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Dredging Equipment Formulas

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List of 9 Dredging Equipment Formulas

Dredging Equipment

Plain Suction Dredge

1) Concentration of Soil in Volumetric Basis

Open Calculator

fx $$C_v = \frac{\gamma_m - y_w}{\gamma_g - y_w}$$

ex $$0.037165\text{m}^3 = \frac{10\text{kN/m}^3 - 9.807\text{kN/m}^3}{15\text{kN/m}^3 - 9.807\text{kN/m}^3}$$

2) Flow Velocity in Suction Pipe

Open Calculator

fx $$Vs = \sqrt{\left(\left(\left(p' + Zs\right) \cdot \frac{y_w}{\gamma_m}\right) - Zs + Z_p\right) \cdot \frac{2 \cdot [g]}{F_l}}$$

ex $$9.099677\text{m/s} = \sqrt{\left(\left(\left(2.1\text{m} + 6\text{m}\right) \cdot \frac{9.807\text{kN/m}^3}{10\text{kN/m}^3}\right) - 6\text{m} + 6.5\text{m}\right) \cdot \frac{2 \cdot [g]}{2\text{m}}}$$

3) Hydraulic Loss Coefficient from Suction Pipe Entrance to Pump

Open Calculator

$$f = \frac{\left(\left(p' + Zs\right) \cdot \frac{y_w}{\gamma_m}\right) - Zs + Z_p}{\frac{Vs^2}{2} \cdot [g]}$$

$$0.02126 = \frac{\left(\left(2.1\text{m} + 6\text{m}\right) \cdot \frac{9.807\text{kN/m}^3}{10\text{kN/m}^3}\right) - 6\text{m} + 6.5\text{m}}{\frac{(9\text{m/s})^2}{2} \cdot [g]}$$

4) Specific Weight of Dry Sand Grains for Concentration of Soil in Volumetric Basis

Open Calculator

$$\gamma_g = \left(\frac{\gamma_m - y_w}{C_v}\right) + y_w$$

$$16.24033\text{kN/m}^3 = \left(\frac{10\text{kN/m}^3 - 9.807\text{kN/m}^3}{0.03\text{m}^3}\right) + 9.807\text{kN/m}^3$$

5) Specific Weight of Mixture for Concentration of Soil in Volumetric Basis

Open Calculator

$$\gamma_m = C_v \cdot \left(\gamma_g - y_w\right) + y_w$$

$$9.96279\text{kN/m}^3 = 0.03\text{m}^3 \cdot \left(15\text{kN/m}^3 - 9.807\text{kN/m}^3\right) + 9.807\text{kN/m}^3$$

6) Specific Weight of Mixture in Suction Pipe

Open Calculator

$$\gamma_m = \left(p' + Zs\right) \cdot \frac{y_w}{Zs - Z_p + \left(f \cdot \frac{Vs^2}{2} \cdot [g]\right)}$$

$$10.67212\text{kN/m}^3 = (2.1\text{m} + 6\text{m}) \cdot \frac{9.807\text{kN/m}^3}{6\text{m} - 6.5\text{m} + \left(0.02 \cdot \frac{(9\text{m/s})^2}{2} \cdot [g]\right)}$$

7) Specific Weight of Mixture in Suction Pipe for Concentration of Soil in Volumetric Basis

Open Calculator

$$\gamma_m = C_v \cdot \gamma_g + (1 - C_v) \cdot y_w$$

$$9.96279\text{kN/m}^3 = 0.03\text{m}^3 \cdot 15\text{kN/m}^3 + (1 - 0.03\text{m}^3) \cdot 9.807\text{kN/m}^3$$

8) Specific Weight of Water in Suction Pipe

Open Calculator

$$y_w = \frac{\left(Zs - Z_p + \left(f \cdot \frac{Vs^2}{2} \cdot [g]\right)\right) \cdot \gamma_m}{p' + Zs}$$

$$9.189366\text{kN/m}^3 = \frac{\left(6\text{m} - 6.5\text{m} + \left(0.02 \cdot \frac{(9\text{m/s})^2}{2} \cdot [g]\right)\right) \cdot 10\text{kN/m}^3}{2.1\text{m} + 6\text{m}}$$

9) Vacuum at Pump Entrance Expressed as Head of Water

Open Calculator

fx $$p' = \left(\frac{Zs - Z_p + \left(f \cdot \frac{Vs^2}{2} \cdot [g] \right) \cdot \gamma_m}{y_w} \right) - Zs$$

ex $$2.09966\text{m} = \left(\frac{6\text{m} - 6.5\text{m} + \left(0.02 \cdot \frac{(9\text{m/s})^2}{2} \cdot [g] \right) \cdot 10\text{kN/m}^3}{9.807\text{kN/m}^3} \right) - 6\text{m}$$

Variables Used

- C_v Concentration of Soil in the Mixture *(Cubic Meter)*
- **f** Hydraulic Loss Coefficient
- F_l Fetch Length *(Meter)*
- p' Vacuum at the Pump Entrance *(Meter)*
- **Vs** Flow Velocity in the Suction Pipe *(Meter per Second)*
- γ_w Specific Weight of Water *(Kilonewton per Cubic Meter)*
- Z_p Depth of Submergence of the Pump *(Meter)*
- **Zs** Depth of the Suction Pipe Entrance *(Meter)*
- γ_g Specific Weight of Dry Sand Grains *(Kilonewton per Cubic Meter)*
- γ_m Specific Weight of the Mixture *(Kilonewton per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
  Specific Weight Unit Conversion

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