ACOUSTICAL CHALLENGES FOR A HOSPITAL CHILLER ROOM ADDITION

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Providing satisfactory acoustical environments in healthcare facilities can be ensured by applying recommended minimum design requirements provided in Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities. The objective of this project was to provide acoustical conditions in compliance with the Healthcare design guidelines when a giant chiller and six pumps were installed in a mechanical room, below an auditorium within a hospital. The job involved conducting measurements in a mechanical room with the same type of equipment and within an auditorium; reviews were made to the floor/ceiling assembly and all penetrations due to these additions. The result was a satisfactory acoustical condition for the occupants after overcoming all challenges.

1. INTRODUCTION

In this paper, the addition of a mechanical room and an electrical room to a hospital in the space below an auditorium discussed. The mechanical room included a Chiller and six pumps and the electrical room contained a transformer. These rooms were considered to be added to a space below an auditorium which was designed and added to the building recently. Initially, the addition of a Cooling Tower to the roof of another building close to the hospital was proposed; however, due to its exceeding noise, it was relocated to the roof of the same building as the Chiller room. The steps taken were included the environmental acoustical assessment to the post-construction evaluation measurements.

2. PROJECT STRATEGY

The goal of this project was to install the proposed mechanical equipment without exceeding the background noise level within the auditorium and in compliance with local city noise By-Laws. A review of the city noise by-law was conducted to avoid any noise violations by cooling tower additions to the roof. Background noise level measurements within the auditorium and the chiller room were conducted to evaluate the acoustical environments within the spaces before any additions, as benchmarks. All calculations and recommendations provided were based on the sound power levels of the equipment provided by the suppliers.

3. MECHANICAL EQUIPMENT

The selected Cooling Tower was Baltimore Aircoil Cooling Tower, Model 3618 C. The total noise level of the unit at 1.5 meter distance from the unit at the fan discharge, case side, and air inlet was equal to 86 dBA, 74 dBA and 80 dBA, respectively. The noise levels at the property line of the neighboring buildings were calculated to be 75 dBA and 66 dBA. The selected Chiller was a CenTraVac centrifugal CVHF 1720 with 1800 tons cooling capacity from Trane supplier. The noise levels at one meter distance from the unit case varied from 80 dBA to 82 dBA at %25, %50 and %100 loads. The two primary and two secondary chilled water pumps along with two condensing pumps were utilized in the Chiller room. The total noise level when the primary chilled pumps and the condensing pumps were running at %100 was calculated to be equal to 85 dBA at one meter distance from the unit case.

4. AUDITORIUM ACOUSTICAL PERFORMANCE

A newly renovated auditorium was located in the space above the Chiller room. The auditorium window was above the Chiller room windows, while the required air to the auditorium was through a space underneath the seats and above the ceiling in the Chiller room. The Noise Criteria – NC within the space was calculated from measured octave band frequencies sound pressure levels to be equal to 22.

5. ACOUSTICAL CHALLENGES

Installation of a Cooling Tower on top of a two storey building due to exceeding the noise levels permitted by the City Noise By-Law at the neighboring properties and all expenses for ducting has not been approved. Even by silencer additions to the air intake and fan discharge, along with quieter fans the noise level at the receivers would exceed the City Noise by-law. The enclosure wasn't an option for the unit due to the limited space on the roof and its high cost. All these limitations lead to relocation of the Cooling Tower.

6. RECOMMENDATIONS AND DISCUSSIONS

The windows in the Chiller room were replaced with an acoustically designed infill and externally louvers with the actual air intakes and exhausts. The ceiling of the chiller room were upgraded to provide required transmission loss by addition of two layer of Gypsum wall boards at 300mm distance from the ceilings to be hung with resilient hangers. The plenum was treated acoustically with acoustical spray and the chiller room was acoustically treated with addition of sound absorptive materials. Vibration isolation provided for the Cooling tower at its new location, the Chiller and pumps to avoid vibration induced noise. The noise of the transformer compared to the

chiller was not an issue. However, since the transformer was in a hospital critical situation, a higher level of vibration isolation such as seismically restrained air mounts was recommended.

7. POST CONSTRUCTION EVALUATIONS

In order to evaluate the effect of the Chiller room addition to the building, measured octave band noise levels before and after construction were compared with each other. The NC level in the auditorium before the construction was NC 22. The pumps additions did not exceed this NC level at all. The chiller additions increased the NC level by 3 and still didn't exceed the standard of NC25-30 for auditoriums.

8. CONCLUSIONS

The addition of a mechanical room and an electrical room to a hospital in the space below an auditorium resulted in retaining Stantec Consulting Ltd. for acoustical services. The applicable city of Vancouver noise by-law, along with ASHRAE standards and Sound & Vibration Design Guidelines for Health Care Facilities, were guidelines for this project. The noise attenuation measures on the walls, ceilings and all penetrations to the mechanical and electrical room were provided. The vibration isolators were recommended based on hospital critical conditions. No appreciable changes in the noise data within the auditorium were investigated through a series of post-construction noise measurements.

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