U.S. Department of Transportation
Federal Highway Administration

Hydrologic & Hydraulic News


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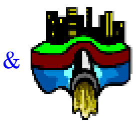

January 2016
Vol. 4, Issue 1

Exploring Change

By Veronica Ghelardi, Federal Lands Hydraulic Discipline Lead

As many of you know, Federal Highway Administration's Federal Lands' offices design and construct transportation projects historically for Federal agencies. In the last 4-5 years, Federal Lands' partnering agencies have changed dramatically. Under Map-21 Congress reduced the National Park Service program and the Forest Highway Program; our bread and butter programs for decades. Congress directed Federal Lands to work with local agencies under the Federal Land Access Program (FLAP). Many counties had never worked with the Federal government before and Federal Lands had to learn to work with new funding sources and partners. These partners require a new way of doing business that is less expensive, quicker to design, and still based on sound engineering judgement.

In 2013 Colorado experienced devastating floods which destroyed multiple roads. The state of Colorado and two counties asked Central Federal Lands (CFL) to help with the design and re-construction of 3 roads with very short timelines.

In order to meet those timelines, CFL used an alternative project delivery method, which integrated the CFL design and industry construction efforts. CFL's cross functional team (CFT) modified the way it functioned and designed the project. The selected contractor bid a "seed" project and started construction while the CFL design progressed. The contractor was also enlisted during the design to provide industry knowledge that met the project goals and resulted in a better outcome and decreased costs.

The CFT also met the timelines and project costs by using the latest 2-dimensional hydraulic modeling, innovative geotechnical engineering regarding rock cuts, multi-disciplined engineered bridge foundations and Argonne National Laboratories to run computational fluid dynamic models to analyze the hydraulic forces on steep rockery walls along the channel.

To the astonishment of the transportation community, these efforts meant that the first project was completed a month ahead of the schedule set by the governor; a $20.0M heavy canyon road reconstruction project, designed and built in less than 12 months!

The success of the design and construction of the Colorado projects now has CFL asking what made the project design process so successful? CFL concluded that one of the main reasons for the success was the innovative CFT. What were the traits of the team - almost the same on all 3 projects - that led to buy-in from all disciplines and the admiration of our

Inside this issue:

Upcoming Hydraulic Events

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FEBRUARY 2016:

- NHI Course 135056 —La Crosse, WI - February 2-4, 2016
- NHI Course 135027 —Houston, TX - February 9-11, 2016
- NHI Course 135067 —Austin, TX - February 9-11, 2016
- NHI Course 135046 —Dallas, TX - February 23-25, 2016
- NHI Course 135056 —Green Bay, WI - February 23-25, 2016

MARCH 2016:

- NHI Course 135056—Austin, TX - March 8-10, 2016
- NHI Course 135080—Austin, TX - March 8-10, 2016
- NHI Course 135080—Childress, TX - March 8-10, 2016
- NHI Course 135046—Tampa, FL - March 15-17, 2016
- NHI Course 135080—Waco, TX - March 22-24, 2016
- NHI Course 135048—Topeka, KS - March 29-31, 2016

APRIL 2016:

- NHI Course 135027—Merrill, WI - April 5-7, 2016
- NHI Course 135048—Houston, TX - April 13-15, 2016

The FHWA Hydraulics Discipline:

Roles and Responsibilities of the Resource Center

By Dan Ghere, Discipline Champion

Looking out the window at the downpour of rain and high winds, knowing of the forecast for 4 inches of rain with flash flood warnings, I was reminded of the importance of hydraulics in highway design. Is that cross slope sufficient to move all this rainfall across the pavement, are the gutter inlets spaced close enough to contain the spread, and are the storm drains large enough to carry all this water? Knowing that this task of quickly moving water away from the highway must also be accomplished using techniques that employ environmental solutions for controlling high runoff volumes and pollutant loads only increased my concerns for how hydraulic designers are able to accomplish this task in their designs so the everyday traveler doesn't have the worry about unsafe roads during rain events.

That window this morning was a windshield and the visibility through the driving rain was also hindered by the heavy spray of water from trucks on a packed highway. Soon the presence of stream crossings added the worries of high water levels, roadway elevations, and adequate clearance. Few travelers worry, as I do, about what is going on along the bottom of that flowing column of water where the dynamic forces are strongest and the churning water is digging at the streambed and around obstructions such as bridge piers and abutments. As this new frontal system brings yet another round of heavy rains, hydraulic engineers also know they have to address these extreme weather events and what effects they may bring if the number of events increases in the future.

Driving in these conditions today was also a reminder that I had this column to write and it seemed like a fitting day to get started. In the last issue of the Newsletter we discussed the makeup of the FHWA Hydraulics Discipline including the Headquarters Office of Bridges and Structures (HIBS), Turner-Fairbank Highway Research Center (TFHRC), the Resource Center (RC) in the Office of Technical Services (OTS), and three Federal Lands Highway Divisions (FLHDs). In this issue we will focus on the Resource Center (RC) Hydraulics Technical Service Team (TST).

Resource Center Team:

The RC Hydraulics TST is comprised of four (4) hydraulic engineering specialists and a hydraulics team manager. The hydraulic specialists include Bart Bergendahl, Eric Brown, Scott Hogan, and Cynthia Nurmi. I serve in the manager role ensuring that the RC team is maintaining its role in assisting the hydraulics discipline in updating technical guidance documents and software products to say abreast of advancing technology in all aspects of highway hy-

(Continued on page 4)

The FHWA Hydraulics Discipline, cont.

draulics and in the deployment of those technologies through training classes, workshops, and responding to technical assistance calls from divisions, state DOTs, and local agencies.

Bart Bergendahl is the newest member of the RC Hydraulics TST, although he has been a part of the FHWA hydraulics discipline for many years. Bart joined the RC Team in October 2014 through a transfer from the Central Federal Lands Hydraulic Team and is located in the Lakewood, Colorado, office. Bart is taking over my former role as the point of contact for the Midwestern states. While Bart is involved in all functional areas of highway hydraulics, he is devoting 30 percent of his time to assisting the TFHRC Sterling Jones Hydraulic Lab with the development of an In-situ Scour Testing Device (see his article on page 8). Other key areas he is involved in are the FHWA bridge scour work group, a future update to HEC 18, the software development of a graphical user interface for HY-12 and a new pump station module. Bart serves as the technical lead on HEC 9 “Debris Control Structures” and HEC 26 “Culvert Design for Aquatic Organism Passage”. He also serves as the technical lead on updates and bug fixes for the Hydraulic Toolbox software.

Eric Brown is our point of contact for the Northeastern states on highway hydraulic issues and he works out of the RC Office in Baltimore, Maryland. One of Eric’s key focus areas is culvert hydraulics for which he serves as the technical lead on HDS 5 “Hydraulic Design of Highway Culverts”, HY 8 “Culvert Analysis Software”, and NHI Course 135056 “Culvert Design” and NHI 135065 “Introduction to Highway Hydraulics”. He is also technical lead in the development of three Web Based Training courses NHI 135086 “Stream Stability Factors and Concepts” WBT, NHI 135087 “Scour at Highway Bridges: Concepts and Definitions” WBT, and NHI 135091 “Basic Hydraulic Principles Review” WBT and two new NHI Web-Based Training Courses on NHI 135093 “Hydraulic Toolbox” and NHI 135094 “HY 8”. Eric is also videoing flume demonstrations of various hydraulic principles for additional training opportunities. Eric’s other activities include performing Hydraulic Program Reviews of state DOTs, assisting headquarters on various climate change initiatives such as TEACR (Transportation Engineering Approaches to Climate Resilience), and providing technical reviews of state DOT Drainage Manuals and technical assistance on specific questions or projects.

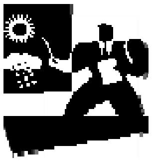
Scott Hogan serves as our point of contact for the Western states and he is located in the RC Office in Lakewood, Colorado. Scott’s primary focus area has been the development, promotion and training of advanced hydraulic modeling of highway stream crossings using the SRH-2D software with its 3D graphical interface. Scott is also heavily involved with the FHWA bridge scour work group and providing assistance to the FHWA Geotech Team on GRS-IBS abutment design issues when placed in a stream environment. Scott serves as the technical manager of five NHI Hydraulic courses including NHI 135041, “HEC-RAS”, NHI 135048 “Countermeasure Design for Bridge Scour and Stream Instability”, NHI 135071, “Surface Water Modeling System with SMS", NHI 135081 "Introduction to Highway Hydraulics Software", and NHI 135090 "Hydraulic Design of Safe Bridges".

Cynthia Nurmi is located in the RC Office in Atlanta, where she serves as our point of contact for the Southern states. Focus areas for Cynthia include highway hydrology, FEMA floodplain regulations, plans of action for scour critical bridges, policy guidance, and climate change. Special activities include serving as the FHWA liaison/coordinator for the National Hydraulic Engineering Conference (NHEC), development and distribution of the FHWA Hydraulic Newsletter, conducting Hydraulic Program reviews for state DOTs and providing technical reviews of state DOT Drainage Manuals. Cynthia provides the technical lead for NHI Courses 135067 "Practical Highway Hydrology", 135080 "Hydrologic Analysis and Modeling with WMS", 135085 "Plans of Action for Scour Critical Bridges" WBT, and a new course in development 135092 "Hydrology" WBT.

A key role of each of the RC Hydraulics TST members is to deploy innovative technologies through workshops, technical publications, and training. Another critical role is to provide technical assistance to division offices, state DOTs, and others on questions of FHWA hydraulic policy, publications, software, and hydraulic design and analysis. Please always feel welcome to contact any of the staff on hydraulic matters of interest to you.

National Hydraulic Engineering Conference: *Save-the-Date!*

The 2016 National Hydraulic Engineering Conference (NHEC) Steering Committee has selected the Red Lion on the River Hotel in Portland, Oregon, as the location of the 2016 NHEC. Dates for the conference are August 9-12, 2016. The theme of the conference is Hydraulic Engineering Diversity: Bridging the Coast and Desert. As with many other states, Oregon is a diverse state hydrologically (coast vs desert), topographically (plains vs mountains), and functionally (farm land vs urban cities). The conference hopes to present solutions to complex and diverse hydraulic conditions that many state DOTs must address. Agenda topics will include stream stability and scour, advanced modeling, hydrology, climate change, environmental, and others. For more information about registering for the conference, reserving your hotel room, or submitting an abstract, please check out the conference website: National Hydraulic Engineering Conference



Brian's Updates on Climate Change

Climate Change Resilience Pilot Projects

For several years, FHWA has partnered with State DOTs and Local Metropolitan Planning Organizations (MPOs) to conduct pilot projects that looked at the process of implementing a vulnerability assessment of its system to climate change and then developing a strategy for adaptation based on that assessment. These pilots used the Climate Change & Extreme Weather Vulnerability Assessment Framework developed by FHWA. The findings from these studies have led to a better understanding of the issues faced by DOTs and MPOs with respect to determining which of their systems are vulnerable to climate change and what are reasonable strategies to adapt to climate change. Information from the pilots has been shared at conferences, webinars, and in documents online. These lessons-learned would be useful to DOTs and MPOs at the planning/strategic level. To learn more, please visit the Climate Change Resilience Pilot website: http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/vulnerability_assessment_pilots/index.cfm.

Transportation Engineering Approaches to Climate Resiliency Study

After investigating vulnerability assessments, FHWA realized that the next step was to learn how climate change and resiliency should be considered in engineering. To that end, FHWA began the Transportation Engineering Approaches to Climate Resiliency (TEACR) Study. The TEACR Study brought together experts to discuss gaps in knowledge and practice for considering climate change in engineering. FHWA published this "Gaps Analysis" report in September 2014. The TEACR Study is investigating nine case studies of transportation assets that have been made resilient to extreme weather events and climate change. FHWA will publish a synthesis of recommendations and approaches for engineering based on the findings of all relevant case studies, including those from the TEACR Study. To keep apprised and find more detailed information, please visit http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/teacr/index.cfm

The Impact of Climate Change on Stream Stability

FHWA is concerned with not just extreme weather events that may increase due to climate change but also the smaller events that effect stream stability by the long duration or greater frequency of occurrence. So, FHWA has begun to evaluate potential channel instability of the Maple River related to Iowa Route 175 in the context of historic instability and the potential impacts of climate change. Phase 1 will include data collection, evaluating historic channel instability and near-term future potential channel change. The study will use a variety of approaches ranging from standard geomorphic methods 2-D and CFD modeling. CFD modeling will be conducted at Argonne National Lab (Argonne) as a comparison to the 2-D model results. Phase 2 may include developing and applying potential climate conditions to evaluate whether and to what degree climate conditions could affect channel instability in this area.

First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events

The Transportation Research Board, Federal Transit Administration, and FHWA hosted the First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events on September 16-18, 2015. More than 250 practioners and researchers gathered to examine efforts to mainstream consideration of climate change and extreme weather resilience in all aspects of the transportation sector, explore the needs of transportation agencies for actionable climate information, and how to adapt transportation systems based on best available science, consistent with sound, risk-based, asset management principles. The entire conference was webcast and a recording is available on TRB's website.

PDF versions of the presentations are linked to the online program here:
http://onlinepubs.trb.org/onlinepubs/conferences/2015/ClimateChange/Program.pdf
(Available presentations are highlighted with a light green text)

Video recordings of the conference are available here:
https://www.cvent.com/events/first-international-conference-on-surface-transportation-system-resilience-to-climate-change-and-ext/registration-cba1008fb1724a6eb2edd2898f16fc91.aspx.
(If you registered for the conference (either in person or virtual) you should have received a confirmation number from TRB for accessing the video recordings. If you did not register for the conference, in order to view the recordings you will need to register. Registration is free for Federal, State, Tribal, and Local Employees. The recordings are available through September 2016.)

HEC 17 Update

To address recent requirements to incorporate climate informed science data and methods into decision making and hydraulic engineering practice, FHWA is updating its Hydraulic Engineering Circular 17: Highways in the River Environment—Floodplains, Extreme Events, Risk and Resilience. The manual will consist of chapters which provide a background of current hydrologic and hydraulic engineering practice, concepts on climate projections, discussion of risk, and then how to combine all of this information into an informed decision and engineering design. Case studies will provide examples of how to implement the guidance. The goal is to complete this first update in the Spring 2016. More updates will be necessary as the science and practice evolves and new policies and regulations develop.

To learn more about the update, see the presentation given by Roger Kilgore at the First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events (see previous article for links to presentation.)

For more information on any of these climate change related topics, please contact Brian Beucler (brian.beucler@dot.gov).

In the Lab with Kornel

Full Scale Computational Fluid Dynamics Modeling for the GRS Abutments at River Crossing

The Need:

The Geosynthetic Reinforced Soil–Integrated Bridge System (GRS–IBS), originally developed by the Federal Highway Administration (FHWA) under the Bridge of the Future Initiative, can help reduce bridge construction time and costs. The GRS abutments in the GRS-IBS are a special type of shallow foundations. When constructed at river crossings, GRS abutments are vulnerable to scour because flow contracts and therefore accelerates in the opening and vortices separating from the abutment corners induce additional scouring forces. Therefore, one must protect GRS-IBS abutments from potential scour.

Riprap Protection:

Riprap is the most common scour countermeasure used to protect the GRS abutment foundations (Figure 1). However, installation of riprap at the channel bed elevation in narrow openings could have an adverse flow effect in the opening. The roughness of the riprap will reduce the velocities over riprap, but increase flow velocities and associated bed shear stresses over the unprotected erodible channel bed leading to additional contraction scour and possible edge failure of the riprap.

Figure 1—Riprap countermeasure field installation for a narrow bridge opening geometry.

CFD Modelling:

The TFHRC Lab is conducting Computational Fluid Dynamics (CFD) modeling of full-scale bridge opening geometries to study the impacts of riprap on the bed shear stresses of the unprotected channel bed in the bridge opening (Figure 2). The riprap layout in the models is based on Design Guide 14 (DG 14) in Hydraulic Engineering Circular No. 23. The research explores the limits of the riprap which influence the bed shear stresses on the unprotected channel bed relative to the bridge opening. The assumption is that for certain flow conditions and bridge opening geometries, riprap aprons based on DG 14 has a significant impact on the unprotected channel bed. Based on the findings from the CFD modeling, FHWA will develop an alternate Design Guide.

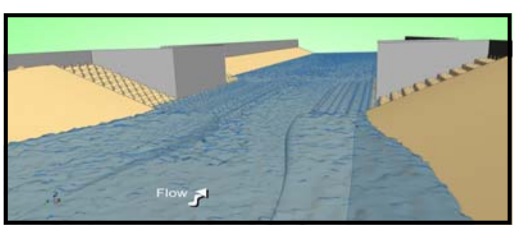


Figure 2—CFD modeling of full scale bridge opening geometry with riprap countermeasure.

Case 1: Shear Stress Varies

The first case studied by the CFD modeling kept the velocities equal in the bridge opening for all bridge geometries but allowed the shear stress to vary. Figure 3 shows two bridge geometries: a) bridge opening of 38 ft and flow depth of 6.2 ft; b) bridge opening of 160 ft and flow depth of 6.2 ft. The shear stress distribution of the unprotected channel bed decayed as the bridge opening geometry increased. Note the high bed shear stress at the toe of the riprap apron for the 38-ft opening bridge and a low shear stress at the riprap apron toe for the 160-ft bridge.

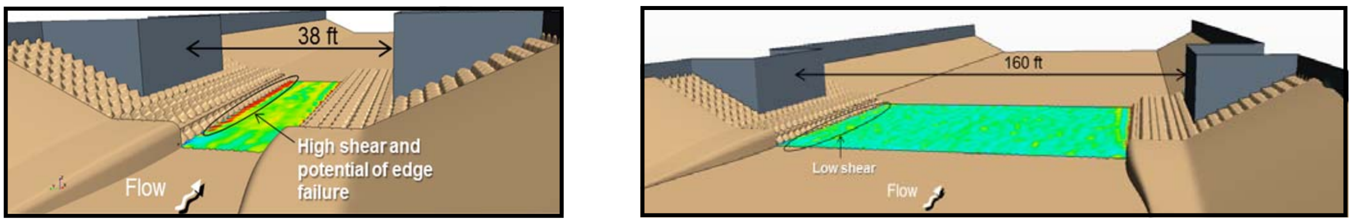


Figure 3—CFD Modeling Results – Case 1: Shear stress distributions of the unprotected channel bed - a) 38-ft bridge opening and b) 160-ft bridge opening

Case 2: Velocity Varies

As the bridge opening increased, the velocity redistributes across the bridge opening (Figure 4).

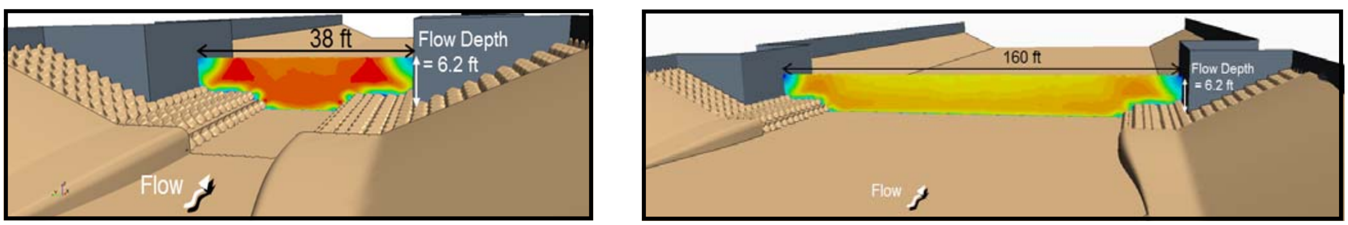


Figure 4—CFD Modeling Results – Case 2: Velocity distributions at bridge opening - a) 38-ft bridge opening and b) 160-ft bridge opening.

Preliminary Recommendations:

Currently the Lab is testing more cases to determine additional impacts of the bridge and countermeasure geometry on the stream bed. However, the Lab preliminarily recommends:

- For flow conditions and bridge openings where the effects of the riprap apron on the unprotected channel bed shear stresses are not negligible, the riprap apron countermeasure should extend across the entire bridge opening to avoid any potential of edge failure.
- For flow conditions and bridge opening geometries where the effects of riprap on the unprotected channel bed are negligible, DG 14 still can be applied.

For more information on this research please contact Kornel Kerenyi (kornel.kerenyi@dot.gov).

In the Lab with Kornel

Bart Bergendahl Reports on the Continued Development of the ISTD

Let's Catch Up:

Progress continues on the development of an In-Situ Testing Device. This past September, the FHWA TFHRC Team completed testing the In-Situ Scour Testing Device (ISTD) at a third location. The results have been the best yet, thanks to the experience gained from the first two sites and some subsequent modifications to the erosion system, operating procedures, and testing protocols.

ISTD Operational Concept:

Before describing the system changes, lessons learned, and latest testing results, a quick reminder of the ISTD operational concept is in order. Referencing Figure 1 below, the system concept is as follows:

1. Place the erosion head down a standard drill casing that is inside a standard hollow-stem auger used for geotechnical investigations (erosion head is gray cylinder with hole down center).
2. Pump water down the casing and around the outside of the erosion head (blue arrows pointed downward).
3. Force water to flow horizontally though an "erosion gap" (red arrows) at the head-soil interface imparting hydraulic shear to the soil surface (imparted shear stress increases with increasing flow or decreasing height of the erosion gap).
4. Eroded soil particles are carried out of the casing by the exiting flow (blue arrows pointed upward through middle of cylinder).

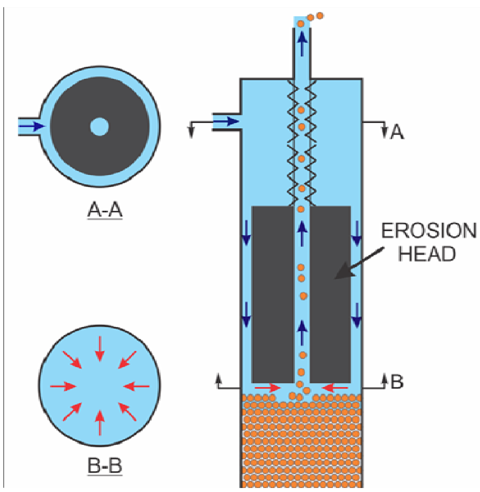


Figure 1—ISTD Operational Concept (Inside diameter of the standard drill casing is 4 inches; diameter of the prototype erosion head is 3.5 inches. Red arrows indicate erosion gap. Blue arrows indicate flow direction.)

System Modifications:

During the first two field tests, the erosion resistance of some subsurface soils indicated that the ISTD required more erosion capacity and the ability to accommodate irregularities in the soil. To obtain this additional capacity, the ISTD had to be converted from a suction system to a pressure system. The field tests also indicated there needed to be modifications (addition of sensors) to accommodate irregularities. These modifications are described next:

First System Modification:

The erosion head was modified as shown in Figure 2. The inflow ports (red) were cast within the erosion head (light gray cylinder) to avoid having to pressurize the entire drill casing for a test. This modification required seals near the top of the head (not shown) to prevent inflow from escaping upward into the drill casing. The optimum sealing configuration is currently being investigated. Once the water leaves the inflow ports, it is once again forced to flow downward, then horizontally through the erosion gap at the erosion head-soil interface, imparting hydraulic shear to the soil surface. The eroded soil is then carried away through the outflow port (blue), located at the center of the erosion head bottom, and passed through a filter so the water can be recycled in a closed system.

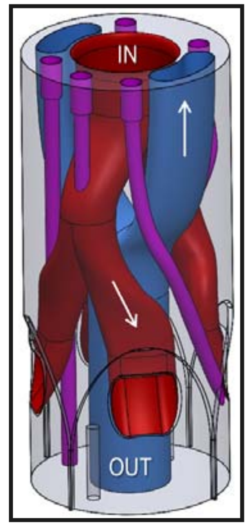


Figure 2— **New 3D-Printed Erosion Head**

The diagram shows the locations of monitoring ports (purple) for the instruments required to control the testing. Also, of particular note, all the erosion heads are manufactured in-house using a 3D printer.

Second System Modification:

Figure 3—ISTD with linear drive.

Once the system is pressurized, it wants to 'eject' the erosion head from the drill casing like a torpedo. To prevent this ejection from happening (at least at this stage), a 'linear drive' was developed to counter the reaction force and feed the piping, which is attached to the erosion head, into the casing at a rate equal to the erosion rate of the soil. The linear drive can be identified as the gray triangular aluminum tower in Figure 3.

Third System Modification:

Figure 4 depicts the eroded surface of a lean clay soil layer 6.5 feet below ground recovered from within the drill casing. Note that the erosion pattern can vary across the diameter of the drill casing. The two samples on the left side of the figure have an even erosion pattern due to the relative homogeneity of the soil. The sample on the far right has an irregular erosion pattern due to the poor homogeneity or small obstructions found in the soil. To detect a non-homogenous


Figure 4—Eroded Soil Sample (Lean Clay) at 6.5ft

(Continued on page 12)

Field Testing of ISTD Begins, cont.

soil condition or obstruction, the ISTD was modified with three sensors on the erosion head: two acoustic and one mechanical. The sensors will indicate irregularities or obstructions in the soil so that the test can be stopped and any obstruction to erosion removed. The test can then continue.

Testing Protocol Modification:

The first two field tests exposed the research team to the 'slaking' phenomenon. For those of you who are unaware, slaking occurs in unsaturated, fine-grained soils typically located above the water table. Because the soil is not saturated, air pockets exist in the pores between the soil grains. Once exposed to water, the air is displaced and the pockets burst, destroying the integrity of the soil. The soil effectively 'dissolves' to a finite depth, without the aid of an external erosion mechanism, such as the shear force of flowing water. Consequently, the next step was to modify the testing protocol to capture the potential for slaking. In general, the testing protocol was modified as follows:

1. Begin test with a very low discharge and hold for 15 minutes to determine whether slaking occurs.

2. If slaking occurs within the 15 minutes, hold the low discharge rate long enough to collect 3-4 'jumps' in depth, so a slaking rate can be determined. (If slaking is present, this protocol element could consume more than 1 hour of testing time.)

   If no slaking occurs, or once slaking data have been collected, increase discharge to 50% of pump capacity and hold long enough to record a good erosion rate.

3. Incrementally increase discharge again and hold long enough to record a good erosion rate.

4. Repeat Step 3, till erosion rates are collected for 3-4 different discharges.

Ultimate Objective:

The ultimate objective of ISTD is to obtain erosion rates for fine-grained soils in-situ. By applying varying shear stresses on the soil, different erosion rates will be obtained. These rates vs shear stress data points can be plotted and a curve fitted to the data. The curve can then be extrapolated to an erosion rate of 'zero', which will identify the critical shear stress for the in-situ soil. Figure 5 illustrates such a curve and the extrapolation to a zero erosion rate.

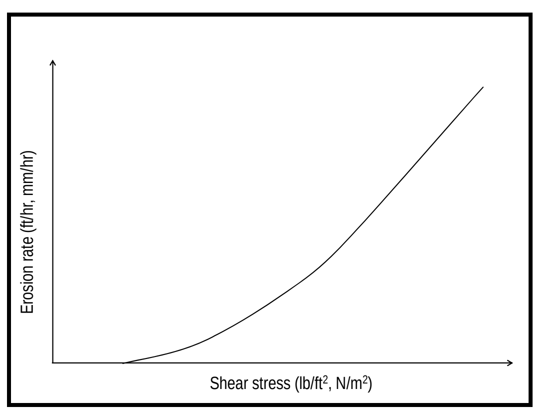


Figure 5—Erosion Rate vs Shear Stress Curve

Preliminary Results:

To begin the process of determining how to calibrate the ISTD and to obtain the erosion rates necessary for a plot like Figure 5, the Team investigated in the third field test whether the varying of the erosion gap or flow rate would influence the shear stress and therefore the erosion rate. The Team can vary the shear stress by either changing the erosion gap or by changing the flow rate.

Figure 6 shows the very encouraging preliminary results from the third ISTD field test. The plot is of erosion depth (mm) vs. time (sec). Three curves are plotted directly from the data collected during the ISTD test on the lean clay soil shown in Figure 4. The green curve shows the flow rates (liters/sec) used during the test. The blue curve represents the erosion gaps (mm) used during the test. The black curve shows the erosion depth (position of the erosion head) with time. The average erosion rate in mm/time can be computed from the black curve by computing the slope of a best-fit straight line fitted to the data for a given testing setup.

During the field test, the Team varied the erosion gap and flow rate to determine if the corresponding shear stress and resulting erosion rate were changing as anticipated. Figure 6 plot shows 4 erosion rates that were computed from the raw data for each of 4 test 'variations'

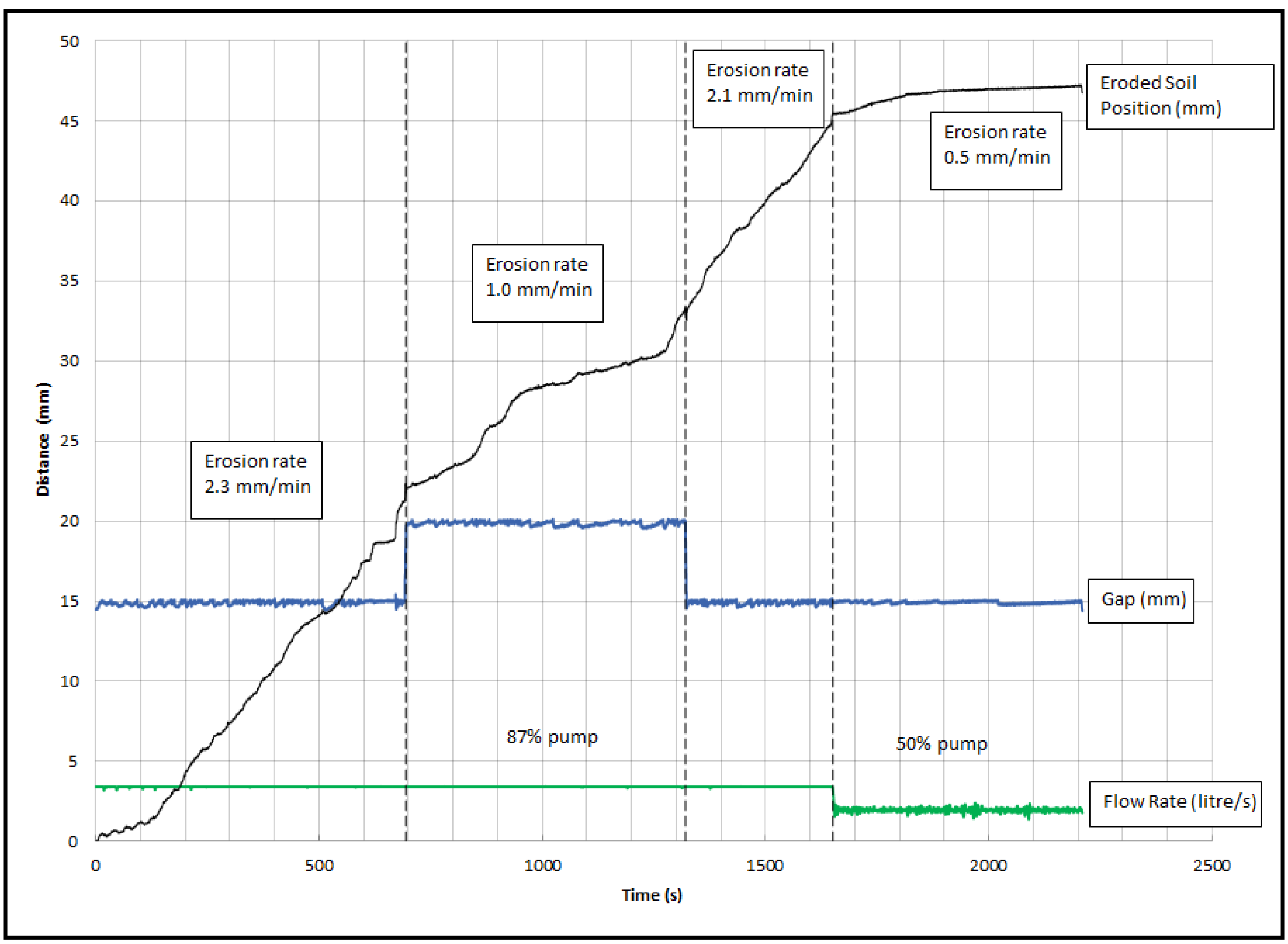


Figure 6—Preliminary Erosion Test Results

Field Testing of ISTD Begins, cont.

within the soil layer. The test variations are delineated by the vertical dashed lines.

Using the left hand erosion rate as a reference, the erosion gap was increased as the first variation. An increased gap will decrease the applied shear stress, which should decrease the erosion rate. The erosion rate decreased as expected from 2.3 mm/min to 1.0 mm/min.

In the second variation (third erosion rate from the left), the Team set the erosion gap to the initial setting. The erosion rate returned to a very comparable value (2.1 mm/min vs. the initial 2.3 mm/min).

Future Plans:

Refinement of the ISTD, including the new pressure system, will continue with one more field test planned for this year and as many as 9 planned for next year.

For more information on the ISTD status and development, contact Bart Bergendahl (Bart.Bergendahl@dot.gov) or Kornel Kerenyi (Kornel.Kerenyi@dot.gov).

Exploring Change, cont.

partnering agencies? Why was this team so innovative and how did it come to be?

CFL is in the process of answering those questions in an attempt to bring a new CFT structure to all of its teams. This new structure is the start of a cultural change that will affect how CFL does business in the future. It will change how team members interact with each other, empower teams to make decisions that are best for the project, question the standard design methods of all disciplines, while staying grounded in sound engineering principles. The objective is to make all teams and team members more nimble, engaged, and creative in the project delivery process. The management of CFL hopes to transfer the innovation, creativity, and inter-dependence of the disciplines seen on the CFT to all CFL teams.

It is an exciting time to be working at Central Federal Lands and it is an honor to be part of the effort to make the agency more innovative, agile and responsive to our partners in the future.

To talk more with Veronica Ghelardi about these changes to CFL, please email her at: veronica.ghelardi@dot.gov.

In the Lab with Kornel

Update on ADA Compliant Grate CFD Modelling

The Need for ADA Compliant Grates:

When making improvements to sidewalks and crosswalks in urban areas, the Minnesota Department of Transportation (MnDOT) needs to use new grate styles to comply with the Americans with Disabilities Act of 1990. ADA safe grates are needed whenever catch basins are in the Pedestrian Access Route (PAR). The Public Rights-of-Way Accessibility Guidelines (PROWAG) requires grates that are located in the PAR cannot allow a ½" sphere to pass through the openings for ADA Compliance. The grates are mainly used on retrofit projects where relocating of the drainage structures are less desired due to cost. However, the manufacturers of ADA-compliant grates were not able to provide information on the hydraulic capacities of those grates.

CFD Modeling:

As we reported in our October 2013 Newsletter Vol 1 Is 2, Argonne National Lab conducted a feasibility study and found that the TRACC high-performance computer clusters could perform CFD modeling for less expense and time than traditional physical modeling. MNDOT then had the Lab analyze 21 cases with varying street, cross street, and gutter slopes for each grate and a traditional vane grate. The geometry for the simulations was built at full street scale, an approach that could not be easily accomplished in a laboratory with a flume.

Results:

Hydraulic performance of the ADA compliant grate was below that of the vane grate for all but the lowest rain water drainage volume flow rates. The performance difference grew larger rapidly as the flow rate increased. The narrow slots of an ADA compliant grate, limited to a width of ½ inch, create more resistance to flow through the grate than those of non-compliant grates with wider slots. Grate hydraulic performance correlated well with the upstream Reynolds number of the approach flow. MNDOT hopes to use the study results to ensure retrofits with the ADA compliant grate do not reduce hydraulic capacity.

Complete details of the study are available in Argonne report ANL/ESD-15/25 available from the Department of Energy Office of Scientific and Technical Information:

http://www.osti.gov/scitech/biblio/1221925.

For more information on this research please contact Steven Lottes (steven.lottes@anl.gov) or Kornel Kerenyi (kornel.kerenyi@dot.gov).

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FHWA Hydraulic Contacts

The FHWA Hydraulic Staff are available to assist you with FHWA Hydraulic related issues. A list of Hydraulic Staff may be found at:
http://www.fhwa.dot.gov/engineering/hydraulics/staff.cfm

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Hydrology and Hydraulics News

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