

VIBRO-ACOUSTICS®

Noise Control | Vibration Isolation | Restraint Systems



CASE STUDY

DATA CENTER, NORTHERN VIRGINIA

Expedited, rigorous mock-up testing verifies design and pressure drop calculations for massive noise control solution.

SITUATION

Located in Northern Virginia, this data center of a major global payments company is a 370,000 square foot 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 data center.

PROBLEMS

As a result of “de-value engineering,” all silencers were omitted from the building at the design stage, leading to a noise control disaster. Without a noise control solution in place, sound levels created by the generator system reached 83 dBA at the property line, violating the county’s noise regulations of a maximum of 62 dBA. At 108 dBA in the equipment yard, workers were forced to wear special ear protection as per OSHA standard. To avoid potential litigation issues with the county, a new noise control solution had to be designed and implemented. As with any generator application, the solution for noise control also had to consider 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.

Another issue to be eliminated was snow infiltration into the generator room caused by high intake air velocities at the original storm louvers. This problem, if left unaddressed, would lead the generators to degrade prematurely. The space limitations in the generator room presented other challenges, and required the solution to be placed on the exterior of the building. Not only did the solution have to keep clear of the equipment yard, but, increasing the project’s complexity, it also 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	1	2	3	4	5	6	7	8	dBA ¹
	31.5	63	125	250	500	1000	2000	4000	8000	
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



An equipment yard occupies the space outside the generator room, and at approximately 175 feet south of the yard, a perimeter fence marks the property line.

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SOLUTION

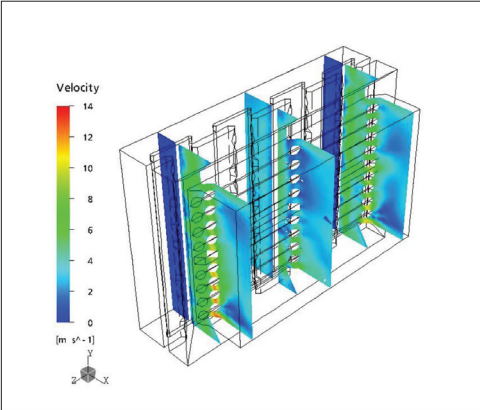
Realizing the severity of the problem, the owner of the data center hired an acoustical consultant to design the noise control solution. The acoustical consultant partnered with Vibro-Acoustics to verify the design and pressure drop calculations, and help write a specification that would ensure the requirements were met without multiple attempts.

Pressed by a tight deadline, Vibro-Acoustics – in just three weeks – managed to reconfigure an aero-acoustic lab, build a full section mock-up of the noise control solution, and verify the acoustics and pressure drop through a series of tests and analyses.

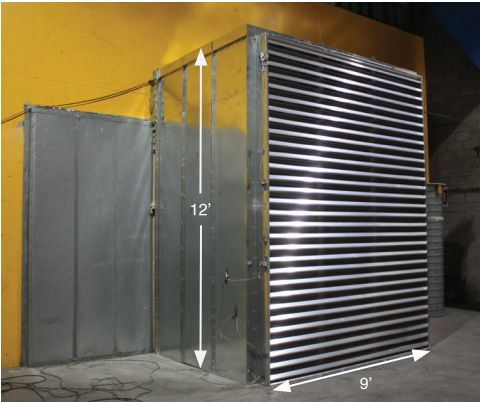
Mock-up testing was carried out in Vibro-Acoustics’ main aero-acoustics lab in Toronto. In preparation for the tests, the lab had to undergo significant modifications. Vibro-Acoustics began by reconstructing a section of wall of the reverberation room to accommodate a new test section. Next, a larger fan was installed with a new enclosure assembly to recreate the design air velocity through the noise control system, allowing acoustics and pressure drop to be tested across the test section. Other additions included 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 – all manufactured concurrently. Starting from the interior, the damper was installed in the reconfigured wall opening to control airflow into the room. A 24" 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). (See right)



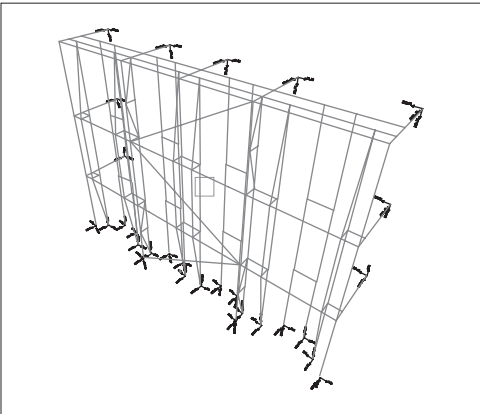
1. **Computational Fluid Dynamics (CFD) analyses** to verify smooth flow and predict pressure drop before initiating subsequent tests.



2. **Fully witnessed system aerodynamic pressure drop test** to measure the actual pressure drop across the assembly (storm louver, baffles, acoustic louver and damper). The test was carried out with 32,400 cfm through the test section and a face velocity of 300 fpm.



3. **Fully witnessed system sound transmission loss test** to measure the sound transmission loss of the entire system.



4. **Finite Element Analysis (FEA)** to evaluate structural capacity, ensuring the solution would withstand 150 mph winds.

CASE STUDY

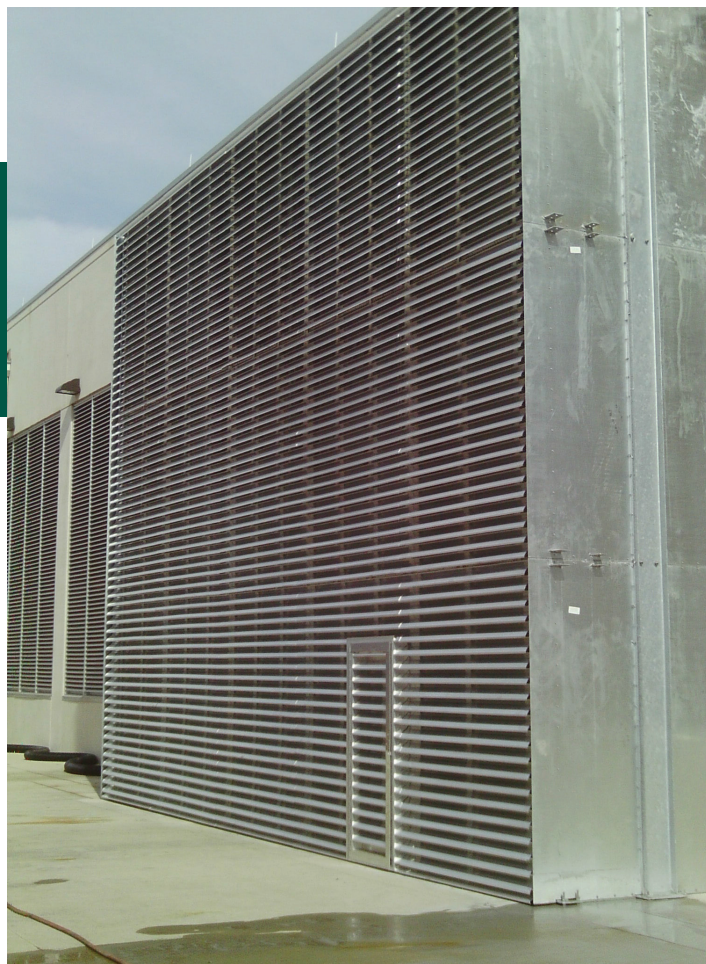
GLOBAL PAYMENTS DATA CENTER

By satisfying all sound and pressure drop requirements as guaranteed, Vibro-Acoustics relieved the acoustical consultant of any doubt as to the solution's viability upon installation.



Above: Vibro-Acoustics Project Manager plans the coordination of the installation process.

Right: On-site installation of the verified noise control solution



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 (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 all four tests, Vibro-Acoustics then proceeded to implement 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 simultaneously to meet the tight delivery requirements. Vibro-Acoustics overcame all obstacles and managed to provide the solution on time with the added benefit of single-source responsibility.

After the solution was installed on the one bay, 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 other ten 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.

BENEFITS

The benefits that came with Vibro-Acoustics' work for the data center were felt across the board. By satisfying all sound and pressure drop requirements as guaranteed, Vibro-Acoustics relieved the acoustical consultant of any doubt as to the solution's viability upon installation. For the owner, the quick three-week turnaround for the in-lab testing allowed the project deadline to be met. The tests also contributed to keeping re-work costs to a minimum, and helped the owner avert possible run-ins with the county. Further, in achieving a pressure drop of under 0.5" wg across the entire solution, Vibro-Acoustics allayed the concern over reduction in generator capacity for the owner, acoustical consultant, and the mechanical engineer.