RECENT EXPERIENCE IN THE DESIGN OF MUSIC RECITAL HALLS

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1 Introduction

Recital Halls are essential teaching/performance spaces at educational facilities for the performing arts. They provide flexible space for the creative training of musicians, performers, technicians and theatre staff; they encourage the development of new musical compositions; and they function as concert venues for education and fundraising to support programmes.

HGC Engineering recently assisted the project team during design, construction and commissioning of the 145 Seat Armouries' Performance Hall at the University of Windsor and the 350 Seat McMaster Concert Hall at McMaster University. The architect in both cases was CS&P Architects Inc. in Toronto.

This article deals with acoustical design elements, primarily the acoustical treatment required to achieve optimum levels of reverberation. Extensive consideration was also given to sound isolation and the control background HVAC noise and those could be the subject of future article.

2 Reverberation Considerations

ANSI S12.60-2010 American National Standard, "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools" [1] provides guidelines for the design of teaching spaces. A recital hall is a teaching space and reverberation must be controlled to enhance speech intelligibility, music quality and sound system performance.

Reverberation is measured by the time it takes sound to die away in the space, using a quantity known as the reverberation time (RT500) measured in the mid-frequency (500 Hz) octave band.

A lack of early reflections and the excessive use of absorptive treatments result in low levels of reverberation (a 'dead' space).

Excessive levels of reverberation cause the space to sound noisy or boomy for some activities, limiting speech intelligibility and sound system functionality.

For concert halls, the reverberation requirements depend strongly on the music performance itself as can be seen in Table 1. HGC Engineering used and adapted reverberation criteria from several sources; Beranek L.L (2004) "Concert Halls and Opera Houses" [2] and Egan, D.M. (1988) "Architectural Acoustics" [3] to develop the design goal for theses spaces. Reverberation times approaching 2 seconds constrain the effective functioning of sound reinforcement systems and result in low levels of speech intelligibility.

In the subject halls the requirement was to place more emphasis on multiuse capability with less emphasis on symphonic repertoire. To reinforce this requirement L.R. Wilson planners suggested that the space be designed to as much as possible duplicate the acoustics of a successful multipurpose music venue, the Stockie Centre in Parry Sound. Measurements of reverberation were conducted there to serve as a benchmark and are reported below.

Table 1: Target Reverberation Criteria

Music Classification	RT500 (Seconds)
Traditional Organ Music or Choir Performance	2.5 to 5.0
Symphonic Repertoire	1.8 – 2.1
Chamber Music Including Secular and Religious Baroque	1.2 – 1.8
Modern/Popular/Band	1.1 – 1.7
Electronic or Amplified Music or Rock Concerts	0.8 to 1.2

3 Design Considerations

Both spaces were to be provided with upholstered theatre seating which is a sound absorbing element which functions to control the acoustics under varying degrees of occupancy. Both incorporated retractable theatre curtains to provide additional acoustical control for the varied uses. Based on all these considerations, a reverberation target approaching 1.5 seconds (500 Hz) was adopted so that the stage curtains could reduce it further towards 1 second when deployed. Another important consideration was the provision of diffusion to enhance a sense of spaciousness avoid defects such as echo and acoustic glare.

Our role in the design process was to direct the creative architectural designs to incorporate absorptive and diffusing elements in appropriate locations and amounts to achieve the goals. Diffusion was provided by multi-angled surfaces and surface textures as can be seen in the pictures in Figures 1 and 2.

Absorption was provided by placing acoustically absorptive treatments behind appropriate areas of perforated or slotted wood features and the ceiling.

Where possible surfaces were oriented to provide early reflections to the audience to enhance the sense of intimacy, enhance inter-musician audibility and clarity remembering that the angle of reflection equals the angle of incidence.

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Figure 1: Armories Performance Hall, U of Windsor [4].

Figure 2: McMaster Concert Hall McMaster University [5].

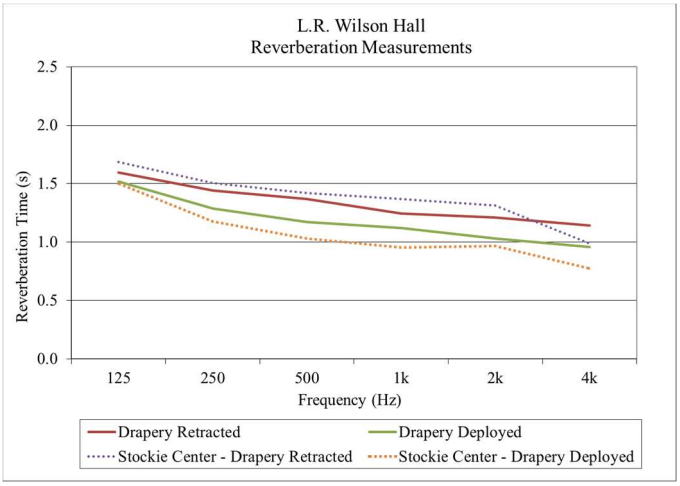

Figure 3: Reverberation Measurements

4 Conclusions

Measurements taken at the Stockie Centre during Design Development and at L.R. Wilson Hall during commissioning are reported in Figure 3 below. The results indicate that the design goals in terms of reverberation were largely met. audience and owner feedback from both the subject halls reports a satisfying experience.

References

[1] American National Standard, “Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools”, ANSI/ASA S12.60-2010 (Revision of ANSI/ASA S12.60-2002)

[2] Beranek, L.L. (2004). Concert halls and opera houses. New York: Springer-Verlag.

[3] Egan, M.D. "Architectural Acoustics" J. Ross Publishing, Originally Published by McGraw Hill Book Co., 1988

[4] Photography by Shai Gill

[5] Photography by Tom Arban