3-12-2026 2D Modeling Webinar on **Evaluating Detailed Bridge Hydraulics and Scour with SMS/SRH-2D and HEC-RAS 2D**

Chat pod comments, live responses, and some post webinar responses

- Will FHWA or state transportation agencies officially adopt HEC-RAS 2D for two-dimensional bridge hydraulic modeling?
    - FHWA has supported SMS/SRH-2D for many years because of the transportation hydraulic features and support.
    - It is up to each state to decide if they prefer to adopt one model software over another.
    - A key factor in this decision is model review. It is important for states and others to be able to review any 2D model submittals.
    - FHWA has provided SMS/SRH-2D hydraulic model training for bridge hydraulics and scour for many years to support the correct application and also train staff at DOTs so they are able to both perform analyses and also review consultant submittals.
    - To date, there has not been HEC-RAS 2D training that has focused on detailed bridge hydraulic modeling and bridge scour analyses.
    - Several states responded that they are using SRH-2D, HEC-RAS 1D, and some HEC-RAS 2D.

- Was the 1D model properly calibrated? (With regard to the example shown of the flow split upstream of a bridge crossing with a main bridge and relief bridge that were a considerable distance apart.)
    - In this situation, it would require much more than a 1D model calibration. It would warrant a split flow analysis and the flow split would need to be calibrated to match the measured flow split. In projects like this, without measured flows, it would be challenging to get a correct answer from a 1D model.
    - The 2D models (both SRH-2D and RAS2D) were not necessarily calibrated by adjusting n values, but by increasing the mesh resolution and adding breaklines until the flow split was fully captured. The refinement continued until the change in results was negligible. At that point the resulting flow split was compared with the measured values. As shown in the presentation, they compare quite well.

- Was multiple opening analysis used in the 1D model?
    - Yes

- Do you have a general rule of thumb for how far away the boundary conditions should be from our area of interest?
    - The standard rule of thumb is 1-2 floodplain widths up and downstream of the area of interest, but this is very dependent on the slope of the channel. For mild slopes, the influence of boundary conditions can be seen for several miles.
    - A sensitivity analysis should always be considered to assess the potential effects of the boundary conditions. This applies to the downstream WSEL, as well as the upstream inflow distribution.

- Have you checked out Ras Alpha 2025 meshing
    - Yes, the RAS mesh used in the presentation utilized the RAS 2025 meshing. As shown, the mesh consists of triangles and quadrilaterals, which is similar to SMS/SRH-2D.

- Why is the lower flow is producing more scour?
    - There are several potential reasons for this, but most often it is a result of a downstream flow restriction that causes a backwater effect at high flows. Consequently, the highest velocities and shear stresses at the bridge occur at the lower flows, prior to the influence of the backwater.

- Is it usually the case that pressure flow scour is maximized when a bridge just starts to overtop?
    - The point of incipient overtopping can be associated with maximum scour, but this is not always the case. This is why it is recommend to evaluate a range of flows to determine the maximum potential scour.

- How might you select the location of the approach section if there was a dam located a very short distance upstream of the bridge?
    - This case would likely be a clear water condition (because the dam traps the sediment). The approach condition is less important for clear water. However, the approach section hydraulics are still needed for abutment scour. The ratio of approach unit discharge to contracted unit discharge is used in determining the amplification factor that is used for computing abutment scour.

- Should the approach section be drawn from dry element to dry element?
    - No, both the SMS and HEC-RAS 2D bridge scour tools report the width of the flow.

- Does it matter where abutment arcs are as long as they are outside the bank arcs and within the flow?
    - The abutment arcs only have to be within the flow. The abutment scour methodology computes the flow depth after scour. So, the reference location when computing scour depth is important. If the arc is placed closer to the toe, the computed scour depth at that location will be less than what would be computed further up the abutment slope.

- Do you recommend extracting the approach section parameters from a single cross-section or averaging results across several upstream sections to reduce local flow variability?
    - It is a good practice to review the results from multiple approach locations, but ultimately, a single representative approach section should be used.

- In regard to approach arcs, if you have a confluence just upstream of your structure in question would you look at both main channels and compare the two scenarios?
    - Good question. You may need to "manually" add the two sections hydraulics to get a good approach condition, but this is a challenging scenario that requires careful consideration.
    - A sediment transport model would be very informative for this scenario, if it is a live bed condition.

- When extracting approach section parameters from breaklines, how does the software determine the main channel width versus the overbank widths? I mean in SMS
    - In SMS, breaklines are not necessary. A single arc is used to define the approach section and bank arcs are added to delineate the main channel from the overbanks.

- Are reference lines (HEC-RAS) different from profile lines?
    - Yes, they are - reference lines are under geometry (start editing to view reference line category), profile lines are for displaying resultant WSE, etc.
    - Reference lines write their output during the simulation so you can view flow and stage results as its computed in each cell at each time steps. Profile lines can be drawn post model runs to view results after the fact. There can be slight differences in results depending on which method you use to view results and other modeling factors.
    - Reference lines are required for the bridge scour feature in HEC-RAS.

- The pier scour equation on slide 19 is the fine grain equation (from HEC-18 Manual). Does SMS and/or HEC 2D have a coarse grain option, and if so, what equation do they use for that?
    - HEC-18 has pier scour equations for both coarse bed material and cohesive material, and these equations are included in the Hydraulic Toolbox scour calculations.

- Can you touch on how SMS calculates angle of attack?
    - For the bridge skew, SMS determines the average angle of the flow vectors relative to the contracted arc, within the bridge section.
    - For pier skew, the angle of the flow vectors approaching the pier are averaged to compute the angle of attack.

- It looks at the flow upstream from the pier.
    - The default offset in SMS is one pier length upstream of the contracted arc, but this can be changed by the user.

- What is the best approach to incorporate fenders into a 2D model when doing Pier scour? (Protection for piers from ship impacts)
    - For fenders and other pier geometries (i.e. pile caps) that are relatively close to the channel bed, it is often best to incorporate these features into the terrain data.
    - Alternatively, an effective width approach (depth weighted width) could be used.
    - Each case is different and the options/consequences should be carefully considered.

- Why is the maximum depth and velocity not the location of maximum unit discharge?
    - In 1D flow, where flow is distributed at each cross section based on available conveyance, the highest velocity will always be coincident with the greatest depth. However, in 2D hydraulics, where momentum and continuity are considered at each element, the highest velocity will not always be associated with the greatest depth.

- Is the bridge scour tool within SMS routinely updated to align with the bridge scour calculator in the FHWA Hydraulic Toolbox?
    - Yes, the bridge scour tool is updated based on the latest FHWA Hydraulic Toolbox. Occasionally, the SMS version gets ahead of the posted FHWA version due to delays in getting new releases approved for their website.

- Would you give any importance to geotechnical survey borehole logs that are done in the roadway approach at or near abutments to feed into streambed gradation values?
    - Most often the roadway approach material samples are not necessarily representative of the streambed material.
    - A better approach is to remove any apparent armor material near the contracted section to expose the substrate material and collect a representative sample to evaluate the d50.
    - In addition, it is recommended to collect a bed material sample upstream of the bridge (near the approach section) to determine a live vs. clear water scour condition. If this is not possible, the contracted section sample is often assumed to be representative of the approach section gradation.

- I have had issues with Hydraulic Toolbox miscalculating Scour Elevation. It will correctly calculate Scour Depth and Streambed Elevation, but the Scour Elevation is off (Streambed Elevation minus Scour Depth wasn't equaling Scour Elevation). Is this a known issue? Is there a solution to this? Hydraulic Toolbox is receiving exported values from my SRH2D model.
    - This is not a known issue, but we will investigate it.

- When is the next Scour course that he has referenced a few times?

- Does the scour course cover the basics of scour for beginners are or is the course aimed towards people already familiar with scour fundamentals and theory?

    - From beginners up to more experienced people. Anyone interested in scour and modeling.

- Any guidance on layer by layer analysis?
    - That's going into the next Edition of HEC-18.

- For abutments located close to the main channel (Type A condition), it is reasonable to expect abutment scour to exceed contraction scour
    - This is often the case, but for situations with a deep, incised thalweg, the abutment scour elevation may be high than the contraction scour elevation.

- Can you use the hydraulic toolbox to compute scour at other sections of the channel (away from bridges)?
    - Sure. The contracted section could represent a channel contraction anywhere in the reach.

- Do you have any recommendations about bridge abutment scour calculation for cohesive soil streambed like clay and silt?
    - If you have the appropriate samples and lab test results (critical shear), there are HEC-18 equations for cohesive materials.

- This might be too much to ask of SMS or RAS, but has there been any consideration given to pairing scour calcs with sediment transport runs, and accounting for bed deformation and lateral migration?
    - Yes, the sediment transport features of SMS/SRH-2D or RAS2D could be used to evaluate contraction scour potential, but not necessarily lateral migration potential. However, the bed material characterization needed to do this correctly is greater than a basic scour analysis.

- When are we getting an "undo" button?
    - From Aquaveo: It is in the long-term development plan. That will still take some time. If you have specific operations that you would like to "undo", please make suggestions.

- Do you recommend average values or maximum velocity near the thalweg?
    - For contraction and abutment scour, maximum values are not appropriate and not consistent with the methodology. Averaged values should be used.

- Are there any documents we could currently evaluate concerning the critical sheer scour that will be included in new version of HEC18?
    - There have been some publications, google NEXTSCOUR