

CASE STUDY: THE USE OF 'HIGH-SOLIDITY' LOW NOISE AXIAL FANS TO REDUCE NOISE FROM A ROOFTOP AIR-HANDLING UNIT

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INTRODUCTION

Controlling the noise from axial (propeller type) condenser fans in an air-handling unit is a challenge, since these fans typically cannot accommodate the added back-pressure introduced by silencers, acoustical hoods or lined plenums. In existing installations where noise from such a unit is found to be excessive, the options for noise control are often severely limited. This paper presents a case study, in which the newer generation of 'high-solidity' low-noise axial fans were found to be an effective means of significantly reducing the noise impact of an existing rooftop air-handling unit.

PROBLEM DESCRIPTION

The air-handling unit of concern was a 15 ton heating/cooling unit, with a pair of 30" diameter propeller fans used to move outdoor air over the condenser coil. The unit was located on the roof of the podium level of the building. About 9 metres away was the residential component of the building – a multi-storey tower with overlooking balconies (see Figure 1).

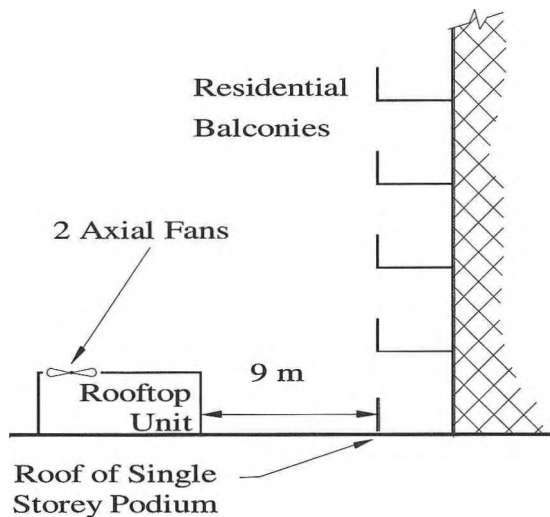


Figure 1: Sketch of Installation

MEASURED SOUND LEVELS

With the existing condenser fans operating, the sound level at the balconies was about 60 dBA. The typical nighttime ambient sound level at the balconies was 45 to 50 dBA. A noise reduction of about 15 dBA was desired.

Sound intensity methods were used to measure the overall sound power of the unit. The results are presented in octave bands, and overall dBA, in Figure 2, along with the manufacturer's published sound power levels. While there were slight differences in octave band values between the measured and published sound power levels, the overall dBA level was almost identical. An examination of the measured sound power levels indicated that virtually all of the measured sound power was attributable to the axial fans.

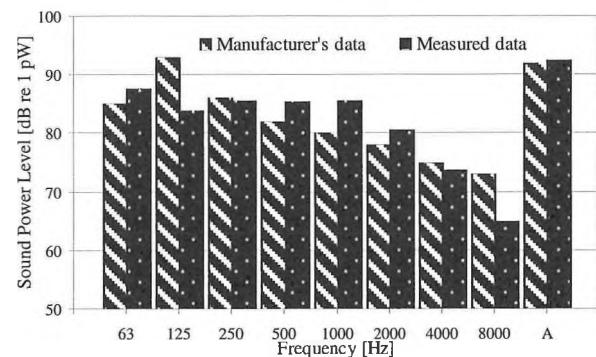


Figure 2: Sound Power Levels of Existing Rooftop Unit

LOW NOISE AXIAL FANS

In recent years, low noise axial fans have been developed, and are in use primarily in large-diameter applications such as cooling towers[1]. These fans are referred to as 'high solidity' fans because the blade area, viewed on axis, almost fully occupies the circular profile circumscribed by its tips (See Figure 3).

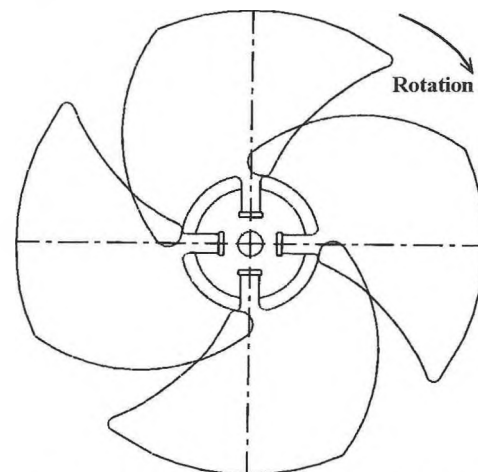


Figure 3: High Solidity Low Noise Fan

The blades are forward swept with a high pitch, and overlap each other in the axial direction. These fans achieve their noise reduction through increased efficiency, such that they can be run at about half the rotational speed of an ordinary axial fan for a given airflow and static pressure.

For this project, a manufacturer of the 'high solidity' low noise fans was contacted. Although the typical use of these fans involves sizes in excess of 28 feet in diameter, smaller diameter fans were found to be available as a special order item. A 30" diameter low noise fan blade was selected by the manufacturer to have comparable flow volume and static pressure characteristics.

NOISE REDUCTION OF NEW FANS

The pair of selected high solidity fan had a combined sound level power level of 76 dBA, overall, according to the manufacturer's published data (see Figure 4). The combined sound power of the two existing fans, as measured in-situ was 92 dBA. The resulting noise reduction possible by replacing the fans was anticipated to be 16 dBA.

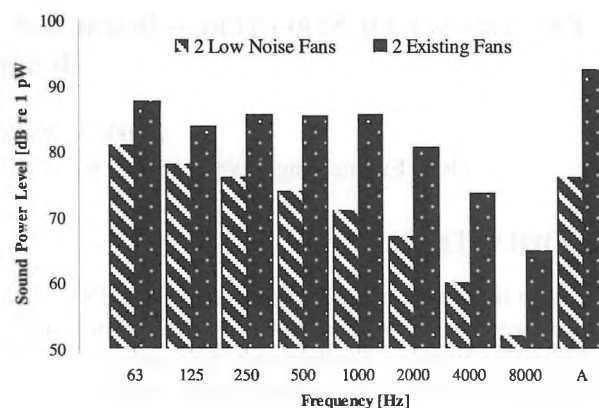


Figure 4: Published Data for Low Noise Fans vs Existing

Procurement and installation of the new fans was yet to be completed for this project, at the time of writing.

References

van der Spek, Henk F. *Advanced Low Noise Air Cooling Fans*, Presentation at the Alberta Acoustical Society "Spring Conference on Environmental and Occupational Noise. April, 2000