CANADIAN ACOUSTICAL DESIGN STANDARDS FOR K-12 SCHOOLS

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1. INTRODUCTION

The ANSI S12.60-2002 standard "Acoustical Performance Criteria, Design Requirements and Guidelines for Schools" has received much interest from education stakeholders since its release, garnering both support and opposition. The impetus for developing this standard stemmed from a realization that :

a) There were previously no U.S national standards and very few mandated state or local acoustical standards for school acoustics;

b) There are significant portions of the K-12 population whose education or learning potential may be compromised by poor classroom acoustics.

With respect to the latter, research has shown that young children and even those as old as about 15 years of age, do not comprehend speech as well as adults in moderately noisy and/or reverberant spaces. [1,2] Children with hearing loss - permanent (estimated at up to 15%) or temporary due to ear infections (up to 25 % of young children at any time), [2] those learning a second language (up to 45% in at least one major Canadian School Board) [3] and those with conditions such as attention deficit disorder (5% or more of all children) [2], require acoustics in classrooms favouring good speech intelligibility.

Given the experience in the U.S., should the ANSI standard for school acoustics or similar guideline/standard be adopted in Canada? Are the needs of Canadian school children adequately served by existing standards, guidelines and design practices? To answer these questions, available information from a number of provincial / territorial Education Ministries were reviewed. School board practices of some of the largest boards in Canada were also reviewed along with those of several architects who specialize in K-12 school design. Finally, the experience of educational audiologists was sought to assess if the status quo on school design is sufficient to meet the needs of those most at risk.

2. SCHOOL ACOUSTICS GOALS

Except for specialized spaces - music rooms, libraries and gyms, the desirable acoustical goal for most school space is good speech communication requiring:

i) low background noise

ii) low reverberation time

iii) sufficient sound isolation from both internal and external noise sources to prevent freedom from acoustical intrusions or distractions.

3. CANADIAN STANDARDS

Table 1 summarizes the findings on current Canadian practice /standards employed in school design There are no Federal standards or other national standards (e.g. CSA) pertaining to acoustics in schools,

3.1 Provincial / Territorial Guidelines

Capital planning guidelines and practices pertaining to school construction for seven provincial Ministries of Education (All Western provinces, Ontario, Quebec, New Brunswick) and one Territory (Nunavut) were reviewed. Combined, these constitute 95% of Canada's population. Alberta alone has sufficiently comprehensive acoustics guidelines for schools [4].

3.2 School Board / Architect Guidelines

School boards (owners) and architects (designers) determine the acoustics considerations constructed. School boards facilities procurement practices were reviewed for the five largest Canadian cities - Toronto, Montreal, Vancouver, Calgary, Ottawa.

Board guidelines or tenders are usually prepared as specifications. Acoustical considerations are mostly absent, hidden within other design requirements for specific spaces, indirectly considered , (e.g., "concrete block walls are preferred") or stated qualitatively (e.g., prevent disturbing mechanical noise). Performance

Table 1: Review Summary for Canadian Acoustical Education Facility Guidelines / Practice

Agency / Entity	% of Agencies Reviewed Having Guidelines (1) / Practice Which Address					
	Background Noise	Room Acoustics	Sound Isolation	Entire School	Specialty (2) Space Only	Constraints (3)
Provincial Ministries	14	50	33	14	43	29
School Boards	20	80	60	0	80	80
Architects	0	100	100	100	0	100

1) A guideline was considered to address an acoustical factor if any space requirement or performance objective had specific acoustic criteria (e.g., STC, RT, NC/RC) or inferred consideration of acoustical concerns (e.g., " sound proof and acoustic treatment"). Guidelines included facility building manuals, outline specifications for materials or specific spaces. Objective, performance based criteria were largely absent from the guidelines. Acoustics is typically addressed indirectly, (e.g., "classrooms shall have T -bar suspended ceilings")
2) Specialty spaces - gyms, music rooms, construction shops libraries and does not include classrooms and general instruction space..
3) Other consideration affecting acoustics: Constraints imposed on the acoustical design (e.g., costs, durability, maintenance)

specifications are rare , acoustical design objectives or rationale absent. Classroom acoustics is largely ignored with the focus on specialty space - music rooms, gyms.

School architects primarily rely on experience and prior project precedents. None were aware of specific school acoustics guidelines. All were cognizant for the need for good sound isolation and control of reverberation, most applying full height partitions and lay-in tile ceilings. Approaches vary substantially, especially for partition selection. None addressed background noise, deferring to the mechanical designer/contractor. Most primarily consider acoustical issues for specialized space - music rooms, auditoria, gymnasia, shop space.

4. AUDIOLOGISTS' VIEW

Educational audiologists serving school boards were interviewed to get the "front line" practitioners assessment of school facility performance. None were aware of acoustical design guidelines for schools in any of their Boards although some were aware of those issued by Alberta. Audiologists would embrace a comprehensive guideline, many having been active advocates within their boards. Key issues identified are:

- High background sound levels found in classrooms but especially those with wall mounted HVAC units. High sound levels in some classrooms have resulted in retrofit sound reinforcement to avoid teacher vocal strain and to address OHSA concerns.
- High background sound levels and reverberation affect student learning. In the worst schools, teacher fatigue and high teacher transfer rates have resulted.
- School acoustics in new schools are no better that those built 20 years ago

5. CONCLUSIONS

Few performance based guidelines exist in Canada which comprehensively address the key acoustical design considerations in schools. With no national and only one provincial standard specifically geared to school acoustics, most schools are being designed based on non-uniform and often qualitative approaches of the Boards and architects involved. The experience of educational audiologists and many in the acoustics design community suggests that acoustics is often not a major consideration in primary learning spaces. High background noise is a major concern.

A comprehensive national guideline and educational outreach program to inform school designers, board facility planners of the benefits of incorporating better acoustics into school designs is needed.

6. REFERENCES

1. Johnson, CE 2000. "Children's phoneme identification in reverberation and noise", *Journal of Speech Language and Hearing Research* 43, 144-157.
2. Nelson, Peggy, Feb2003. " Sound in the Classroom Why Children Need Quiet", *AHSRAE Journal*, February 2003
3. Sources: Toronto District School Board, www.tdsb.on.ca Commission Scolaire de Montreal, www.csdm.qc.ca
4. Alberta Infrastructure, "Standards and Guidelines for School Facilities", April 2001