Child Street
16 State House Station
Augusta, Maine 04333

Maine Department of Transportation

Transportation Research Division

Experimental Construction Report ME 00-20
First Year Interim Report on Experimental Utilization of Tire Shreds to Enhance Highway Drainage
June 2001

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Introduction

In the summer of 2000 shredded tires were used in an experimental project on a full highway reconstruction project in the town of Rome. Shredded tires were used to construct a subgrade French drain in the ditch profile. The picture at right shows the completed ditch and shoulder area during the spring of 2001. The French drain is located beneath the riprap on the road side of the ditch.

The shredded tires were installed in part to see if the insulating value of the material would prevent ice buildup in the subsurface drain. Highway drainage structures frequently get plugged with ice during winter. This poses problems especially during spring runoff when the need for improved drainage is greatest. Shredded tires have been shown to reduce frost penetration in some highway applications. If the insulating properties could be used to prevent water from freezing in a subsurface drain the drain, then the material could promote drainage, decrease erosion, increase highway life and decrease maintenance costs.

During construction of this project, temperature sensors (thermocouples) were installed in several locations within the drain to monitor temperatures; the goal being to determine if temperatures approach the freezing point. In addition, two monitoring wells were constructed in which water levels can be measured during the springtime period when runoff occurs.

Construction details are described in a construction report dated December 2000. During the spring of 2001 temperature readings and water levels were measured and the overall performance of the drainage system was evaluated. This report presents the initial set of observations. Monitoring will continue for several years. Future data will be published in a final report after monitoring is completed.

> *During spring of 2001 freezing temperatures did not occur within the French drain profile. In addition, water levels in the drain range from a low of 0.17 feet up to almost 2 feet. The estimated flow out of the drainage system including both intercepted subsurface flow together with surface runoff ranged from 1 gpm to 35 gpm (estimated not measured).*

Monitoring

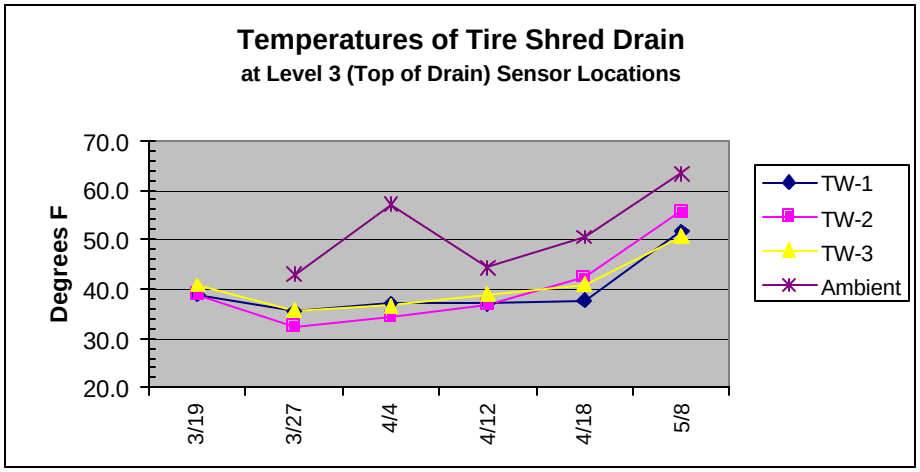
In the photo at right, the arrows indicate the riser pipe and the thermocouple leads. The riser pipe can be seen at the far right. The wire thermocouple leads, which are normally stored inside the riser pipe have been pulled out and are just visible leading towards the road. A handheld digital thermometer was used to record the ground temperatures

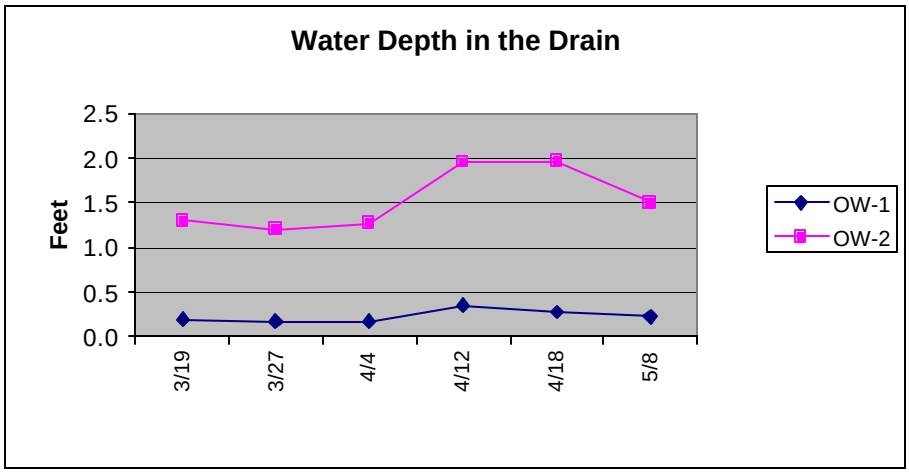
The photo at left shows the cross culvert and outfall at the end of the French drain.

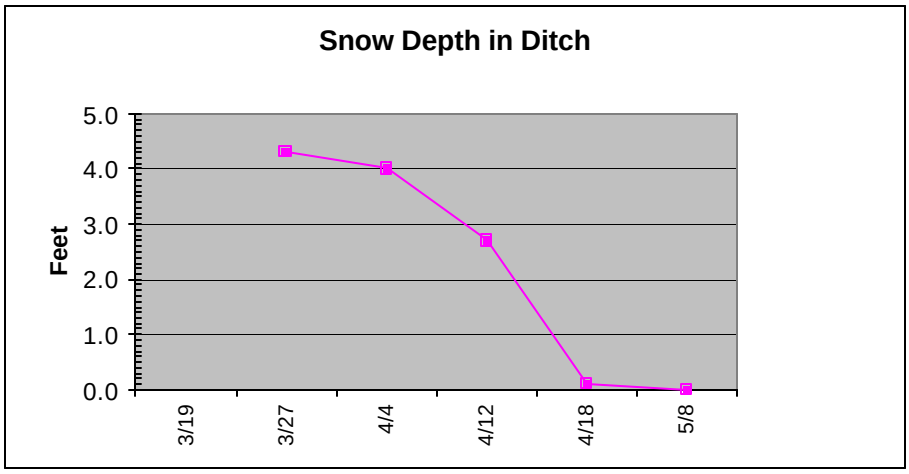
This cover photo of this report shows the ditch and the cross culvert inlet at the lower end of the experimental section. In that section the water level in the drain at OW-2 was almost 2 feet. This represents significant storage capacity. The photo taken on April 12, 2001.

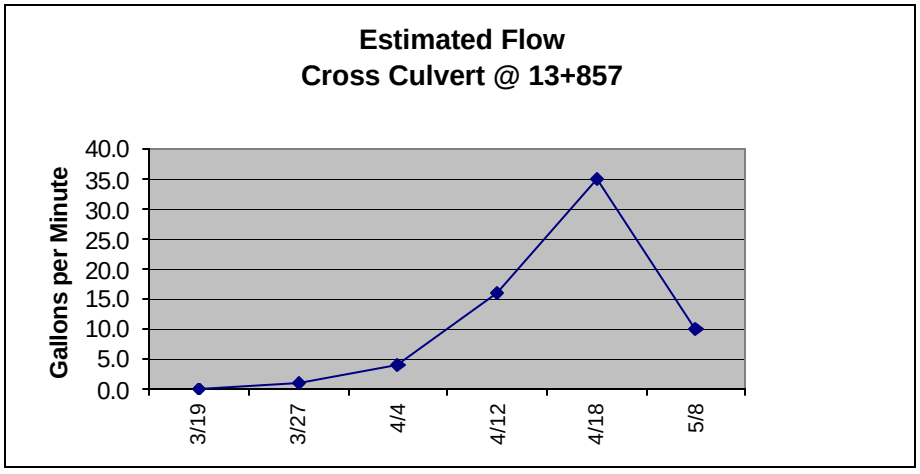
Discussion of Results

The results show that the drain performed very well during the past spring. The temperatures within the drain never reached the freezing point, a large amount of water flowed from the system. The large amount of snowfall may have help prevent ditch freezing due to the insulating effect of the snowpack. Groundwater geologists have reported that in many areas of Maine the ground never really froze this past winter due to the snow depth. The unfrozen ground more easily absorbed water from the melting snow. In this regard this past spring may not have been a representative winter and spring from an evaluation standpoint. One of the main goals of this experimental construction technique is to see if the tire shreds will prevent freezing, thereby preventing ice formation and clogging during spring runoff. Weather conditions this past spring did not present the kind of conditions to really test the effectiveness of the system. Future monitoring will yield additional information during a variety of weather conditions. The following series of charts graphically show the results.




Water Depth in the Drain
Feet
2.5
2.0
1.5
1.0
0.5
0.0
3/19
3/27
4/4
4/12
4/18
5/8
OW-1
OW-2


Snow Depth in Ditch
Feet
5.0
4.0
3.0
2.0
1.0
0.0
3/19
3/27
4/4
4/12
4/18
5/8


Estimated Flow
Cross Culvert @ 13+857
Gallons per Minute
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
3/19
3/27
4/4
4/12
4/18
5/8

Experimental Construction Project 00-20
Rome Route 27 Tire Shred French Drain
Temperature (°F) & Water Level Data (ft.)

	TW-1			OW-1	TW-2			TW-3			OW-2				
Date Spring 2000	1	2	3	Depth (ft.)	1	2	3	1	2	3	Depth (ft.)	Ambient Air Temp.	Weather	Snow Depth (ft.)	Estimated Flow @ Sta. 13+857
Mar.19	37.5		38.8	0.19	38.6	38.7	38.9	40.1	41.0	40.8	1.30		Sunny		N/A
Mar. 27	37.7		35.5	0.17	34.9	33.1	32.4	35.5	35.2	35.6	1.20	43.0	Sunny& Breezy	4.3	1.0
April 4	38.0		37.1	0.17	37.4	35.4	34.3	38.5	37.5	36.6	1.27	57.2	Sunny	4.0	4.0
April 12	37.9		37.0	0.35	39.8	39.1	36.8	38.3	38.8	38.9	1.95	44.3	Cloudy w/Showers	2.7	16.0
April 4	38.8		37.7	0.28	40.6	41.6	42.5	39.4	40.7	41.0	1.96	50.5	Overcast & Breezy	0.1	35.0
May 8	47.4		51.7	0.22	47.5	50.1	55.7	49.7	50.3	50.7	1.50	63.4	Sunny	0.0	10.0

Notes 1. TW indicates a thermocouple well. OW indicates an observation well.
2. At TW-1 temperature readings were eliminated due to a defective sensor installation.
3. Thermocouple sensor vertical positioning is as follows: No. 1 is positioned near the bottom of the drain, No. 2 is near the approximate middle of the drain, and No. 3 is near the top of the drain and just below the stone riprap.
4. Water flow at Sta. 13+857 are visual estimates and not measured values.

Prepared by:

William Thompson

Transportation Planning Analyst

Reviewed By:

Dale Peabody

Transportation Research Engineer

Other Documents Available:

Construction Report March 2001