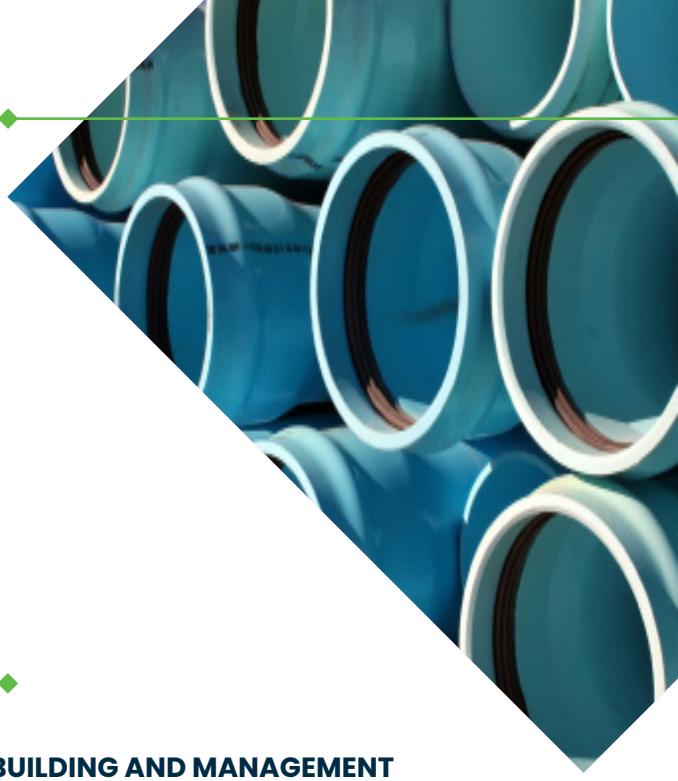
Bentley
Advancing Infrastructure

PRODUCT DATA SHEET



OpenFlows™ HAMMER®

Transient Analysis and Modeling

A COST-EFFECTIVE APPROACH FOR CONTROLLING TRANSIENTS

Transient pressures can cause catastrophic damage to pipes and equipment, risk the safety of operators, allow the intrusion of dangerous contaminants into the system, and interrupt service to customers. Over time, the increased wear and tear on pipes and pumps can lead to premature failure.

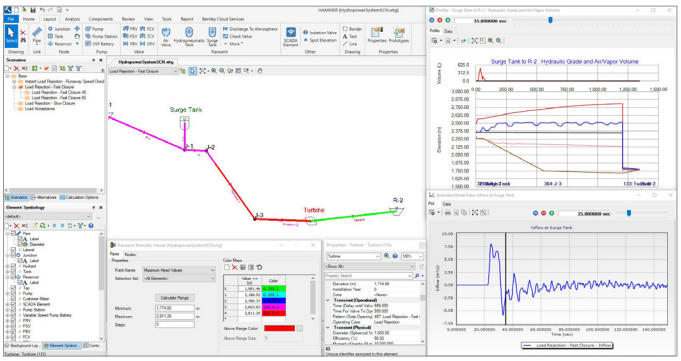
The most cost-effective approach for controlling transients is to perform a transient analysis to locate trouble spots and determine appropriate surge control strategies. OpenFlows HAMMER gives water professionals the power to successfully perform this critical analysis, even on high-profile projects.

PROVEN TRANSIENT ANALYSIS ALGORITHM

Use the method of characteristics (MOC) – the benchmark standard for hydraulic transient flow analysis – to compute results at intermediate points along the pipeline and accurately capture critical outcomes such as mid-pipe negative pressures that could otherwise be overlooked.

SUPERIOR INTEROPERABILITY

You can employ OpenFlows HAMMER out of the box as a stand-alone application, or you can work from within MicroStation®, ArcGIS Pro, or AutoCAD using the same HAMMER model for true interoperability across platforms.



Integrated issue resolution

MODEL BUILDING AND MANAGEMENT MADE EASIER

If you already have an OpenFlows WaterGEMS® or OpenFlows WaterCAD® model, you can simply open it in HAMMER to get started, as these products share a common file format. To build a network directly within HAMMER, use the element layout buttons, or leverage your existing geospatial data, CAD drawings, databases, and spreadsheets with versatile tools for model building and load allocation. HAMMER can also open model files created with EPANET.

A WIDE RANGE OF HYDRAULIC COMPONENTS

Enable precise simulation of the impact of a wide range of surge protection devices and rotating equipment such as pumps and turbines.

You can select from more than 20 devices and perform an unlimited number of operating scenarios to develop the most appropriate strategy for surge mitigation.

COMPREHENSIVE SCENARIO MANAGEMENT

Scenario Management Center gives you full control to configure, run, evaluate, visualize, and compare an unlimited number of what-if scenarios within a single file. Support your decision-making by evaluating and comparing multiple surge-protection alternatives, as well as pump and valve operation strategies.

RESULT INTERPRETATION TOOLS

The analysis and data visualization features allow users to capture fast-moving transient phenomena, determine their impact on the system, and select the most appropriate surge protection equipment for the job.

Thematic mapping, interactive animations, contour plots, and a host of report-ready graph and profile options provide the information required in a format that makes sense.

SYSTEM REQUIREMENTS

MINIMUM: 800 x 600 resolution, Windows, 10, 8 GB RAM
RECOMMENDED: 1920 x 1080 resolution, Windows 10, 16 GB RAM
BROWSER COMPATIBILITY: Stand-alone application and runs within ArcGIS Pro, ArcMap, MicroStation, AutoCAD, See: Platform Compatibility

OpenFlows™ HAMMER® At-A-Glance

INTERFACE AND GRAPHICAL EDITING

- Ability to run from within four compatible platforms:
  - » Windows
  - » MicroStation (MicroStation license required)
  - » ArcGIS Pro (ArcGIS Pro license required)
  - » AutoCAD (AutoCAD license required)
- Element morphing, splitting, and reconnecting
- Scaled, schematic, and hybrid environments
- Automatic element labeling
- Ability to track model changes by user, date, and element
- Unlimited undo/redo
- Element prototypes
- User data extensions
- Aerial views and dynamic zooming
- Named views manager
- Multiple background layer support
- Ability to add online Bing Maps as a background

INTEROPERABILITY AND MODEL BUILDING

- Complete compatibility with OpenFlows WaterCAD and OpenFlows WaterGEMS
- EPANet import/export
- Spreadsheet, database, ODBC, shapefile, DXF and DGN file, geodatabase*, geometric network*, and SDE* connections (*when running from within ArcMap)
- GIS-ID property to maintain associations between records in the data source/GIS and elements in the model
- Graphical SCADA element
- Customer meter element
- Automatic demand allocation from geospatial data such as customer meters
- Geospatial-based water consumption projection
- Daily, weekly, monthly, and superimposed patterns
- Composite demands with global editing
- Area, count, discharge, and population-based loading
- Demand loading based on pipe length
- Elevation extraction from DEM, TIN, shapefiles, CAD drawings and surfaces
- Lateral service connection links – no need to split pipes

MODEL MANAGEMENT

- Unlimited scenarios and alternatives
- Active topology
- Global attribute tabular editing
- Sorting and persistent filtering on tabular reports
- Dynamic and static selection sets
- Customizable engineering libraries
- Global engineering units management
- Sub-model management
- Network navigator for automatic topology review and connectivity consistency
- Automatic element validation
- Automated model skeletonization
- Complete flexibility for project options (pressure wave speed, liquid specific gravity and vapor pressure, and run duration)
- Support for ProjectWise®

HYDRAULICS

- Method of characteristics for transient analysis
- Wave speed calculator
- Built-in steady-state and extended-period simulation engines
- Transient force computation
- Turbine modeling: load acceptance and rejection
- Steady-state/EPS friction methods: Hazen-Williams, Modified Hazen-Williams, Darcy Weisbach, or Manning's equation
- Transient friction methods: steady, quasi-steady, unsteady, or unsteady (Vitkovsky)
- Rule-based or logical controls
- Variable-speed pumping
- Transient analysis batch run

RESULTS PRESENTATION

- Thematic mapping
- Advanced dynamic profiling
- Contour plots
- Profile plots along a path
- Time history graphs at a point
- Synchronized maps, profiles, and point history visualization
- Advanced tabular reporting with FlexTables
- Record AVI video of time analysis

HYDRAULIC ELEMENTS

- Reservoir
- Pump: shut down after delay, constant speed (no curve), constant speed (with curve), variable speed
- Turbine
- Pressure regulating valve
- Flow control valve
- Loss element (including orifice)
- Sprinkler
- Valves types: check, gate, globe, butterfly, needle, ball, user-defined
- Dead-end pipe
- Constant flow draw-off
- Periodic head/flow

TRANSIENT SOURCES

- Valve closure (including partial closure) and opening
- Pump: controlled shutdown, trips, startup
- Rapid demand or pressure change
- Multiple, simultaneous transient sources

SURGE PROTECTION DEVICES

- Surge tank: open, spilling, one-way, variable-area, differential, with orifice, with bladder
- Hydropneumatic tank: sealed, vented, dipping tube
- Pressure relief valve
- Surge anticipation valve
- Rupture disk
- Air valve: single-acting, double-acting, slow-closing, triple-acting
- Discharge to atmosphere