Montana Department of Transportation
Research Program
June 2001

RESEARCH CONSTRUCTION REPORT

Thin-Whitetopping Overlay Composite

Location:	Kalispell, Montana
Project No.:	STPP 1-2 (93) 121 East Idaho St.
Description:	Experimental construction project consisting of milling approximately 130mm of Asphalt Cement (AC) and placement of 130mm Portland Cement (PCCP) onto the milled surface to create a composite pavement. Project length-0.8 kilometer.
Date of Construction:	September 2000
Weather:	Sunny to overcast, average 76°F, 24°C
Report Origin:	Craig Abernathy, Research Program

Purpose

East Idaho St. was suffering severe 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 pavement preservation. 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 researcher point of view. Not all events were document in this report. This effort is to establish a baseline of documentation that will assist with future performance evaluations with this project. Figures 1-3 showed East Idaho before construction.

Figure 1

Figure 2


Figure 3

Documentation

In the construction of whitetopping, some simple but key factors must be adhered to in producing a quality product. The asphalt pavement must be of sufficient thickness and quality to support the PCCP layer. The milled surface must be cleaned and dry. Once the PCCP has been placed, finished and broomed or tined, curing compound must be applied in a timely basis. Timing of saw cuts is necessary to prevent premature curing. This project encompassed well-documented good construction practices. MDT Staff was knowledgeable about the plans and specifications. The contractor was well staffed and paid attention to details.

These images show the milled asphalt Before and after cleaning. Sweeper and vacuum trucks were used extensively before PCCP placement. The westbound lanes of East Idaho were the first to be constructed. Traffic control was well planned and the public was quickly trained how to maneuver through this area.


Cleaned Surface


Milled Surface before Cleaning

In order to keep grade and allow the Bidwell Deck Paver to be used, a five-foot slipform paver (Power Curber 5700-B, figure 4) placed the initial Whitetopping from the centerline. Placement started from the east end. The contactor allowed too much water to


Figure 4

Figure 5

be added to the concrete in the mixing truck. In addition, water was being added to promote smoother flow down the chute. Apparently, the amount of fibers (3lb. Per cu/yd) in the mix was clumping in the chute and the driver felt it was necessary to add more water. This in turn increased the slump to a level in which while finishing the exposed (northern edge) of the placement it sloped downward, no longer a flat surface. Figure 5 shows the slumped edge and the spillage left behind from the paver. Since this edge would no longer match the edge when the deck paver would be used the contractor was asked to remove approximately 2/10 of a meter

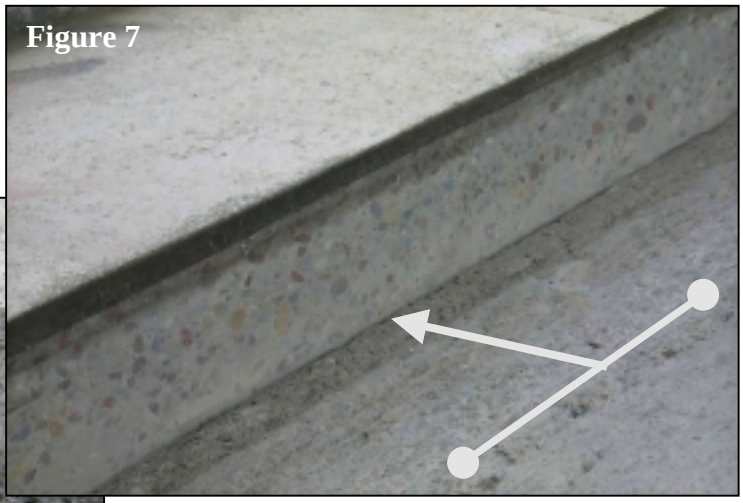
Figure 7

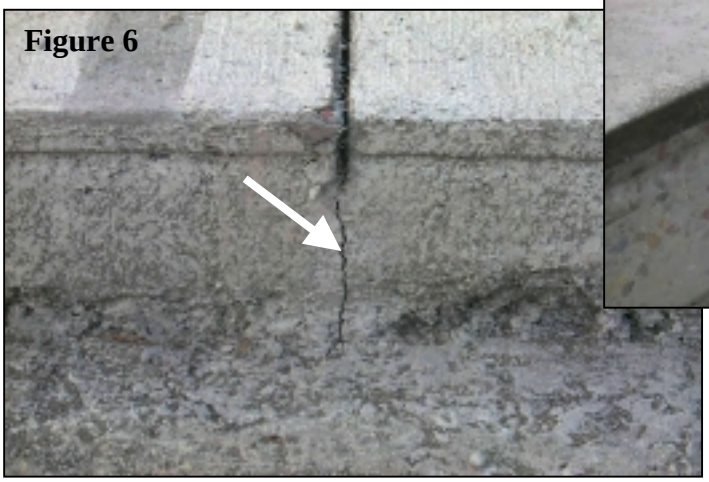
Figure 6

from the edge of the sloped area. This was done by saw cutting down to the AC layer. Although this was an unfortunate event to the contractor, it did show how well the PCCP had bonded to the asphalt layer. To bust away the sawed portion of concrete a forklift was needed. The removed pieces had asphalt still attached to the PCCP. Figure 7 shows approximately, how much material was removed. Figure 6 is a

representation of the cracking at the saw cut joint. This cracked within several days after placement.


Figure 8

Figure 8 is showing the application of water-based latex curing compound. The worker was having difficulty in applying a uniform layer of compound. The sprayer head and tank pressure was not tested before application. After trial and error, this was corrected and the contractor placed the compound by the approved method. Prior to the use of the Bidwell Paver, curing compound was also applied as a bond breaker to the curbing as seen in figure 9. Mixing of the 55-gallon drum was done by rolling it up and down the street. Future evaluations will determine in using curing compound in this fashion was an effective application in preventing sympathetic cracking.


Figure 9

During the saw cutting of the westbound slip-form section, the contractor allowed the saw slurry to drain and wash onto the cleaned, milled asphalt as seen in the images below.

Figure 10

When the slurry had dried it left behind a friable material (Figure 10) that could be easily removed with a fingernail. A substantial coating of this slurry had been deposited on the surface of the milled asphalt. This material would interfere with the bonding of the PCCP to the asphalt layer. Vacuuming and sweeping was repeated with this stretch of the project to remove the slurry wash. The surface was restored to its original condition before the saw cutting.

Figure 11

At the intersection of 7th ave. and East Idaho there was found to be an insufficient thickness of asphalt to support the PCCP Layer (Figure 11). The thin layer of asphalt was removed to perimeter with sufficient extent to the asphalt layer of necessary thickness. Then the asphalt was removed completely to the base material. During placement of the PCCP, this would allow the cutout section to be full-depth with the passing of the Bidwell Paver. This procedure is an acceptable method to deal with this type of situation. The full-depth section as placed did not affect the pattern of saw cutting. Nor was any doweling used. The storm sewer insert and cap were not part of the cutout section.

Figure 12

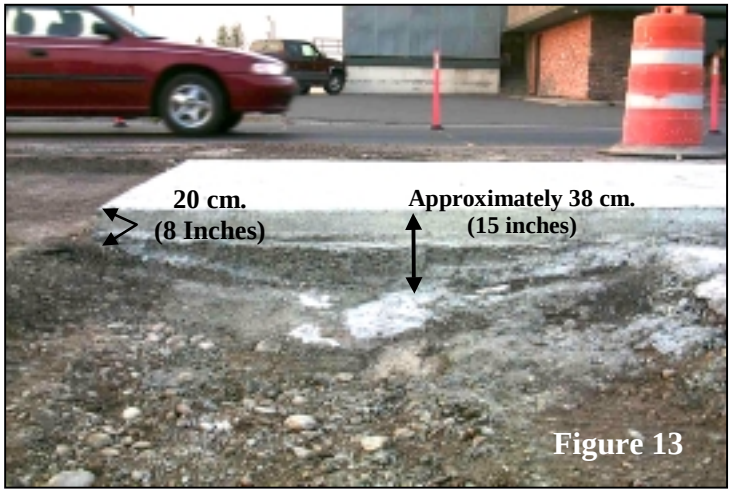

Figure 13

The east-end westbound transition was reconfigured due to the Project Engineer's uncertainty that the current design would not adequately support the load transfer from the old section of roadway to the new whitetopping. It was decided to trench out about fifteen inches at the beginning of the project. In addition, mill the existing AC pavement back about thirty feet from the transition area. This would allow sufficient weight distribution through the transition area from moving vehicles. Figure 12 shows the finished transition prior to the set-up of the Bidwell Paver. The AC pavement was milled back at a later date. As seen in figure 13, the thickest part of the transition is approximately fifteen inches, and approximately eight inches in depth at the beginning of the whitetop pavement. The trough then slopes back up to the milled AC. Research will closely observe the effectiveness of the design change. Figure 14 is the beginning of the project using the Bidwell 3600 Deck Paver. The rails for the paver were supported by the existing curb and the slip-formed five-foot whitetopping pavement previously placed.

Figure 14

Figure 15

Once the Bidwell was in place and operating, placement of the PCCP went smoothly. The contractor coordinated two front dispensing concrete trucks to be in front of the Bidwell constantly (figure 15). The finishing crew was diligent in finishing and brooming. Curing compound was applied soon after the brooming (figure 16).

Figure 16

The concrete mix design specified a 2″ slump (approximate), air entrainment and 3 lb. Per cubic yard of polypropylene unfibrillated fibers. These fibers were manually loaded into the trucks at the batch plants. The fibers were introduced first with water, agitated and then followed by the aggregates, cement and additives. The batcher stacked the appropriate amount of fibers per load for the drivers (figure 17). At this time, fiber reinforcing is a standard practice for thin whitetopping applications. This practice will be closely monitored to see if the addition of fibers decreases cracking and/or spalling with the thin whitetopping.

Figure 17

Another important factor in the placement of whitetopping is the vibration needed to properly consolidate the PCCP. The contractor used a motorized backpack foundation style vibrator or stinger for this project (figure 18). Only one vibrator was used. It was noted that the individual operating the vibrator initially was inserting the vibrating head too long into the concrete. To much vibration can unconsolidated the PCCP. The MDT inspector instructed the operator on the correct procedure. Only one vibrator was used during placement. Upon observing the amount of effort this individual needed to keep up with the

Figure 18


Figure 19

placement, there should have been two vibrators used in this project. This most likely was the reason on a small section of the placement that the PCCP was not vibrated sufficiently to remove the pockets left by the workman's boots. The yellow outline on figure 19 approximately shows the lack of consolidation. The circumstance that caused this to happen was quite clear. The workman operating the stinger took a very short break to quickly eat. While doing this, the paver continued to operate and proceeded to move over the spot that had not been vibrated. This unconsolidated section looked fine until the saw crew begin cutting at this spot. At that time the weight and action of sawing breached the PCCP.

Upon consultation with MDT and the Prime, it was decided to remove the section of damaged concrete. Corings were taken to ascertain the extent of damage. The area was then removed by sawing and jack hammering the unconsolidated section away. Care was taken not to disturbed the adjacent viable panels. Two solutions were discussed; either to remove the AC layer and place full-depth PCCP or to dowel the section and replace the layer of whitetopping. The latter was chosen as seen in figures 20 & 21. This fix was determined to promote the best transfer of loadings. Once the PCCP was placed, the joints were cut the same prior to removal. This type of repair will be monitored closely for its effectiveness. Figure 22 shows the completed repair.


Figure 20


Figure 21

Figure 22

At the intersection of East Idaho & 7th Ave EN, hydraulic oil was spilled while the PCCP was being placed in the westbound, left lane (Figure 23). Apparently a hydraulic hose, which operated the concrete chute, failed during placement. Oil then pored directly into the PCCP. The paver was halted while the contractor attempted to remove the substance. The contractor did do a plausible job in removing as much oil as possible. However much still remained in the placement, and an oil sheen could be seen on the surface after finishing. The yellow outline is the approximate area of contamination. Research will monitor this area closely for potential failure of the PCCP.

Research will conduct formal annual evaluations Until 2005, and continue to informally evaluate up to five years. The 2002 report will include a complete crack map of the project.

Figure 23

Finished Project – Looking East