

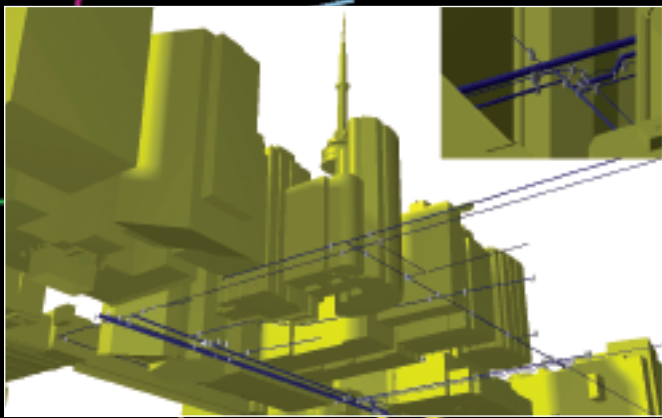
# AUTOMATIC SKELETONIZATION OF WATER MODEL ALLOWS THE CITY OF TORONTO TO SAVE OVER ONE MILLION DOLLARS

## SKELETONIZATION OF WATER DISTRIBUTION MODEL ALLOWS THE CITY TO COMPLY WITH TWO DIFFERENT DEPARTMENT'S MODEL REQUIREMENTS FOR MAJOR COST SAVINGS

The City of Toronto operates and maintains an extensive water network that includes more than 3,500 miles of water mains, over 65,000 water valves, almost 42,000 hydrants, and 450,000 service connections; moreover, the water network is up to 150 years old in some areas.

The Canadian climate increases the occurrences of water main breaks and potential service disruption. For these reasons, information about the water facilities is essential to the operation and maintenance of a system of this size, age, and complexity.

The Survey & Mapping Unit of the Technical Services Division of the City of Toronto maintains an as-built mapping environment that emulates the real world network with 307,956 pipes/segments. The system architecture includes MicroStation, GeoGraphics, Bentley Water and Oracle. The Bentley Water data model has been extended to include facility attributes to populate the City's data warehouse and work order management system.



### PROJECT OVERVIEW

#### Project

Toronto Water Integrated Network Skeletonization (TWINS)

#### Organization

City of Toronto

#### BE Awards category

Public Works

#### Project objectives

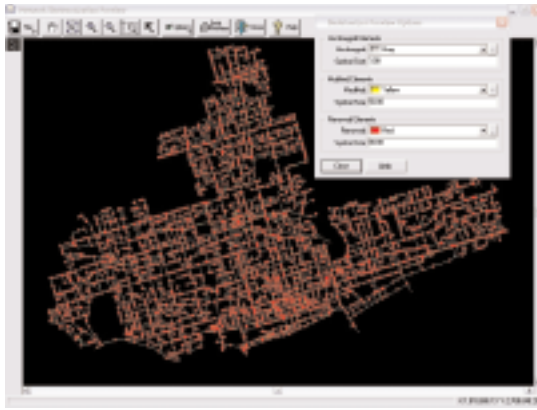
Develop a twin skeletonized network for their asset management group.

#### Fast facts

- Skeletonization is the process of reducing a network model for maximizing the efficiency, speed, and manageability of the water distribution model.
- The city's asset management group was worried about the increasing complexity of the model.
- Bentley's Haestad Methods WaterGEMS's Skelebrator module provided the technology to automate the skeletonization process without losing the hydraulic equivalence of the model and the network connectivity.

#### Bentley products used

- MicroStation
- MicroStation GeoGraphics
- Bentley Water
- WaterGEMS



The City's asset management group is a key user of data as they must model the water network and manage the Capital Work Plan. However, the increased number of graphic elements and associated database records required to maintain the level of detail (LOD) of the Physical Water Network presented a risk to the efforts of the asset management group. There were concerns that increased LOD would increase the complexity of the work without adding value to the modeling activities. City staff debated at length on the water network standard. Fortunately, the need to mitigate this risk coincided with the Bentley acquisition of Haestad Methods and the City's exposure to the capabilities of WaterGEMS.

Skeletonization consists of selecting for inclusion in a water distribution model only the parts of the hydraulic network that have a significant impact on the behavior of the system. Bentley's Haestad Methods WaterGEMS enabled the auto-skeletonization of the Physical Water Network to create a twin network, appropriate for the different business requirements.

From a financial point of view, the savings from implementation of a simplified twin network across the entire City (conversion from the Physical Water Network LOD) was estimated to be \$ 600,000 (Canadian) with additional downstream maintenance costs of \$500,000 (Canadian) over the next ten years. Alternatively, the cost of not creating a twin presented a risk that the Physical Water Network with its increased LOD would disable the asset management and capital planning activities.

The Skelebrator module of the newly acquired WaterGEMS offered a unique integration opportunity to provide a twin skeletonized network to the asset management group and eliminate any associated risk to the modeling activities. As Bentley SELECT Subscribers, the City of Toronto was able to obtain the Skelebrator module for a very low cost; a nominal fee compared to the estimated costs to create and maintain a skeletonized network over the next ten years. "By enabling us to automatically skeletonize our complex water network from a high level of detail to less granular detail, WaterGEMS allowed us to bridge the data needs of two different user groups, while saving the City over one million (Canadian) dollars", says Bob Gaspirc, Manager of Mapping Services, City of Toronto.

While the physical network contains 307,956 pipes, the twin network only contains 76,989 pipes; one fourth the complexity. The portions of the Physical Water Network that are not modeled are not ignored; rather the effects that these features contribute to the system are accounted for within the parts of the Physical Water Network that are included in the twin network.

Bentley technology provided a bridge not only between two different user groups but also between two different data models and two different businesses. The process is automated, repeatable, and sustainable. The solution is scalable and flexible, allowing for skeletonization of additional users with different needs and associated LOD.

With the acquisition of WaterGEMS, the City began to generate the twin water network. The project was launched in December 2004. Approximately five days of staff time was required to develop the conversion rules and the pilot conversion was confirmed in January 2005. The existing network was completed shortly after to coincide with the start of Capital Works Planning.

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