Montana Department of Transportation
Research Program
February 2002

RESEARCH CONSTRUCTION REPORT

Thin-Whitetopping Overlay Composite

Location:	Glendive, Montana – North Dawson County
Project No.:	STPP 20-1(6)0 P-20, Highway 16
Description:	Experimental construction project consisting of milling approximately 38mm of Asphalt Cement (AC) and placement of 100mm Portland Cement (PCCP) onto the milled surface to create a composite pavement. Project length-0.9 kilometer.
Date of Construction:	May 2001
Weather:	Sunny to overcast, windy, average 74°F, 22°C
Report Origin:	Craig Abernathy, Research Program

Purpose

Highway 16 (P-20) suffered from rutting, plastic deformation and transverse cracking with the current AC pavement. The Montana Department of Transportation decided to construct a thin-whitetopping project based on minor rehabilitation criteria. Whitetopping is an alternative to the regular program of mill & fill. This procedure bonds a flexible layer to a rigid layer to form a composite pavement to eliminate rutting and plastic deformation. This report will document events from the researchers point of view. Not all events were documented in this report, nor was the research reviewer present during the entire construction project. This effort is to establish a baseline of documentation that will assist with future performance evaluations with this project.

Documentation

In the construction of whitetop, some simple but key factors must be adhered to in producing a durable product. The asphalt pavement must be of sufficient thickness and quality to support the PCCP layer. The milled surface must be clean and dry. Once the PCCP has been placed, finished and broomed or tined, curing compound must be applied in a timely manner with appropriate application. The liquid curing compound should be white, to avoid excess heat absorption from the sun. In addition, the white color enables construction workers to check more easily for coverage uniformity and gaps in the coverage. The liquid compound must be constantly agitated during application to ensure

Figure 1

that the mixture is applied correctly. Timing of saw cuts is necessary to prevent premature curing and spalling from the saw blade action with joints. Due to the thickness of whitetopping pavement, it requires the additional admixture of putting polypropylene unfibrillated fibers in the mix (3lb.per cubic yard). This gives added strength to the concrete and it assists in preventing the spread of cracks. Figure 1 is view of the milled AC looking north about midway of the project. The roadway was milled to an approximate depth of 38 mm (1.5 inch). Towards the northern end of the project, corings showed an insufficient layer of AC. The old AC layer needed to be built up to adequately support the PCCP layer. Plant mix asphalt was laid down at an average approximate depth of 50 mm (2 inches). To assure a rough surface for PCCP placement, sand was placed to allow traffic to wear the surface to insure adhesion of the whitetop (figure 2).

Figure 2

The contractor then began the installation of metal forms (approximately 4″ x 2″ C-channel tube) that the paver would set on while placing

the PCCP layer. Workers drilled into the surface far enough so they were able to hammer the metal stakes firmly into the ground in which the steel forms (or rails) will be attached. Figure 3 shows the installation of the metal forms.
Once the forms were installed and correctly aligned, the contractor set the paver onto the forms to begin paving. The paver used was an Allen Three-Tube Roller Paver (figure 4). The action of the paver was a back and forth motion, with each forward motion the unit would advance several feet. Unfortunately, (as seen in figure 5) the weight of the paver crushed the metal forms. Once this happened, paving was discontinued and the paver removed from the roadway.

Figure 3

Figure 4

Figure 5

The (estimated) 6-7 yards of concrete could not be competently placed and was subsequently removed from the pavement.

The next day the contractor modified the rail system by adding a wooden 4″x4″ with a 1″x4″ attached to the bottom. This wooden support was laid beside the metal form. This worked reasonably well in supporting the weight of the paver. As the paver progressed, workers would move the wooden rails from the rear of the paver and place them in front to keep up with the speed of paving. Being only

wood, the add-ons eventfully were compressing and splintering, the contractor modified the rail system once more by using square tube steel with flat steel stock on top to keep the needed height.


Figure 6


Figure 7

This was also placed beside the original metal forms. Figure 6 shows the metal form set-up and figure 7 illustrates how the wood was used.. This procedure was used for the southbound lane of the project. The northbound lane used the double form scenario on the right side of the lane only. The flat metal stock was laid atop the left side of the southbound whitetop lane. This allowed the tube roller to set on the PCCP layer without damage during the paving process. Figure 8 is an overview of the paving process. Note the two virbrators (or stingers, shown by


Figure 8

yellow arrows) being used to consolidate the concrete. The contractor did a good job in pacing the consolidation with the speed of the paving. Once the concrete was placed, curing compound was applied to prevent premature curing. Figure 9 shows Greg Miller of Holcim Inc. (formerly Holnam) instructing the contractor on the correct application of compound on the finished concrete. Figure 10 is how the contractor was applying the cure the following day. There were noticeable gaps in coverage. It was difficult to impress upon the contractor the critical aspect of applying adequate cover to the fresh concrete. A special provision had even specified a double shot to insure sufficient coverage. This procedure was discussed in several meetings with the contractor prior to and during the start of the project. This may result in premature cracking and reduce the life of the pavement. This reviewer was not present during the southbound lane construction, and is unsure if this application practice was continued throughout the completion of the project.

Figure 9

Figure 10

Once the PCCP had cured sufficiently, the saw team began cutting the joints with an average spacing of 1.2 meters minimum and 1.5 meter maximum. Cutting width averaged at 3 mm with an average depth of 25 mm. There seemed to be an inordinate amount of spalling at the joints while cutting. There was speculation that the polypropylene fibers were the cause of this spalling. Although there was various saw spalling during the Kalispell whitetopping project, there seemed to be substantially more for this project (as observed on the southbound lanes). It is assumption only, but this excessive spalling may be from the result of cutting into too green of concrete. Timing of the cuts is critical for this type of pavement application. The spalling is unsightly, but should not interfere with the performance of the whitetop. Figure 11 is a sample image of the saw cut spalling.

Another concern from the sawing process was the slurry residue resulting from concrete dust being washed from the whitetop onto the milled asphalt surface. The contractor felt it was unnecessary to remove this waste product from the AC surface on a daily basis. It was explained to the contractor on the necessity of having a clean dry surface for the PCCP layer to bond with the AC layer. The contractor stated that the slurry debris was concrete paste and there was no concern about sufficient bonding. In turn, it was explained to the contractor that the slurry was dust created from the sawing

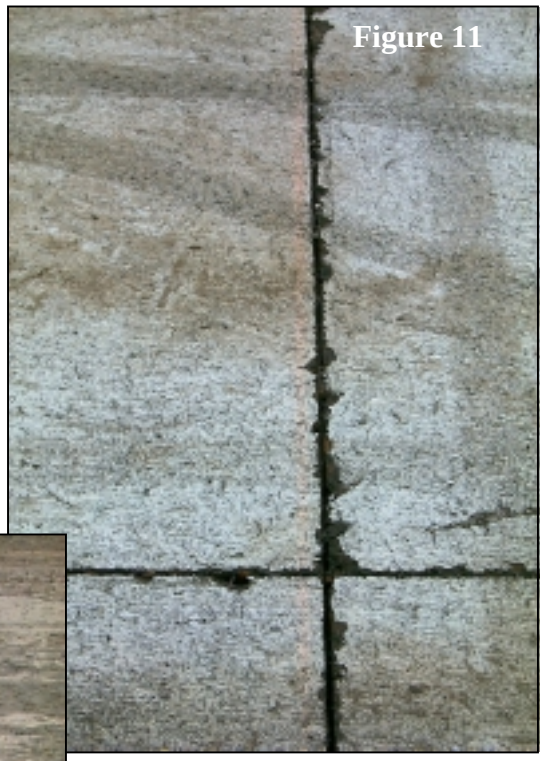
Figure 11


Figure 12

of joints, and the dust had no hydration or exothermic reaction to represent un-cured Portland cement. Basically, it was dirt, and of sufficient thickness and friability to be a detriment to that section of pavement. Figure 12 is an example close-up of the slurry wash on the milled AC. It was not observed if the contractor eventually complied with this request. Figure 13 is a view of the southbound PCCP being placed on the AC with slurry residue.


Figure 13

Transverse cracking on the southbound lane appeared soon after the PCCP had cured. Speculation on the part those individuals who had witnessed the construction gave reasons of poor curing which may have created shrinkage cracking or late timing with the


Figure 14


Figure 15

joint cuts. In addition, if the bond between the two layers is compromised the load transfer may also cause premature cracking. Figure 14 & 15 are examples of cracking observed. Lines have been superimposed over the image to better view the lay of the crack.

Figure 16 is an overview of the north and southbound lanes completed prior to striping. The first annual evaluation will be held in the summer of 2002. This formal evaluation period will encompass five years with an additional informal evaluation period which may last up to an additional five years.


Figure 16