Important Methods to Predict Channel Shoaling Formulas PDF

Formulas
Examples
with Units

List of 14
Important Methods to Predict Channel Shoaling Formulas

1) Change of Ebb Tidal Energy Flux across Ocean Bar between Natural and Channel Conditions Formula

Evaluate Formula

Formula

$$E_{\Delta T} = \left(\frac{4 \cdot T}{3 \cdot \pi}\right) \cdot Q_{max}^{3} \cdot \left(\frac{d_{NC}^{2} - d_{OB}^{2}}{d_{OB}^{2} \cdot d_{NC}^{2}}\right)$$

Example with Units

$$161.6417 = \left(\frac{4 \cdot 130\,s}{3 \cdot 3.1416}\right) \cdot 2.5\,m^3/s^{3} \cdot \left(\frac{4\,m^{2} - 2\,m^{2}}{2\,m^{2} \cdot 4\,m^{2}}\right)$$

2) Coefficient given Water Surface Slope by Eckman Formula

Evaluate Formula

Formula

$$\Delta = \frac{\beta \cdot \rho \cdot [g] \cdot h}{\tau}$$

Example with Units

$$6.6522 = \frac{3.7E\text{-}5 \cdot 1000\,kg/m^3 \cdot 9.8066\,m/s^2 \cdot 11\,m}{0.6\,N/m^2}$$

3) Density of Water given Water Surface Slope Formula

Evaluate Formula

Formula

$$\rho = \frac{\Delta \cdot \tau}{\beta \cdot [g] \cdot h}$$

Example with Units

$$901.9603\,kg/m^3 = \frac{6 \cdot 0.6\,N/m^2}{3.7E\text{-}5 \cdot 9.8066\,m/s^2 \cdot 11\,m}$$

4) Depth after Dredging given Transport Ratio Formula

Evaluate Formula

Formula

$$d_2 = \frac{d_1}{t_r^{\frac{2}{5}}}$$

Example with Units

$$3.002\,m = \frac{5\,m}{3.58^{\frac{2}{5}}}$$

5) Depth before Dredging given Transport Ratio Formula

Evaluate Formula

Formula

$$d_1 = d_2 \cdot t_r^{\frac{2}{5}}$$

Example with Units

$$4.9966\,m = 3\,m \cdot 3.58^{\frac{2}{5}}$$

6) Depth of Navigation Channel given Depth of Channel to depth at which Ocean Bar meets Sea Bottom Formula

Evaluate Formula

Formula

$$d_{NC} = D_R \cdot \left(d_s - d_{OB} \right) + d_{OB}$$

Example with Units

$$3.98\,\text{m} = 0.33 \cdot \left(8\,\text{m} - 2\,\text{m} \right) + 2\,\text{m}$$

7) Hoerls Special Function Distribution Formula

Evaluate Formula

Formula

$$V_R = a \cdot \left(FI^{\,b} \right) \cdot e^{c \cdot FI}$$

Example

$$0.3414 = 0.2 \cdot \left(1.2^{\,0.3} \right) \cdot e^{0.4 \cdot 1.2}$$

8) Maximum Instantaneous Ebb Tide Discharge per Unit Width Formula

Evaluate Formula

Formula

$$Q_{max} = \left(E_{\Delta T} \cdot \frac{3 \cdot \pi \cdot d_{OB}^{\,2} \cdot d_{NC}^{\,2}}{4 \cdot T \cdot \left(d_{NC}^{\,2} - d_{OB}^{\,2} \right)} \right)^{\frac{1}{3}}$$

Example with Units

$$2.5\,\text{m}^3/\text{s} = \left(161.64 \cdot \frac{3 \cdot 3.1416 \cdot 2\,\text{m}^{\,2} \cdot 4\,\text{m}^{\,2}}{4 \cdot 130\,\text{s} \cdot \left(4\,\text{m}^{\,2} - 2\,\text{m}^{\,2} \right)} \right)^{\frac{1}{3}}$$

9) Ratio of Depth of Channel to Depth at which Seaward Slope of Ocean Bar Meets Sea Bottom Formula

Evaluate Formula

Formula

$$D_R = \frac{d_{NC} - d_{OB}}{d_s - d_{OB}}$$

Example with Units

$$0.3333 = \frac{4\,\text{m} - 2\,\text{m}}{8\,\text{m} - 2\,\text{m}}$$

10) Shear Stress at Water Surface given Water Surface Slope Formula

Evaluate Formula

Formula

$$\tau = \frac{\beta \cdot \rho \cdot [g] \cdot h}{\Delta}$$

Example with Units

$$0.6652\,\text{N/m}^2 = \frac{3.7\text{E-}5 \cdot 1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 11\,\text{m}}{6}$$

11) Tidal Period given Change of Ebb Tidal Energy Flux across Ocean Bar Formula

Evaluate Formula

Formula

$$T = E_{\Delta T} \cdot \frac{3 \cdot \pi \cdot d_{OB}^{2} \cdot d_{NC}^{2}}{4 \cdot Q_{max}^{3} \cdot \left(d_{NC}^{2} - d_{OB}^{2} \right)}$$

Example with Units

$$129.9986\,\text{s} = 161.64 \cdot \frac{3 \cdot 3.1416 \cdot 2\,\text{m}^{2} \cdot 4\,\text{m}^{2}}{4 \cdot 2.5\,\text{m}^3/\text{s}^{3} \cdot \left(4\,\text{m}^{2} - 2\,\text{m}^{2} \right)}$$

12) Transport Ratio Formula

Evaluate Formula

Formula

$$t_r = \left(\frac{d_1}{d_2} \right)^{\frac{5}{2}}$$

Example with Units

$$3.5861 = \left(\frac{5\,\text{m}}{3\,\text{m}} \right)^{\frac{5}{2}}$$

13) Water Depth where Seaward Tip of Ocean Bar meets Offshore Sea Bottom Formula

Evaluate Formula

Formula

$$d_s = \left(\frac{d_{NC} - d_{OB}}{D_R} \right) + d_{OB}$$

Example with Units

$$8.0606\,\text{m} = \left(\frac{4\,\text{m} - 2\,\text{m}}{0.33} \right) + 2\,\text{m}$$

14) Water Surface Slope Formula

Evaluate Formula

Formula

$$\beta = \frac{\Delta \cdot \tau}{\rho \cdot [g] \cdot h}$$

Example with Units

$$3.3\text{E-}5 = \frac{6 \cdot 0.6\,\text{N/m}^2}{1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 11\,\text{m}}$$

Variables used in list of Methods to Predict Channel Shoaling Formulas above

- **a** Hoerls Best-fit Coefficient a
- **b** Hoerls Best-fit Coefficient b
- **c** Hoerls Best-fit Coefficient c
- d_1 Depth before Dredging *(Meter)*
- d_2 Depth after Dredging *(Meter)*
- d_{NC} Depth of Navigation Channel *(Meter)*
- d_{OB} Natural Depth of Ocean Bar *(Meter)*
- D_R Depth Ratio
- d_s Water Depth between Sea Tip and Offshore Bottom *(Meter)*
- $E_{\Delta T}$ Change in Mean Ebb Tide Flow Energy Flux
- **FI** Filling Index
- **h** Eckman Constant Depth *(Meter)*
- Q_{max} Maximum Instantaneous Ebb Tide Discharge *(Cubic Meter per Second)*
- **T** Tidal Period *(Second)*
- t_r Transport Ratio
- V_R Hoerls Special Function Distribution
- **β** Water Surface Slope
- **Δ** Coefficient Eckman
- **ρ** Density of Water *(Kilogram per Cubic Meter)*
- **τ** Shear Stress at the Water Surface *(Newton per Square Meter)*

Constants, Functions, Measurements used in list of Methods to Predict Channel Shoaling Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[g]**, 9.80665 *Gravitational acceleration on Earth*
- constant(s): **e**, 2.71828182845904523536028747135266249 *Napier's constant*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Pressure** in Newton per Square Meter (N/m^2) *Pressure Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s) *Volumetric Flow Rate Unit Conversion*
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3) *Density Unit Conversion*

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