



National Regional Sediment Management Program: RipRap and Scour Calculator



Description

CHANLPRO, the program our agency used to size riprap, is the prototypical example of orphan software. It does not work on some operating systems, the source code is not available, and ERDC experience suggests that some districts have returned to hand calculations to design rock placement because it is difficult to load, run, or use.

This research unit develops a riprap sizing and bend scour calculator with three primary objectives:

- Reproduces the CHANLPRO capabilities.
- Includes additional equations and algorithms that have emerged as scour-protection best-practice over the last decade.
- Includes these capabilities directly into HEC-RAS, which generates the hydraulic data required for these analyses, to streamline the workflow.

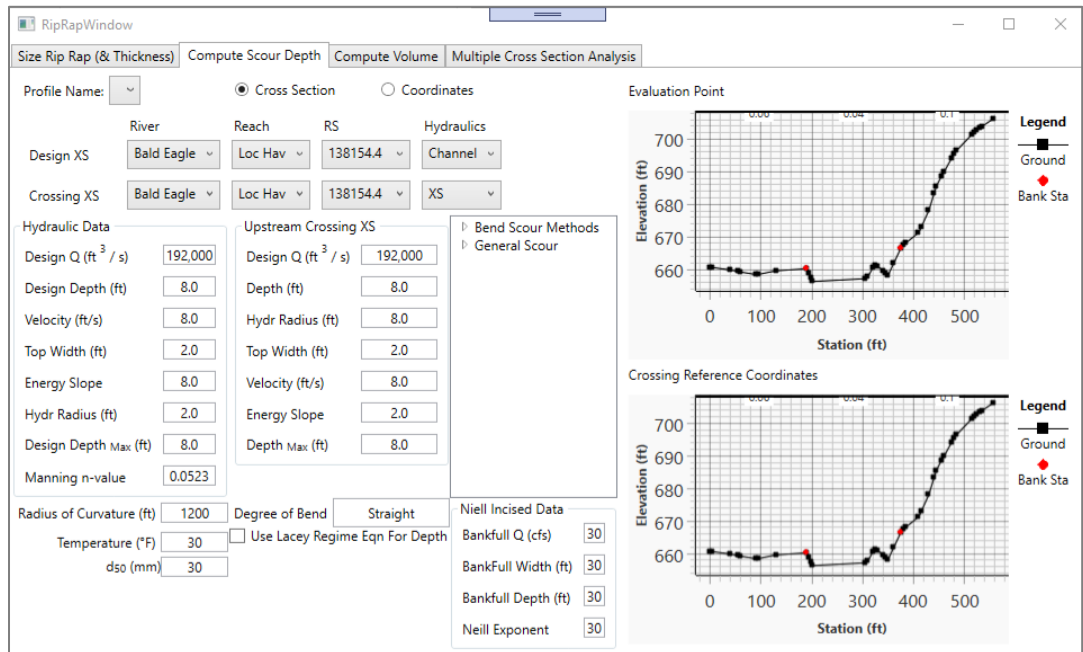


Figure 1: HEC-RAS Riprap Calculator Prototype

Issue/Challenge To Address

The USACE has a class of tools the HH&C COP calls “orphaned software.” These programs are still the best available tool for important, standard, USACE analyses. But the developers have retired, the source code is not available (or compliant), the interface requires old DOS command line and text file input foreign to a new generation of engineers, and some do not even run on recent operating systems.

The program USACE engineers use to size riprap falls into this category. It is not supported, does not run, and does not reflect the best practice. The size and volume of rock drives the cost of many of our bank protection projects, as well as FRM projects that require toe protection. Our agency needs to provide a usable tool that formalizes best practice and makes these calculations accessible again.



Successes Lessons Learned

In the first year of this work unit HEC developed a working scour calculator that computes general and bend scour with nine empirical equations (Figure 1). We also designed the riprap calculator and developed computational pseudo code (Figure 2)

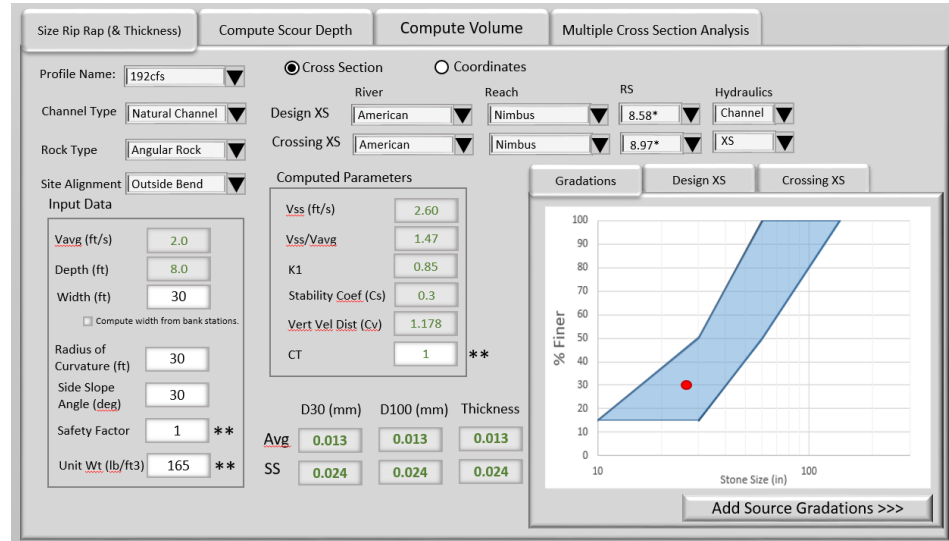


Figure 2: Riprap Calculator Design.

Projected Benefits Cost Savings Value Added

This work formalizes best practice and guide engineers in rock sizing and rock volume calculations. Because rock size and volume drive project cost, this will save money and add value by avoiding costly over-conservatism as well as costly project failures from *ad hoc* calculations. By embedding this calculator directly in HEC-RAS which generates the hydraulic data required for the analysis, this tool will save analyst time by streamlining the workflow and preventing costly errors.

Expected Products

- General and Bend Scour Calculator
- Riprap Size and Volume Calculator
- User Manual and Training Video.

Stakeholders/Users

Nearly every district of the USACE sizes riprap and uses HEC-RAS. This work has potential users and stakeholders across the USACE (and among the balance of the 100,000 HEC-RAS users in other agencies, in the private sectors, and around the world). HEC and CHL are currently working closely with the St Paul and Sacramento Districts on a high-profile rock-sizing project on the American River, supporting the analysis and making sure the tool we develop will support each aspect of a large rock-sizing project.

Leveraging Opportunities

This work leverages work on the American River levee project and funding from Maricopa County, another stakeholder who recognizes the value of formalizing this analysis within HEC-RAS.

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