KEY ISSUES IN THE DESIGN OF EDUCATIONAL BUILDINGS

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Abstract: This paper summarizes the key issues in the architectural acoustic design of educational buildings in United Kingdom. These key issues are interpreted from a consultant's point of view. The key issues derived from the practice are: the ventilation strategy, internal planning, and reverberation control in large rooms, rain noise and BREEAM credits.

1 Introduction

The greatest lesson learned in any project, and particularly with educational buildings, is not being involved at the initial concept stage of the design. Occasionally acoustics is seen as a supplementary aspect of the design and subsequently we are presented with a completed scheme which is fundamentally acoustically flawed with little opportunity to be Building Bulletin 93 Acoustic Design of Schools (BB93) [1] compliant and with great challenges to prove teaching and learning spaces are fit for purpose.

We would expect to be involved in the initial discussions with the college user groups, educationalists and design team such that the acoustic, educational and design concepts can be developed in harmony from the outset. This enables the preparation of an informed and appropriate development strategy proposal and project brief in line with the combined aspirations for the project and the employers design requirements. This will greatly assist in steering the design development through the design process as each participating member will have a clear understanding of the parameters and impact of their input to the other disciplines.

This paper summarizes the key issues which are considered to be crucial in the design of educational building from a consultant's point of view.

2 Key Issues

2.1 The Ventilation Strategy.

This is largely determined by the external ambient noise levels, which are established by on-site noise surveys as a first priority in the design process.

Where the aspiration is for natural ventilation, detailed design discussions should take place in order to determine minimum façade openings and air flow requirements, particularly when room sizes preclude single sided ventilation. Where ventilation incorporates extract into spaces adjoining teaching and learning spaces, e.g. corridors or atria, appropriate attenuated airways need to be designed with limited pressure drop, so as to ensure appropriate rates of ventilation are achieved at all floor levels, if more than single storey, whilst maintaining adequate sound insulation between these spaces. Hybrid systems incorporating extract fan assistance, or treatments to enhance natural draft, should also be considered at this stage, if appropriate.

On noisy sites, the placement and orientation of buildings on the site and internal planning should also be investigated at an early stage to optimise the possibility and extent of natural ventilation.

2.2 Internal Planning.

Increasingly, the concepts of the delivery of education through ‘transparency’ and ‘openness’ are often expressed in the architectural design as open plan teaching areas and teaching areas which are directly linked to large atria or central hubs or social focus areas of the building. Basically this is at odds with the precepts of BB93.These types of responses to these concept present difficult acoustic challenges where compliance with BB93 Airborne Sound Insulation between spaces is required. Alternative Performance Standards are inevitably relied upon; however, fitness for purpose must always be proven and maintained. Building costs for such concepts and the associated acoustic treatments necessary for compliance can be high.

Wherever possible, the use of corridors off teaching spaces is recommended.

2.3 Reverberation Control in Large Rooms.

In large rooms, whether they be high class rooms, atria, gymnasiums or halls, the control of reverberation times to BB93 criteria will generally require acoustically absorptive treatment to the walls as well as the ceiling, particularly so if it is proposed to utilise an exposed concrete soffit for thermal control. Wall treatment is most efficiently placed at mid level; however, conflict with robustness and maintenance usually precludes this placement. Additionally available wall space can be limited. The use of perforated liner sheets to the underside of lightweight roofs should also be avoided for a variety of acoustic reasons. These factors should be investigated at an early stage.

2.4 Rain Noise.

To ensure adequate reduction of rain noise to teaching and learning spaces, lightweight roofs will need additional mass and particularly ETFE roofing must be avoided. Where possible, roofs should be of concrete construction.

2.5 BREEAM Credits

BREEAM (BRE Environmental Assessment Method) [2] is the leading and most widely used environmental assessment method for buildings in United Kingdom. It sets the standard for best practice in sustainable design and has become the de facto measure used to describe a building's environmental performance.

Where BREEAM credits are sought, the acoustic requirements can be extremely onerous, if chasing all available credits. This is particularly so for Sound Insulation to Music Spaces (as BB93 criteria is already difficult to achieve with relatively normal construction methods), Rain Noise (as the criteria is based on Heavy Rainfall) and Reverberation Control in large rooms, as pre-completion testing is now required.

3 Conclusion

The key issues in the design of educational buildings were shown from a consultant’s point of view. In order to avoid compromised ventilation strategy, internal planning, reverberation time, the sound insulation and the rain noise, we would expect to be an integral and equal partner in the design team from the outset, with all design decisions to be taken giving equal weight and consideration to all team members.

References

[1] Building Bulletin 93 Acoustic Design of Schools, London (last revised by November 2003)

[2] http://www.breeam.org