

Hydraulic Analysis of a Dry Fire Line Piping Network for a Twin Tunnel Subway Design Project Using AFT Fathom™

Platinum Pipe Award 2011 Winner – Model Creativity/Appearance

Company: Hatch Mott MacDonald
Location: Millburn, New Jersey, USA

Hatch Mott MacDonald is a full service consulting engineering firm offering services including planning, project development, studies and analysis, design, procurement, construction engineering and facility maintenance and operations. It is ranked as the 39th largest design firm in the United States and employs over 23,000 worldwide. Hatch Mott MacDonald is accomplished in the fields of transportation, tunnels, water supply, wastewater, environment, gas pipelines, buildings, and utilities.

The Toronto Transit Commission (TTC) has hired Hatch Mott MacDonald as consulting engineers on two upcoming tunneling projects: a subway expansion and a new Light Rail Transit system. The design of all commuter tunnels involves careful consideration to the fire protection system that will safeguard the public in an incident of emergency.

“AFT Fathom is, above all, reliable software. This is crucial to Hatch Mott MacDonald, a company whose reputation depends on the reliability of the final product.”

A Dry Fire Line (DFL) piping system is used for the suppression of fire in the tunnels with governing standards that outline strict design requirements. These complex piping systems require in-depth hydraulic analysis to calculate system parameters such as outlet pressure and flow rate.

A DFL system is composed of pipe networks, fittings, valves, and hose connections that are empty, or dry (to avoid freezing in non-heated spaces in cold climates), and are filled with water only when an emergency situation arises. The water source for the DFL system is normally a local fire hydrant that connects to a fire department pumper truck and ultimately to a set of fire department connections located at grade. Water is pumped from grade to the tunnels through the DFL piping network and supplies water to a series of fire hose connections, strategically located along the tunnels.

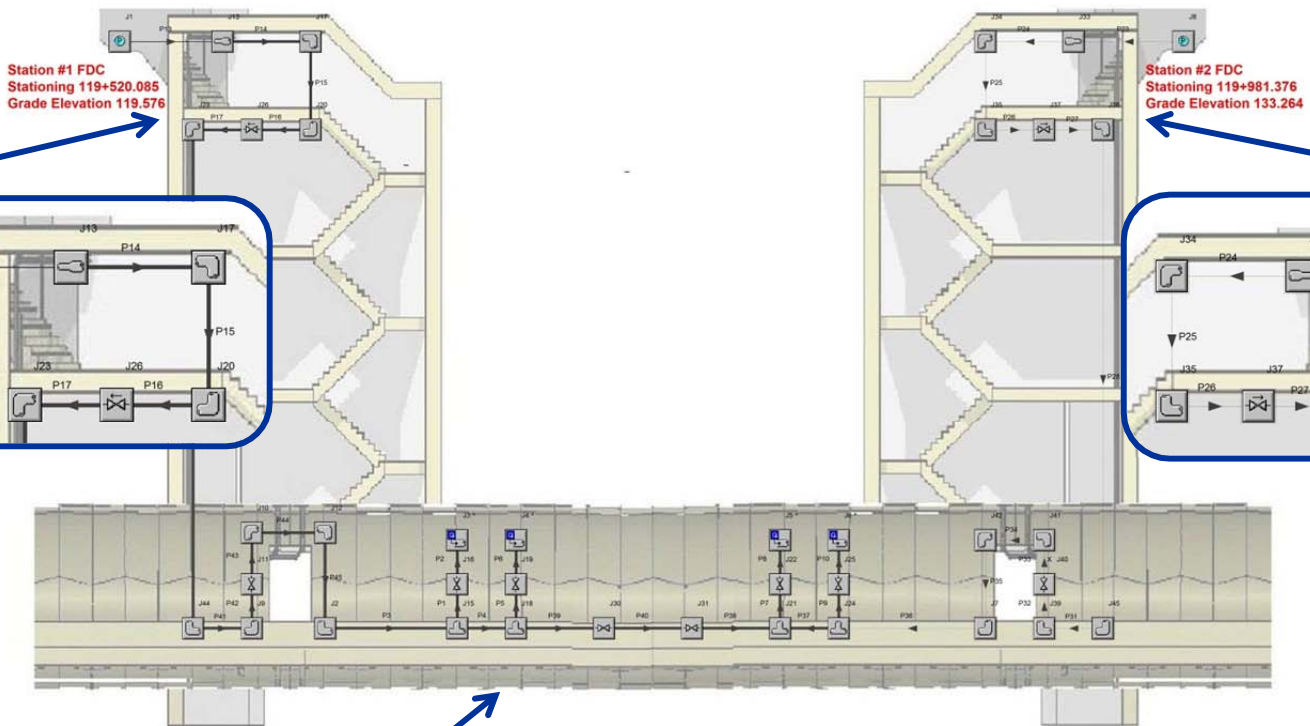
A hydraulic model of the DFL piping network was created in AFT Fathom to study the pressure drop in the system by regulating the input pressure at grade and output pressure at the farthest set of fire valves in the

tunnels. The model includes different scenarios, depending on flow direction and operational fire valves. This design will be installed into each section of new subway tunnels, between stations and at emergency exit buildings.

According to Hatch Mott McDonald, there are many benefits of using AFT Fathom software.

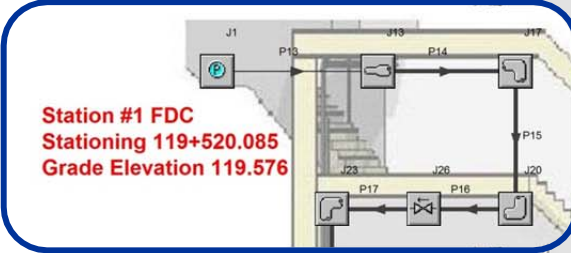
AFT Fathom:

- Allows preliminary designs to be tested, and based on the results, either continue designing or begin generating new and better ideas. The user interface provides an intuitive and physically complete design experience. The ability to easily separate one model into its different scenarios has also proven to be beneficial to our design process.
- Is a time saving alternative that limits hand calculations to verification of the design, not the design itself. AFT Fathom's software stability eliminates man hours spent on troubleshooting.
- Provides wide model flexibility. Effortless global junction and pipe specification modifications, combined with excel data importing, allows for seamless adjustment of existing models to new requirements.
- Is transparent in its methods. All theory is included in the well laid out user guide, which allows engineers to fully understand and, for that reason, trust what the software has produced.
- Makes reporting results easy through its customizable output layout. Results can be easily copied, or exported to excel files, and parameters and junctions can be reordered to best suit a specific application.
- Enables a model to be made more presentable when required. Junction display options, background pictures, and varying pipe thicknesses make the models more realistic, and easily understandable.
- AFT Fathom is, above all, reliable software. This is crucial to Hatch Mott MacDonald, a company whose reputation depends on the reliability of the final product. It is robust, and forthcoming with its calculation approaches.



Station #1 FDC
 Stationing 119+520.085
 Grade Elevation 119.576

Station #2 FDC
 Stationing 119+981.376
 Grade Elevation 133.264



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