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ALDER HEY CHILDREN'S HEALTH PARK

Audiology Booths Acoustic Specification

07/03/2014

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Alder Hey Children's Health Park

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1 Introduction

This document sets out the acoustic performance criteria which are to be achieved for the audiology booths at the new Alder Hey Children's Health Park Project in Liverpool.

The following documents are relevant to the acoustic performance in hospitals, and in particular audiology booths:

- Health Technical Memorandum 08-01: Acoustics, published by the Department of Health;
- Health Building Note 12-01 Supplement C – 'ENT and audiology clinics' published by the NHS Estates; and
- Health Technical Memorandum 2045 – Acoustics: Audiology published by the Department of Health.

The Acoustic Specification is to be read in conjunction with Section A of the Architectural Specification and associated Architectural and Structural Drawings. MEP drawings and specifications will form part of a separate appendix.

In addition to the relevant HTM's and HBN's, the following documents should be used in the design of the Acoustic Booths

- Building Regulations (Current Addition)
- BS 8300
- Alder Hey Hospital Fire Strategy Document

The audiology booths covered by this document are HUB.002.S203/1, HUB.002.S203/2 and HUB.002.S203/3 which are all standard sized booths without observation rooms and HUB.002.S204 which is a large audiology booth with adjacent observation room.

Only the audiology booths (and not the observation room) are covered by this document.

Tenderers are to use products, equipment, materials and finishes sympathetic to the overall hospital design, but ensure conformity with the Acoustic Performance Criteria.

Tenderers will be required to provide detailed acoustic calculations showing how their proposed solutions will enable the acoustic criteria to be achieved. Assumed noise levels for different activities around the test rooms must be clearly identified.

The hospital is specifically designed for children and, as such, tenderers should be cognisant of this in their submissions.

All audiology booths will be used for sound-field testing and tenderers shall take account of the potential for very high signal noise levels when testing profoundly deaf patients, or patients with a very high hearing impairment. Spaces adjacent to booths must be quiet enough to meet their own ambient noise criterion whilst signals as specified in Section 4 are being played.

2 “Shell” Performance

The construction of the shell within which the audiology booths shall be installed will be as follows;

2.1 Internal Walls

Internal walls (both between adjacent rooms and the corridors) will be of lightweight construction (partition type 4) with a weighted sound reduction of R_w 59dB. These partitions will be constructed from structural slab to the soffit. Due allowance should be made for flanking and workmanship etc. when determining the sound insulation requirements of the booth. Tenderers shall clearly detail their assumptions.

2.2 Doors between “Shell” and Corridor

Given that the audiology booths will be accessed directly off a corridor (which includes a limited waiting area) allowance should be made for a double door or single high performance door to the audiology booths. The shell will comprise a structural opening – refer to the architectural specification for the dimensions of this opening.

2.3 External Walls

The external walls will be as follows (refer to architects drawing AH_BDP_Z7_01_DR_A_200_Y101);

- HUB.002.S203/1
 - Velfac modular aluminium / timber window system
 - Glazing - acoustically rated to $R_w + C_{tr} \geq 25\text{dB}$
- HUB.002.S203/2
 - Pre-cast the inner leaf of the pre-cast concrete wall panels will be circa 200mm thick – acoustically rated $R_w + C_{tr} \geq 35\text{dB}$
 - Window - acoustically rated to $R_w + C_{tr} \geq 25\text{dB}$
- HUB.002.S203/3
 - Pre-cast the inner leaf of the pre-cast concrete wall panels will be circa 200mm thick – acoustically rated $R_w + C_{tr} \geq 42\text{dB}$
 - Window - acoustically rated to $R_w + C_{tr} \geq 25\text{dB}$
- HUB.002.S204
 - Pre-cast the inner leaf of the pre-cast concrete wall panels will be circa 200mm thick – acoustically rated $R_w + C_{tr} \geq 42\text{dB}$
 - Windows – acoustically rated to $R_w + C_{tr} \geq 32\text{dB}$

2.4 Floor below Audiology Booths

A stepped slab of nominally 305mm precast composite construction will be provided beneath the entirety of the audiology booths, comprising a 75mm pre-cast panel topped with 230mm in-situ solid concrete. A 170mm deep zone will be provided in order to accommodate a floating floor as part of the audiology booth.

2.5 Floor above Audiology Booths

A flat slab of nominally 300mm precast composite construction will be provided above the entirety of the audiology booths, comprising a 75mm pre-cast panel topped with 225mm in-situ solid concrete.

3 Trust Requirements

Email correspondence with BDP has confirmed that there are no Trust requirements other than following the appropriate HTM / HBN's.

3.1 Floating Floor

It is required that a concrete floating floor is incorporated into the design of each audiology booth. Appropriate isolators shall be selected to control both structure-borne noise and vibration isolation.

4 Reverberation Times

The booths shall be provided with appropriate acoustic surface finishes such that the unit complies with the reverberation time criteria in Table 1 which are as per the HTM2045 recommendations;

Table 1 Maximum permissible reverberation times

One-third octave band centre frequency (Hz)	Recommended Reverberation Times (s)
31.5*	≤ 0.8
40*	≤ 0.8
50*	≤ 0.5
63*	≤ 0.5
80	≤ 0.5
100	≤ 0.3
125 to 4000	0.2 to 0.25

*** These criteria shall be viewed as targets and not formally binding due to the reliability of product test data at these frequencies.**

It is accepted that compliance for the range 31.5 to 100Hz will be via calculation only. For 125Hz and above this shall be demonstrated through post-construction commissioning / testing.

5 Internal Noise Levels

5.1 Maximum Permissible Ambient Sound Pressure Levels

The booths shall be designed such that the total ambient sound pressure levels from all sources do not exceed the values specified in Table 3 for more than 2% of the time.

For the avoidance of doubt these limits include the following:

- Mechanical and electrical services, including noise transfer related to the hand wash basins and noise generated by electrical fittings;
- External noise break-in;
- Noise from horizontally and vertically adjacent spaces (including audiology booths, especially where sound-field testing is undertaken); and
- Vibration causing structure-borne noise to be re-radiated.

For the audiology booths where sound-field testing is undertaken the tenderer shall assume the maximum sound pressure levels at the patient's ear as outlined in Table 4.

For the wash-hand basins, attention is brought specifically to potential noises from the water supplies and waste pipes and potential acoustic crosstalk via water pipes, waste pipes and the soil vent system.

The audiology booths shall be provided with mechanical ventilation cooling in accordance with the Mechanical Specification, whilst still complying with the noise limits specified in Table 3. The Tenderer shall assume the details provided in Appendix A for demonstrating compliance with the acoustic criteria in Table 3 and any other relevant sections of this Specification. The tenderer will be responsible for all additional attenuation, including provision of cross-talk attenuators, where required.

Tenderers must determine the amount of attenuation required to meet the criterion for the total of all noise sources. Allowance shall be made for reasonable noise levels created in adjacent spaces (i.e. corridors)

Noise levels in adjacent spaces shall be controlled so that the criteria set out in Table 2 are not exceeded through consideration of the above referred sources of noise when measured as an $L_{eq,1min}$ (with slow time weighting).

Table 2 Noise criteria for adjacent rooms to be achieved during testing in booths

Room Reference	Room Name	Noise Criterion
HUB.002.U010	Audiology Workshop	NR30
OPD.CD1.CD01/40 / HUB.002.U013/01	Corridor / sub wait	NR35
HUB.002.S226	Observation room	NR25
HUB.002.U002/03	ENT C/E	NR25
Various Ground & First Floors	Consultation / Examination Rooms below and above	NR25
Any other rooms (e.g. as a result of flanking or transfer via building services)		NR25

Table 3 Maximum permissible ambient sound pressure levels, dB

One-third octave band centre frequency (Hz)	Maximum permissible ambient sound pressure levels L_{max} (re 2×10^{-5} Pa) dB Test tone frequency range 125 Hz to 8 kHz
31.5	55
40	47
50	41
63	35
80	30
100	25
125	20
160	17
200	15
250	13
315	11
400	9
500	8
630	8
800	7
1000	7
1250	7
1600	8
2000	8
2500	6
3150	4
4000	2
5000	4
6300	9
8000	15

Noise levels to be measured in accordance with the general requirements of the Association of Noise Consultant document ANC-9701 Part 1 - Noise Measurement in Buildings.

Table 4 Maximum permissible ambient sound pressure levels, dB

One-third octave band centre frequency (Hz)	Maximum permissible ambient sound pressure levels L_{\max} (re 2×10^{-5} Pa) dB
500	93
630	93
800	92
1000	92
1250	92
1600	93
2000	93
2500	91
3150	89
4000	87
5000	89
6300	
8000	

Noise levels to be measured in accordance with the general requirements of the Association of Noise Consultant document ANC-9701 Part 1 - Noise Measurement in Buildings.

Tenderers shall provide the following:

- Calculations demonstrating that the internal and external sources will comply with the values in Table 3;
- Details of the assumed source noise levels used in the calculation, including for the corridor; and
- Calculations of the noise levels in adjacent spaces as a result of noise from testing within the audiology booths.

All calculations shall be in one-third octave band centre frequencies between 31.5Hz and 8kHz (accepting the limitations of test data at 63Hz and below)

6 Vibration

Continuous & intermittent vibration shall be assessed in terms of the RMS value of the frequency-weighted acceleration on the floors of the occupied areas. The frequency weighting must be Wg as specified in BS6841:1987 'Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock'.

The frequency-weighted acceleration shall be limited to 0.0035m/s² RMS in the x and y axis and 0.005m/s² RMS in the z axis.

Allowance should be made for measurements of the RMS vibration levels in the structural slab where the booths are to be installed prior to the design / construction of the isolators for the audiology booths.

Reradiated noise levels due to vibration shall be designed so with due regard to the overall ambient noise limits in Table 3.

7 Commissioning

Tenders shall allow for suitable commissioning testing of the following post-installation:

- Reverberation time in all booths.
- Internal ambient noise levels in all booths with all mechanical and electrical equipment operating at normal duty. Where mechanical systems are variable measurements shall be obtained at representative operating points, including maximum settings.
- Internal ambient noise levels in adjacent spaces when sound field testing is undertaken at the maximum levels stated in Table 4 (spaces to include Corridor, Observation Room, one Consultation / Examination Room immediately above and another immediately below the room where testing occurs)
- Airborne sound insulation measurements of the following:
 - between all booths and the corridor / sub wait area;
 - Allowance for testing of one booth to the floor below;
 - Allowance for testing one booth to the floor above; and
 - Allowance for testing horizontally between one booth and an adjacent room (without an interconnecting door).
- Vibration measurements (RMS tri-axial measurements) in all booths with all mechanical and electrical equipment operating at normal duty.

The exact programme and rooms to be subject to airborne sound insulation testing will be subject to availability of adjacent spaces. As such, where 'allowance' is noted above, the exact rooms / spaces to be tested will be defined close to the completion of the installation of the booths, when the level of completeness of adjacent spaces can be determined.

8 Responsibility

Tenderers should note that they will be responsible for ensuring that their design and installation achieves all of the acoustic criteria identified within this document. They are, therefore, invited to comment on the acoustic performance of the “shell” which will be provided (see Section 2).

In particular, any opportunities to provide a single acoustic doorset capable of achieving the same acoustic design criteria rather than the currently proposed two no. doorsets, should be considered.

Appendices

Appendix A Mechanical System Acoustic Data

{To be confirmed upon receipt of info from Hoare Lea / Crown House}

Appendix B Architectural References

BDP Architectural Specification

Section A, AH_BDP_ZZ_XX_SP_A_A Rev C01

BDP Drawings

AH_BDP_Z7_01_DR_A_200_Y101
AH_BDP_Z7_XX_DR_A_370_1061
AH_BDP_ZZ_LG_DR_A_670_1111
AH_BDP_ZZ_LG_DR_A_670_1112
AH_BDP_ZZ_LG_DR_A_670_1113
AH_BDP_ZZ_LG_DR_A_670_1114
AH_BDP_ZZ_LG_DR_A_670_1115
AH_BDP_ZZ_LG_DR_A_670_1116

GA-FIRST FLOOR ZONE 7 TILE Y1
ZONE 7 SECTIONS – Z7 AA
LOWER GROUND – FIRE STRATEGY
GROUND FLOOR – FIRE STRATEGY
FIRST FLOOR – FIRE STRATEGY
SECOND FLOOR – FIRE STRATEGY
THIRD FLOOR – FIRE STRATEGY
FOURTH FLOOR – FIRE STRATEGY

AH_BDP_Z7_01_DR_A_770_HUB_002_S203_01
AH_BDP_Z7_01_DR_A_770_HUB_002_S203_02
AH_BDP_Z7_01_DR_A_770_HUB_002_S203_03
AH_BDP_Z7_01_DR_A_770_HUB_002_S226
AH_BDP_Z7_01_DR_A_770_HUB_002_S204
AH_BDP_Z7_01_DR_A_770_HUB_002_U010

HUB 002 Audiology Booth Standard
HUB 002 Audiology Booth Standard
HUB 002 Audiology Booth Standard
Observation Room Audiology 2
HUB 002 Audiology Booth Large
OPD HUB 002 Audiology Workshop

WSP Drawings

AH_WSP_Z7_01_DR_S_230_2177
AH_WSP_Z7_01_DR_S_230_2197

ZONE 7, LEVEL 01 GENERAL ARRANGEMENT
ZONE 7, LEVEL 02 GENERAL ARRANGEMENT

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