



U.S. Department
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Dr. Larry Arneson Retires!

On August 31, 2013, Dr. Larry Arneson, a distinguished hydraulic engineer at the Federal Highway Administration (FHWA), retired after 35 years of service.



FHWA is grateful for Dr. Arneson's extensive contribution to the National Hydraulic Engineering program. We wish Dr. Arneson well in his post-retirement pursuits.

A Career of Innovation and Technology Deployment!

Dr. Arneson began his career at Federal Lands in the early 1980's. He worked primarily in the Western Bridge Group and became very interested in bridge hydraulics and floodplain analysis. He then transferred to the FHWA Region 8 Office in order to focus on promoting the bridge hydraulics and floodplain analysis full-time to state Departments of Transportation. When the Regional Offices were dissolved in the late 1990's, Dr. Arneson continued his role as a senior Hydraulic Engineer at the FHWA Resource Center. He eventually became the manager for the Resource Center's Hydraulic Technical Service Team. Throughout his career he has represented FHWA on the American Association of State Highway and Transportation Officials Technical Committee on Hydrology and Hydraulics and the American Society of Civil Engineers' Sedimentation Committee.

In the 1990's, Dr. Arneson played a key role in FHWA's scour program development, including the Hydraulic Engineering Circulars 18, 20, and 23. He also was instrumental in the development and implementation of the National Highway Institute's (NHI's) scour courses NHI 135046, 135047, and 135048.

In tandem with the development of bridge hydraulics and scour program, Dr. Arneson recognized the need for tools to facilitate bridge hydraulic and scour analysis. So, Dr. Arneson led the innovation of advanced 1- and 2-dimensional analysis software, such as WSPRO and FESWMS.

Dr. Arneson returned to his first love of bridge hydraulics at the end of his FHWA career by leading the creation of the new HDS 7 Hydraulic Design of Safe Bridges document and the companion NHI Course 135090.

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Save the Date!

2014 NHEC

August 19-22, 2014

Sheraton Hotel
Iowa City, IA

Upcoming Hydraulic Events

November 2013							December 2013							January 2014						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
					1	2	1	2	3	4	5	6	7				1	2	3	4
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30	31	

NOVEMBER 2013:

- NHI Course 135010—Baltimore, MD - November 6-8, 2013
- NHI Course 135046—Jackson, MS - November 19-21, 2013

DECEMBER 2013:

- NHI Course 135027—Atlanta, GA - December 3-5, 2013
- NHI Course 135082—Rocky Hill, CT - December 3-5, 2013
- NHI Course 135048—Reno, NV - December 10-12, 2013

JANUARY 2014:

- NHI Course 135047—Helena, MT - January 9, 2014
- 93rd TRB Annual Meeting —Washington, DC - January 12-16, 2014
(for specific times and dates: <https://sites.google.com/site/trbcommitteeafb60/>)

Hydraulic Program Reviews Improve the State of the Practice

Hydraulic engineering continues to be a dynamic and evolving technical field. The past decade has seen a boom in the amount of research, development, and deployment devoted to topics such as climate change and adaptation, scour evaluation methods, infrastructure rehabilitation, new pipe materials, aquatic organism passage, two- and three-dimensional modeling, software tools, regulation and policy, to name a few. As the hydraulics discipline evolves, it is incumbent upon Departments of Transportation (DOT) to periodically reevaluate their hydraulic engineering policies, practices, and procedures within the context of the national state of practice and best practices. To this end, more than fifteen states have had the FHWA National Hydraulics Team conduct a Hydraulic Program Review for them. These reviews have provided helpful insight to assist with their periodic reevaluations.

What is a Hydraulic Program Review?

A typical Hydraulic Program Review is performed by a team of experienced FHWA hydraulic engineers, the FHWA Division Bridge Engineer, and a state DOT representative. The team conducts a preliminary assessment of hydraulic manuals, other documentation, sample design drawings, and reports from in-house staff and consultants. Then the review team meets for a week with management, hydraulic units, and other associated units to discuss the hydraulic program. Sometimes the team goes to project sites when additional specific technical assistance has been requested by the state. An exit meeting held with management summarizes commendations, findings, and recommendations observed in the review. A follow-up formal report documents the review discussions, exemplary practices, and recommendations for improving technical procedures, communications, and work flow.

Benefits from a Review:

One of the benefits of the hydraulic program review is that it provides you the opportunity to showcase your unit's exemplary practices and consistency with national practice to upper management. The review will also highlight to management your particular needs, such as for staffing, training or software. Another benefit is the identification of ways to improve the efficiency of your program or to justify policy or procedural changes to align the program with national practice.

How to Request a Review:

To request a review of your hydraulic program or if you want additional information, please contact your Division Bridge Engineer or a FHWA Resource Center Hydraulics representative (<http://www.fhwa.dot.gov/resourcecenter/teams/hydraulics/index.cfm>).

NOAA To Research Precipitation Trends

Extracting Historical Precipitation Trends from NOAA Atlas 14

Between climatologists and hydraulic practitioners there are distinctions in terminology and expectation of climate change with respect to extreme weather events. Climatologists may focus on changes in smaller more frequent events whereas hydraulic practitioners may focus on larger less frequent events for design. In 2012, the National Weather Service (NWS) Office of Hydrologic Development (OHD) published information (Bonnin et al, 2012*) which indicated that the historical trends in the number of exceedances of precipitation frequency thresholds in selected areas of the U.S. are small, in many cases statistically insignificant, and showing both increases and decreases. These results would appear at first glance to be inconsistent with results obtained by the climate community. However there is published analysis that demonstrates that, rather than being inconsistent, the results address different characteristics of the climatology of precipitation and, specifically, characteristics relevant to civil engineering design.

The Study

To help FHWA and hydraulic practitioners understand the potential changes to events important in hydraulic design, the FHWA has partnered with OHD to further its 2012 investigation. The investigation will consist of three tasks:

- Extend 2012 historical trend analysis of rainfall exceedance to the rest of the country.
- Examine the possibility that the trends in the number of historical rainfall exceedances obtained by OHD and the climate community can be shown to be consistent.
- Synthesize and recommend appropriate data analysis techniques for developing IDF curves in the US, because the trends in the number of historical rainfall exceedances do not shed light on the specific intensity/depth-duration-frequency (IDF) curves used by engineers.

The study began September 2013 and should be completed in late fall 2014. Results from the tasks will be summarized in reports prepared for FHWA. FHWA will use the information to help inform eventual guidance for engineers in adaptation strategies using historical precipitation data trends.

* Bonnin, et. al, 2012—

http://amazon.nws.noaa.gov/articles/HRL_Pubs_PDF_May12_2009/Geoff_Bonnin/10.1111_j.1752-1688.2011.00603.x.pdf

FHWA Launches New Countermeasure Study

Performance and Effectiveness of Scour Countermeasures Evaluated by USGS

Scour countermeasures have become a major part of Federal Highway Administration's (FHWA's) national bridge scour program and are considered vital in reducing the vulnerability of bridges to scour. However, due to the lack of field verification of the performance and effectiveness of these countermeasures, there remains uncertainty in the reliability of scour countermeasures for protecting foundations, especially for use at new bridges. FHWA, therefore, has teamed with the U.S. Geological Survey (USGS) to conduct a comprehensive investigation of scour countermeasures. Through this investigation FHWA hopes to evaluate and improve its published guidance and technical procedures for the selection, design, construction and maintenance of scour countermeasures and possibly reevaluate its policy of not using scour countermeasures at new bridge piers.

The Project

The USGS will perform various levels of site evaluations at approximately 100 bridges with scour countermeasures. Some of the techniques to be used include stream side investigations and underwater reconnaissance using state-of-the-art survey techniques such as terrestrial LIDAR, multi beam echo-soundings and side-scan sonar. The USGS will document each evaluation in templates and then summarize its findings in an official USGS Scientific Investigations Report.

As a complement to the USGS site evaluations, the J. Sterling Jones Hydraulics Research Laboratory (HRL) will run hydraulic physical models and computational fluid dynamics (CFD) on several bridge sites. The goal of these lab tests is to test and model at high flows the stability and performance of the as-built countermeasures observed in the field. These results will also be used to evaluate FHWA guidance on scour countermeasure design.

We Need Your Bridges!

In order to obtain a representative sample of bridges in varying conditions, the USGS will evaluate approximately 100 bridges. To determine the project bridges, FHWA will develop an initial list based on the NBI codes for Item 113. The USGS will then determine if the bridges are located near stream gages in order to obtain flood history. Once a final list has been developed, the FHWA will contact each respective bridge owner for permission and to obtain the hydraulic support data, design plans, and maintenance reports necessary to evaluate the design conditions and countermeasure performance. Bridge owners who know of specific bridge locations that have designed and installed countermeasures that fit the project categories are encouraged to contact Dave Henderson (dave.henderson@dot.gov) or Dan Ghere (dan.ghere@dot.gov) of FHWA for consideration of those bridge sites in the site selection.

Aging Culverts – To Repair or Replace?

Lands Implements New Culvert Assessment and Managerial Decision-Making Tools

To address concerns about the condition of aging culverts owned by Federal Land Management Agencies, the Federal Lands Highways (FLH) has developed and implemented culvert assessment criteria and decision-making procedures. These procedures are documented in the recently released TD-10-005, "Culvert Assessment and Decision-Making Procedures Manual."

The Manual

The Culvert Assessment and Decision Making Procedures Manual details the Level 1 Assessment for routine cases and Level 2 Assessments for special circumstances or conditions. The manual details how to rate the condition and determine performance. Photos in the appendices provide examples of the condition ratings and performance. Flowcharts outline the Decision Making Procedures for action to take on a culvert, based on condition and performance.

Level 1 Assessment

The Level 1 assessment procedures minimize the use of quantitative criteria and maximize the use of qualitative descriptions, coupled with photographs and engineering judgment. These procedures enable a two-person field crew to take only 15 minutes on average to assess the condition and performance of a given culvert.

For the [Condition Assessment](#), the field crew evaluates 13 aspects of the culvert, including invert deterioration, joints and seams, corrosion and chemical attack, cross-section deformation, cracking, liner and wall, mortar and masonry, liner and wall, invert rot and marine borers, headwall and wingwall, apron, flared end section, pipe end, and scour protection. Based on these evaluations, the culvert is rated Good, Fair, Poor, or Critical.

For the [Performance Assessment](#), the field crew determines whether a performance problem exists or not. The crew documents what the problems are, the indicators from the field inspection for the problem, and potential causes.

With the condition and performance assessments, managers use the provided flow charts to determine which [Decision Matrix](#) applies to the culvert. The matrix provides replacement and repair options which can be selected for the assessed culvert.

More Information

For more information about the Level 1 rating criteria, performance assessment, and decision making tools and the Level 2 assessment procedures, please refer to the Culvert Assessment and Decision-Making Procedures Manual at <http://www.cflhd.gov/programs/techDevelopment/hydraulics/culvert-assessment/index.cfm>. Also, the FHWA Hydraulic Toolbox now includes these assessment and decision making tools for your use.

HRL Hydraulic Research

Improving Hydraulic Safety of Covered Bridges



Scale Model of Covered Bridge

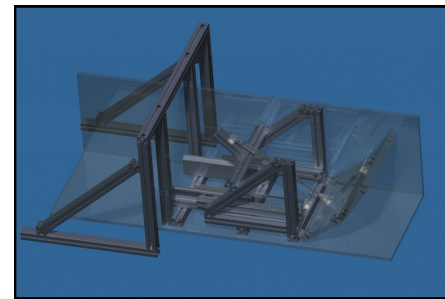


Pine Bluff Bridge, IN
(Howe Truss)

Researchers at the J. Sterling Jones Hydraulics Research Laboratory (HRL) will begin a new study to assess the hydrodynamic vulnerability of covered wooden bridges using both physical and CFD modeling. The researchers will take into account variances in covered bridge designs and framing. They will also assess the hydrodynamic loading for partially and fully submerged flow conditions. The scale model of the covered bridge to be used in the physical modeling will be made using a 3-D printer in order to accurately model details of the bridge. The study is scheduled to be completed by Fall 2015. Results of the study will be incorporated into guidance on estimating hydro-dynamic loads on covered bridges. For more information about this and other HRL projects, please contact Kornel Kerenyi at kornel.kerenyi@dot.gov.

Determining Hydrodynamic Wave and Tsunami Wave Bridge Deck Response Forces

Researchers at the HRL are also set to start another physical modeling project. This project will investigate the hydrodynamic wave and tsunami wave drag, lift forces and moment structural response of bridge decks. Researchers will mount scaled model bridge decks to a force balance* and measure the hydrodynamic loads when waves impact the bridge deck. The project is scheduled to be completed in Fall 2015. Study findings will be incorporated into guidance for bridge deck design.



Wave Force Generator



Check out the video of the Tsunami Wave Generator.

* A force balance is a device that can measure the force response of flow/fluid force acting on a bridge model structure. The device/balance is designed so that the mounting support for the bridge model has minimal impact on the response force. For more information, please contact Kornel Kerenyi at kornel.kerenyi@dot.gov

Cutting Edge Technology for the States

TPF Study "High Performance CFD Modeling Services for Highway Hydraulics" (TPF-5(279))

The Federal Highway Administration established an Inter-Agency Agreement with the Department of Energy's Argonne National Laboratory Transportation Analysis Research Computing Center (TRACC) to get access and support for High Performance Computational Fluid Dynamics (CFD) modeling for highway hydraulics research conducted at the Turner-Fairbank Highway Research Center Hydraulics Laboratory. Now, the Transportation Pooled Fund (TPF-5(279)) extends the use of the TRACC computing capabilities and services to State Departments of Transportation to conduct highway hydraulics research.

The TPF-5(279) Objective and Scope of Work

The objective of the pooled fund is to provide research and analysis for a variety of highway hydraulics projects managed or coordinated by State DOTs; to provide and maintain a high performance Computational Fluid Dynamics (CFD) computing environment for application to highway hydraulics infrastructure and related projects; and to support and seek to broaden the use of CFD among State Department of Transportation employees.

The scope of work for the pooled fund includes:

Computational Mechanics Research on a Variety of Projects:

The TRACC scientific staff in the computational mechanics focus area will perform research, analysis, and parametric computations as required for State DOT projects.

Computational Mechanics Research Support:

The TRACC support team, consisting of highly qualified engineers in the CFD focus areas, will provide guidance to users of CFD software on an as needed or periodic basis determined by the State DOTs.

Computing Support:

The TRACC team will use the TRACC clusters for work done on projects; The TRACC system administrator will maintain the clusters and work closely with the Argonne system administrator's community; The TRACC system administrator will also install the latest versions of the STAR-CCM+ CFD software and other software that may be required for accomplishing projects.

Interested in CFD Research?

If you are interested in using the TPF-5(279), you can contribute funds and then FHWA will transfer the funds to the established IAA for your project. For more information on the TPF-5(279) you may contact Kornel Kerenyi (kornel.kerenyi@dot.gov) or visit the website <http://www.pooledfund.org/Details/Study/515>. If you would like more information about the TRACC, you may visit their site <http://web.anl.gov/TRACC/>. To learn more about the CFD modeling used by FHWA, please check out <http://www.fhwa.dot.gov/research/tfhrc/labs/hydraulics/tfhrc/lab/nummodeling.cfm>.

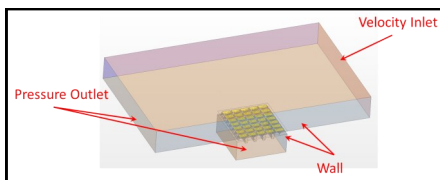
States Use CFD to Solve Hydraulic Issues

Minnesota Tests Its ADA-Compliant Grates for Hydraulic Capacity

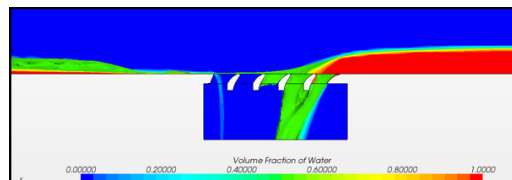
When making improvements to sidewalks and cross-walks in urban areas, the Minnesota Department of Transportation (MNDOT) needed to use new grate styles to comply with the American Disability Act (ADA). Unfortunately, the manufacture of the grates could not provide the hydraulic characteristics of the ADA compliant grates. To determine such characteristics, one would usually run physical model testing of the grates in a hydraulics lab varying the flows and slope. MNDOT has opted for a less expensive and faster approach by modeling the grates using high performance numerical Computational Fluid Dynamic Modeling (CFD) developed and run by the Transportation Analysis Research Computing Center (TRACC) via the pooled fund TPF-5(279).

The CFD Model

To determine the feasibility of modeling the grates and determining the hydraulic capacity in CFD, the ANL modeled two grates using manufacturer schematic drawings. ANL then added boundaries, such as the velocity input, curbs, and pressure outlets downstream of the grate and below the grate. The model ended up having more than 2.5 million cells. To analyze the grate, the ANL used Free Surface VOF Analysis, a K-Epsilon Turbulence Model, and Implicit Unsteady Calculations.



CFD Model of Grate



Cross-section of CFD Model



Results?

Results from the feasibility model confirmed that CFD would be capable of modeling the grates and providing the hydraulic capacity. The next step will be to conduct a series of runs altering the geometry and flow.

MNDOT will use the results from the CFD modeling to develop a standard plate for an ADA grate. The grate will also be included in the updated MNDOT drainage manual. Calculations for the grate will be described in the MNDOT Drainage Handbook.

For more information about this study or conducting a similar study of your own, please contact Kornel Kerenyi (kornel.kerenyi@dot.gov).

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FHWA Resource Center:
Dan Ghere
Eric Brown

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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