AFT Fathom™ Instrumental in Reconfiguring Office Building HVAC System

CASE STUDY

HVAC System
Commercial Building Industry

Swanson Rink
Denver, Colorado, USA
Platinum Pipe Award Winner - Correlation to Test/Field Data

Swanson Rink was tasked with increasing the airflow for the second floor of a two-story office building as part of a remodeling project.

The remodel would increase the office building's occupancy, leading to a rise in cooling demands. The east side of the building is served by an air handling unit (AHU-1), and the west side of the building is served by a second air handling unit (AHU-2).

Increased cooling is typically provided by raising fan speed. However, the AHUs serving this space were already operating close to their maximum airflow rate and did not have the capacity to increase the fan speed significantly.

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Product performance data for the AHUs and fans was unavailable, so there were no fan curves to determine if the fans could accommodate the increased airflow.

Rory Heim, mechanical engineer at Swanson Rink, used AFT Fathom in conjunction with a thermal loads program to analyze the fan performance required by different load configurations.

The thermal loads program used the standard 55 F (13 C) supply air temperature to condition the space and calculated the required cubic feet per minute (CFM). Heim then modeled the system in AFT Fathom using the calculated airflow rate values to determine the new desired operating points for each AHU fan (see Figure 1).

When the static pressure and airflow rates of each AHU were measured, Heim determined the real static pressures were too low compared to the AFT Fathom model's desired pressures at the same flowrate.

"AFT Fathom allowed us to accurately determine the minimum system conditions we needed for a functional design," said Heim. "When those minimum system conditions—CFM/static pressure—couldn't be met by existing equipment, AFT Fathom allowed us to rapidly evaluate different strategies to satisfy the restricting design parameter—fan performance."

To remediate the airflow rate issues, Heim performed a simulation in the HVAC load calculation program. The supply air temperature of the AHUs was reduced in the program from 55 F to 50 F (13 C to 10 C). This determined the space would require 75% airflow for the same amount of cooling. The lower airflow requirements allowed the fan to provide a higher static pressure.

With this lower supply air temperature, AFT Fathom predicted AHU-1's requirements to be 19,695 CFM (558 m^3/min) and 1.15 in. water (29.2 mm water). AHU-2's requirements were predicted to be 22,952 CFM (650 m^3/min) and 1.48 in. water (37.6 mm water).

Swanson Rink sets the standard for what it means to be a consulting engineering firm. For more than 64 years, clients have demanded their technical expertise in engineering, technology, and management services to provide solutions that are reliable, sustainable and meet customers' specific business needs. Swanson Rink focuses on solving complex problems for mission critical data centers, airports and corporate clients.

While visiting the site, Heim discovered a static pressure sensor at the outlet of each AHU. He had the building engineer set each AHU fan close to the desired CFM values and report the airflow and static at that operating point.

The reported operating points for AHU-1 were 22,502 CFM (637 m^3/min) and 1.24 in. water (31.5 mm water); for AHU-2, they were 21,587 CFM (611 m^3/min) and 1.36 in. water (34.5 mm water).

Based on these values, Heim was confident that each AHU would be able to deliver the amount of air needed to condition the office building's second floor.

Heim said that receiving measured field data from existing equipment that closely matched their model data gave the team confidence in the model. It allowed the team to move forward with the assurance that post-construction data would closely match AFT Fathom predicted data.

The project has since been completed and the system balanced to Swanson Rink's design values. The AFT Fathom model was in close agreement with the installed operating points (see Figure 2). The final operating points were 20,849 CFM (590 m^3/min) and 1.03 in. water (26 mm water) for AHU-1 and 25,297 CFM (716 m^3/min) and 1.12 in water (28 mm water) for AHU-2.

"If you calculate a percentage error based on our design and the installed operating points, the model may seem inaccurate, but in this case, the model was invaluable in being able to demonstrate that our designed system would perform within the existing fan parameters," said Heim. "To be within 0.09" (AHU-1) and 0.12" (AHU-2) of static between our desired operating points at 50 F and the BAS (building automation system's) measured operating points, speaks to the accuracy of our model and the abilities of AFT Fathom to accurately model complicated ducting systems."

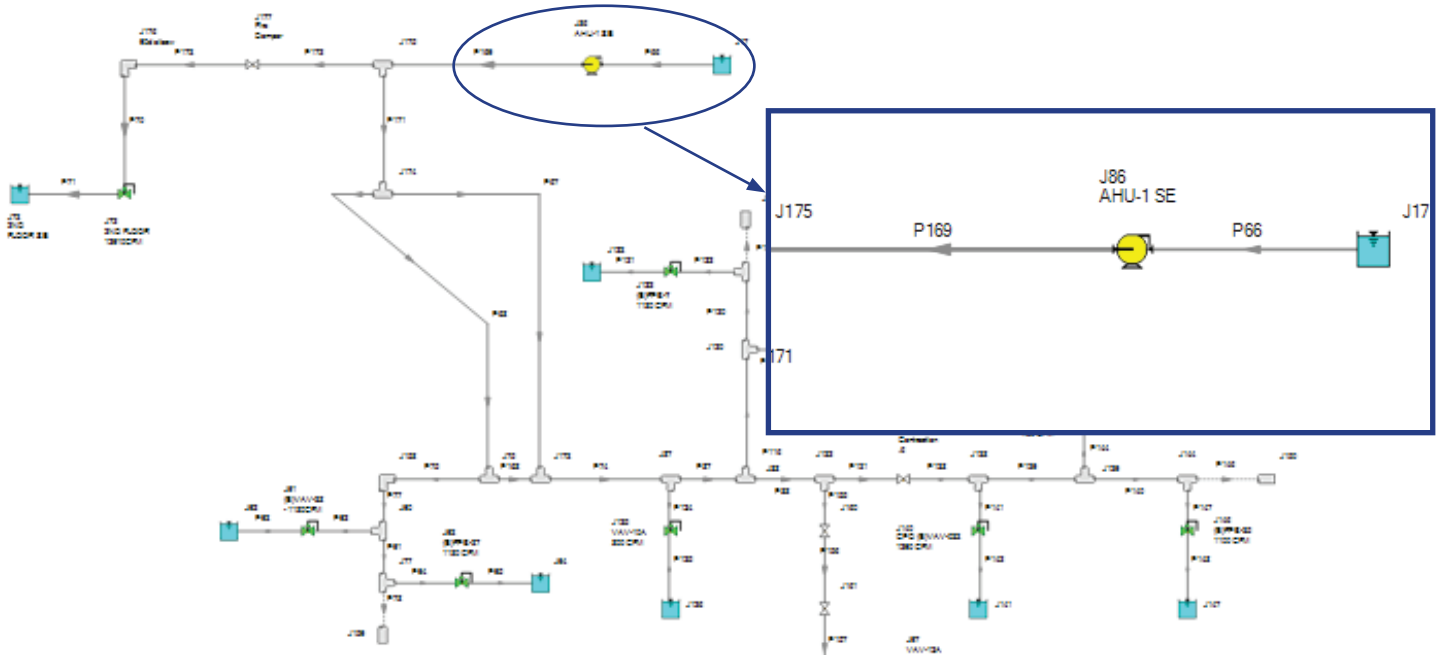

Figure 1 - AFT Fathom model showing Air Handling Unit-1

Unit	AFT Fathom Prediction	Field Data
AHU-1	19,695 CFM (558m^3/min)	22,502 CFM (637m^3/min)
AHU-2	22,952 CFM (650 m^3/min)	21,587 CFM (611 m^3/min)

Unit	AFT Fathom Prediction	Field Data
AHU-1	1.15 in/wc (29.2 mm water)	1.24 in/wc (31.5 mm water)
AHU-2	1.48 in/wc (37.6 mm water)	1.36 in/wc (34.5 mm water)

Figure 2 - Field measured data & AFT Fathom model predictions