Enhancements to the FHWA-FST2DH Model for Simulating Two-dimensional Depth-averaged Flow and Sediment Transport TPF-5(248)

Enhance the Two-Dimensional Depth-Averaged Flow and Sediment Transport Model to improve its performance to produce a more reliable sediment transport analysis.

WHAT IS THE NEED?

Scour is the most common cause of bridge damage, which needs to be assessed and measured to minimize the damage. Two-Dimensional Depth-Averaged Flow and Sediment Transport Model (FST2DH) is a two-dimensional hydraulic model released by the Federal Highway Administration (FHWA), which is used for modeling flows in floodplains and through complex bridge openings, to show the length and height direction of debris and sediment flow in water at either river bends or under the bridges.

The FST2DH model is currently supported by two associated tasks for licensing renewal agreements “Surface-water Model System” (SMS) and “Watershed Modeling System”, both contain graphical user interface. Even with the supporting systems, the FST2DH was developed more than ten years ago and since then many improvements have been made to computational procedures employed by the program. Due to the increasingly more difficult types of problems that are routinely being encountered, the model needs faster computation and updated algorithm to continue to keep pace.

WHAT ARE WE DOING?

State Departments of Transportation (DOTs) and practitioners noticed that the FHWA-FST2DH Model for Simulating Two-dimensional Depth-averaged Flow and Sediment Transport showed instabilities for some cases, therefore, an improvement of the model was needed. FHWA decided to transition from FHWA-FST2DH to Sedimentation and River Hydraulics Two-Dimensional (SRH-2D) model developed by the U.S. Bureau of Reclamation (USBR).
The SRH-2D hydraulic modeling program has been used by USBR and other agencies for many years. It is recognized for its ability to achieve stable solutions to complex hydraulic problems quickly and effectively.

WHAT IS OUR GOAL?

The goal is to produce an improved modeling tool that will achieve a more reliable sediment transport analysis capability. An updated User’s Manual will also be provided that will document the capability and any new features of the modeling tool.

WHAT IS THE BENEFIT?

The faster computation and update of the algorithm will save time, increase productivity, and provide better solutions to complex water flow, design of hydraulic structures such as bridges, river training works that can provide erosion control, better water quality, and flood mitigation.

WHAT IS THE PROGRESS TO DATE?

FHWA hydraulic engineers have evaluated the current program’s capabilities and see a significant potential benefit of the USBR SRH-2D model for future Department of Transportation (DOT) hydraulic-related projects.

Many new features have been incorporated into a SMS SRH-2D custom graphical interface. The SRH-2D model is being widely used by states and 2D modeling is soon becoming the standard of practice, since FHWA's Every Day Counts program adopted the 2D hydraulic modeling initiative CHANGE (Collaborative Hydraulics: Advancing to the Next Generation of Engineering).

Through this initiative, more than 40 states are participating and helping to advance hydraulic engineering using 2D modeling. Many new resources are being developed through this program, including: both introductory and advanced training, guidance documents, case study examples, informational web meetings, sample scopes of work and policy verbiage for 2D modeling, and much more. The most 2D modeling features and tools that have been adding to the SMS interface to support the enhancement of the FST2DH model include the following:

- A new simulation dashboard for monitoring simulation progress, convergence and stability
- A new monitoring line coverage for additional simulation verification
- New results folder for better data management
- A file packaging option to more easily archive and transfer project files
- Improved results for bridge pressure flow (water surface elevation and pressure head)
- New measuring tool features
- New materials coverage features for easily reviewing and editing hydraulic computations
- New notes tab features for project documentation
- New bridge scour tools and interface with the FHWA Hydraulic Toolbox

IMAGES

Picture 1: 2D modeling tools allow for more reliable hydraulic design and more effective collaboration and communication with project partners.