OpenFlows™ Hydraulic Toolset

Hydraulic Calculator Set for Easy, Quick Analysis and Design

Bentley's OpenFlows Hydraulic Toolset is a powerful and easy-to-use hydraulic calculator software that helps engineers solve design challenges for individual hydraulic components (as opposed to the entire network model, which is better analyzed in OpenFlows Water, Sewer, or Storm). Quickly calculate and analyze a variety of hydraulic elements with this powerful companion application.

The FEMA-approved culvert analysis capabilities streamline complicated culvert hydraulics, handling everything from single-barrel culvert crossings to complex embankment cross-drain systems with multiple barrels having different shapes, sizes, and entrance types, special tailwater considerations, and roadway overtoppings. Culverts can be automatically sized for a specified maximum headwater and flow.

For hydraulic elements, such as open channels, pipes, roadway inlets, gutters, orifices, and weirs, the hydraulic analysis capabilities help engineers to quickly calculate depth, flow, side slope, discharge rate, roughness required and more. Engineers can specify the element property to solve for, instantly see results for other properties such as velocity, hydraulic radius, and Froude number, and produce detailed reports, rating curves, and flow profiles.

COMPREHENSIVE ANALYSIS AND DESIGN

Culvert analysis offers three flexible simulation types–**Quick Culvert Calculator** for simple culverts with known characteristics, **Culvert Analyzer** for more complex systems with roadway overtopping and multiple barrels of different shapes and sizes, and **Culvert Design Calculator** to easily compare hydraulic performance for multiple design options. Culvert computations use the widely accepted U.S. Federal Highway Administration's Hydraulic Design of Highway Culverts (HDS-5) methodologies.

For common hydraulic structures, such as pressure pipes, open channels, weirs, orifices, and inlets, the many available worksheet types provide quick solutions and tabular and graphical output. The **Pipe Design Solver** can solve for your choice of pipe length, start, or stop elevation or pressure, discharge, diameter, or roughness. The **Inlet and Gutter Hydraulic Calculator** is based on Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 22 methodologies and includes grate, curb, combination, ditch, and slotted-drain inlets for both on-grade and in-sag

installations. The **Open Channel Hydraulics Calculator** solves for discharge, capacity, normal depth, gradually varied flow profile, channel dimensions, slope, or roughness, and allows the user to choose a weighted roughness method. The **Weir and Orifice Calculators** can be used to evaluate and size rectangular, broad-crested, V-notch, and Cipolletti weir types, and rectangular, circular, and generic orifice structures.
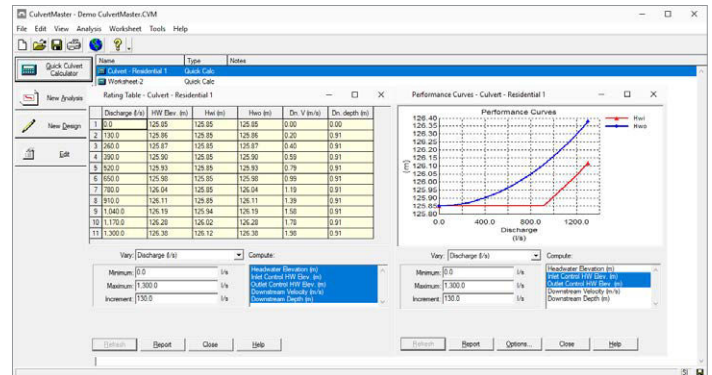
Engineering libraries let users specify common parameters that can be shared across projects
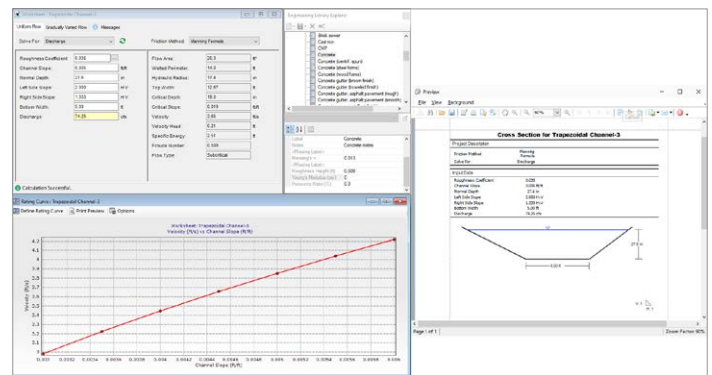
Design and analyze any type of hydraulic structure.

SYSTEM REQUIREMENTS

MINIMUM: Microsoft Windows 10, Windows 10 (64-bit), Windows 8, Windows 8 (64-bit), Windows 7, Windows 7 (64-bit).

Note: Windows 7 operating system is supported only with its service pack (SPI) installed.

OpenFlows Hydraulic Toolset At-A-Glance

OpenFlows Hydraulic Toolset includes the capabilities of OpenFlows CulvertMaster® and OpenFlows FlowMaster®.

CULVERT DESIGN AND ANALYSIS CAPABILITIES

- US FHWA HDS-5 culvert analysis methodology and entrance types
- Culvert section shapes: box, circular, arch, horizontal ellipse, and vertical ellipse
- Specify constant or variable tailwater elevations, or compute from outlet channel section
- Outlet channel section shapes: rectangular, triangular, trapezoidal, and irregular
- Roadway or broad-crested weir to check overtopping
- Engineering libraries for culvert materials, section sizes, and inlet types
- Gradually varied flow algorithm for drawdown and backwater analysis
- Pressure or partial free-surface flow conditions
- Inlet and outlet control conditions
- Rainfall intensity/duration/frequency data from tabular or equation format input
- Specification of design event and check event peak discharges
- Optionally compute discharge with rational method or NRCS TR-55 Graphical Peak discharge method
- Automatic weighting of rational method runoff coefficient or NRCS Curve Number from tabular catchment subarea input
- Detailed reports of inputs and outputs
- Rating tables and performance curves (single or multiple elements)

HYDRAULIC ELEMENT ANALYSIS CAPABILITIES

- Circular pressure pipes and gravity flow pipe section shapes: circular, box, elliptical, and irregular
- Open channels for section shapes: rectangular, triangular, trapezoid, parabolic, and irregular
- Gradually varied flow profile analysis of prismatic open channels
- Friction-loss methods: Kutter, Manning, Darcy-Weisbach (Swamee-Jain), Darcy-Weisbach (Colebrook-White), and Hazen-Williams
- Weir shapes: sharp-crested rectangular, V-notch, Cipolletti, broad-crested rectangular, and trapezoidal
- Submerged and unsubmerged weir conditions
- Orifice shapes: rectangular, circular, and generic (including the modeling of sluice gates)
- Inlet capacity analysis using US FHWA HEC-22 methodology
- Inlet types: grate, curb, combination, ditch, and slotted drain
- Gutter spread and depth for inlets on grade or in sag, and capture efficiency for inlets on grade
- Inlet local depression and clogging factor
- Uniform and composite conventional gutter shapes
- Detailed reports of inputs and outputs
- Rating tables and rating curves
- Family of rating curves when varying an additional attribute
- Advanced tabular reporting with filtering and sorting capabilities
- Gradually varied flow profile graphs and tables
- Cross section plots

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