Montana Department of Transportation
Research Programs
April 2020

INSTALLATION REPORT AND ANNUAL EVALUATION

The Use of 3D Synthetic Geocomposite for Added Subsurface Drainage Layer in Asphalt Cement (AC) Pavement

Location: Gallatin County/Butte District: State Highway 287 (P-87), R.P. 6.81-6.95

Project Name: Jct. Raynolds Pass - Quake Lake

Project Number: STPP 87-1(11)0

Experimental Project: MT-15-02

Project Description: Geocomposite Application

Principal Investigator: Craig Abernathy, Experimental Program Manager (ExPM)

Date of Construction: September/October 2016

Date of Inspections: April/August 2017-April/October 2018/May 2019 & April 2020

Objective

The project is located on US 287 (P-87) in Madison and Gallatin Counties, from the junction with Montana Highway 87 (P-13) approximately 7.0 miles to southbound, toward West Yellowstone. Work to be performed includes cold milling, plant mix surfacing, seal and cover, guardrail installation, dig outs, and signing and pavement marking.

The section of Highway 287 in question (R.P. 6.81-6.95); as of four years ago had deteriorated to the point a dig out was performed and treated using usual methods of rehabilitation, (geotextile, special borrow, CAC, PMS). The section has failed, and the Department has initiated to install a synthetic subsurface drainage layer (SSDL), under the assumption that water retention within the pavement layers deteriorated the structural base course contributing to the premature failure of the pavement.

The Department has elected to install **Tensar RoaDrain 5 (TD-5)** as an experimental feature in this project. The following link directs you to the products information page:

http://www.tensarcorp.com/Systems-and-Products/Roadrain-roadway-drainage-system

This report and other project information located:
http://www.mdt.mt.gov/research/projects/roadrain.shtml

Experimental Design

The project will involve the installation of the RoaDrain 5 geocomposite on an approximate 700 ft. (0.13 mile) section of roadway. The graded slope will have an 8" perforated HDPE pipe installed edge drain to aid in the SSDL system.

At R.P. 6.41 to 6.59 another dig out with similar subsurface characteristics will be constructed with conventional practice. This will be added as an informal performance control to the RoaDrain section.

Construction Documentation: The Research Section will document the construction methods, activities and equipment, material placement, weather, and specification conformance etc.

Post Documentation: Will entail semi-annual site visits/inspections of the section for visual documentation for inclusion into the annual and final reports; in addition to include any maintenance activities associated with the surface or base treatment during the analysis timeline.

Evaluation Schedule

Research will monitor and report on performance for a minimum period of five years annually, with every year up to *ten years (informally). This is in accordance with the Department's "Experimental Project Procedures". Delivery of a construction/installation report, interim, 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.

2016:	Installation/Construction Report
2017-2020:	Semi-Annual Inspections/ Annual Evaluation Reports
2021:	*Final Evaluation/Final Report

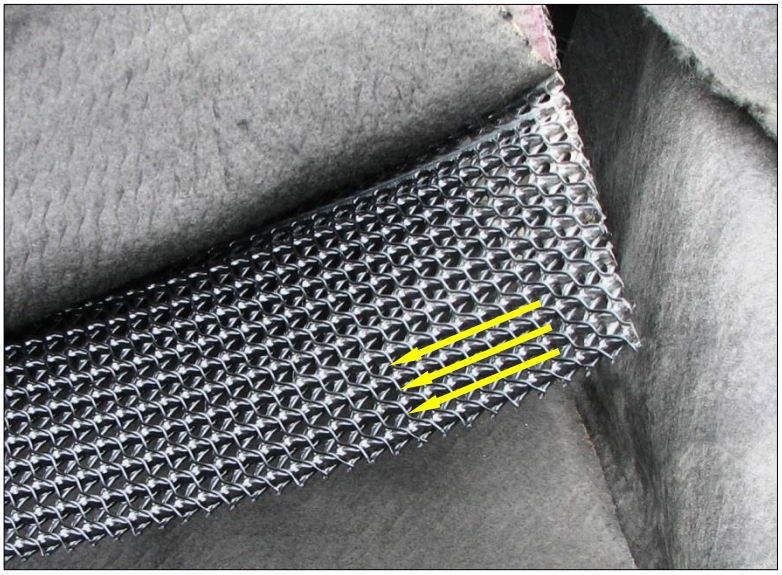
*If considered the extra data collection and analysis will add value to the overall results of the project the evaluation schedule may be extended.

The purpose of an experimental projects report is to document the phases and events of any given experimental feature to provide the reader with an understanding of the specific activities required to install or incorporate the research element into an active construction or maintenance project. This report also establishes a baseline for defining performance for any given feature under actual service conditions to determine its relative merits.

The following images depict the general practice of applying the RoaDrain SSDL and ongoing performance documentation. Other than stated in this report no issues were reported during construction which may affect the performance of the geosynthetic.

September 2016: Project Installation

← The RoaDrain SSDL arrives on site in stacked rolls which are approximately 12.75' (3.9m) in width, and in a pre-cut length specified to transverse the necessary roadway, shoulders and edge drain.



← The SSDL has a tri-planer geonet core with a non-woven geotextile (or fabric) that is laminated (heat welded) to the top and bottom of the core.

Here the fabric is peeled back to expose the core construction.

Although difficult to see; the construction of the core creates a channel conduit which runs perpendicular to the placement in the roadway offering a path of least resistance to moisture migration (yellow arrows).

← Beginning with the northbound lane, the subgrade was excavated to an average depth of 40" (102cm), view south.

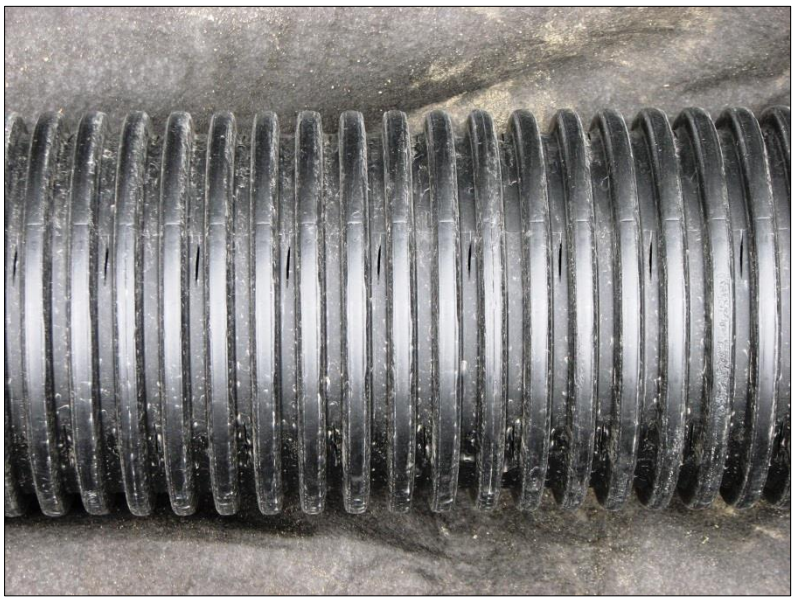
The edge drain may be seen at the left of the image (yellow arrow).

🡸 Geotextile lined ditch with 8" (20cm) corrugated perforated plastic pipe.

Northbound lane; view north.

🡸 Aggregate used to cover the drainpipe was 1.5" minus.

Several static passes of a steel drum roller were used to smooth the exposed base.



🡸 Close-up of eight inch (8") corrugated perforated drainpipe within the lined edge drain trench.

🡸 The contractor applied a paint line to mark the starting edge of the first section of SSDL.

The SSDL was laid directly on the subgrade.

🡸 The SSDL is rolled out and the leading edge is placed directly over the edge drain.

🡸 The geosynthetic lining the trench is placed over the SSDL.

🡸 The fabric filters (top and bottom) are set wider than the drainage core to ensure ample length for an effective overlap seaming of the subsequent adjacent rolls (yellow arrow).

🡸 With direction from the vendor's representative, the SSDL segments were alternately placed at a required spacing during installation in order to allow the cores to be butted together; and to have the bottom fabric layers completely cover the base.

🡸 Here the SSDL is correctly laid as to insure butted cores on both sides of the roll.

🡸 The contractor overlaps the bottom fabric layers and to create the core seams.

This procedure maximizes the drainage properties of the SSDL units.

← Another image depicting the contractor's effort to ensure the core sections are butted and the fabric is sufficiently overlapped at the bottom and top of the core seam.

← To prevent movement and maintain alignment during fill placement; high–strength spray adhesive is applied at the seam overlap.

The insert below is a cross-section depiction of the butted cores and overlapping of fabric seams to the individual sections of SSDL.

🡸 After the first three sections of SSDL are placed, the contractor begins to apply the first lift of crushed aggregate course (CAC or special borrow); view north.

🡸 SSDL segments are continuously installed throughout the northbound portion of the project.

🡸 The northbound SSDL placement is almost complete (view south).

Two lifts of CAC were applied at approximately 1.5' (.46m); the material was placed with a loader and spread with a tracked dozer.

🡸 Excavation of the southbound lane beginning on the north end.

Once excavation is complete, the SSDL will be rolled out to be butted and seamed jointly, as done in the northbound lane.

🡸 Almost completed southbound installation.

In addition of using spray adhesive to keep the SSDL seam sections aligned prior to the cover material, piles of aggregates were used as well.

🡸 The SSDL was cut to the proper length in relationship to the roadbed approximately as seen by the red dash line.

🡸 To prevent possible migration of sediment into the core of the SSDL, a section (or cap) of geosynthetic fabric was folded under and over the edge prior to placement of the CAC.

The southbound fill (CAC) was applied in the same manner as the northbound section.

🡸 The edge drain outlet (located at the south end of the northbound lane), was completed by attaching a non-perforated corrugated pipe angling away from the roadbed.

🡸 Completed edge drain. The drain outlet was capped with a wire mesh to prevent animal intrusion.

Several weeks after the completed project, water was observed trickling out of the drain.

The design of the SSDL into the section also considers possible water migration from the north side toe slope to the edge drain (see page four); basically, an attempt to capture all water sources that may infiltrate the roadbed.

⬇ **Completed project**: Top image is view south; bottom image is view north.

Site inspection: April & August 2017

Shot of project section in April; visually the pavement surface is tight with no visible distress to report to date (view north).

Note: Although difficult to see in this image, the pavement section outlined in red did have a slight rise (or bulge) due to perceived frost heave.

Shot of project section in August, a seal & cover has been applied; the small section of frost heave as seen in the April site visit has receded with no (visual) detriment to the pavement surface (view north).

Inspection of the drain outlet at the south end of the project (in April and in August) had no noticeable water exiting the pipe.

Site inspection: April 2018

← ↓ Representative images of pavement section condition; views east and west respectively.

No additional distress to report during this inspection.

Site Inspection October 2018

🡸 🡻 Representative images of pavement section condition; views east and west respectively.

No additional distress to report during the fall inspection.

Site Inspection – May 2019

🡐 🡓 Representative images of pavement section condition; views east and west respectively.

🡅 Although difficult to see in this image there are several pronounced undulations in the roadbed with the red arrow pointing to the most noticeable.

This distress is located midway of the project as first documented in April 2017 (view west).

🡄 The red arrow in the above image points approximately to a medium-severity transverse crack seen at left.

This heave area was outlined on the pavement by four yellow sprayed boxes (black arrow).

Site inspection: April 2020

← Representative image of project during 2020 inspection. East end, view west.

← West end of project, view east.

↑ No additional distress to report since the May 2019 site evaluation. Next inspection will take place in spring of 2021.

Supplemental: Heat Damaged SSDL and Subsequent Repair During Installation

← One of the SSDL rolls was found to have a factory defect where the filter fabric has melted and exposed the geonet core.

Inspecting the SSDL determined the defect at the top layer of fabric only, and the bottom layer was not affected.

←Close-up of melted fabric layer and exposed core.

← Per manufacturers instruction, the repair is to cut a section of geosynthetic (the same fabric that was used to line the edge drain and to cap the edge of the SSDL), to a width approximately 3' to center over the defect.

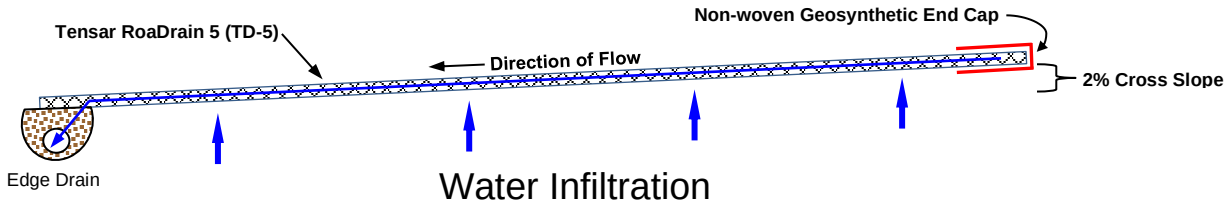
Prior to the placement of the fabric patch, spray adhesive is applied to prevent movement of the patch during the application of the CAC.

← Additional adhesive is applied to the edge of the patch.

Supplemental: Exposed Excavation of Previous Fix

🡸🡻 Southbound excavated cross-section of roadbed; two photo examples of the previous repair constructed several years ago.

Cross Section of RoaDrain Design Properties



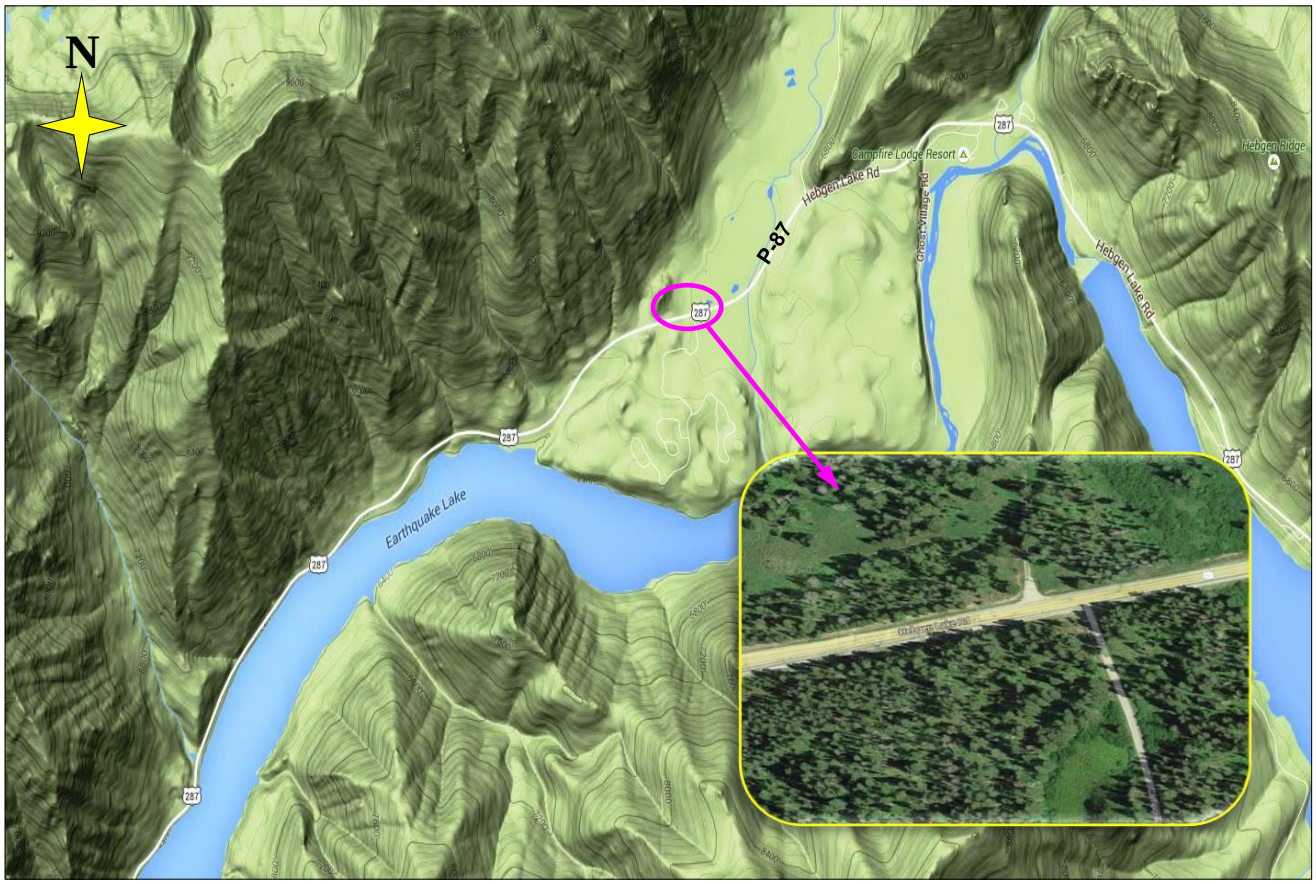
The illustration describes the basic intent of the RoaDrain SSDL:

As subsurface water migrates through the filter fabric and into the geonet composite core; with the excavated base at a cross slope approximately 2%, channels the moisture to the path of least resistance to the edge drain and funneled down-slope to the drain outlet.

The edge of the SSDL away from the drain is covered (or capped) by a section of geosynthetic fabric (as seen in the diagram as a red box) to prevent any intrusion of sediment which may clog the internal channels of the core.

Project Location

Gallatin County: State Highway 287 (P-87); Approximate Reference Point 6.81-6.93



Disclaimer

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Data resulting from an in-service evaluation of a submitted product or procedure is public information and will not be considered privileged. The MDT may, at its discretion, release all information developed during and after an evaluation.