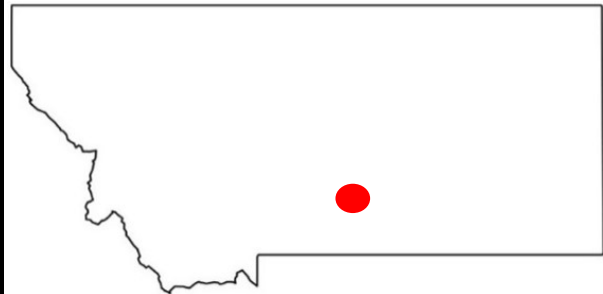
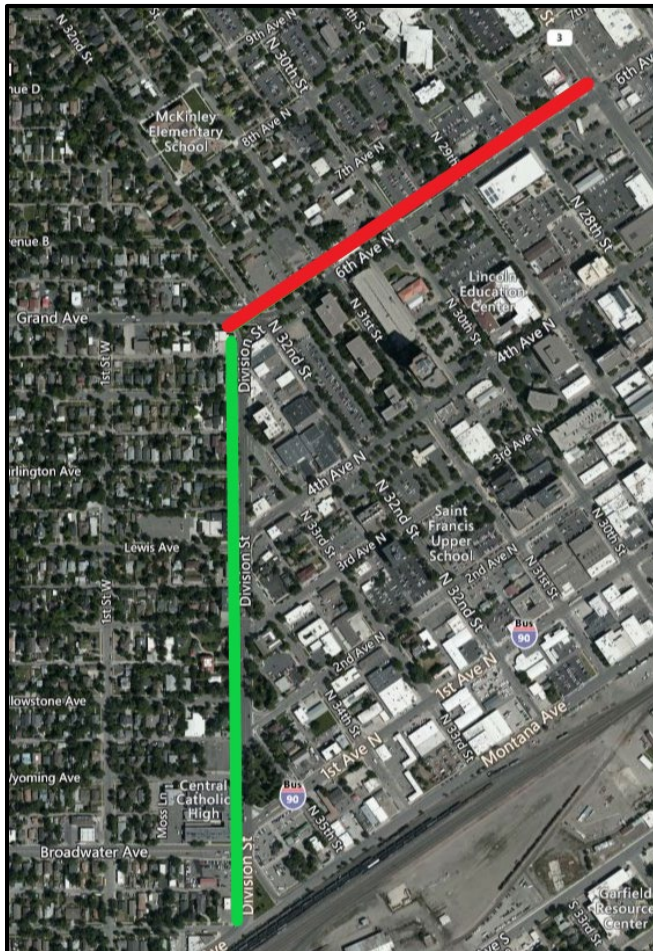


**Experimental Feature Evaluation  
 December 2022**

<b>Experimental Feature:</b>	Ace Fibers in Plant Mix Asphalt
<b>Location:</b>	Billings District, Yellowstone County, City of Billings, Division St and 6 <sup>th</sup> Ave N
<b>MDT Project Name:</b>	Division St – Billings & 6 <sup>th</sup> Ave N – 27 <sup>th</sup> to 32 <sup>nd</sup>
<b>MDT Project Number:</b>	UPPIP 1017(2)7[9003] & UPPIP 1029(4)[9004]
<b>Experimental Project Number:</b>	MT-18-03
<b>Principle Investigator:</b>	Chad DeAustin, Experimental Project Manager, (ExPM)
<b>Construction Date:</b>	July 2018
<b>Date of Inspections:</b>	April 2019, April 2020, May 2022

**Project Map**



- / 6<sup>th</sup> Ave – 27<sup>th</sup> to 32<sup>nd</sup> section
- / Division St – Billings section

## Feature Description & Outline

Surface Tech is vendor for the Ace Fiber (pre-treated aramid fibers coated with Sasobit wax) used in the production of fiber reinforced asphalt cement, FRAC. Surface Tech was on site during construction to monitor the inclusion of the Ace Fiber during AC production. Surface Tech also provided the Ace Fiber Line-Vac delivery system which is the device that introduces the fibers into the drum. It is estimated that over 18 million fibers are dispersed for each ton of mix providing 3-dimensional reinforcement. The intent of these fibers is to improve resistance to cracking and rutting while providing a higher dynamic modulus and increased service life.

Because untreated aramid fiber is a very lightweight and difficult material to work with, the fibers are soaked in a wax binder. This pre-treatment adds weight to the fiber clips and prevents them from blowing away or clumping during the delivery and feeding process. If untreated with the wax, fibers do not distribute evenly in the mixing process.

The reinforced asphalt cement was produced by Knife River – Billings in their Gencore Ultraplant 400. The plant mix on this project is specified as a 3/8" mix.

## Evaluation Procedures & Schedule

The measures of effectiveness (MOE) prevalent with this project will focus on:

- Construction practices (constructability, construction time, cost effectiveness, etc.),
- Visual inspection of the plant mix,
- Ride and rut data evaluation.

In accordance with MDT's Experimental Features Procedures, the Experimental Project Manager will monitor and report on performance for a minimum of five years annually. This includes delivery of a work plan, construction report, annual reports, and final project report.

2018: Installation/Construction Report  
2019-2022: Annual Inspections/Evaluation Reports  
2023: Final Evaluation/Final Report

A dedicated [webpage](#) will display all reporting from the experimental feature.

**2022 Update – May**

The surface shows little change from previous visits. There is surface wear but that is expected on a highly urban route. There were a few cracks found using the Pathweb web application but not seen during the site visit.



↑ Division St and Burlington Ave, view north.



↑ Close-up of surface on Division St.



↑ 6<sup>th</sup> Ave N and N 31<sup>st</sup> St, view west.



↑ Close-up of surface on 6<sup>th</sup> Ave N.

## Construction Documentation – July 2018



← The Ace Fiber arrive on-site at the hot plant packed in 40 lb. cardboard boxes which will produce approximately 153 tons of FRAC.



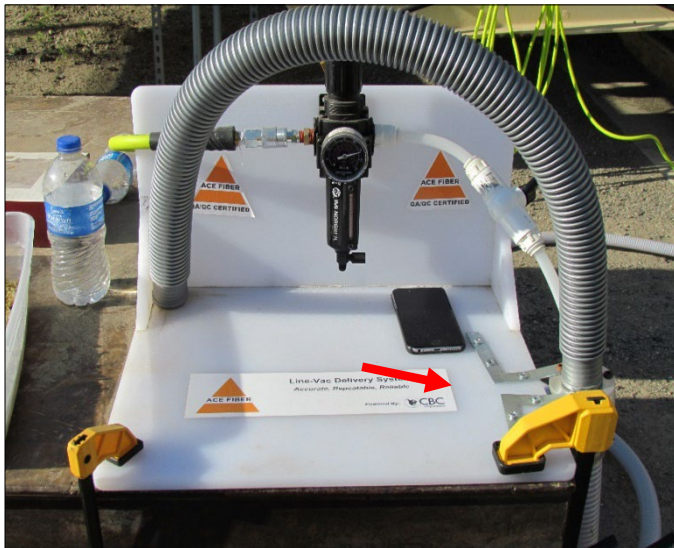
← The wax treated aramid fibers (known as clips) are approximately .75 inch (19mm) in length. With a fiber tensile strength of 400,000 psi and fiber melting temperature of 800F (427C). Each clip contains over 10,000 individual aramid fibers.



← The clips are soaked in Sasol Sasobit (a synthetic hard wax). Each clip by weight, contains 50% wax and 50% fiber, with a wax melting point of 216F (101C). The wax application gives the fiber the needed weight to adequately be distributed into the mixing drum. As the Sasobit wax melts, it allows the dry fibers to disperse evenly into the asphalt and aggregate mix.



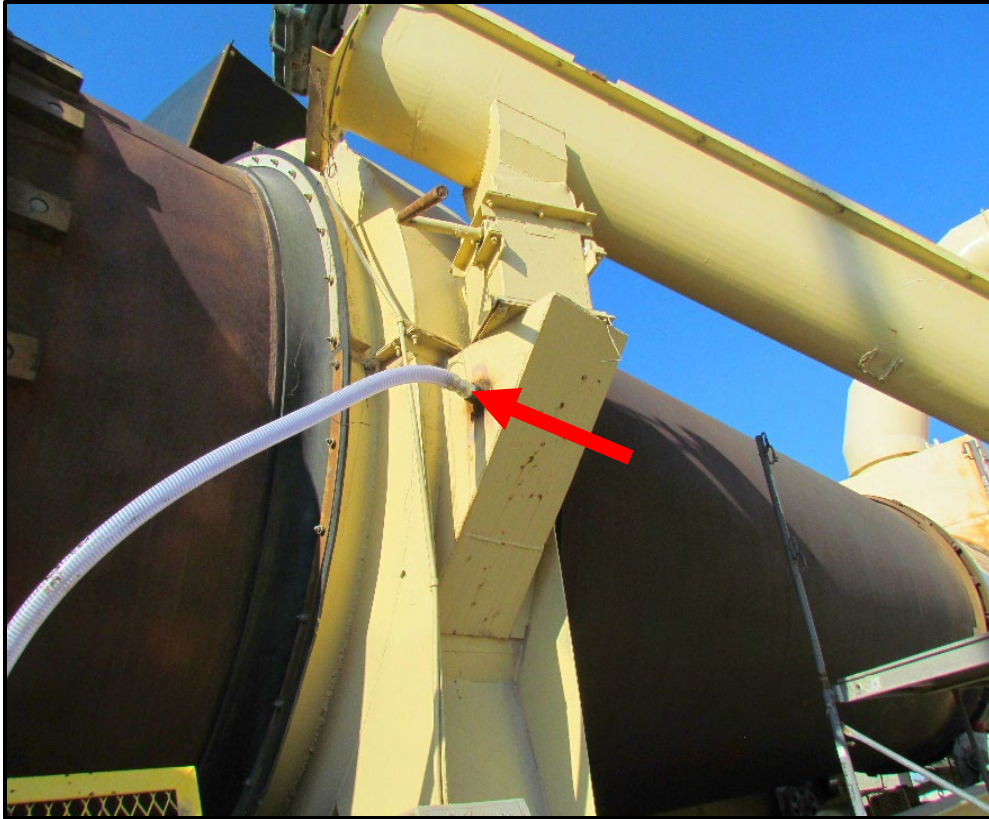
← Overview of the Ace Fiber Line-Vac Delivery System (LVDS) set-up near the hot plant mixing drum. Based on a production rate of 280 tons per hour fiber insertion (or goal) would be at an application rate of 19.6 oz. per minute (based on a 4.2 oz. per ton). Each tub would hold 19.6 oz. with four tubs on deck ready for production.



← A close-up view of the Ace Fiber LVDS set-up. The iPhone acts as the timer for the technician to ensure each tub is metered in at the one-minute per tub application rate.



← The pilot house personnel give the technicians the go ahead to begin vacuuming the pre-weighed fibers from the tubs. Suction is generated by using an Exair compressed air powered (in-line) vacuum generator. The air pressure is regulated at 125 psi.



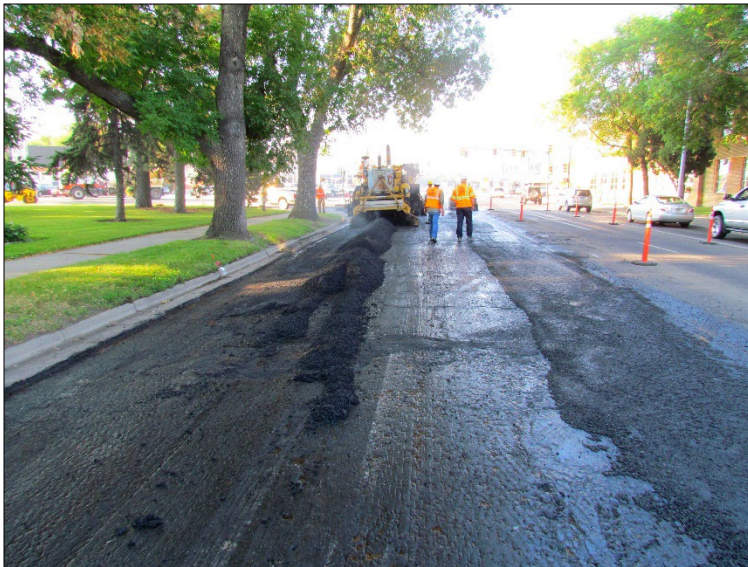
↑ Per Surface Tech's recommendation, Knife River modified their baghouse return chute with an adapter to accept the fiber vacuum hose. This added the fibers to the aggregate at the same point as the asphalt binder.



↑ After milling, several sections of pavement needed full depth replacement.



← Division St, view north. Representative image of the paving phase. The paver operators stated no perceived issues with the altered PMS during the paving process. Workers handling rakes at the paving edges did state the mix felt somewhat sticky.



← Additional image of FRAC paving on Division St, view south. Note the area to the right in the image which required a patch after milling. It was stated that all sections repaired prior to paving included the fiber reinforcement.



← Double steel drum rollers were used for compaction.





↑ Close-up of uncompactied FRAC. The fibers were not noticeable in the mix, however if you handled and separated the aggregate, the fibers were visible.



↑ Compactied FRAC.



↑ Representative image of the completed project. 6<sup>th</sup> Ave N, view west.

Preconstruction Documentation – May 2018



↑ Representative pavement distress in areas on Division St. of fatigue cracking (view south near Lewis Ave).



↑ Heavy rutting at the intersection of Division St. & Broadwater Ave. (view south).



↑ Pavement distress on 6<sup>th</sup> Ave N. specifically fatigue cracking and previous patching (view west).

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