

RipRap and Scour Calculator

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DESCRIPTION

We are developing a Rip Rap and Scour calculator in HEC-RAS that computes riprap size and volume based on HEC-RAS hydrodynamics. The tool has three basic components:

- 1) Compute river and toe scour with a suite of empirical equations.
- 2) Compute an appropriate d_{30} and select the best available rip rap gradation based on HEC-RAS hydrodynamics.
- 3) Compute total rock volume required based on the riprap size, thickness, and launchable toe.

STATUS

We have started development of the Scour and RipRap calculators, in the HEC-RAS HD editor including:

- Interface design of the ensemble scour calculator that computes general and bend scour with 9 empirical equations.
- Prototype application of the scour calculator.
- Interface design for the rip rap sizing calculator.
- Pseudo-code of the calculations behind the scour and rip rap calculators

The interface is divided into four main tabs: "Size Rip Rap (& Thickness)", "Compute Scour Depth", "Compute Volume", and "Multiple Cross Section Analysis". The "Compute Scour Depth" tab is active.

Profile Name: e.g. Bank Full (dropdown)

Design Method: Cross Section, Coordinates

Design Parameters:
River: American (dropdown), Reach: Nimbus (dropdown), RS: 8.58* (dropdown), Hydraulics: Channel (dropdown)
Crossing XS: American (dropdown), Nimbus (dropdown), 8.97* (dropdown), XS (dropdown)

Hydraulic Data:
Design Q (ft³/s): 192,000
Design Depth (ft): 8.0
Velocity (ft/s): 8.0
Top Width (ft): 2.0
Energy Slope: 8.0
Hydr Radius (ft): 2.0
Design Depth_{Max} (ft): 8.0
Manning n-value: 0.0523

Upstream Crossing XS (Bend Scour Only):
Design Q (ft³/s): 192,000
Depth (ft): 24.8
Hydr Radius (ft): 29.8
Top Width (ft): 1367
Z Velocity (ft/s): 5.47
Z Energy Slope: 0.00349
Z Depth_{Max} (ft): 8.0

Bend Scour Methods:
 Maynard (ft)
 Zeller (ft)
 Thorne (ft)
 USACE (ft)
 General Scour
 Zeller (ft)
 Neil (ft)
 Lacey (ft)
 USBR Env (ft)
 USBR Vel (ft)

Radius of Curvature (ft): 1200 → Degree of Bend: Straight

Temperature (°F): 30 Use Lacey Regime Ean for Depth

d₅₀ (mm): 30

Bankfull Data:
Bankfull Q (cfs): 30
Bankfull Width (ft): 30
Bankfull Depth (ft): 30
Neill Exponent: (empty field)

Evaluation Point: (Two 3D cross-section plots showing scour depth and velocity distribution)

Figure 1: Interface design for the ensemble scour calculator.

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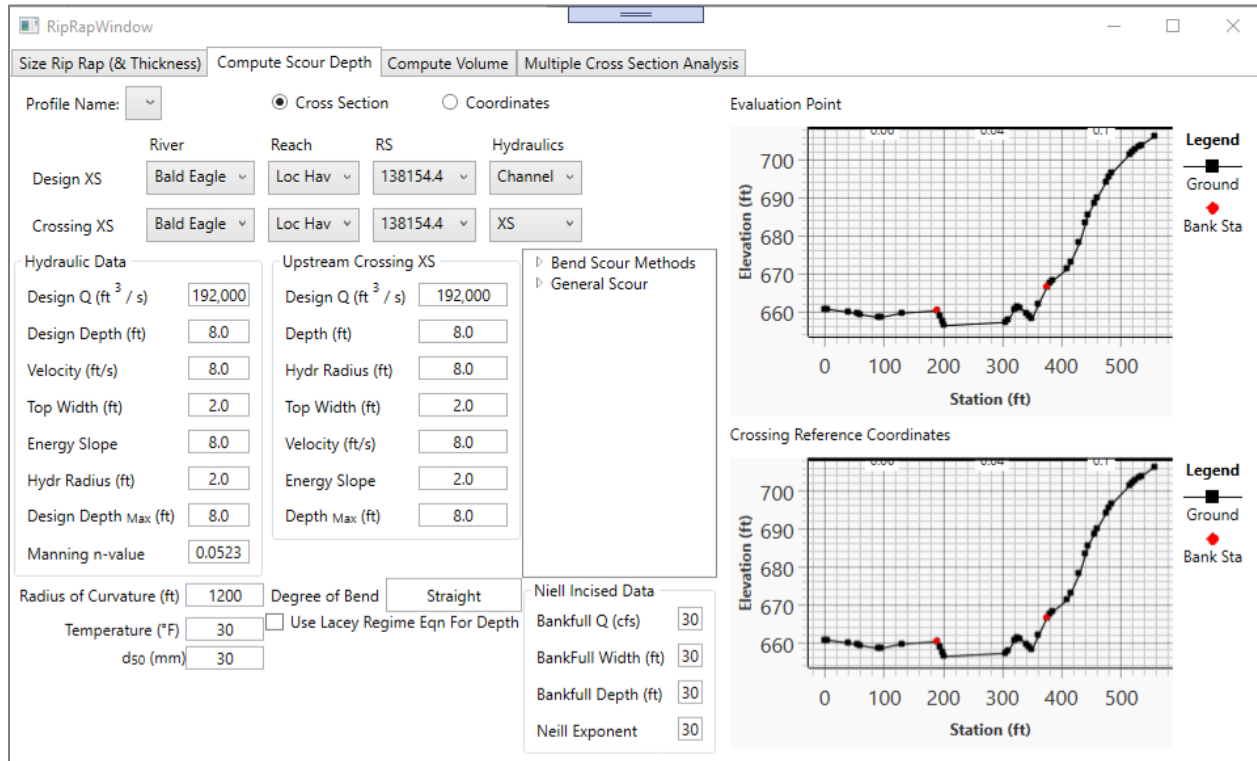


Figure 2: Preliminary prototype application of the ensemble scour calculator.

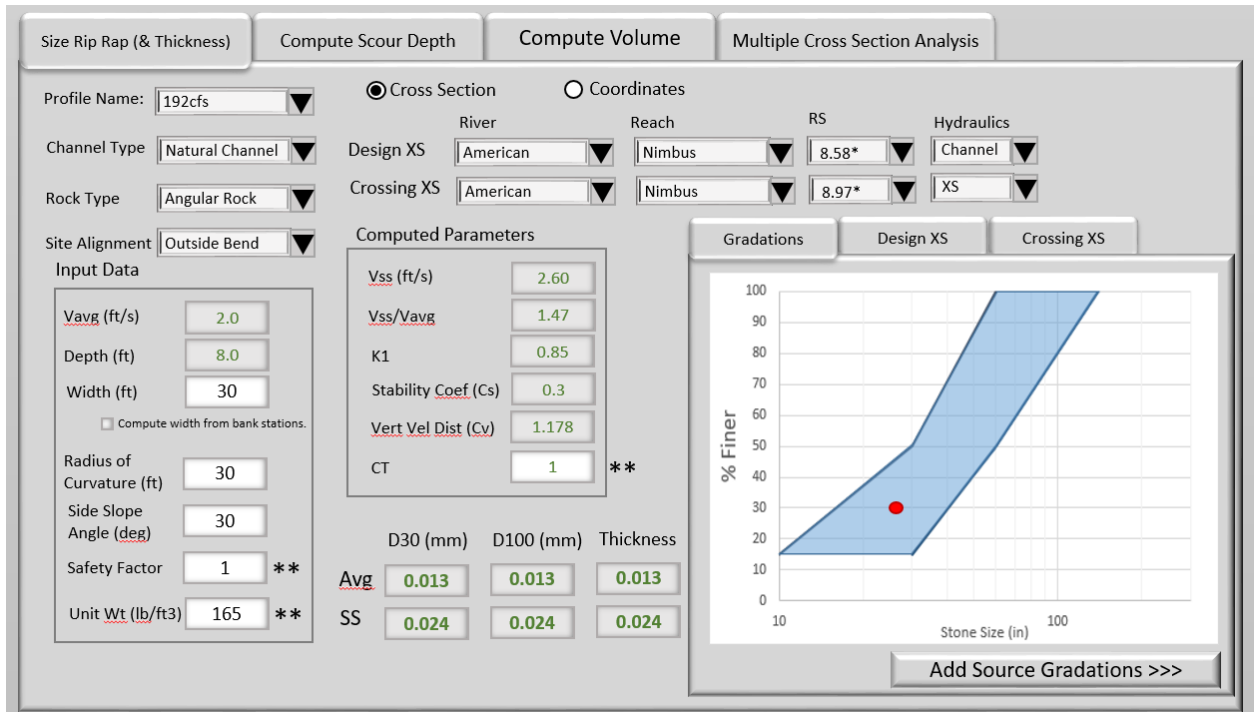


Figure 3: Rip-Rap Calculator Interface Design.