RECENT EXPERIENCE WITH ACOUSTICAL PRIVACY CONSIDERATIONS IN ACADEMIC SETTINGS

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1 Introduction and Background

The provision of increased levels of acoustical privacy and confidentiality has become an ever more important consideration in the design and functionality office spaces and interview rooms. Occupants have always had a desire for freedom from distraction and an enhanced feeling of privacy, but with the advent of privacy of information legislation, confidential levels of privacy are an expectation.

In academic settings such spaces involve exam rooms for special needs students, mental health offices in student services facilities, cooperative education and other interview rooms and registration offices where sensitive information may be discussed.

This article discusses two investigations related to reportedly poor levels of acoustical privacy in academic settings with regard to applicable criteria, suitable acoustical measurements and analysis methods and contributing factors.

2 The Spaces

Both situations are typical private offices with carpet, suspended fibreglass acoustical tile or drywall ceilings, desks bookshelves and chairs. There were no other specific acoustical treatments. They both had similar wall partitions comprised of 5/8 inch Gypsum Wall Board (GWB) on each side of 3 5/8 inch metal studs with batt insulation in the inter-stud cavities. Such a construction typically has a Sound Transmission Class (STC) rating approaching STC 45 in the field and is generally acceptable in providing good privacy between enclosed offices for normal speech situations. In bot h cases our inspections indicated that the wall assemblies were built with industry standard construction techniques with no obvious deficiencies.

Supply, return and transfer ducts appeared to be provided with internal acoustical lining and were not observed to be a significant path of sound transfer in either case.

The common complaint was that conversations were audible from adjoining offices to varying degrees depending on voice level and with varying levels of intelligibility, all of which led to a feeling of poor privacy, and particularly where conversations were expected to be confidential.

2.1 Engineering Faculty Offices

The gypsum partitions separating the offices from each other extended 100 mm above the finished ceiling but did not extend to the underside of the ceiling stab. Batt insulation was placed between the metal studs above the acoustical tile ceiling.

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The weak link in this case resulted from a Value Engineering exercise in which the drywall was omitted from the studs above the suspended acoustical ceiling which was comprised of a thin fibreglass tile not rated for sound transmission. This allowed sound to travel up and over the wall partition through the batt insulation ceiling tiles. A ceiling tile with a CAC rating of at least 35 is needed to provide even a basic level of privacy between enclosed offices if there is no effective plenum barrier in place.

Speech in a normal voice was audible and intelligible depending on voice level and orientation. Loud speech was clearly audible and intelligible. Staff felt like they had to speak in quiet voices to maintain some level of privacy, and that is generally not an acceptable condition for most individuals who occupy private offices.

Physical remedial actions would involve replacing the ceiling tiles with a high CAC tile and/or extending the drywall to the underside of the slab and sealing all penetrations. Drywall construction was not considered to be viable by facilities staff, and the installation of a sound masking, was also a consideration.

2.2 Business College Interview Rooms

In this case, the GWB partitions separating the rooms did extend from slab to slab demising them from adjacent spaces. A glazed wall partition and solid core wood entry door demised them from the corridor and an exterior waiting room.

Penetrations above the ceilings were found to be sufficiently well sealed. There were no obvious dominant paths of sound transmission between adjoining spaces indicating that the demising constructions comprise a functionally effective isolation system with no weak links. Door seals had not been installed. The gaps around the doors were the primary contributors to sound transfer into the corridor and an adjacent waiting area.

Since there are no specific weak links with the exception of installing missing door seals, specific remedial actions related to these demising constructions were not indicated. Upgrades to all components of the constructions would be required to effectively increase the sound isolation.

Conversations in a normal voice were audible, but generally unintelligible. Conversations in a raised voice were understandable to some degree, depending on the talker and the associated voice level, particularly into the corridors and

3 Measurements and Analysis

Physical inspections were conducted and measurements were undertaken to determine the degree of sound transmission between the spaces and also to record the levels of background HVAC noise within the spaces themselves.

3.1 Sound Transmission

Standardized field tests to determine the ratings of the demising constructions were performed in accordance with the protocols of ASTM standard E-336 [1]. This test is performed by placing a sound source (pink noise) in the "source room" and measuring spatially averaged sound levels in that room, and in the adjacent "receiver" rooms.

Because ASTM 336 was generally developed to be used in residential settings, the sizes and configurations of the rooms under test did not allow for the calculation of the STC or the more current ASTC rating. For this reason these measurements are used to calculate the Noise Isolation Class (NIC) rating as per ASTM Standard E-413[2]. The results are summarized in Tables 1 and 2 below.

Table 1: Faculty Office NIC Summary

Source Room	Rec Room	NIC Rating
204C	204B	33
204E	204D	29
204Q	204P	29
204Q	204R	28
335A	335B	29
335A	335F	29
435F	437B	37
435F	437C	30
435F	437G	29

Table 2: Business College Source Room 305

Receiver Room	NIC Rating
304	36
306	42
307	38
308	44
312	51
313	41
Hallway	28
326	34

The results indicate significantly lower NIC ratings in the faculty offices as would be expected from the constructions and the subjective audibility ratings. Nevertheless, both situations suffered from a perceived lack of privacy. For this reason, we question the use of the NIC rating system alone to provide suitable criteria to address privacy concerns.

3.2 Background HVAC Sound Levels

The other factor which affects speech intelligibility is the level of background sound, generally determined by using the Noise Criterion (NC) rating system.

In office settings where some level of background sound is helpful in reducing audibility and increasing the levels of perceived privacy, the simpler dBA rating system is also useful. A background sound level in the range of 40 to 45 dBA is appropriate in spaces for face to face communication where acoustical privacy is a consideration.

The background sound levels in all the rooms were found to be quite low, generally from 25 to 35 dBA, indicating that low background sound levels are a factor contributing to a perception of low interoffice speech privacy.

3.3 Speech Intelligibility Index

The Speech Intelligibility Index (SII) [3] is a measure of speech privacy which combines an analysis of sound transmission and background sound levels to achieve a more reliable and understandable measure of speech intelligibility.

Two levels of speech were used to calculate the SII for several of the interview rooms; the normal speech level and the raised speech level. The normal speech level is the normal vocal effort two people would use when talking if they were in an environment where they are not concerned about speech privacy. It is also a useful tool to demonstrate the relative improvements afforded by remedial actions, including the installation of a properly designed sound masking system.

An SII value of greater than 0.3 represents poor or no privacy. An SII value of less than 0.1 generally indicates confidential privacy. Representative SII results are shown in Table 3.

Table 3: SII Business College Source Room 305

Speech Level	Rec. Room	SII	
		No Sound Masking	With Sound Masking
Normal	304	0.03	<0.01
	307	0.02	<0.01
	Corridor	0.30	0.13
Raised	304	0.24	0.09
	307	0.20	0.05
	Corridor	0.53	0.38

4 Conclusion

The results of this study suggest that SII analysis methods provide a reliable and understandable way of investigating acoustical privacy and the relative benefits of remedial measures, including the installation of a properly designed sound masking system which can increase the perceived levels of privacy substantially.

References

[1] ASTM standard E-336, "Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.

[2] ASTM Standard E-413, "Classification for Rating of Sound Insulation Class"

[3] ANSI S3.5-1997 "Methods for Calculation of the Speech Intelligibility Index".