# TECH NOTE: CRAFS™ RESULTS FROM NTPEP-SRD TEST PROGRAM - 2016

The National Transportation Product Evaluation Program (NTPEP), in cooperation with test labs at TRI and TTI, and members of the sediment retention device (SRD) manufacturing community hosted a pilot testing program in 2016 to assess current large scale testing facilities and test methodology. The program intent was to provide the Erosion Control Technical Committee within the NTPEP additional data for determination of appropriate evaluation processes for the SRD products as part of the larger Erosion Control Testing and Audit Program managed through NTPEP. CRAFS™ was included in that program, and we gained documented "proof of performance" for the product with several valuable extra bits of information from the tests.

Preliminary testing while developing the CRAFS™ product and technology provided "proof statements" that showed the "corrugated retention and filtration system" provides 3 to 4 times faster filtered seepage of sediment runoff retained than does a traditional linear silt fence. The reason, CRAFS™ structures provide much more surface area of its filter fabric adjacent to the sediment runoff it retains. (See: 6-15-13 CRAFS vs Linear RAFS-Time for Filtered Seepage)

NTPEP-SRD tests at TRI provided test results proving that CRAFS™ will greatly reduce soil loss from one rainfall-induced event that provided from moderate to extreme conditions of sediment runoff . A summary of tests' data is presented in the attached documents. (See: NTPEP SRD Pilot Project TEST METHOD FOR DETERMATION OF SEDIMENT RETENTION DEVICES (SRDs) PERFORMANCE lN REDUCING SOIL LOSS FROM RAINFALL-INDUCED EROSION DURING PERIMETER CONTROL APPLICATION - Results Including SRD Retention Efficiency [Ret Eff])

If you're interested in using the "Cummulative R Factor" and the "Average P Factor" measured by the test for CRAFS™ for calculating sediment loss estimates for a project site, the factors needed are in that table. But if you're interested in the filter efficiency of CRAFS™ and to learn some of the extra performance benefits of that SRD preventing sediment contamination downstream, you need to have seen the tests while running or at least look at the photos closely and read-on.

**CRAFS™ Stability**
he structural stability of the system's corrugated system resisted the severe stresses caused by all the rainfall events created in the test … CRAFS™ had no problems maintaining vertical stature and the system's retention and filtration capabilities, regardless of the severity of rainfall event tested and the total duration of the each test !

**CRAFSTM Filtration Efficiency**
Results from this test method didn't include the SRD Filtration Efficiency. But the "Average P Factor" calculated is defined as …

**Cumm Soil Loss for SRD / Cumm Soil Loss for Control (i.e., soil loss of un protected surface)**

A simple calculations from the results provided will yield retention efficiencies throughout the test's duration, for the 3 test set ups, each with 3 rainfall events from moderate to severe.

**CRAFS™ Average Retention Efficiency measured in this test program = 95%.**
Note that the CRAFS™ retention efficiency varied form 86% to 98% with the various rainfall intensities. And all retention efficiencies were significantly greater than 90%, except for Plot Slope 1 / Intensity 4.02 in/hr. That's because a gap formed between the edge of the CRAFS™ unit and the side wall of the test flume, and a visibly obvious "momentary "piping failure" was noticed to occurred around the retention unit. But the piping failure experienced a self-healing phenomena, thanks to the "Divides and Distributes" function discussed as a CRAFS™ performance benefit (read on to: CRAFS™ Divides and Distributes … Impedes Progression of Localized System Failures )

**Total Dewatering Time for Retained Sediment Runoff**
A "short coming" of this test method was, it did not record "total retention time required for dewatering the retained sediment runoff". However, CRAFS™ 's rapid filtered seepage prevented any long durations of ponded runoff upstream of the SRD that could lead to system instability and failure caused by retained runoff.

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The best indication of filtered seepage rate of CRAFS™ in these tests was the level of the retained runoff on the upstream side of the system as seen in the photo documentary. Even under the heaviest rainfall event, the level of runoff upstream of the CRAFS™ structure was less than half its total height. Note that slow filtered seepage rates through a traditional silt fence are the cause of frequent overflow and knock down failures experienced .
( See 6-13-16 NTPEP-SRD Test Retained Water Below Half CRAFS™ Height

**CRAFS™ Divides and Distributes ... Impedes Progression of Localized System Failures**
One of the many performance benefits of the CRAFS™ structure is that it divides and distributes the sediment runoff it retains into multiple adjacent retention and filtration wedges. These "wedges" are structurally connected at their upstream vertexes. But the runoff retained within each wedge cannot flow or seep into the adjacent wedge. In that regard, they function independently of one another, so each "wedge" fares its share of the entire system's retention and filtration performance. This division and distribution greatly expedites the filtered seepage process.

An unforeseen benefit from the CRAFS™ wedges is "reduced impact of localize failures in the sediment retention system. If a failure due to knock down or scour beneath occurs in one location of the silt fence, all the retained sediment runoff upstream of the silt fence will flow towards and escape through the outflow location. So a localized failure means a total system failure for all the adjacent segments of that same silt fence system.

If there's a localized failure within one of the CRAFS™ independent retention wedges, the escape of retained sediment runoff is limited to that single retention wedge and what it has retained. So a localized failure doesn't automatically progress into a "total system failure" ! That's a BIG BENEFIT for preventing sediment contamination downstream caused by system failures.

Note that all SRD need routine inspection to correct problems that result from failures. But when CRAFS™ can restrict the extent of a system failure to a very limited segment, that can eliminate progressive failure within the entire sediment control system, and give time for corrective measures to resolve the problem.

**The tests run on CRAFS™ at the TRI facility in Anderson, SC did not provide any side by side tests of other SRD included in this program. So there's no visual comparative performance between different SRD tested. The final report on the NTPEP-SRD Test Program should provide some generic representation of those results.**

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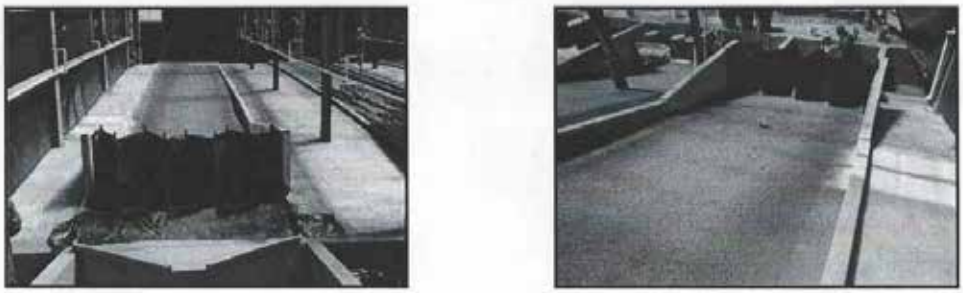
# TECH NOTE: CRAFS™ RESULTS FROM NTPEP-SRD TEST PROGRAM - 2016

NTPEP
AASHTO | NATIONAL TRANSPORTATION PRODUCT EVALUATION PROGRAM

CRAFS Silt Fence System
NTPEP SRD Pilot Program
July 13, 2016

## TYPICAL TESTING PICTURES - SLOPE 3



Slope Prepared and SRD Installed

After 2 in/hr Event

After 4 in/hr Event

After 6 in/hr Event

**Note the water levels upstream of the CRAFS™ structure during each rainfall event. Despite the torrential downpour in the 6"/hr rainfall event, CRAFS™ provided rapid filtered seepage that never allowed the retained runoff to get above "half height" of the vertical filter fabric in its corrugated structure. After the last rainfall event, the system was structurally stable and ready to deal with the next severe downpour !**

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## SLURRY FILTRATION TESTS

### Time Required for Total Filtered Seepage ... Linear RAFS Versus Corrugated RAFS

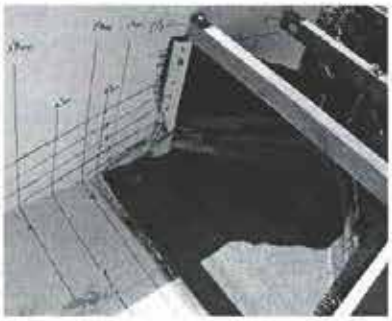
5a) Slurry Filtration Test – Linear RAFS
Immediately following slurry impact

5b) Slurry Filtration Test – CRAFS
Immediately following slurry impact

6a) Slurry Filtration Test – Linear RAFS
1 Hour after initial slurry impact

6b) Slurry Filtration Test – CRAFS
1 Hour after initial slurry impact

7a) Slurry Filtration Test – Linear RAFS
Retained sediments after fluid drainage complete (>4 hours)



7b) Slurry Filtration Test – CRAFS
Retained sediments after fluid drainage complete (~74 minutes)

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# TECH NOTE: CRAFS™ RESULTS FROM NTPEP-SRD TEST PROGRAM - 2016

NTPEP SRD Pilot Project

TEST METHOD FOR DETERMATION OF SEDIMENT RETENTION DEVICES (SRDs) PERFORMANCE IN REDUCING SOIL LOSS FROM RAINFALL-INDUCED EROSION DURING PERIMETER CONTROL APPLICATION

Results Including SRD Retention Efficiency (Ret Eff)

Test Date: 6-8-16

Rainfall Rates (Intensity): 2, 4, & 6 in/hr (target)

Bed Slope (flume): 3 to 1

Event (of reinfall): 20 minutes per intensity (rate) … (X 3 events per test = 60 minutes per total test)

Product: CRAFS (Corrugated Retention & Filtration System)

| Plot | Intensity (in/hr) | Runoff (galllons) | Cumm. R Factor | Soil Loss (lbs/plot/event) | Turbidity (NTU's) | Cumm. Soil Loss (T/A) | Average P Factor | Ret Eff (%) (1) |
|---|---|---|---|---|---|---|---|---|
| | 2.09 | 10.66 | 6.97 | 0.406 | 312 | 0.028 | 0.02006 | 98 |
| Slope 1(2) | 4.02 | 106.07 | 51.16 | 20.570 | 2558 | 1.429 | 0.14127 | 86 |
| | 5.91 | 160.28 | 159.4 | 12.410 | 1888 | 2.274 | 0.07217 | 93 |
| | | | 6.97 | | 9999 | 1.378 | | |
| Bare Soil Controls | | | 51.16 | | 9999 | 10.115 | | |
| | | | 159.4 | | 9999 | 31.513 | | |
| | 2.05 | 11.84 | 6.69 | 0.448 | 413 | 0.031 | 0.02306 | 98 |
| Slope 2 | 4.21 | 119.92 | 54.35 | 9.514 | 1673 | 0.679 | 0.06316 | 94 |
| | 6.38 | 178.98 | 179.98 | 8.160 | 1370 | 1.234 | 0.03469 | 97 |
| | | | 6.69 | | 9999 | 1.323 | | |
| Bare Soil Controls | | | 54.35 | | 9999 | 10.745 | | |
| | | | 179.98 | | 9999 | 35.583 | | |
| | 2.13 | 11.04 | 7.26 | 0.394 | 744 | 0.027 | 0.01871 | 98 |
| Slope 3 | 4.13 | 102.91 | 53.99 | 9.784 | 2262 | 0.693 | 0.06496 | 94 |
| | 6.34 | 199.17 | 177.82 | 15.170 | 1345 | 1.727 | 0.04912 | 95 |
| | | | 7.26 | | 9999 | 1.435 | | |
| Bare Soil Controls | | | 53.99 | | 9999 | 10.673 | | |
| | | | 177.82 | | 9999 | 35.155 | | |

FOOTNOTES:

95 Avg Incld (2)
96 Avg w/o (2)

(1) "Ret Eff (%) = Retention Efficiency (minimum) for the NTPEP-SRD Tested …
Ret Eff (%) = 100% - (Avg P Factor X 100) = 100% - [(Cumm Soil Loss for SRD / Cumm Soil Loss for Control)X100]

(2) During the runoff event on Slope 1 at rainfall "Intensity (in/hr) = 4.02" …
an extreme soil loss cavity developed momentarily, then self healed, between the flume wall and the CRAFS™ structure … Effluent Turbidity (NTU), Cumm Soil Loss, and Average P Factor as well as Ret Eff (retention efficiency) all reflect the SRD system performance anomoly.

**NOTE: All other data from the Slope 1 Test Run as well as the entire Test Runs in Slope 2 & Slope 3 show comparable "acceptable" performance results for the SRD tested.**