

ACOUSTIC DESIGN FOR AN OFFICE BUILDING LOCATED DIRECTLY UNDER AN AIRCRAFT RUNWAY FLIGHT PATH

Tom Paige, P.Eng.
Vibron Limited
1720 Meyerside Drive
Mississauga, Ontario L5T 1A3

INTRODUCTION

A new truck terminal was constructed adjacent to Toronto's Pearson International Airport. Aircraft using one of the east-west runways fly directly over the site. While most of the activities associated with the operation of the truck terminal are not noise-sensitive, a two-storey office building was constructed on the site for administrative staff, and acceptable noise levels had to be achieved in the office spaces. This paper describes the acoustic design recommendations for the exterior walls, roof, windows and doors of the office building to ensure that the aircraft noise intrusions would be reduced to a suitable noise-criteria level.

AIRCRAFT NOISE MEASUREMENTS

Prior to construction, sound-pressure-level readings were taken at the location of the proposed office building during aircraft takeoffs for a wide variety of airplanes. The sound-level meter was programmed to hold the maximum level in each frequency band during the measurement duration. The top curve in Fig. 1 shows a typical noise-level spectrum measured at the site during the takeoff of a jet aircraft (Boeing 737). The overall noise level associated with this spectrum is 98 dBA. The predicted noise level meets the NC-40 criteria.

OFFICE-BUILDING NOISE CRITERIA

Background noise levels in typical office spaces are set by noise from building mechanical systems, office equipment and functional activities. These noise levels are assessed using standard noise criterion (NC) curves. The maximum recommended background noise level in a typical office space is NC-40.

The design recommendations presented in this paper are based on the premise that, if the aircraft noise intrusions are reduced to the background noise level in the office spaces, they will not be obtrusive.

Various designs for exterior construction elements were assessed by computer modeling until the resulting noise levels in all of the office spaces met the NC-40 criteria.

DESIGN RECOMMENDATIONS

The exterior walls were constructed in a cavity-wall configuration with concrete block on the inside and a high-density exterior cladding material on the outside. The roof was also constructed using an acoustic-cavity configuration consisting of built-up roofing on the outside and a resiliently-suspended sound-isolation drywall ceiling on the inside. A typical T-bar acoustic-tile ceiling was also suspended below the drywall membrane ceiling. Supplementary ballast material was provided on the roof to increase the surface density. The exterior glazing consisted of two panes of glass, the outer pane having a thickness of 13 mm and the inner pane having a thickness of 6 mm. The panes were separated by an air space having a depth of 50 mm. Vestibules were provided for all entrance doors.

PREDICTED NOISE-INTRUSION LEVEL

The predicted aircraft noise-intrusion level in the 2nd-floor office spaces, with all of the above design recommendations implemented, is shown in Fig. 1. The overall noise level associated with this spectrum is 46 dBA. The predicted noise level meets the NC-40 criteria.

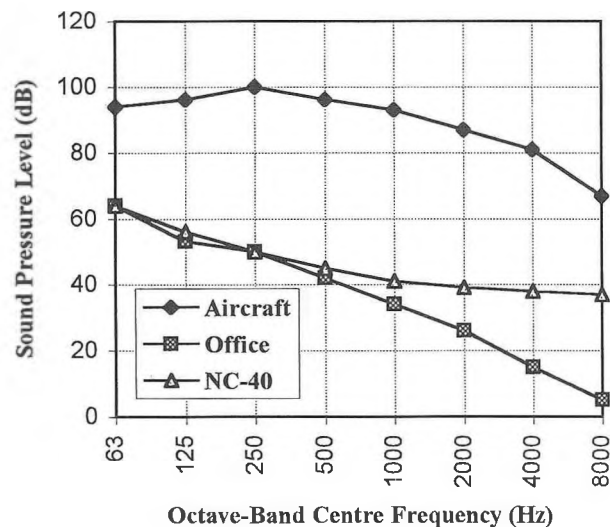


Fig. 1: Aircraft Noise-Intrusion Level in Office Spaces.