Hydrologic and Hydraulic News

January 2017   Volume 5 Issue 1

Are You Ready For C.H.A.N.G.E?

Collaborative Hydraulics: Advancing to the Next Generation of Engineering or C.H.A.N.G.E. is a FHWA Hydraulics Discipline innovation launching in 2017 through the Every Day Counts (EDC) program. Our vision for the C.H.A.N.G.E. innovation is the widespread use and understanding of the "next generation" tools for hydraulic engineering to promote better quality of hydraulic design and collaboration within DOTs and with other stakeholders.

The C.H.A.N.G.E. Tools and their Advantages:

The current state-of-the-practice tools for transportation hydraulic engineering are 1-Dimensional (1-D) hydraulic modeling tools with limited 2-Dimensional (2-D) graphics. However, the "next generation tools" of 2-D hydraulic modeling software with 3-Dimensional (3-D) graphical visualization have matured significantly and are now easier to use and ready to become the "go-to" software for design. Advantages of these "next generation" tools include:

- Better Representation of Hydraulic Conditions – both numerically and visually – leading to improved design assumptions.
- Enhanced Communication – 3-D graphical visualizations derived from 2-D modeling better communicate the complex interaction between waterways, the transportation infrastructure, and the surrounding environment.
- Streamlined Delivery - improved communication through 2-D and 3-D visualizations can reduce environmental and regulatory impediments to projects and streamline delivery.

Benefits to Your State DOT:

State DOTs who sign up for the C.H.A.N.G.E. innovation will designate a Champion or group of Champions to lead the transition to 2-D modeling and 3-D visualizations. C.H.A.N.G.E will help the Champion become proficient in the "next generation" tools by providing resources, such as:

- Training on modeling software use and how to communicate the results to stakeholders effectively.
- Technical guidance resources on best-practice modeling techniques.
- User forums and other means of peer exchange for modelers and reviewers.
- Technical modeling assistance with a limited number of design projects.

Want to learn more:

Read additional articles discussing the "next generation" tools and case studies demonstrating the advantages of the tools beginning on page 8 in this newsletter. Also, visit the C.H.A.N.G.E. website at:

https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/change.cfm.

Table of Contents

Upcoming Hydraulic Events

February 2017

- NHI Course 135047 —Phoenix, AZ - February 1, 2017
- NHI Course 135056 – Corpus Christi, TX – February 7-9, 2017
- NHI Course 135095 – San Antonio, TX – February 7-9, 2017
- NHI Course 135065 – Eau Claire, WI – February 14-16, 2017
- NHI Course 135067 – Corpus Christi, TX – February 14-16, 2017
- NHI Course 135047 —Secaucus, NJ - February 20, 2017
- NHI Course 135080 – Hydrologic Analysis and Modeling – February 21 – 23, 2017
- NHI Course 135095 – Vancouver, WA – February 21 – 23, 2017
- NHI Course 135046 —San Antonio, TX - February 22-24, 2017

March 2017

- NHI Course 135041 – Pierre, SD – March 7-9, 2017
- NHI Course 135056 – Fort Worth, TX – March 7-9, 2017
- NHI Course 135067 – Corpus Christi, TX – March 13-16, 2017
- NHI Course 135095 – Atlanta, GA – March 14-16, 2017
- NHI Course 135027 —Dallas, TX – March 21 - 23, 2017
- NHI Course 135028 – Austin, TX – March 24, 2017
- NHI Course 135046 —Dallas, TX – March 28-30, 2017
- NHI Course 135056 – Warren, PA – March 28-30, 2017

April 2017

- NHI Course 135027 —Lubbock, TX – April 4 – 6, 2017
- NHI Course 135080 – Dallas, TX – April 4-6, 2017
- NHI Course 135056 – Waukesha, WI – April 11-13, 2017
- NHI Course 135056 – Houston, TX – April 18-20, 2017
- NHI Course 135041 – Lubbox, TX – April 24-26, 2017
- NHI Course 135080 – Austin, TX – April 25-27, 2017

The FHWA Hydraulics Discipline:

Colleagues, Customers, Partners, and Memories

By Dan Ghere

It's time for me to sit back and gaze through a life time of memories of friends, colleagues, and adventures.

I grew up in a rural area of central Illinois. Most of my free time as a child was spent on the banks of the Kaskaskia and Embarras Rivers. The Kaskaskia was in a basin of mostly cohesive soils while the Embarras had a much higher concentration of sandy soils with faster currents. Little did I know back then that my every day adventures were experiences with hydraulic engineering. In my freshman year of college during a hydraulics lab class with a hydraulics flume, I identified and connected many basic hydraulic principles with my childhood experiences. During the following semesters, I loaded up on as many hydraulic courses as I could fit in my schedule as I was sure that was the engineering field I wanted to pursue. My second interest was geotechnical engineering, which turned out to be a great companion to hydraulics as I followed a career in highway engineering.

My career in hydraulics started in 1967 with Illinois DOT. Early on I learned that the engineering knowledge you gained in college was not always for direct application on the job. Applying hydraulic engineering principles to a highway environment was seldom a direct fit and it was through various FHWA manuals, software programs, and conversations with work colleagues, FHWA and other state hydraulic engineers that I found direct applications for solving my engineering mysteries.

Through my many years working with the AASHTO Technical Committee on Hydrology and Hydraulics (TCHH), I developed a strong appreciation for the knowledge, dedication, and friendship of fellow hydraulic engineers across the country. The opportunity to share ideas, experiences, problems, and solutions with others through the AASHTO TCHH will always be a highlight of my memories.

The work on the AASHTO TCHH also gave me considerable face-to-face time with many different FHWA hydraulic engineers over the years. This face-to-face time strengthened my appreciation and respect for the work FHWA has done to advance the state of hydraulic practice in highway engineering. My appreciation deepened when I joined the FHWA National Hydraulics Team in 2001 as I became more aware of the dedication, knowledge, and skills of this diverse group. I am very thankful to have had the opportunity to be a part of the FHWA National Hydraulics Team because it has also given me the opportunity to work with so many others in the hydraulics, geotechnical, environmental, and structures disciplines from state DOTs, FHWA, and our consultant friends.

As retirement is closing in I look forward to sitting back and enjoying those memories. Good-bye friends and colleagues. I wish you well.

Editor's Notes: We will miss Dan Ghere and are grateful for his contribution to the highway hydraulic discipline. We wish him well in retirement. If Dan assisted you previously and you need assistance again from FHWA, please contact Eric Brown (eric.r.brown@dot.gov).

In the Lab with Kornel:

Advanced Full Scale Computational Fluid Dynamics Modeling for Abutment Scour in Erodible Rock

The Need:

The scour mechanism and erosion resistance of rocks are very different from those of granular bed materials. Current Federal Highway Administration (FHWA) scour design guidelines (Hydraulic Engineering Circular No. 18 (HEC18)) present a method to evaluate the pier scour depth in erodible rock, but no method is provided for the estimation of local abutment scour. Abutment scour depth has to be computed by either assuming the river beds contain uniform bed material or disregarding the characteristics of bed materials, which may result in unrealistic and overestimated scour depths. Therefore, an approach that can properly account for the erosion resistance of rocks is needed for evaluation of the abutment scour depths in erodible rock.

Hydraulic Loading and Soil Resistance Concept:

In HEC18, the method to evaluate pier scour in erodible rock is based on the comparison between the hydraulic loading and the soil resistance. The hydraulic loading at the pier is computed based on the approach stream power multiplied by a factor that amplifies the power because of the presence of local vortex systems which reduce the power as scour becomes deeper. The erosion resistance of rock is represented by the critical stream power required to initiate rock scouring, which is derived from the rock's erodibility index. The pier scour will stop at equilibrium where hydraulic loading is equal to soil resistance (Figure 1). Turner-Fairbank Highway Research Center (TFHRC) Hydraulics Laboratory is using this scour concept as a preliminary approach for estimating the abutment scour in erodible rock.

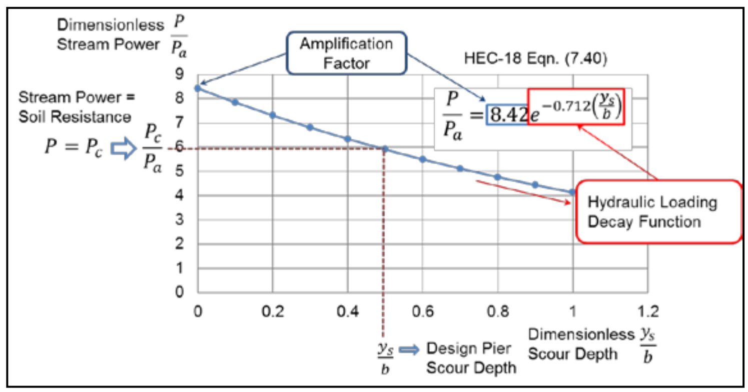


Figure 1: Hydraulic Loading Decay Function for Pier Scour in Erodible Rock

CFD Modeling:

Two major challenges in the development of the approach are: 1) to analyze the functional relationship between dimensionless scour depth and decaying stream power, i.e., the hydraulic loading decay function, and 2) to determine the amplification factor accounting for local vortex systems around abutments. The TFHRC Lab is conducting an advanced Computational Fluid Dynamics (CFD) model of full-scale bridge opening (Figure 2) geometries to develop the hydraulic loading decay function. The research explores the equilibrium abutment scour depths of bridge openings with rock of different erosion resistance. To isolate the local abutment scouring mechanism, the assumption is that each case maintains the same upstream flow condition and the contraction scour depth in the opening is negligible. Based on the findings from the CFD modeling, FHWA will develop design guidance for abutment scour in erodible rock.

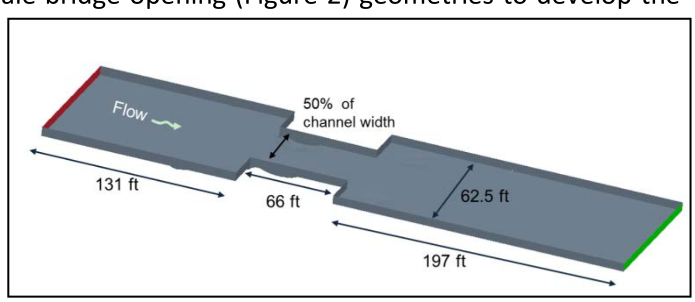
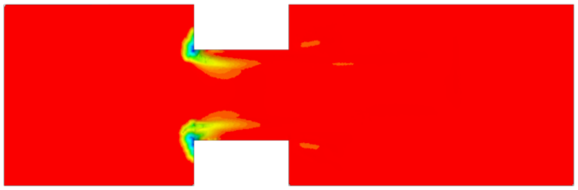


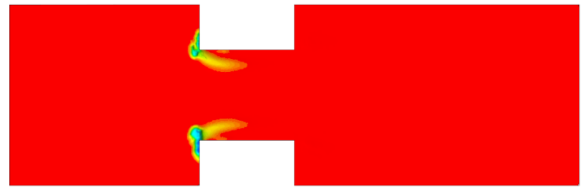
Figure 2: CFD Modleing of A Full Scale Bridge Opening Geometry.

Preliminary Results:

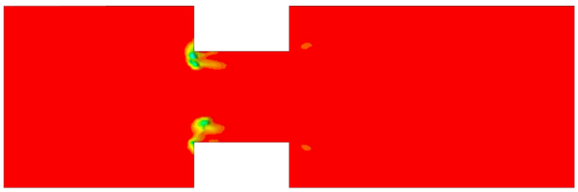
Figure 3 shows the preliminary modeling results for the bathymetry and the maximum scour depths at equilibrium for five cases with rocks of different erosion resistance. Under the equilibrium condition, the hydraulic loading of each case is equal to the critical stream power (erosion resistance) of rock.



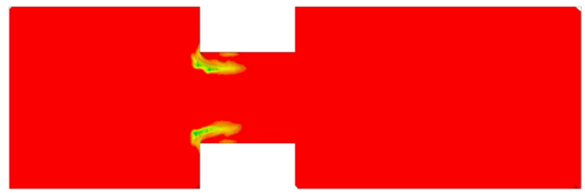
Case 1 – max scour depth = 7.0 ft, critical stream power = 0.20 lb/ft·s



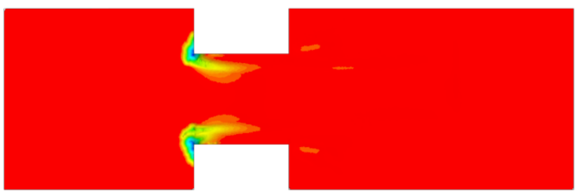
Case 2 – max scour depth = 6.6 ft critical stream power = 0.32 lb/ft·s



Case 3 – max scour depth = 5.1 ft critical stream power = 0.59 lb/ft·s



Case 4 – max scour depth = 4.1 ft critical stream power = 0.91 lb/ft·s



Case 5 – max scour depth = 3.4 ft critical stream power = 1.26 lb/ft·s

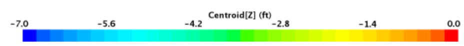


Figure 3: CFD Modeling Results – Bathymetry of the Equilibrium Scour for Five Cases with Different Erosion Resistance

The curve in Figure 4 shows the preliminary hydraulic loading decay function developed based on the curve fitting of CFD modeling results of the five cases. The plot is of dimensionless hydraulic loading vs. dimensionless maximum scour depth. With the preliminary decay equation, one may compute the hydraulic loading at different scour depths and compare the results with the soil resistance to determine where scour stops.

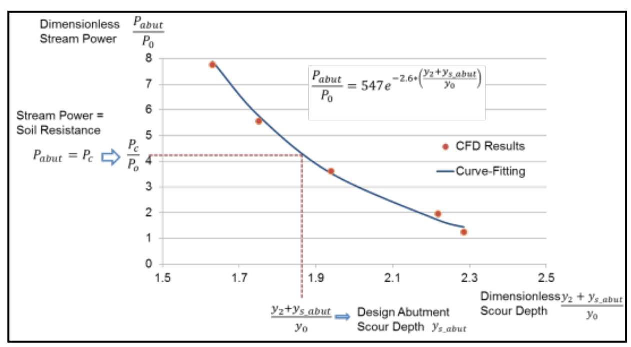


Figure 4: Preliminary Hydraulic Loading Decay Function to Determine Abutment Scour in Erodible Rock

Future Plans:

Refinement of the hydraulic loading decay function will be performed based on more cases of CFD modeling for different contraction ratios and bed erosion resistance. The results will be used to develop FHWA's future scour design guidance.

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

Brian's Updates:

HEC 17 Highways in the River Environment: Extreme Events, Risk and Resilience Released and Upcoming Webinar Training

FHWA has recently published HEC 17 Highways in the River Environment: Extreme Events, Risk and Resilience. The updated circular is a major and significant update that provides technical guidance and methods for assessing the nexus of riverine and transportation as it relates to floods, floodplain policies, extreme events, climate change, risks, and resilience.

Specifically, HEC-17 describes and discusses:

- FHWA and other floodplain policies and guidance
- Uncertainty associated with hydrologic models
- Nonstationarity and two drivers: climate change and land use/land cover changes
- Several tools for identifying and adjusting for trends in the historical record
- Techniques for projecting floods
- Global/regional climate models, downscaling techniques, and emissions scenarios
- Risk and resilience and the probabilistic nature of flood events

Recognizing that all plans and projects do not merit the same attention, HEC-17 also provides a five level analysis framework and specific guidance for addressing non-stationarity, including climate change. Finally, the manual provides case studies to illustrate several of the concepts.

For more information on HEC 17, please refer to the FHWA Transmittal Memo:
http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hec17_announcement.cfm

To download the new HEC 17, please refer to the following link:
http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif16018.pdf

FHWA is hosting three webinars to provide an overview of HEC 17 and allow you to ask questions of FHWA staff. The webinars will be held:

- HEC 17 Webinar 1: Introduction, Floodplains, Riverine Flood Events, Non-Stationarity (Chapters 1-4)
  January 25, 2017, 10 am to 12 pm
  Recording: https://www.fhwa.dot.gov/engineering/hydraulics/media.cfm
- HEC 17 Webinar 2: Climate Modeling and Risk and Resilience (Chapters 5 and 6)
  February 8, 2017, 11 am to 1 pm
  Register:
  https://collaboration.fhwa.dot.gov/dot/fhwa/WC/Lists/Seminars/DispForm.aspx?ID=1295
- HEC 17 Webinar 3: Analysis Framework and Case Studies (Chapters 7 and 8)
  February 22, 2017, 11 am to 1 pm
  Register:
  https://collaboration.fhwa.dot.gov/dot/fhwa/WC/Lists/Seminars/DispForm.aspx?ID=1296

For more information about HEC 17 and the webinars, please contact Brian Beucler at Brian.Beucler@dot.gov.

Community (FREE) Editions of SMS and WMS

FHWA has partnered with Aquaveo to develop software tools that address specific issues of transportation hydrology and hydraulics. The hydrologic analysis software developed is the Watershed Modeling System (WMS), which delineates drainage basins, calculates runoff, analyzes storm drains, etc. The Surface Water Modeling System (SMS) software developed is a graphical interface and analysis program for a number of two-dimensional hydraulic modeling programs, including SRH-2D, that are used for modeling complex bridge hydraulics. To use the software, all State DOTs receive licenses via a pooled fund.

With the latest releases WMS 10.1 and SMS 12.2 (beta), a Community Edition of the software is now available. The Community Edition of WMS is a version of the full WMS but has some limitations on the allowable number of sub-basins, GIS Layers, coverages, terrain data layers, and storm pipes. The Community Edition of SMS allows a basic interface to open and view files, generate one mesh, run one SRH-2D simulation, and view results. For more information about the Community Editions, please visit Aquaveo's Wiki page:

- http://xmswiki.com/wiki/WMS:What%27s_new_in_WMS_version_10.1
- http://xmswiki.com/wiki/SMS:What%27s_New_in_SMS_12.2

To download the Community Editions of WMS 10.1 and SMS 12.2 (currently BETA) at:

- http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm

State DOTs may continue to use the full Pro Editions of the software with their license. The Pro Editions can compute more complex hydrologic and hydraulic conditions and take advantage of the advanced capabilities of the software.,

The FHWA Resource Center Hydraulics Team provides technical support to all State DOTs, while Aquaveo provides technical support to all other Pro Edition users. Links to additional resources and tutorials on how to use each software package can be found on the FHWA Hydraulics Software page:
http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm

FHWA training recommends the following training for users of WMS and SMS:

- NHI Course 135080 Hydrologic Analysis and Modeling with WMS
- NHI Course 135095 Two-dimensional Hydraulic Modeling of Rivers at Highway Encroachments

Information on these courses and upcoming sessions are listed on the NHI web page:
http://www.fhwa.dot.gov/engineering/hydraulics/training.cfm

EDC4 - C.H.A.N.G.E – Benefits of 2-D Modeling

Better Representation of Hydraulic Conditions

Case Study 1: Dungeness River, WA: Bridge Maintenance and Repair

To mitigate a scour critical bridge on the Dungeness River, the Washington State DOT (WSDOT) developed a hydraulic model for the mitigation design. Initially, WSDOT used a 1-D model (Figure 1). Flows in this reach include a main flow path and a secondary flow path through a relief culvert. Correctly orienting the cross-sections to represent these different flows was challenging because 1-D models assume flow is in only one direction. The 1-D model also assumed a constant water surface elevation across the width of the channel. Due to the complexities of the hydraulics, WSDOT decided to develop a 2-D model for a better representation of hydraulic conditions at the bridge, specifically to evaluate the approach angles of flow at the piers.

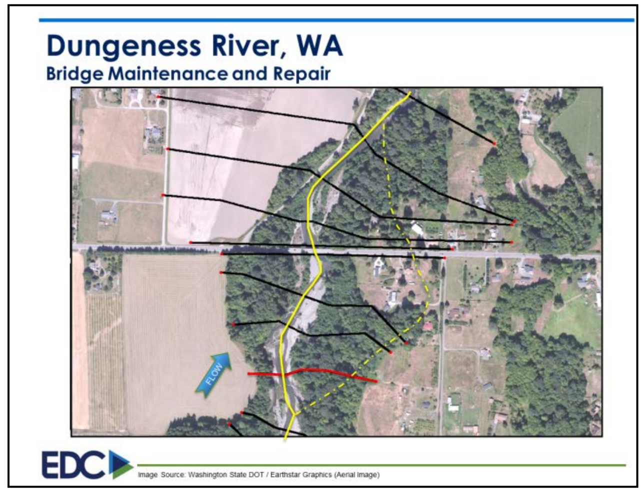


Figure 1: Cross-section layout for 1-D hydraulic model.

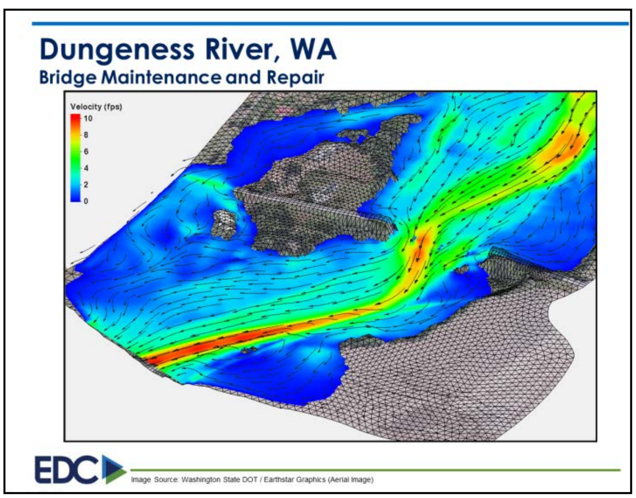


Figure 2: Velocity results from 2-D hydraulic model.

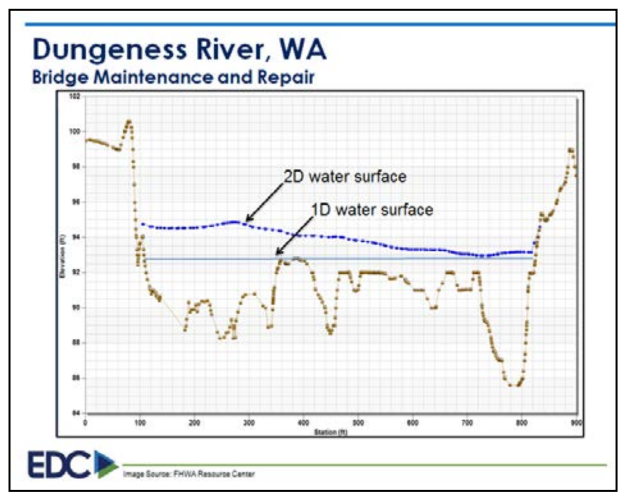


Figure 3: Cross-sections for 1-D and 2-D hydraulic models.

A 2-D hydraulic model represents the geometry and topography by a network of elements rather than cross sections. WSDOT specified the limits of the project area, provided terrain mapping and a few other parameters, and then directed the software to automatically create the network of elements. The 2-D model then computed water depth, velocity, and flow direction at each one of the elements to compute a better representation of the flow. Output from the 2-D model included a 3-D visualization which can show flood limits and flow velocities and directions (Figure 2). The plot in Figure 3 compares the water surface elevations obtained by the 1-D and 2-D models.

Case Study 2: Sacramento Wash, AZ: Road Maintenance and New Bridge Design

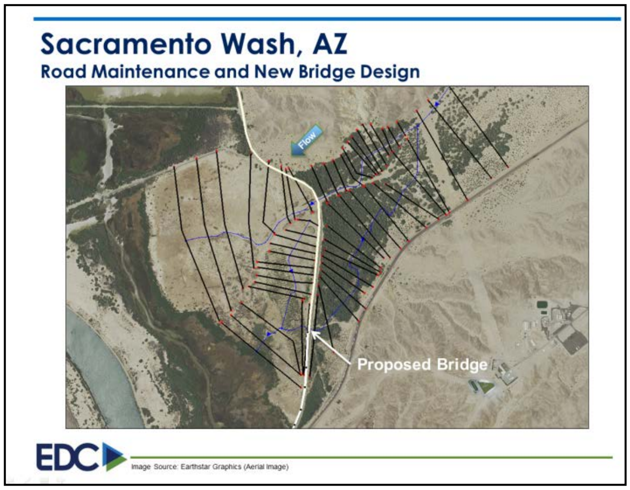


Figure 4: Cross-sections for 1-D hydraulic model.

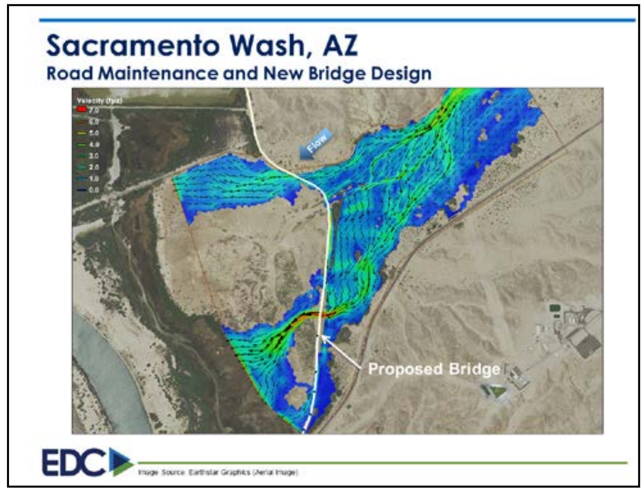


Figure 5: Velocities and flooding extent from 2-D hydraulic model.

Flow has historically crossed the low point of the county road on the Sacramento Wash in Arizona and sediment frequently deposits on the road. Proposed improvements involve construction of a new bridge on the lower flow path along with upstream channel improvements to divert flow from the road. Originally, the engineer developed a 1-D model to represent the site conditions and multiple flow paths (Figure 4). The one-dimensional modeling indicated that the design flow was contained in the channel through the proposed bridge and that there was no roadway overtopping!

A subsequent two-dimensional analysis showed that multiple flow paths still persisted and the roadway was still overtopping in multiple locations (Figure 5). The color contours denote velocity and the overall footprint represents the floodplain limits for the design flow.

Note arrows show multiple flow directions and multiple locations where flow spills over the road. This type of scenario is very challenging, if not impossible, to accurately analyze with a 1-D model. For many years, 1-D models were the best technology that was readily available and user friendly, but that is no longer the case. We should be using 2-D modeling for all projects like this with complex flow conditions.

Case 3: Wabash River, IL: Maintenance/ Planning/Asset Management

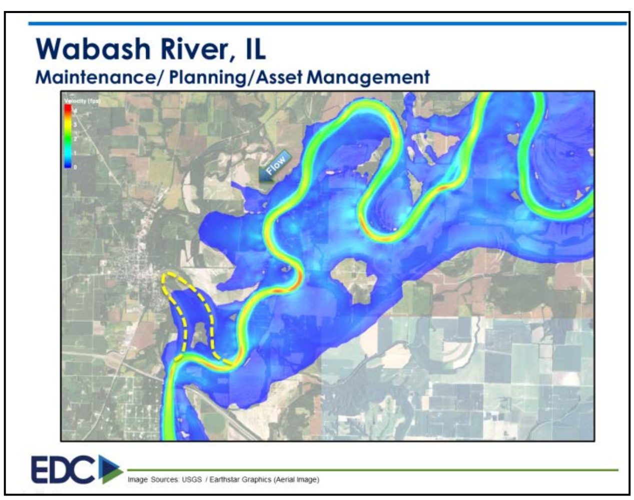


Figure 6: Velocities and flooding resulting from 2-D hydraulic model.

In 1984, a large river meander cut off (shown by the dashed yellow line in Figure 6) and the new bend in the Wabash River is migrating toward the roadway and could adversely impact the I-64 bridge. The USGS is working with the Illinois and Indiana DOTs to evaluate the upstream channel stability and migration rate. The USGS is using a 2-D model to estimate velocities around the outside of the bends. With the velocity information, the USGS will estimate the rate of bank migration to anticipate changes and develop an effective plan to protect the bridge.

EDC4 - C.H.A.N.G.E – Benefits of 2-D Modeling

Case 4: Shell Creek, NE: Floodplain Analysis and Design

The Nebraska State Highway 81 in eastern Nebraska crosses Shell Creek. Figure 7 shows the main bridge to the far right and a relief structure to the left of the bridge (highlighted by the row of trees). The bridge was designed using a 1-D model to pass the 100-year flood flow. Since construction, however, smaller floods have overtopped the roadway multiple times. To help analyze the problem of the flooding, engineers conducted a 2-D model of the floodplain, river, and bridges.

Figure 7: Roadway overtopped during a flood smaller than a 100-yr flood.

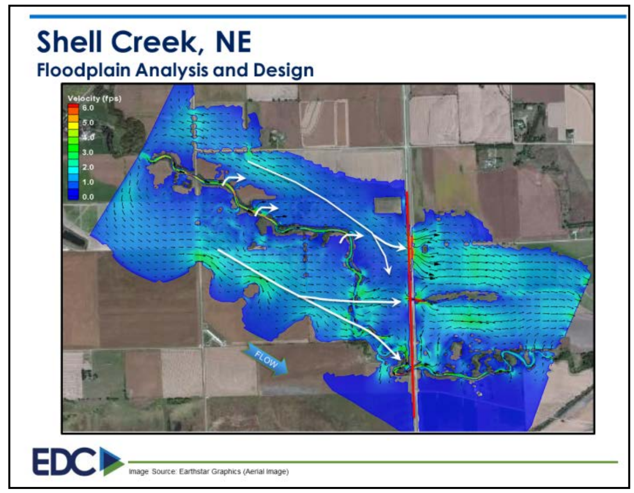


Figure 8: Velocity and flood flows depicted by 2-D hydraulic model.

Figure 8 shows the floodplain limits and velocity contours from the 2-D modeling results. The flow arrows show that flow spills out of the channel in several locations and there are multiple flow paths evident across the floodplain. All of these flow paths are very difficult to discern during a site investigation. The 2-D analysis shows that approximately a 4 to 5-year flood event will overtop the roadway.

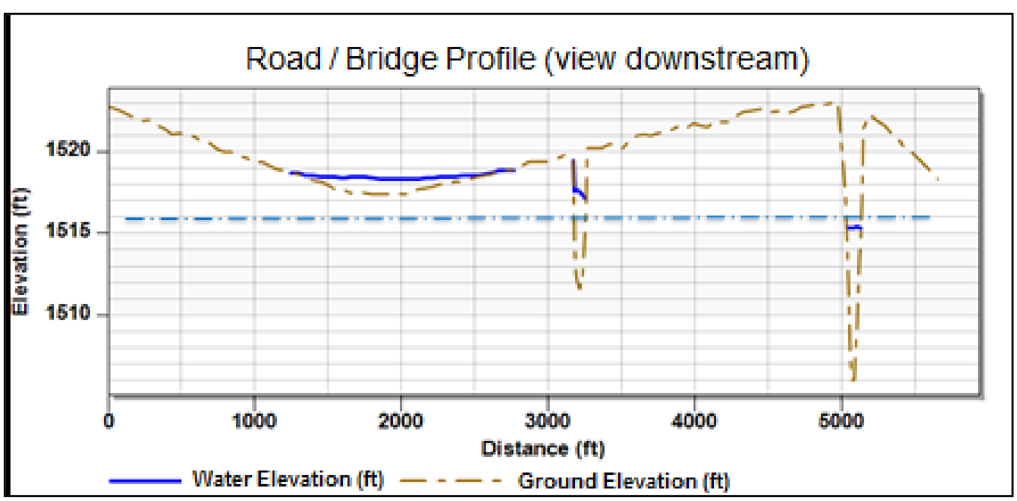


Figure 9: Cross-section showing water surface elevation depicted by 1-D (horizontal dashed line) and 2-D (solid curvy line) hydraulic models.

So what went wrong with the 1-D model? The cross-section in Figure 9 shows the main bridge on the right, relief bridge in the middle, and overtopping on the left. The horizontal dashed line shows the water surface computed by the 1-D model. As noted earlier, a 1-D model requires many simplifying assumptions and only computes a single water surface elevation for each cross section. So, the 1-D model could not represent the multiple flows in the floodplain that actually led to a higher water surface elevation in the overtopped section of the roadway. The 2-D model did capture this information and showed the higher (3 feet higher) water surface elevation in the overtopped roadway section.

Enhanced Communication and Streamlined Delivery

Case Study 5: Skagit River, WA: Avoidance of Habitat Impacts

The focus of this project on the Skagit River in Marblemount, WA, was to develop a habitat friendly way to protect the roadway. Engineers used 2-D modeling to obtain flow velocity and depth results. This flow and depth information played an essential role in the project delivery process by demonstrating to the resource agencies that the project would have minimal effects on ESA listed salmon. Figure 10 was used to show the reduced velocities on the roadway and no change in the velocities of the stream where the Salmon Redds swim.

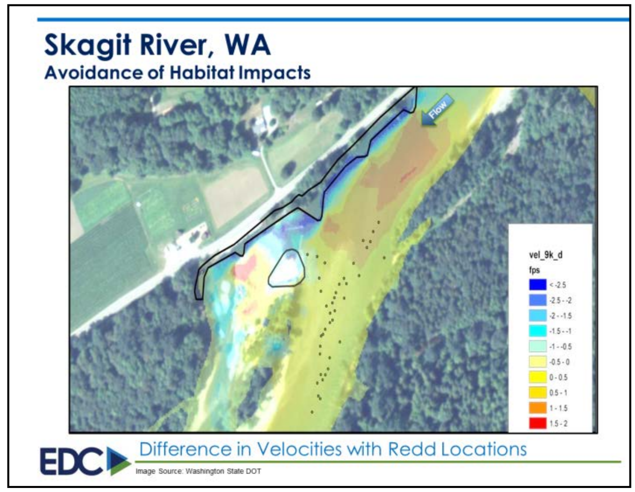


Figure 10: Velocities along road and in main portion of stream shown from 2-D hydraulic model.

Case Study 6: Mobile, AL: Sea Level Change Impacts

2D modeling tools and graphics can be used to assess and depict the effects of sea level rise scenarios on storm surge. The analyses that were conducted under the Gulf Coast 2 study helped local and State officials better understand the potential increased hazards that even small increases in sea level rise could have on transportation infrastructure.

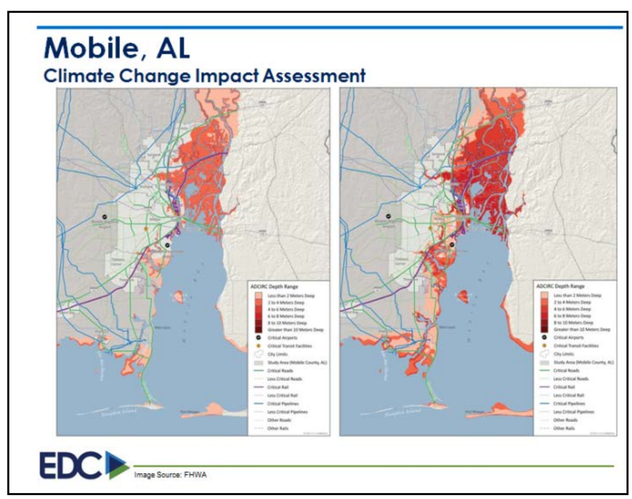


Figure 11: Output from 2-D models that show impact on roadways of sea level change.

EDC4 - C.H.A.N.G.E – "Next Generation" Tools

History of Hydraulic Modeling Tools

In 1960 FHWA released its first guidance on the Hydraulics of Bridge Waterways, HDS-1. HDS-1 presented a very basic approach to evaluating bridge hydraulics. In 1964, the HDS-1 methodology was developed into a computer code for the mainframe, called HY-4.

In 1966, the Army Corps of Engineers (USACE), Hydraulic Engineering Center, released a new program for the mainframe computer, called HEC-2, which was the first real version of a one-dimensional bridge hydraulic model that could compute a water surface profile along the centerline of a channel through a bridge opening and provide a reasonable estimate of the impact associated with the bridge encroachment. The methodology introduced with HEC-2 is essentially the same methodology that engineers use today. The USACE adapted HEC-2 to personal computers in 1984. At the same time, the USGS developed the WSPRO program to analyze bridge hydraulics. The USACE created a graphical user interface for the HEC-2 program and released it as HEC-RAS in 1996. Both the HEC-2 and WSPRO programs are 1-D models.

In 1988, FHWA began to investigate the use of 2-D hydraulic modeling for bridge design. These early modeling efforts were not user friendly and could take weeks to set up and run. FST2DH was the finite element model FHWA developed in the 1990's and 2000's. The 2010's saw a rapid development of the "next generation" tools to make them easier to use, quicker to run, and provide significant visualization tools. 2-D data is also readily available to state DOTs. The FHWA supported the development of the SRH-2D modeling program and the USACE developed the RAS-2D program. Other 2-D modeling tools have also been developed and are used by engineers for transportation design.

Sedimentation and River Hydraulics Model (SRH-2D)

For transportation related projects, FHWA currently recommends and supports the Bureau of Reclamation's Sedimentation and River Hydraulics Model (SRH-2D). Users have been applying SRH-2D to investigate 2D hydraulic situations for more than a decade. FHWA especially believes that SRH-2D is the model of choice for detailed bridge hydraulics and scour analysis because it has comprehensive and validated bridge hydraulic modeling and sediment transport capabilities. Specific training for modeling bridge hydraulics with SRH-2D is available through NHI Course #135095 (www.fhwa.dot.gov/engineering/hydraulics/training.cfm). SRH-2D also has an available custom graphical interface within the Surface Water Modeling software (SMS). The combined SRH-2D/SMS application has several specific tools that are useful for evaluating detailed bridge hydraulics, bridge scour, project floodplain impacts, and countermeasure design (www.fhwa.dot.gov/engineering/hydraulics/software.cfm). Some of these tools include:

- HEC-RAS 1-D cross section import for comparison and reference
- Computations and summaries for minimum, maximum, and average hydraulic parameters at specified cross sections for bridge scour evaluation, and comparison with alternatives or 1-D model results
- A dataset calculator to compare datasets (e.g. existing vs. proposed) or compute additional parameters (e.g. unit discharge (depth * velocity))
- Observation lines to measure discharge at user specified locations
- Delineation of areas based on user specified criterion and ability to export GIS shape files (i.e. floodplain boundaries, specific habitat zones based on velocity and depth, etc.)
- 3D terrain visualizations for presenting and evaluating results

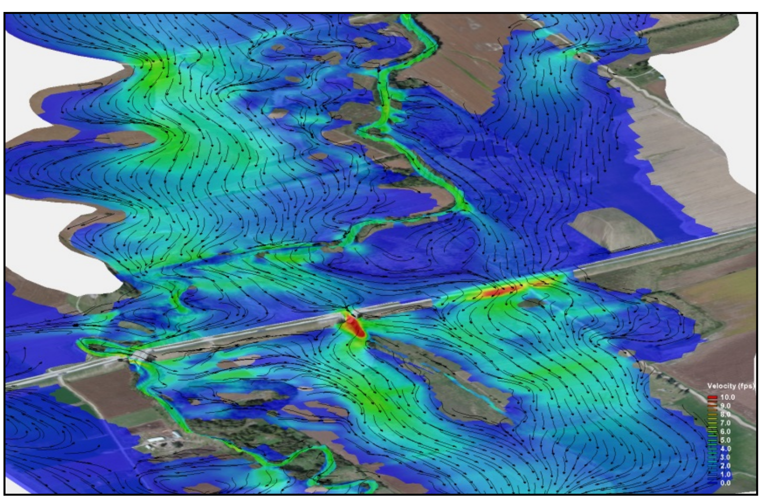
SRH-2D is available and functional without the SMS interface or license, but the custom interface in SMS provides a much more user friendly option and adds several additional features as noted above. FHWA provides licenses for the SMS SRH2D custom interface to all State DOT and FHWA engineers. Anyone in a review role can obtain a free license directly from Aquaveo (www.aquaveo.com/regulatory-review). Aquaveo has also developed a Community Edition of SMS that provides free access to the basic components of the SRH-2D custom interface.

HEC-RAS 5.0 (RAS2D)

The Corps of Engineers recently released HEC-RAS 5.0 (RAS2D) that offers several new features and modeling capabilities, along with an improved RAS Mapper interface. The RAS2D model and interface is available to all users without requiring any licensing. However, additional software is needed to prepare topographic data for the model. The Corps' RAS community also has a large and experienced user base as a result of the ubiquitous application of 1-D HEC-RAS predecessors. As of summer 2016, RAS2D does not have comprehensive bridge modeling capabilities to directly represent pier, abutment, and deck geometry. As a "work around" some RAS2D users have used terrain data to represent the pier and abutment geometry. However, to FHWA's knowledge, there has been no testing of results or establishing procedures for mesh development. As a result, at this time, though many are attempting (or being asked) to use RAS2D for hydraulic modeling bridges, FHWA is reluctant to recommend it for detailed bridge hydraulics and scour until RAS2D developers (and user community) can validate the methodology and develop specific bridge modeling guidance. Given the Corps resources and strong user community, FHWA anticipates and welcomes example applications on bridge projects with demonstrated procedures and results.

Other Available 2D Models

In addition to SRH-2D and RAS2D, there are several other suitable 2D hydraulic models available for various applications, such as FLO-2D, TUFLOW, RiverFlow2D, ADH, River2D, and others that have been available for years and continue to be improved with the advancing technology. In the past, folks might recall that FHWA supported FESWMS 2DH. The FESWMS model still exists, but FHWA felt the superior capabilities of SRH-2D justified our support and switch to that model.



Acknowledgements

We would like to thank the following for their contributions to the articles in the newsletter:

FHWA Headquarters Office:
Brian Beucler

Turner Fairbank Hydraulics Lab:
Kornel Kerenyi

FHWA Resource Center:

Dan Ghere
Scott Hogan

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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