

# HAMMER

## Transient Analysis and Modeling

If left unchecked in a water or sewer system, transient pressures can cause catastrophic damage to pipes and equipment, risk the safety of operators, allow intrusion of dangerous contaminants into the system, and interrupt service to customers. Over time, increased wear and tear on pipes and pumps as a result of hydraulic transients can lead to premature failure.

The most cost-effective approach to control transients is to perform a transient analysis to locate trouble spots and determine appropriate surge control strategies. Used successfully on high-profile projects for more than 15 years, HAMMER puts the power to perform this critical analysis in the hands of water system professionals.

### Proven Transient Analysis Algorithm

HAMMER uses the Method of Characteristics (MOC) – the benchmark standard for hydraulic transient flow analysis. The MOC computes results at intermediate points along the pipeline, accurately capturing critical outcomes (such as mid-pipe negative pressures) that could otherwise be overlooked.

### Superior Interoperability

HAMMER users enjoy the power and versatility afforded by working across CAD, GIS, and stand-alone platforms while accessing a single, shared, project data source. With HAMMER, utilities and consultants can choose to model from within four interoperable platforms:

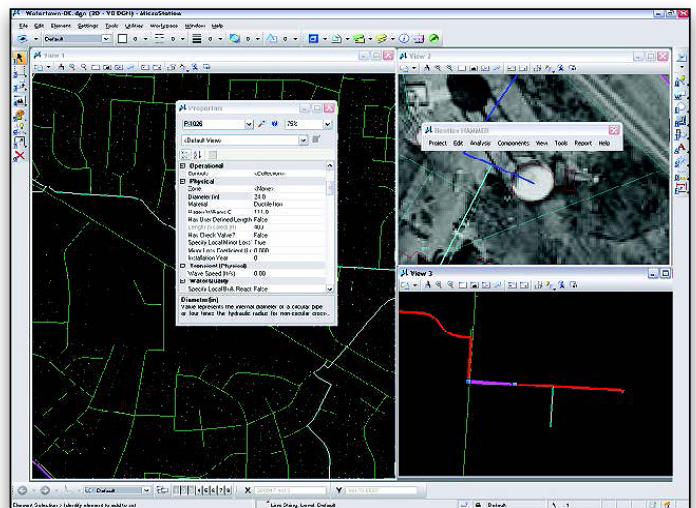
- Windows stand-alone for ease of use, accessibility, and performance
- ArcGIS for GIS integration, thematic mapping, and publishing
- MicroStation for bridging geospatial planning and engineering design environments, and
- AutoCAD for CAD layout and drafting

### Model Building and Management Made Easier

With HAMMER you can build your network from scratch using simple drag-and-drop layout tools, or import your network data from EPANet.

Alternatively, engineers can leverage geospatial data, CAD drawings, databases, and spreadsheets to jumpstart the model building process. The included LoadBuilder and TRex modules help engineers allocate water demands and node elevations based on geospatial data helping them to avoid potential manual input mistakes and streamline the model building process. HAMMER also provides drawing and connectivity review tools to guarantee a hydraulically coherent model.

WaterCAD or WaterGEMS users can even open their WaterCAD or WaterGEMS models directly in HAMMER (or vice-versa), eliminating any import or conversion process.



*HAMMER can run from within MicroStation, ArcGIS, and AutoCAD, or as a stand-alone application.*

### A Wide Range of Hydraulic Components

HAMMER allows you to precisely simulate the impact of a wide range of surge protection devices and rotating equipment (pumps and turbines). The user 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

HAMMER's Scenario Management Center gives engineers full control to configure, run, evaluate, visualize, and compare an unlimited number of what-if scenarios within a single file. Engineers can easily make decisions by comparing unlimited scenarios, analyzing surge protection alternatives, or evaluating pump and valve operation strategies.

### Result Interpretation Tools

The analysis and data visualization tools in HAMMER 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, and contour plots, and a host of report-ready graph and profile options provide the information required in a format that makes sense.

## System Requirements

Refer to the 'Installation Requirements' section of the HAMMER ReadMe file:

[www.bentley.com/HAMMER-Spec](http://www.bentley.com/HAMMER-Spec)

### Platform pre-requirements:

HAMMER runs without platform restrictions as a stand-alone application.

It also runs from within ArcGIS, AutoCAD, and MicroStation. The requirements are also available in the HAMMER ReadMe file.

Find out about Bentley at: [www.bentley.com](http://www.bentley.com)

### Contact Bentley

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### Global Office Listings

[www.bentley.com/contact](http://www.bentley.com/contact)

## HAMMER At-A-Glance

### Interface and Graphical Editing

- Ability to run from within four compatible platforms:
  - » Stand-alone Windows
  - » ArcGIS (ArcMap)
  - » MicroStation
  - » AutoCAD
- Element morphing, splitting, and reconnection
- Scaled, schematic, and hybrid environments
- Automatic element labeling
- Unlimited undo, redo
- Element prototypes
- User data extensions
- Aerial views and dynamic zooming
- Named views manager
- Image, CAD, and GIS background layer support

### Interoperability and Model Building

- Complete compatibility with WaterCAD/WaterGEMS
- EPANet import/export
- Spreadsheet, database, ODBC, Shapefile, DXF 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
- SCADAConnect for live data connections to and from SCADA systems (available for an additional fee)
- Graphical SCADA element
- Customer Meter element
- Automatic demand allocation from geospatial data
- Geospatial demand allocation from customer meters and lump-sum geospatial data
- Geospatial-based water consumption projection
- Daily, weekly, monthly, and superimposed patterns
- Unaccounted for water and leakage estimation
- Composite demands with global editing
- Area, count, discharge, and population-based loading
- Pipe-length-based demand loading
- Elevation extraction from DEM, TIN, shapefiles, CAD drawings, and surfaces

### 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
- Orphaned nodes and dead-end pipes queries
- Complete flexibility for project options (pressure wave speed, liquid specific gravity and vapor pressure, and run duration)
- Support of ProjectWise/ProjectWise Geospatial Management

### Hydraulics

- Methods 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
- Three types of friction methods (steady state using Hazen-Williams or Darcy-Weisbach friction coefficients, quasi-steady, and unsteady friction methods)
- 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 histories visualization
- Advanced tabular reporting with FlexTables
- Publishing of i-models in 2D or 3D, including to Bentley Map Mobile

### Hydraulic Elements

- Reservoir
- Pump: shut down after delay, constant speed (no curve), constant speed (with curve), variable speed
- Turbine
- Pressure regulating valve
- Flow sustaining valve
- Loss element (including orifice)
- Sprinkler
- Check valves
- Gate valve
- Globe valve
- Butterfly valve
- Needle valve
- Ball valve
- User-defined valve
- Air valve: single-acting, double-acting, slow-closing, triple-acting
- Discharge to atmosphere
- Dead end
- Constant flow draw-off
- Periodic head/flow

### Transient Sources

- Valve closure (including partial closure) and opening
- Pump, controlled shutdown, trips, startup
- Rapid demand change; rapid pressure change
- Multiple transient sources supported simultaneously

### 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