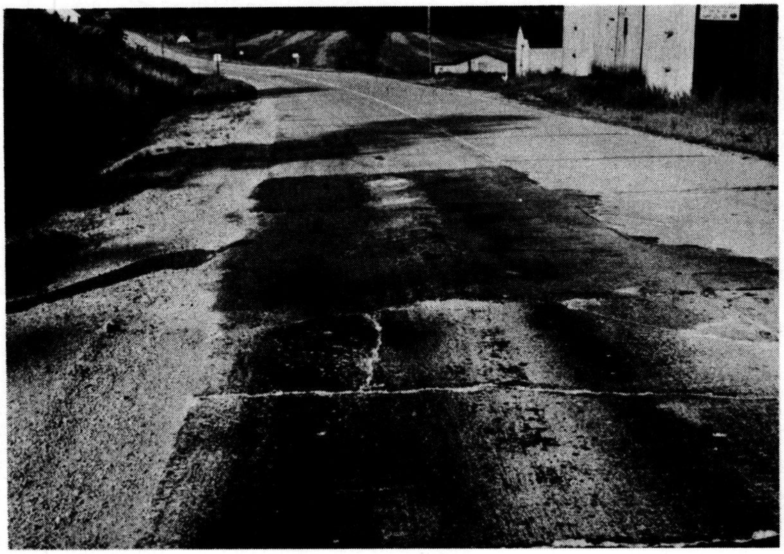

Figure 3. Condition of old pavement prior to resurfacing. View shows faulted and pumping slabs and extensive bituminous patching.

Figure 4. Condition of old pavement prior to resurfacing. View shows a pumping joint that has broken through an extensive bituminous patch.

wet weather. When the spring finally came, with settled weather, a survey of the pavement indicated that the pavement corrective measures set up by the plan were not adequate to take care of the condition. Negotiations were started with the contractor to perform the additional corrective work necessary to bring the old pavement to a satisfactory condition for resurfacing under an extra-work contract. The contractor was unwilling, at the unit prices bid under his contract, to perform the additional corrective work.

Since the unit prices he was asking for the additional work were so high, the department decided to do the additional corrective work with maintenance forces.

This project was an excellent opportunity to determine the value of old pavement preparation before resurfacing. The preparation work consisted of removing the badly broken areas of pavement, excavating the wet subgrade, and replacing with granular subbase

Figure 5. View showing old concrete removed preparatory to patching. This is a minimum width removal of 4 feet.

Figure 6. View showing a large size plain concrere patch on left. Right side partially patched. Surface of patches were float finished and were not edged.

material, installing drains, and then placing pavement patches of either plain portland-cement concrete or of the flexible type. Before any work started, an accurate condition survey of the pavement was made and recorded on a condition survey form (see Figure 9 for an example). The survey noted all faulted joints and extent of the faulting, patches, cracks and breaks in the slabs, pumping joints, and other conditions considered to have an influence on the resurfacing. Figures 1 through 4 illustrate the condition of removal areas at the time of the condition survey.

Pavement marked for removal was broken into small pieces with a gravity hammer. The edges of the removal areas were trimmed, where necessary, with pneumatic drills and chisels. The minimum size of removal area was 4 feet by 4 feet. The edges of all patches were parallel and at right angles to the centerline of the pavement. This prac-

Figure 7. Typical condition of the resurfaced pavement December 1, 1954.

Figure 8. Typical condition of the resurfaced pavement December 1, 1954.

tice necessitated the removal of some sound pavement in areas of triangular corner breaks. It was felt that if small triangular patches were placed, however, they would soon be rocking under the traffic load. Figure 5 illustrates a minimum width of removal.

Wet subgrade soil, under the removal areas, was removed to the affected depth. The subgrade in the areas was then shaped and compacted. Where the areas of removal would allow, rollers were used, and small areas and the subgrade around the edges of all patches were compacted with pneumatic tamps, which were heavy pneumatic pavement breakers equipped with 10-by-10-inch tamping heads.

Granular subbase material, a local bank-run gravel, was placed on the prepared subgrade. Compaction was accomplished in the same manner as for the subgrade. The subbase material had enough fines for compaction, yet was free draining. The porous backfilled underdrains were next installed from subgrade elevation, with enough fall to

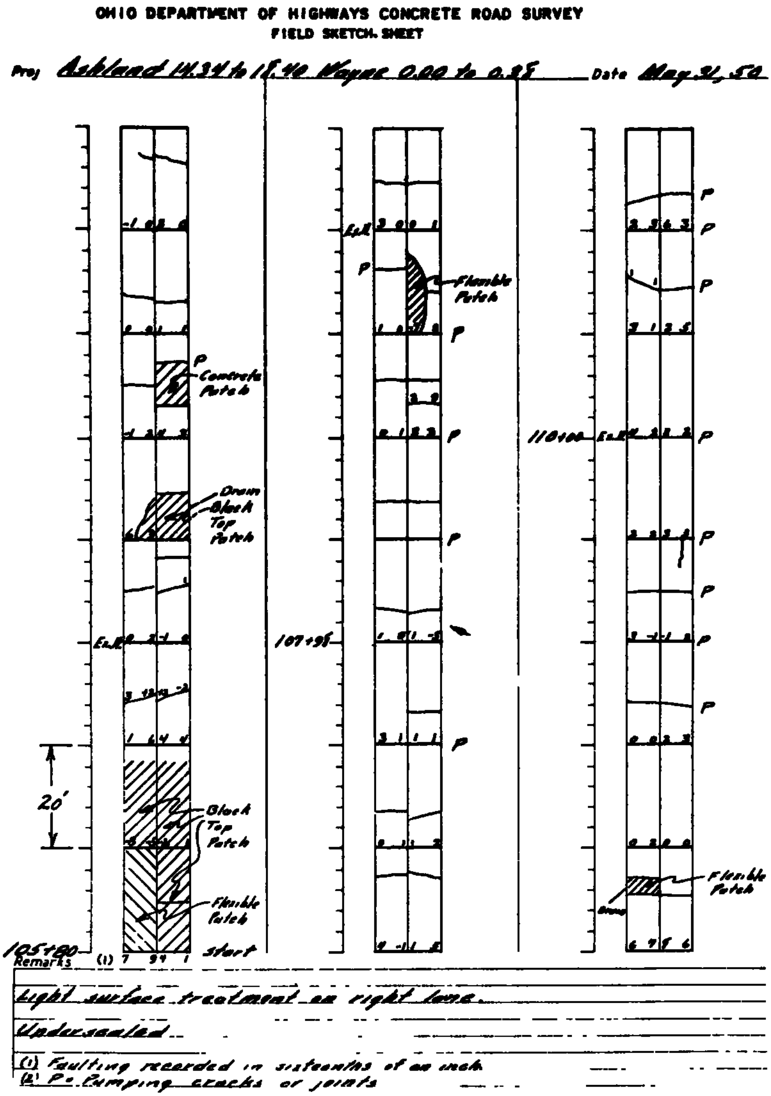

Figure 9.

drain through the berm to either the side ditch or through the slope of the fill. Some of the drains were installed without tile, however, the same size of filter material (Ohio No. 6 size 3/8 to 1/8 inch) was used in both cases.

The plain-cement-concrete patches were all placed 9 inches thick, except in the minimum-sized areas. The thickness in the 4-by-4-foot areas was increased to 12 inches. The edges of this size patch were undercut about 3 inches. It was believed that this treatment of the small patches would better enable them to resist moving under the traffic load. Figure 6 illustrates some of these patches. The surface of the patches was given a float finish and no edging was done.

The flexible patches were made up of a 5-inch course of dry-bound macadam and a

3-inch course of bituminized macadam. The dry-bound macadam was made from Ohio No. 12 size limestone (3½ to 1½ inches) and filled with limestone screenings. The bituminized macadam was plant mixed using MC-5 and Ohio No. 46 size limestone (¾ to

TABLE 1

CONDITION SURVEY
MAY 23, 1951
ASHLAND 14.34 to 18.40 WAYNE 0.00 to 0.38
T-35 RESURFACING OF CONCRETE PAVEMENT

Station		Right of Left	Type of Patch	Remarks
From	To			
106+52	106+72	R	Flex.	Slight depression that enables one to locate patch area. Some cracks in patch area.
106+83	106+93	R	Conc.	No surface evidence of patch.
108+58	108+71	R	Flex.	Slight opening at centerline over patch.
109+06	109+09	L	"	No surface evidence of patch.
109+80		R		4 to 5 area depressed as much as 1/2" over old crack.
110+65	110+78	R	Flex.	No surface evidence of patch.
111+58	111+63	R	"	" " " " " Drain running.
114+87		R		No surface evidence of loose area of concrete.
115+35	115+38	L	Flex.	" " " " patch.
127+70	128+35	L	"	" " " " "
129+00	129+80	L	"	" " " " "
130+10	130+30	L	"	" " " " "
131+50	131+70	L	"	" " " " "
132+00	132+17	L	"	" " " " "
132+30	132+82	R	"	" " " " " Drain running.
132+50	132+75	L	"	" " " " "
133+23	133+50	R	"	" " " " "
133+57		R		Drain running.
133+90	134+00	L	Flex.	No surface evidence of patch.
136+58	136+78	R	"	" " " " "
136+69	136+85	L	"	" " " " "
137+97	138+09	R	"	" " " " "
138+37	138+57	R	"	" " " " "
138+53	138+62	L	"	" " " " "
139+48	139+68	R	"	" " " " "
141+69	141+79	R	"	" " " " "
143+50	143+70	R	Conc.	" " " " "
144+66	145+15	R	Flex.	" " " " " Drain dry.
145+62		R		Drain running.
148+35				Pumping joint. Faulting at centerline.
150+54	150+70	R	Flex.	No surface evidence of patch. Drain running.
154+35	154+49	R	"	" " " " " " "
154+75	154+81	R	"	" " " " "
154+84		R		Drain dry.
158+96	159+00	L	Flex.	No surface evidence of patch.
161+58	161+70	R	Conc.	" " " " "
164+36	164+50	R	"	" " " " "
164+70		L		Drain missing.
164+81	164+83	L	Flex.	No surface evidence of patch.
165+06	165+11	R	"	" " " " "

⅜ inch). The compaction of these courses was accomplished the same as for the subgrade and subbase material.

The total area of the pavement removed was 3,342 sq. yd. Of this amount, 666 sq. yd. was removed and replaced under the contract using plain portland-cement-concrete patches. The remainder was removed and replaced with maintenance forces and was divided into 1,073 sq. yd. of flexible patches and 1,603 sq. yd. of plain portland-cement-concrete patches. The total area of all the patches was 5 percent of the total area of the pavement.

After the corrective work was accomplished, the resurfacing was placed at the rate of about 90 tons per hour. Three rollers, one three-wheeled, 10-ton finishing and two 8-to-12 ton tandem rollers, were necessary to get satisfactory density in the resurfacing courses. The project was completed in the latter part of June 1950.

Annual condition surveys have been made each May since the project was completed. The pavement and drains were carefully checked and a record made (see Table 1). The pavement was last examined on December 1, 1954. Figures 7 and 8 illustrate the present general condition of the pavement.

From the experience gained with this project, it is believed that the importance of conditioning an old portland-cement-concrete pavement before resurfacing has been well demonstrated. The resurfacing is now 4½ years old and is in good condition. This length of service is almost two thirds of the life of the original pavement. Traffic during this time has steadily increased and is now probably 25 percent greater than when the pavement was originally built. With a moderate amount of maintenance, this resurfacing should last at least 4½ years more. By the end of that time the economic worth of such pavement preparation before resurfacing can be determined with accuracy.