CASE STUDY

Data Center
Northern Virginia

VIBRO-ACOUSTICS by Swegon

SCOPE & TESTING

With a deadline of 3 weeks, Vibro-Acoustics **reconfigured an aero-acoustic lab, built a full section mock-up of the noise control solution, and verified the acoustics and pressure drop** through a series of tests and analyses.

PROJECT TESTING

> Computational Fluid Dynamics (CFD) analysis verified a smooth flow and predicted pressure drop

> An aerodynamic pressure drop test measured the actual pressure drop across the assembly

> A sound transmission loss test measured the sound transmission loss of the entire system

> Finite Element Analysis (fea) evaluated structural capacity, ensuring the solution would withstand 150 mph winds.

OVERVIEW

THE DATA CENTER, located in Northern Virginia, is a 370,000 sq.ft. building that processes millions of electronic transactions from around the world. The data center's generator system is located in 11 bays at the south end of the building. The 22 generator sets of 2.5 megawatts each are designed to work simultaneously, if necessary, to provide a total of 55 megawatts of backup power to run the center.

! CHALLENGES

DUE TO "DE-VALUE ENGINEERING," silencers were omitted from the building at the design stage, causing a noise control disaster. The noise control solution required consideration of the performance rating of the generator fans. This required the entire solution to maintain a maximum pressure drop of 0.5" wg including system effects. Failure to meet this requirement would ultimately result in an unacceptable reduction in generator capacity.

Snow infiltration into the generator room caused by high intake air velocities at the original storm louvers was one of the challenges Vibro-Acoustics faced during this project. This issue, if left unaddressed, would lead the generators to degrade prematurely. The space limitations in the generator room required the solution to be placed on the exterior of the building. While keeping clear of the equipment yard, the solution had to be designed to withstand winds of 150 mph.

County vs Measured Sound Pressure Levels at Property Lines (dB re: 20 microPa)										
Octave Band Center Freq. (Hz)	**0 31.5**	**1 63**	**2 125**	**3 250**	**4 500**	**5 1000**	**6 2000**	**7 4000**	**8 8000**	**dBA[1]**
County Regulations	70	72	70	65	59	55	51	47	44	62
Fence Line Measured	75	73	90	86	80	75	71	63	71	83

(1) Overall dBA presented for general intent only; dBA is not part of regulation

With no noise control system in place, the generator system sound levels reached 83 dBA at the property line, violating county regulations. At 108 dBA in the equipment yard, workers were forced to wear ear protection.

SOLUTION

The owner of the data center hired an acoustical consultant to design the noise control solution.

The acoustical consultant and Vibro-Acoustics verified the design and pressure drop calculations, and created a specification that would ensure the requirements were met.

Testing was carried out in Vibro-Acoustics' lab in Toronto. In preparation, the lab required significant modifications including: reconstruction of a wall in the reverb room, a larger fan with new enclosure assembly, a new variable-frequency drive (vfd), a reconfigured tunnel, and new duct connections.

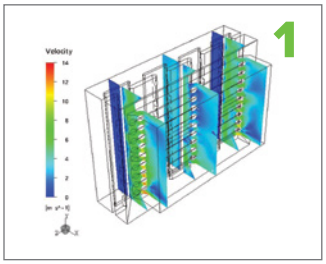
Vibro-Acoustics built a section of the design solution, which consisted of a damper, an acoustic louver, offset baffles and a storm louver. Starting from the interior, the damper was installed in the reconfigured wall opening to control airflow into the room.

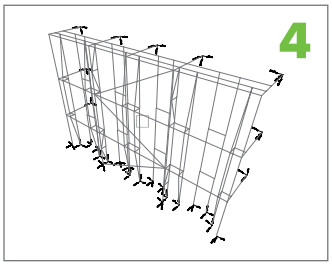
A 24 in. deep acoustic louver was placed in front of the dampers, followed by two rows of offset baffles, which helped provide additional attenuation and to minimize snow ingress. These components were encased in a 12' × 9' × 7' enclosure, and to cap it off, a 12' × 9' storm louver was set in front to complete the test section.

To test the design, Vibro-Acoustics performed the following:

1. Computational Fluid Dynamics (cfd) analyses
2. Fully witnessed system aerodynamic pressure drop test
3. Fully witnessed system sound transmission loss test
4. Finite Element Analysis (fea)

VIBRO-ACOUSTICS by Swegon





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County Regulations	70	72	70	65	59	55	51	47	44	62
Fence Line Measured (before solution)	75	73	90	86	80	75	71	63	71	83
Fence Line Measured (with solution)	64	64	71	56	49	43	39	30	31	56

(1) Overall dBA presented for general intent only; dBA is not part of regulation

After successfully completing testing, Vibro-Acoustics implemented the solution on one of the 11 bays of the data center's generator room. With site dimensions gathered, the damper, acoustic louvers, baffles, structural steel and storm louver were all manufactured to meet the tight delivery requirements.

After the solution was installed, a sound pressure level test was performed to confirm that the expected levels were achieved. The favorable test results enabled Vibro-Acoustics to supply the solution for the remaining bays.

On top of supplying the noise control solution with detailed installation instructions, Vibro-Acoustics also sent a team of engineers on-site to supervise the installation of the solution on the 11 bays.

V-A Lab with new wall construction

On-site installation of the verified noise control solution