Greetings,

Welcome to the newest edition of Hydrolink, the AASHTO Technical Committee on Hydrology and Hydraulics’ newsletter.

In the past few years several long standing members, Bill Baily, Matt O’Connor, Hani Farghaly and Karuna Pujara, have retired or changed jobs from their respective agencies, and resigned from TCHH (AASHTO Technical Committee on Hydrology and Hydraulics). With a total of 69 years of serving on TCHH these four engineers made major contributions to the goals of the committee.

Bill was the hydraulic engineer for Wyoming DOT and joined TCHH 1994. After serving nearly 24 years Bill worked on multiple TCHH manual update efforts and was always willing to share his experience with the group. Bill was willing to dig into the weeds on issues and shared papers and software produced and implemented for his agency. Bill commented, “My experience with the task force has been very rewarding. I will miss the participation in the committee’s activities. I plan to remain active in Hydraulics and will polish up many software programs used in my practice.”

Matt worked for Illinois DOT and joined TCHH in 2001 serving nearly 16 years on TCHH. Matt retired in 2017 but continued to work part time the following year. Matt was a member of the work group that published this newsletter and provided stability and support to the group throughout his tenure. Both IDOT and TCHH will find it hard to find someone with the same level of experience and friendliness to take his place.

Hani worked for the Ontario Ministry of Transportation. He summed up his 17 years on TCHH as “I have served on the AASHTO TCHH since 2002 and it has been an enriching experience. I always looked forward to our annual meetings and to meeting friends that were more than colleagues. I hope that I was able to make a contribution over the years I was part of this highly professional and informed group. I certainly learned a lot from the information exchange, personal discussions and participation with the drainage manual.”

Karuna Pujara works for the Maryland State Highway Administration and joined TCHH in 2005. Karuna showed a dedication to TCHH staying on and serving her stint as Chair of TCHH even after changing jobs at her agency. Karuna’s focus on people and connections with the environmental side of hydraulics helped the committee look for areas of common interest with SCOE and other environmental groups. Karuna continues to work at MDOT SHA proving there is life after hydraulics after all.

These people all served with integrity, knowledge and a willingness to share their expertise and friendship. We in TCHH are blessed to have had the opportunity to know and work with them all.
I also wanted to take this opportunity to thank Nick Wark, VTrans, for serving as the TCHH Chair for the last two years. Nick graciously accepted the appointment in the midst of significant membership turnover and the AASHTO reorganization. Through his thoughtful leadership we were able regain the committees focus on research and problem solving, as well as, push through a study to help reorganize the AASHTO Drainage Manual into more manageable sections that can be readily updated as new peer reviewed research becomes available.

Wishing everyone a healthy and prosperous 2019.

-Steve

Update on the Use of Spray Applied Pipe Linings as a Structural Renewal for Gravity Storm Water Conveyance Conduits

Jeffrey Syar, Ohio DOT
Mo Najafi, University of Texas Arlington

A group of researchers from CUIRE at the University of Texas at Arlington are developing a design methodology for use of spray applied pipe linings (SAPLs) for structural applications in renewal of culverts and drainage structures. The team includes several partner companies, Structurepoint, Inc., Columbus, Ohio; LEO Consulting, LLC, Chesterfield, Missouri; and Rehabilitation Resource Solutions, LLC, Columbus, Ohio. The project is funded through the partnership of State DOTs via the Transportation Pooled Fund Program.

The most important step in the designing of a trenchless renewal technique is the selection of the most appropriate, cost-effective, and reliable method. Obviously, selection of a solution is based on the recognition of the problem or problems with the existing pipeline system. The design of a pipeline renewal system includes (1) identification of pipe conditions and problem recognition and classification, (2) prioritization of problem considering strategies and long-term plans, (3) selection of an appropriate pipeline renewal method, (4) designing renewal methods based on project specific conditions, and (5) implementation and monitoring.

The key factor in current design guidelines is whether the existing pipe is structurally sound enough to continue to carry the earth, live, and hydrostatic loads imposed on it. It is well known that existing flexible pipes gain structural strength through the soil-structural interaction, thus making them a composite system. There are many documented instances of existing corrugated metal pipes with significant invert loss that continue to hold their shape due to the load carrying capacity of the surrounding soil. If the existing pipe is structurally sound enough to continue to maintain shape and carry the earth and live loads imposed on it then several internal lining techniques might be applicable, including sliplining (SL), cured-in-place pipe (CIPP), spray applied pipe lining (SAPL), and close-fit pipe (CFP). It is important to note that any lining technique used must be preceded by restoration of the surrounding soil integrity. Voids in the embedment or invert must be completely filled to restore the strength provided by the soil. The thickness and strength of the internal liner in this case is required to be sufficient to resist only the hydrostatic loads imposed by the groundwater table. Although these methods are designed to increase the structural load carrying capacity of the existing pipe, they do resist continued structural deterioration and they maintain the soil-structure interaction composite system. The linings are required to resist the live loads and dead loads. However, the dead loads are calculated in similar manner to what is required in a steel tunnel liner plate structure as per AASHTO LRFD Bridge Design Specifications, Section 12.13. Consequently, above linings are designed as semi-structural renewal methods.
If a pipe is deteriorated to the point from where it cannot continue to carry the earth loads and live loads imposed on it, it will lose its shape and collapse. The collapse may be catastrophic or it may occur over an extended time, depending on the rate of surrounding backfill loss. Renewal methods applied at this stage are designed to serve as standalone structures. Methods such as sliplining (SL), cured-in-place pipe (CIPP), panel lining (PL), or close-fit pipe (CFP) might be appropriate, but the wall thickness of the new pipe will be thicker than in the case described previously, and the installer must assure that the surrounding soil strength is restored otherwise subsidence of the soil may occur after the renewal method is completed. The existing pipe has to maintain hydraulic capacity, which will further limit renewal at this stage due to reduced cross sectional area. If hydraulic capacity cannot be assured, the new pipe can, under certain conditions, be replaced by in-line replacement techniques, such as pipe bursting (PB) or hand tunneling (HT). Another renewal method is “invert concrete field paving” for corroded corrugated metal pipes (CMPs). If none of the trenchless renewal methods (TRM) can be employed (e.g., because of shape, soil voids and localized collapse, alignments, size, joint settlements, hydraulic capacity problems), the pipe might have to be replaced using a parallel line installed by the trenchless construction methods (TCM). In some cases, a combined number of different trenchless renewal methods or even a combination of open-cut and trenchless method might be considered. The latter approach would be considered when the surface disruption associated with conventional open-cut technique could be tolerated.

**Background**

To reduce emergency projects and impacts to the travelling public, departments of transportation (DOTs) can use spray applied pipe linings (SAPLs) to renew deteriorated gravity storm water conveyance conduits and culverts provided they are discovered prior to loss of soil-structure interaction. The American Association of State Highway Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP) developed a Technical Committee for Spray Applied Pipe Liners (SAPL) in an effort to implement this new technology. The SAPL Task Committee (TC) consists of DOTs, manufactures of resin based material, and manufactures of cementitious based materials. An early request from the DOT members was to ensure that the spray applied lining functioned as a structural liner. However, it was quickly realized that no standardized structural design methodology existed for this technology. Manufacturers utilize different design methodologies with some using the Cured-In-Place Pipe (CIPP) ASTM F1216 methodology and others using various classical analytical structural design equations developed for other purposes. A gap in knowledge was identified and preliminary discussions for research among the SAPL TC members were formed.

Once the pooled funded research project obtained commitments from participating DOTs the research needs statement (RNS) was developed and advertised through Ohio DOT’s Research Program. The University of Texas at Arlington’s (UTA’s) Center for Underground Infrastructure Research and Education (CUIRE) was selected by the partnering DOTs. The objective of the project is to develop design methodologies and equations for structural application of SAPL for Circular Pipe and Pipe Arch shapes with span larger than 36 inches. Participating DOTs include: DelDOT, FDOT, MnDOT, NCDOT, NYSDOT, Ohio DOT, and PennDOT with Ohio DOT being the lead State.

SAPL vendor material physical property testing is being performed by a third-party lab contracted through the AASHTO NTPEP program ([http://www.ntpep.org/Pages/SAPL.aspx](http://www.ntpep.org/Pages/SAPL.aspx)). This data will be incorporated into the

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**Some Benefits of SAPLs**

- No traffic disruptions
- Fast
- Non-worker entry
- Durability
- Environmentally friendly
pooled funded research project. The development of practical spray applied structural culvert pipe linings could be of enormous benefit to the Departments of Transportation. Such linings could be a cost-effective strategy in extending service life and managing the future burden expected from the aging network of culverts and storm sewers. Compared to other culvert rehabilitation systems, spray applied linings promise greater cost effectiveness and less community disruptions.

Objectives, Methodology, and Project Update

The primary objective of this two-year research project that commenced in December 2017 is to develop design equations for structural renewal of gravity storm water conveyance culverts using spray applied pipe linings for both cementitious and resin-based materials and for circular and non-circular (NC) shapes. Design equations developed with this project will use loading as detailed in the AASHTO’s Load and Resistance Factor Design (LRFD) Bridge Design Specifications and will be applicable for round and pipe arch shapes. All parameters of the host culvert that may impact the design thickness such as vertical or horizontal deflections, unsymmetrical racking, section loss, cracks, material geometry (corrugations), or protrusions such as bolts and flanges will be considered. Additionally, practical limitations on the use of these design equations will be included.

The methodology for this research and the status of each item include:

- Literature search to minimize amount of laboratory testing and field inspections- Completed
- Survey of U.S. DOTs and Canadian agencies- Completed
- A database of previous projects and experiences of participating DOTs with SAPLs- Completed
- Field data inspections of in-situ SAPL installations at participating DOTs- Completed
- Review of CIPP ASTM F1216 design equations- Active
- Soil box testing to develop and validate structural design equations with circular and pipe arch shapes with resin and cementitious SAPL materials at various thicknesses- Active
- Determine if metal pipe corrugations need to be complete filled with SAPL material (as claimed by some SAPL vendors) - Active
- Life cycle cost analysis - Anticipated
- Finite element computational modeling-Anticipated
- Development of a performance-based construction specification-Anticipated
The following SAPL suppliers have expressed interest in participating in this important evaluation program, up to publication of this paper. Some of these vendors already have started or completed testing through NTPEP.

- A.W. Cook
- Advantage Reline
- CentriPipe
- Epoxytec
- HydraTech Engineered Products LLC
- Inland Pipe Rehabilitation (IPR)
- Lafarge
- Vortex/Quadex Lining Systems
- MCOR
- Milliken
- Raven Lining Systems
- Sherwin-Williams
- Sprayroq
- Standard Cement
- Superior Coating Solutions
- The Strong Company

To participate in this active project, DOTs and vendors can contact Mr. Jeffrey Syar, P.E., Administrator, Ohio DOT Office of Hydraulic Engineering, Phone: 614-275-1373, Email: Jeffrey.Syar@dot.ohio.gov; or Dr. Mo Najafi, P.E., Phone: 817-272-9177, Email: najafi@uta.edu, the Principal Investigator for this project.

**HyDrone-RCV-G2 Technology Research Evaluation 2018**

Julie Heilman, Washington State DOT

The cornerstone of Land Surveying is based on traditional process and procedure. The profession acknowledges but is resistant to outside influence and more or less, has been unchanged throughout time. Additionally, hydraulic modeling in its current state has been in use for nearly 60 years. Modeling techniques have been overly conservative and do not meet current needs of utilizing best available science and technology.

Today, hydraulic and topography data has never been easier to collect. The conglomeration of various technologies from the Land Survey profession and 2D hydraulic modeling software are expediting the data acquisition and graphical visualization process. Accuracy and precision standards once thought to be gratuitous are now common practice and are becoming industry standards. Overall, this result leads to a better represented solution for our infrastructure and resiliency.

One example of a data acquisition tool that is currently being used is the HyDrone-RCV-G2, by Seafloor Inc. This is a portable, remotely controlled or fully autonomous catamaran platform developed for hydrographic survey applications. Working in conjunction with the HydroLite-TM portable echosounder, AutoNav, Leica CS15 data collector, Leica GS14 GNSS antenna and Leica TS15 total station, data can be collected in water bodies remotely.
Data output collected from Hydrone

Since February of 2018, WSDOT South Central Region Survey crew and HQ Hydraulics Section has evaluated nine locations with the HyDrone technology described above. SR 12 Tucannon River and McNary Pond, SR 24 Yakima River, SR 101 Elwha River and Indian Creek, SR 223 Yakima River, SR 410 Rock Creek and I 90, Cle Elum River and Lake Easton. Site evaluation consisted of the following:

- **Canopy:** The Leica GS14 GNSS antenna operates best with unobstructed sky. Dense trees, foliage, rock out cropping, and metal structures can impede the satellite consolation that provide an element of triangulation. Also, the HyDrone uses differential GPS to navigate itself when functioning autonomous. This form of satellite navigation will generally yield an accuracy of 3 to 10 meters. This means as the vessel travels to its predetermined way points its position can vary up to 3 to 10 meters, which can increase exponentially in the presence of heavy canopy.

- **Ground based control:** In the event that the GNSS is not applicable ground control must be placed within line of sight to the vessel in the water. While this process can be more laborious, but it is always a solid go to. In this case we replace the Leica GS14 GNSS antenna with a 360-degree prism and the Leica TS16 Total Station.

- **Cellular / Radio coverage:** To achieve an acceptable coordinate when utilizing GNSS, or otherwise called ground-based correction, the Leica CS15 data collector must receive coordinate correction from either a Real Time Network (RTN) or a local ground base point. Believe it or not there are numerous locations in Washington where cell coverage is absent. Due to the remote locations or project topography we have not been successful when using the local base method.

- **Water ingress and egress:** At each of the locations water access with this gear has presented an obstacle. Team safety is first priority and delivering twelve, expensive instruments safely to and from the water body can create their own challenges. This has not restricted our process at any location at this point, however is always a consideration.

- **Water body width, depth and flow rates:** Obviously a more quiescent flow, wide, deep and unobstructed project location will yield the most stress-free results. Locations such as SR 12 McNary Pond and I 90 Lake Easton were excellent test locations. This gave us an opportunity to truth sonar depths and adjust pitch, yaw and acceleration settings. At other locations depths and flow rates seem to alter our vessels productivity. While each circumstance was very different and lent itself to new solutions, conditions often changed throughout the reach and needed to be adjusted often. Locations that were turbulent were often riddled with log jams and weirs. Moreover, were too shallow for the vessel’s thruster depths. On average the vessel performed best in water moving no faster than 12-15 mph with a minimum depth of 2 feet.

- **Emergency exit vessel extraction:** Throughout the reach conditions change dramatically. Quiescent and laminar flows can quickly be altered by root balls, stumps and submerged obstructions. Each location was evaluated to determine a plan to extract the vessel if or when an emergency occurred.
At the SR 12 Tucannon River location the vessel lost radio contact, was quickly overtaken by the current and was caught in a log jam down river. Since extra precaution was taken by securing a tether to the vessel, the spotter on the bank was able to extract the vessel without incident.

**Location observations and findings:**

**SR 12 Tucannon River:** 2500 CFS (USGS), heavy bank lined trees and brush, steep slopes to access, no cell coverage, zero satellites, 50 ft wide obstructed with root wads and sand bars, minimum depth .5 feet. No data was able to be collected

**SR 12 McNary Pond:** Lake, open sky, cell coverage, 18 satellites, 200 ft wide and unobstructed, minimum depth 2 feet.

SR 24 Yakima River: >100 CFS (estimated), bank lined trees and brush, cell coverage, 22 satellites, 168 ft wide and unobstructed, minimum depth 3 feet.

SR 101 Elwha River: 1000 CFS (USGS), bank lined trees and brush, steep slopes to access, cell coverage, 12 satellites, 200 ft wide obstructed with root wads and sand bars, minimum depth .5 feet. No data was collected.

SR 101 Indian Creek: >100 CFS (estimated), heavy bank lined trees and brush, steep slopes to access, no cell coverage, 3 satellites, 80 ft wide obstructed with root wads and sand bars, minimum depth .5 feet. No data was collected

SR 410 Rock Creek: 25 CFS (estimated), bank lined trees and brush, easy to access, no cell coverage, 8 satellites, 10 ft wide limited obstructions, minimum depth .5 feet. No data was collected

I 90 Cle Elum River: 1000 CFS (USGS), open sky, cell coverage, 29 satellites, 150 ft wide and unobstructed, minimum depth 4 feet. No data was collected.

In the end, technology for survey data collection to support hydraulic modeling is advancing and improving and the department should utilize the technology, as it is available and continue to improve our processes and infrastructure resiliency.

The Hydrone was purchased for $20,430 through Kuker-Ranken Inc, which is a provider of survey graded equipment. This purchase was done to conduct research on the advancements in technology. The South Central Region survey crew has determined there are benefits to having this as a tool will continue to use it as a on applicable settings and will provide training to other regions that determine it will work for their applications.
Foundation failure is a major cause of bridge collapse in the US accounting for about 60% of all failures. Leading causes that contribute to these failures during design include adequately measuring the geotechnical properties associated with cohesive soils, the complex interactions between the hydrodynamic forces of flowing water and the soil resistance forces, and the use of scour depth prediction equations that produce estimates with high uncertainty. Several USGS and DOT studies has shown that bridge foundation design in cohesive soil can be grossly over and under designed using the existing FHWA HEC-18 equations. In order to better understand the complex erosion mechanism of cohesive soils around bridge foundations, the University of Tennessee, Knoxville conducted a physical model study in a large outdoor flume (40’x4’x2’) funded by Tennessee Department of Transportation (TDOT) (Figure 1). The experimental design for the study considered several factors; they were: i) the influence of flow sequence (low-medium-high flow and vice versa) instead of using constant flow velocity on scour development and propagation, ii) the influence of stress history from multiple flow events on scour propagation, which can be termed as a soil fatigue memory effect, and iii) the influence of soil bulk density (BD) on scour depth development and propagation. Within the flume, a vertically positioned 10.16 cm diameter (D) acrylic cylinder was placed into a 4’x4’ test chamber on the flume bottom filled in 12-inches of natural cohesive sediments, collected from a local stream bed. The natural cohesive soil consisted of 3% sand, 72% silt and 25% clay (by weight) and the in-situ BD was 1.86 g.cm⁻³. A constant flow depth of 15.25cm (h) was maintained for 18 experiment runs. The range of flow velocity used in these experiments was between 80-102 cm.s⁻¹.

Study results suggested that scour commenced on the lateral sides of the cylinder and maximum scour depth also occurred along the sides irrespective of flow velocity and BD condition. For each flow and BD condition, both the τ_max (range 0.07-0.21 psi) and R_d (pier Reynolds No. range 66265-98087) values were higher, which consequently lead to greater downstream-directed scour propagation. It was also observed that shallow water conditions (since h/D < 2.0) influenced the lateral and transverse scour hole formation at the downstream side of the cylinder compared with the sides and upstream of the cylinder.

Scour propagation under multi-flow conditions showed that depending on the soil BD conditions, almost similar maximum scour depths were observed for both the L-M-H and H-M-L flow sequences. However, the final scour depth was much higher for lower BD condition (Figure 2). Scour rate was found dependent on initial flow and BD, where regardless of flow sequence scour rate was always slow at medium flow velocity. It was also observed that at higher BD condition (1.81-2.04 g.cm⁻³) scour depths initiated after 3 to 12 hours of flow. Whereas, at lower BD condition, scour initiated almost instantly for both low and high flow.

Analyzing the time dependent scour development, it was observed that the HEC-18 scour depth equations for cohesive soils over predicted the equilibrium depths. It was also identified that at field BD conditions, those equations were estimating substantially higher scour depths compared with observed scour depths from this study. Findings from this study identified that the predicted equilibrium depth for this natural cohesive sediment was not similar to the non-cohesive sediments and supports the hypothesis that the influence of multi-flow events, previous stress history (memory effect), and scour time dependency are critical for scour development and propagation in cohesive soils. These factors need to be incorporated into a scour prediction equation for cohesive soils in order to reduce the uncertainty with its current relational factors. Further research through a similar study design specifically targeting more flow events are necessary to better understand the scour development in natural cohesive soils and development of an equilibrium scour depth equation.
A pooled funded research project can be developed when significant or widespread interest is shown in solving a common or regional transportation-related problem. The research activities may be jointly funded by several federal, state, regional, and local transportation agencies, academic institutions, foundations, or private firms as a pooled fund study. Pooling resources reduces marginal costs and provides efficient use of taxpayer dollars while creating diverse relatable research via input from various participants. It provides greater benefits as compared to individual entities conducting or contracting for research on their own.
Pooled funded studies must be sponsored by either a State DOT or the FHWA. Within each State DOT and the FHWA, specified individuals are authorized to create and post a project solicitation on the website. Typically, the authorized user is the AASHTO Research Advisory Committee member in the State DOT. Regional or local transportation agencies, private companies, foundations, and colleges/universities may partner with any or all of the sponsoring agencies to conduct pooled fund projects.

Highlighted Pooled Funded Research

**Design Guidelines and Mitigation Strategies for Reducing Sedimentation of Multi-Barrel Culverts** - The Iowa Department of Transportation (IDOT) in conjunction with the University of Iowa requests participation in a pooled fund study to mitigate sedimentation in multi-barrel culverts. The Iowa-led DOT initiative aims at expanding research carried out in Iowa to other states through a Transportation Pooled Fund (TPF) Program solicitation. The TPF solicitation, titled *Design Guidelines and Mitigation Strategies for Reducing Sedimentation of Multi-barrel Culverts*, is available at: [https://www.pooledfund.org/Details/Solicitation/1483](https://www.pooledfund.org/Details/Solicitation/1483)

Highlights of the work performed in Iowa can be found here:

1) A short (~ 4 mins) video describing the web-based geospatial application that is aimed at supporting culvert monitoring and design with special emphasis on the sedimentation processes. The summary video is available at: [https://www.youtube.com/watch?v=sMfmNpX-JoM](https://www.youtube.com/watch?v=sMfmNpX-JoM) (for better viewing please adjust for high resolution in the “Settings” tab of the Youtube’s bottom toolbar). The web-platform provides systematic procedures for storing culvert inventory info, assessing culvert sedimentation status (using field survey and aerial imagery), analyzing and forecasting culvert sedimentation potential (using visual analytics and machine-learning to establish correlations between sedimentation degree and the watershed relevant variables). These interactive tools facilitate an improved understanding of the overall culvert-watershed interactions in Iowa. Because the web-portal was built with generic databases (i.e., USGS, SSURGO, RUSLE, EPA StreamCat, NHDP Plus, etc.), it can be easily extended for any stream location in the U.S. that is prone to sedimentation. You can access and test the fully-functional web-portal is available at: [http://iowawatersheds.org/idotculverts](http://iowawatersheds.org/idotculverts).

2) **Self-cleaning Box Culverts: From Research to Implementation**. So far, three hydraulically-powered solutions for mitigation of sedimentation at culverts were identified (one fully tested and implemented at a culvert site and one currently under implementation). A short presentation of these three solutions is available at: [http://iowawatersheds.org/idotculverts/data/solutions.pdf](http://iowawatersheds.org/idotculverts/data/solutions.pdf)

A commitment of $20,000 over a three-year period is the participation fee for interested parties. The level of support we receive through this program will help to define how many and which of these activities that can be accomplish. For more information, contact either (David.Claman@iowadot.us or marian-muste@uiowa.edu).

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**Survey on Highway Hydraulics State of Practice Coming Out Soon** Andrea Hendrickson, Minnesota, DOT

The objective of the NCHRP Project 20-05 Synthesis Topic 50-02 *Highway Hydraulic Engineering State of Practice* is to document significant changes that state DOTs have made to their hydraulic engineering policies and practices over the past decade in response to emerging technology, regulatory requirements, environmental concerns, alternative project delivery methods, and other factors. The study will highlight the
To gather information on current highway hydraulic engineering practices a questionnaire will be sent out January 2019. The good news is that this questionnaire will be significantly shorter than previous surveys on this topic! Because of the tight project timeline we are asking people who receive the survey to respond promptly. Thanks for your participation in making this project a success.

Welcome New TCHH Members

Kevin Flora, P.E., D.WRE
California Department of Transportation

Kevin Flora has worked for the California Department of Transportation (Caltrans) for over 30 years and has directed the Caltrans Bridge Scour program for the past 23 years which has provided him with the opportunity to participate on several scour-related NCHRP Panels and FHWA Task Forces. He has been responsible for overseeing the bridge scour evaluation program for all state-owned bridges in California and has sought to develop and use innovative practices whenever possible. Examples of these activities include software development for channel cross-section analysis and scour computations, advanced field data acquisition techniques using an Acoustic Doppler Current Profiler (ADCP) for model calibration and bathymetric survey augmentation and advanced 2 and 3-dimensional hydraulic modeling. Consequently, Kevin has developed an adrenalin addiction for collecting data from Caltrans inflatable boat during floods believing that collecting flow and scour data during high flows is essential for improving our understanding and modeling techniques.

In addition to his work with Caltrans, Kevin has run a consulting business for hydraulic software development and has served as an International Consultant for bridge scour mitigation work in India. He has also taught courses in Open Channel Flow and the Hydraulic Lab as an adjunct professor at the California State University, Sacramento.

Kevin graduated from Cal Poly, San Luis Obispo in 1988 with a B.S. in Civil Engineering. He obtained a Master’s degree in Water Resource Engineering from UC Davis in 2003. Currently, Kevin is enrolled in the Doctorate program at Stony Brook University in NY in pursuit of his goal to implement a physics-based numeric model for bridge scour and river migration using Computation Fluid Dynamics (CFD) code.

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Saul Nuccitelli, PE, CFM
Chief Hydraulics Engineer
Texas Department of Transportation
Saul Nuccitelli joined TxDOT as the department’s Chief Hydraulics Engineer in 2017. In this role, he is responsible for maintaining TxDOT’s statewide policies on stormwater, including the Hydraulic Design Manual, drainage software, standards and specs, training, and research or special initiatives with universities and other state/federal agencies. He has over 25 years of civil engineering experience having worked in both public and private agencies. His primary focus has been in water resources including stormwater master planning and asset management, floodplain mapping, drainage modeling and design, drainage criteria, and municipal drainage charge rate structures. His experience includes many years assisting FEMA at regional and national levels managing their floodplain mapping and map change permitting processes.

Saul is passionate about continuous improvement for drainage and water resources practitioners. As a result, he is currently serving on two NCHRP Project panels – Highway Hydraulic Engineering State of Practice and FloodCast – A Framework for Enhanced Flood Event Decision-Making for Transportation Resilience. He is also serving on several TxDOT research panel teams including Streamflow Measurement at TxDOT bridges, Analysis of Curb Inlets in the new TxDOT Standard Inlet and Manhole Program, Traffic Safety Improvements at Low Water Crossings, Development of Concrete Median Barrier for Flood-Prone Areas, Update Rainfall Coefficients with 2018 NOAA Atlas 14 Rainfall Data, and Development of a Generalized Skew Update for Texas Flood Frequency Analyses. Saul has presented at over a dozen conferences regarding various stormwater topics.

Saul obtained a BS and MS in Civil & Environmental Engineering from the Massachusetts Institute of Technology in 1992 and 1994, respectively. He was awarded Young Engineer of the Year in 2004 by NSPE for the state of Texas, and while he’s not young anymore, he’s still young at heart. He stays active by chasing frisbees (playing Ultimate) and chasing his 4 kids and 2 pets around with his wife, who is much better at keeping up than he is.
**Calendar of Events**

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**Joint Meeting of the AASHTO Committee on Design and Council on Active Transportation**

**In collaboration with TRB Roadside Safety Design Committee**

**Save the Date**

Registration Opens March 2019

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This newsletter is published biannually by the AASHTO Technical Committee on Hydrology and Hydraulics. To be added or removed from the mailing list, to suggest articles, or to provide comments contact: Andrea.Hendrickson@dot.state.mn.us, or call 651-366-4466.

For more information on the Technical Committee on Hydrology and Hydraulics, see [https://design.transportation.org/technical-committees/hydrology-and-hydraulics/](https://design.transportation.org/technical-committees/hydrology-and-hydraulics/).

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