

Montana Department of Transportation  
Research Programs  
December 2013

**SHRINKAGE REDUCING ADMIXTURE (SRA) AND SYNTHETIC POLYOLEFIN FIBERS (SPF) TO MITIGATE EARLY AGE BRIDGE DECK CRACKING**

**Location:** Interstate Highway 90: Columbus Area/Stillwater County – Hensley and Keyser Creek Structures

**Project Name:** Br Deck Rehab / Repair 11

**Project Number:** NHPB STWD (44)

**Experimental Project No:** MT-12-12

**Type of Project:** Bridge Deck Cracking

**Principal Investigator:** Craig Abernathy, Experimental Project Manager (ExPM)

**Experimental Design Description**

Early age bridge deck cracking has been an issue for MDT and other states for several years. Bridge deck cracking allows water and deicing chemicals to infiltrate the deck, which can result in reduced service life.

Modify MDT's current SD concrete mix with a combination of a Shrinkage Reducing Admixture (SRA) and Synthetic Polyolefin Fibers (SPF) and use on a test project. A special provision with mix requirements would be provided in the contract documents with the amounts of SRA and SPF preselected and placed in the contract documents as separate bid items. Results of the proposed concrete testing may alter the amount of admixtures to be used in the mix. Admixture amounts could change and the contractor costs adjusted prior to deck placement if deemed necessary.

All concrete used in the test project bridge decks to be supplied from a single supplier to maintain a consistent source of cement and aggregate. The SRA should be from a single manufacturer and be compatible with all other admixtures in the mix. Research shows SRA can affect other admixtures, in particular air entraining admixtures. The sequence of adding the SRA is important and will need to be added in accordance with the SRA supplier. The concrete supplier will conduct a trial truck batch with the SD-SRA concrete to determine the amount of time that the air content remains stable.

The following details the selection of the admixtures:

**Shrinkage Reducing Admixture (SRA)** – Provide a commercial, pre-packaged SRA. Label each container with mixing instructions, lot number, date of manufacture and shelf life. An expiration date may be used in lieu of the date of manufacture and shelf life. SRA will be rejected if the shelf life or expiration date has been exceeded.

Products include:

- MasterLIFE SRA 20** (BSAF Admixtures)
- SIKA CONTROL 40** (SIKA Corporation)
- Eclipse 4500** (W. R. Grace)

Approved equal to products listed above can be used with MDT acceptance.

**Macro Synthetic Fiber Reinforcing (FR)** - Provide FR satisfying ASTM C 1116: Standard Specification for Fiber Reinforced Concrete.

Products include:

- MasterFiber MAC 100 Plus** (BSAF Admixtures)
- Sika Fiber MS 20** (SIKA Corporation)
- STRUX 85/50** (W. R. Grace)

Approved equal to products listed above can be used with MDT acceptance.

Mix designs for both SD and SD-SRA Concrete. Representative materials of those to be used in both SD and SD-SRA concrete mixes to run the tests ASTM C 157 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete and ASTM C 1581 Standard Test.

### **Evaluation Procedures**

The test project has within its limits 2 sets of bridges requiring total bridge deck replacement. One bridge in each set would have the deck cast with current SD concrete and the other bridge deck would be cast with the modified SD or SD-SRA concrete, the bridges selected are shown below.

| <b>Structure Number</b> | <b>Location</b> | <b>Structure</b> | <b>Direction</b> | <b>Concrete Type</b> |
|-------------------------|-----------------|------------------|------------------|----------------------|
| I00090407+08621         | 2 KM W Columbus | Keyser Creek     | E.B.             | SD                   |
| I00090407+08622         | 2 KM W Columbus | Keyser Creek     | W.B.             | SD-SRA               |
| I00090414+02351         | 9 KM E Columbus | Hensley Creek    | E.B.             | SD                   |
| I00090414+02352         | 9 KM E Columbus | Hensley Creek    | W.B.             | SD-SRA               |

Concrete testing will be performed after the project has been awarded. MDT will procure the concrete suppliers materials and mix designs and have an independent testing agency perform the appropriate shrinkage testing procedures on both mixes to compare the shrinkage performance. Additional testing at different dosages of admixtures may be performed at additional costs to determine the optimum amounts of admixtures and is not currently a part of this study. All information received from testing results will be included in the Research construction report or supplemented into the final report as they become available.

## **Construction Inspection**

Construction inspection documentation will be required at the batch plant and at each bridge location during all construction activities including batching, placement, curing and form removal. In addition all environmental conditions should be documented such as temperature, humidity and wind speeds.

## **Research Monitoring**

Research staff will perform on-site bridge deck inspection for a 2 year period after construction to monitor bridge deck cracking and document the performance of each set of bridges.

An inspection will occur immediately after removal of deck forms, one week later, one month later, and every 3 months to the end of the monitoring period. Currently it is assumed digital documentation will suffice but progressive crack maps may be added if applicable.

In addition to Research documentation the Material Bureau's Deck Evaluation Crew will be participating in the inspections as stated above to develop an ongoing deck crack density report.

**Construction Documentation:** Will include information specific to the installation events.

**Post Documentation:** As described in 'Research Monitoring'.

## **Evaluation Schedule**

Research will publish a construction report 3 months after the last deck placement and then quarterly adding to the construction report.

Annual or semi-annual reports is required as well as a final project report (responsibility of Research). A web page will be dedicated to display all reporting from the project.

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| 2014: | Installation/Construction Report                      |
| 2015: | Once a Quarter Inspections/ Annual Evaluation Reports |
| 2016: | Final Evaluation/Final Report                         |