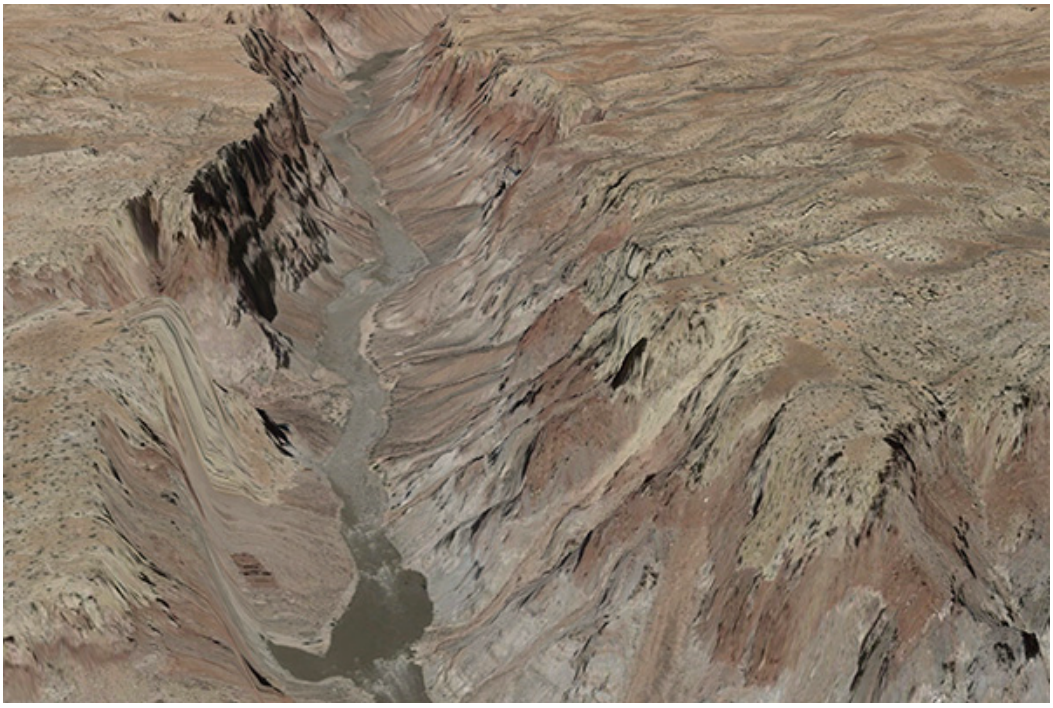


Google Earth®

Fig. 1 Cataract Canyon, Green river, Utah.

HOW TO CALCULATE ONLINE SEDIMENT DISCHARGE BY THE COLBY METHOD?

Victor M. Ponce

Professor Emeritus of Civil and Environmental Engineering

San Diego State University, San Diego, California

08 March 2024

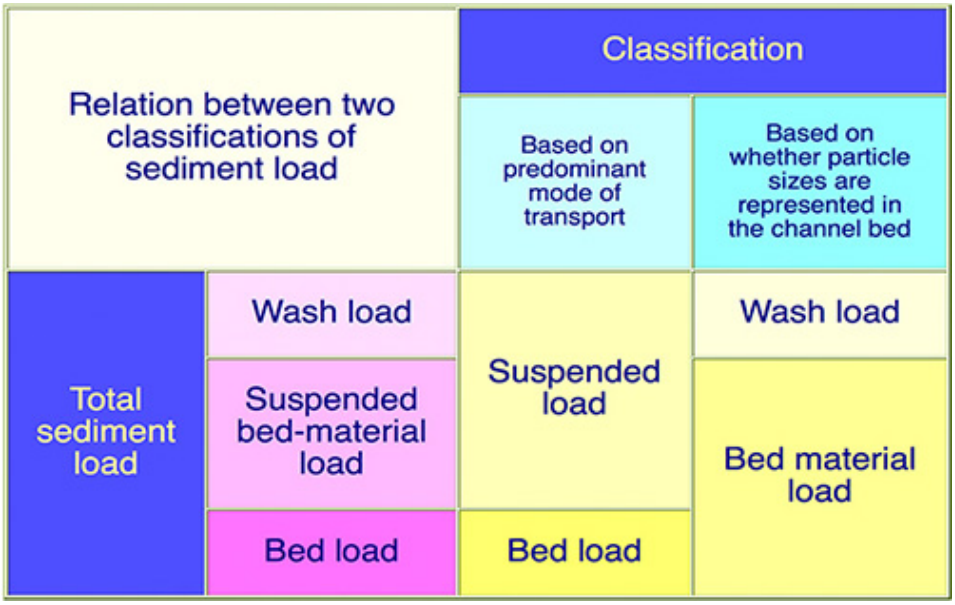
ABSTRACT. Knowledge of sediment transport discharge and concentration is a requirement in the design of hydraulic conveyance structures. In this article, we present an online calculator of sediment load (sediment discharge and sediment concentration) by the Colby 1964 method. The method is known to be particularly accurate for the calculation of sediment load in alluvial streams. An example of the calculation using **ONLINECOLBY** rounds up the experience.

1. INTRODUCTION

Knowledge of sediment transport discharge and concentration is a requirement in the design of hydraulic conveyance structures. Applications are in flood control and associated hydraulic structures. Currently, there are quite a few methods available for the calculation of sediment discharge; however, none are so convenient, straight forward, and predictable as the Colby 1964 method (**Colby, 1964**; **Ponce, 2014a**). In this article, we present an online calculator of sediment load (sediment discharge and sediment concentration) by the Colby 1964 method. The method is known to be particularly accurate for the calculation of sediment load in alluvial streams. An example of the calculation using **ONLINECOLBY** rounds up the experience.

2. THE COLBY METHOD

The **Colby (1964)** method for the calculation of sediment discharge, herein referred to simply as the "Colby method," is a methodology to calculate the discharge of sands. The method is based on Colby's earlier work (**Colby and Hembree, 1955**; **Colby, 1957**; **Ponce, 2014b**). It relies heavily on the relationship between sediment discharge and mean velocity, with flow depth and channel width as additional parameters. Secondary parameters are water temperature, bed material size, and wash load concentration (Fig. 2).



Ponce (2014c)

Fig. 2 Relation between two classifications of sediment load.

3. USE OF THE ONLINE CALCULATOR

The online calculator **ONLINECOLBY** was developed in 2020 at the **Visualab**, Department of Civil, Construction, and Environmental Engineering, San Diego State University, San Diego, California. We run the calculator with the following input data:

- Units [Select one]: SI Units (metric)
- Mean velocity v (m/s): 1
- Mean flow depth d (m): 2
- Channel width B (m): 10
- Water temperature T (°C): 20
- Bed material size d_{50} (mm): 0.5
- Wash load concentration C_w (ppm): 300

Output from the calculator is shown below. The discharge of sands, or sediment discharge, is: **Q_s = 488.1839 M. Tons per day**; the concentration of sediment is: **C_s = 0.2825 kg/m^3**.

online_colby: Sediment load (discharge and concentration) by the Colby method

Formulas

$$q_u = f(v,d)$$

$$k_1 = f(T) \qquad k_2 = f(C_w) \qquad k_3 = f(d_{50})$$

$$q_s = [1 + (k_1 k_2 - 1)k_3]q_u \qquad Q_s = Bq_s$$

Reference

Ponce, V. M., 1989. Engineering Hydrology, Principles and Practices,
Prentice Hall, pages 560-564.

INPUT DATA:

[Description] [Sample input file]

[Default units: U.S. Customary]

Units: SI units (metric) / U.S. Customary units

(SI units) [U.S. units]

Mean velocity v (m/s) [ft/s]: 1 m/s

Mean flow depth d (m) [ft]: 2 m

Channel width B (m) [ft]: 10 m

Water temperature T (°C) [°F]: 20 °C

Bed material size d_{50} (mm): 0.5 mm

Wash load concentration C_w (ppm): 300 ppm

OUTPUT:

[SI (metric) units]

Discharge of water:

Q = 20 m^3/s

Discharge of sands [per unit width]:

q_s = 48.8184 M. Tons/day/m

Discharge of sands:

Q_s = 488.1839 M. Tons/day

Concentration of sediment:

C_s = 0.2825 kg/m^3

Calculate Reset

Your request was processed at 12:30:34 am on March 9th, 2024 [240309 00:30:34].

Thank you for running online_colby. Please call again. [201027]

REFERENCES

Colby, B. R., and C. H. Hembree. 1955. **Computations of Total Sediment Discharge, Niobrara River Near Cody, Nebraska**. *U.S. Geological Survey Water-Supply Paper 1357*, Washington, D.C.

https://ponce.sdsu.edu/colby_and_hembree_1955.pdf

Colby, B. R. 1957. **Relationship of unmeasured discharge to mean velocity**. *Transactions, American Geophysical Union*, 38(5), Oct., 708-717. *https://ponce.sdsu.edu/colby1957agu.pdf*

Colby, B. R. 1964. **Discharge of sands and mean velocity relations in sand-bed streams**. *U.S. Geological Survey Professional Paper 462-A,* Washington, D.C. *https://ponce.sdsu.edu/usgsprofessionalpaper462A_colby1964.pdf*

Ponce, V. M. 2014. **Engineering Hydrology: Principles and Practices**. *https://ponce.sdsu.edu/enghydro/index.html*

240311