Montana Department of Transportation
Research Programs
Update March 2016

EXPERIMENTAL FEATURES PROJECT
CONSTRUCTION REPORT

EVALUATION OF WARM MIX ASPHALT (WMA) PAVEMENT

Project Name	Project Number	Project Location	Project Length
Monida-Lima (SB)	IM 15-1(109)0	Interstate 15, Beaverhead County, Butte District- approximate RP 0.0 to RP 17.1	17.1 miles

FHWA Project Number: MT 10-02

Project Type: Evaluation of warm mix asphalt (WMA) pavement on a highway construction project using three different WMA technologies,

Principal Investigators: Kris Christensen, Research Project Manager

Objective

Determine the effectiveness of Warm Mix Asphalt (WMA) using three WMA additives and technologies compared to MDT's standard Hot Mix Asphalt (HMA) surfacing.

Experimental Design

This experimental features project originally consisted of three different WMA projects throughout the state. The project was revised to include only the I 15 project. The Monida-Lima (SB), I 15 project consisted of placing three types of warm mix asphalts with different technologies (Evotherm, Sasobit, and foaming) and a hot mix asphalt control section. Each section of the different technologies is approximately a quarter of the project length. The beginning and ending point of each section and the product used will be clearly defined.

Evaluation Procedures and Schedule

Materials tests were performed consistent with a HMA project. MDT Research or a designated representative was onsite during construction to document the production and placement of the WMA. Any anomalies during construction that may affect performance were documented.

After completion of construction, the test and control sites will be delineated for continued performance evaluation. Four 300 feet test sections per mile (estimate 16) will be designated for each WMA technology and the control section. Data collection will include rut and ride measurement, crack mapping, and documentation of visual distress.

Research will monitor performance annually for a period of five years. MDT Research will complete a construction/installation report, annual reports, and final project report for this project. All products will be distributed internally to appropriate staff and posted to MDT's Research Programs website.

Figure 1- FHWA mobile reasearch testing facility and staff

This report is general documentation of the placement of the three WMA technologies and not meant to replace any other project related documentation. Information includes visual representation of each technology, applicable anecdotal support, reported construction issues that may affect performance, supporting reports from the Construction Engineering Services Bureau (CES Project Review Report), and materials test data from the Butte District Materials Lab. In addition to on site MDT personnel, the FHWA Mobile Research Testing facility and representatives of Washington State University were on site evaluating the construction of this project. As well as, company representatives for Sasobit and Evotherm. When their reports and documents regarding this project become available, they will be posted on MDT Research's web site along with this report.

Figure 2- Washington State University representatives

Construction

The following information contains the general events during the placement of the three warm mix features, including images that represent the practice per application as documented from site visits and information compiled by the Butte District Materials Lab. During construction, MDT Research staff was on site one day for each WMA technology.

Figure 3- Hot plant facility

Sasobit

The first WMA technology used was the additive Sasobit which was blended into the asphalt at the Idaho Asphalt refinery. According to the Sasobit manufacturer, plant mix temperatures should be approximately 50° Fahrenheit (F) lower than average plant mix temperatures for hot mix asphalt. On this project, the average plant discharge temperature for

Figure 4- Beginning of Sasobit paving section, note the “wave” of plant mix in front of rollers

the hot mix asphalt (HMA) was 320˚F.

MDT Research visited the construction and hot plant sites on September 14, 2011. The mix temperature started out approximately 321˚F. The plant operator planned to slowly lower the temperature to 275˚F. When research visited the plant site, the mix temperature was 290 F˚.

Figure 5- Beginning of Sasobit paving section when plant and placement temperatures were high

The average discharge temperature at the plant was 285˚F.

The Sasobit WMA application appeared to have issues with compaction when placed at high temperatures. Observed were excessive mat rollout to 15 feet instead of normal 12 feet, moisture on the plant mix, and a “wave” of

plant mix near the front of the roller during compaction. The contractor used an extra roller to try to counteract some of these issues. Once the temperature was brought down the plant mix was easier to work with and the previous issues were remedied. There was some cracking at the beginning of the Sasobit section due to the compaction issues with the higher temperatures. The contractor applied a tack coating to these areas to mend them by having traffic eventually knead out the cracks.

Figures 7 and 8- Evotherm additive baskets at mix plant facility

Evotherm DAT

Evotherm DAT (Dispersed Asphalt Technology) is a concentrated solution of water and chemical additives directly injected into the asphalt line at the hot plant. It was the second WMA technology used on the Monida-Lima (SB) project and according to the manufacturer, mix temperatures should be 85-100°F less than hot mix temperatures. MDT Research visited the construction and hot plant sites September 21-22, 2011.

As with the Sasobit technology, the temperature at the plant started out hot and was slowly lowered to 270° F. The average discharge temperature was 274°F. Paving with the Evotherm started well and continued throughout. It compacted well and the density tests were on target. In addition, the contractor was able to begin finish rolling sooner than expected.

Figure 9- Foaming mix system at hot plant facility

Foaming

The last WMA technology used was foaming. The water for the foamed warm mix product was injected using the Aesco/Madsen's static inline vortex mixing system. Plant mix temperatures for foaming are suggested to be 35-50°F less than hot mix temperatures.

MDT Research visited the construction and hot plant sites on September 29, 2011 for this WMA technology. The plant temperatures started hot at 300° F as with the previous WMA technologies. The plant operator planned to lower temperatures to 270° F. The average discharge temperature for this technology was 285° F. According to the contractor, the foamed asphalt worked well and was the easiest to work with compared to the other WMA technologies.

Figure 10- Close-up of foam mixed asphalt

Test Data

The Butte District Material Lab compiled the test data information for this report on the first ten samples of each warm mix technology and the control hot mix asphalt.

Charts 1 and 2 show the temperatures at the mix plant and on the road surface. Charts 3 through 8 show the volumetric properties of the plant mix for each WMA technology and the control hot mix asphalt. The data includes rice density, in place density (after compaction of the mat), Air Voids, Voids in the Mineral Aggregate (VMA), and Voids Filled with Asphalt (VFA).

For more information and the target readings for each test, please see the Monida-Lima Construction Engineering Services (CES) Project Review Report posted on MDT Research's experimental projects web site.

Conclusion

Other than the compaction issues with the Sasobit mentioned previously, the installation of the warm mix asphalts had no construction issues reported during paving operations.

Construction Update 2012

Research staff visited the the Monida-Lima site along with Butte District Construction and contractor staff to view reported cracking in the pavement. This visit was May 31, 2012 and the entire project had not received a seal coat application. Reflective cracking in the pavement was seen and documented throughout the whole project including each section of WMA technology and HMA in both northbound and southbound lanes (see Figure 11). After this review, the Butte District decided to perfom crack seal work after the seal coat application. The entire project was sealed and covered July 2012.

Figure 11- Examples of surface cracking in hot mix asphalt pavement in southbound lanes (left), warm mix asphalt pavement (center), and hot mix asphalt pavement in northbound lanes (right)

Evaluation

2013

Research staff visited the project site May 2013. There was no visible difference between all sections of each WMA technology or the HMA pavement in either the southbound or northbound lanes. Reflective cracking was present and cover material from the seal and cover (done July 2012) was missing from the roadway throughout whole project. The figures below represent the visual condition of the pavement in the southbound and northbound lanes.

Figure 12- Examples of reflective cracking in warm mix asphalt pavement (top) and hot mix asphalt pavement in northbound lane (right)

Figure 13- Examples of cover material loss along the roadway shoulder and center line in southbound lanes

2014

Research staff visited the project site late August 2014. Similar to 2013's visit, there were no visible differences between all sections of the WMA technology or the HMA pavement in either the southbound or northbound lanes. Reflective cracking was present and cover material from the seal and cover was missing from the roadway throughout whole project. The figures below represent the visual condition of the pavement in the southbound and northbound lanes.

Figure 14- I 15 southbound (top) and northbound (right) approximately RP 16

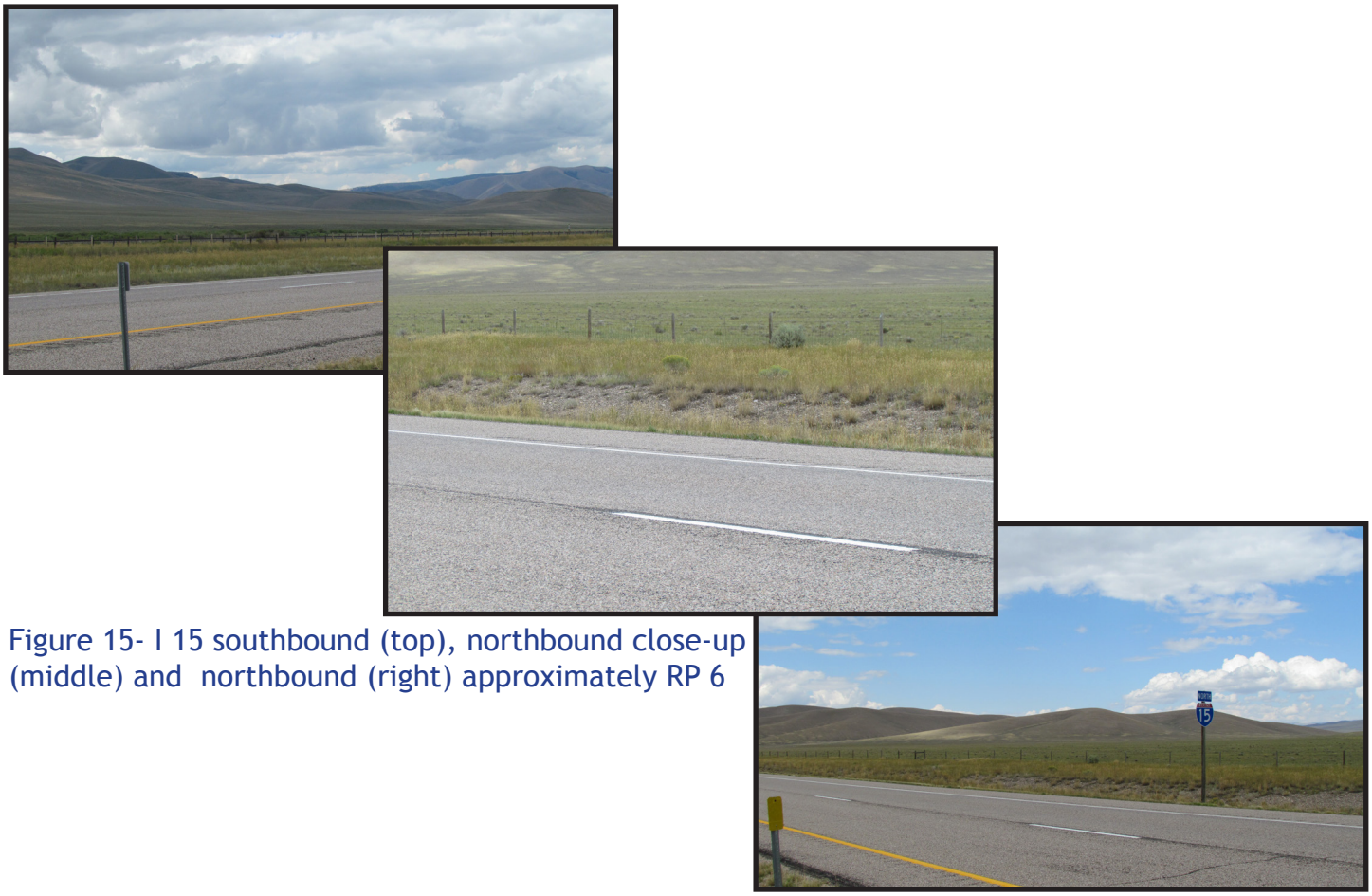

Figure 15- I 15 southbound (top), northbound close-up (middle) and northbound (right) approximately RP 6

2015

Research staff visited the project site mid-September 2015. Similar to previous visits, there were no visible differences between all sections of the WMA technology or the HMA pavement in either the southbound or northbound lanes. Reflective cracking was present and cover material from the seal and cover was missing from the roadway throughout whole project. The figures below represent the visual condition of the pavement in the southbound and northbound lanes.

Figure 16- Sasobit treatment southbound (left) and HMA northbound (below) approximately RP 17

Figure 17- Evotherm treatment southbound shows cracking near the centerline and missing seal and cover material near RP 9

Figure 18- Reflective cracking and missing seal and cover material in southbound lane near RP 4.5

Figure 19- Foaming treatment soutthbound shows cracking near the centerline and missing seal and cover material near RP 1

Figure 20- HMA northbound shows cracking near the centerline and missing seal and cover material near RP 5

Figure 21- HMA northbound close-up shows cracking near the centerline and missing seal and cover material near RP 5