MOTT MACDONALD

Technical Note

Huddersfield Royal Infirmary proposed new Accident and Emergency (A&E) Department

Project:	100102983		
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Subject:	Noise assessment and specification of for Huddersfield Royal Infirmary Accident and Emergency Department roof located air source heat pumps and plant room air handling units		

Purpose and Scope

This technical note is in support of the Huddersfield Royal Infirmary proposed new Accident and Emergency Department planning application and is supplementary to the Noise Impact Assessment (Report HG0052-MM-ED-XX-RP-Y-000001_P02).

The update is related to the proposed relocation of the air source heat pumps (ASHP's) from the car park to the roof of the proposed Accident and Emergency Department subsequent to the submission of Report HG0052-MM-ED-XX-RP-Y-000001_P02.

The sound level from the proposed Accident and Emergency Department roof located ASHP's at the facades of the nearest residential receptors and existing hospital buildings is predicted, and the contribution of the proposed Emergency Department plant room air handling units (AHU's) to the sound level is also predicted and used to specify the minimum requirements for the AHU noise attenuators.

Noise Assessment

Residential receptors

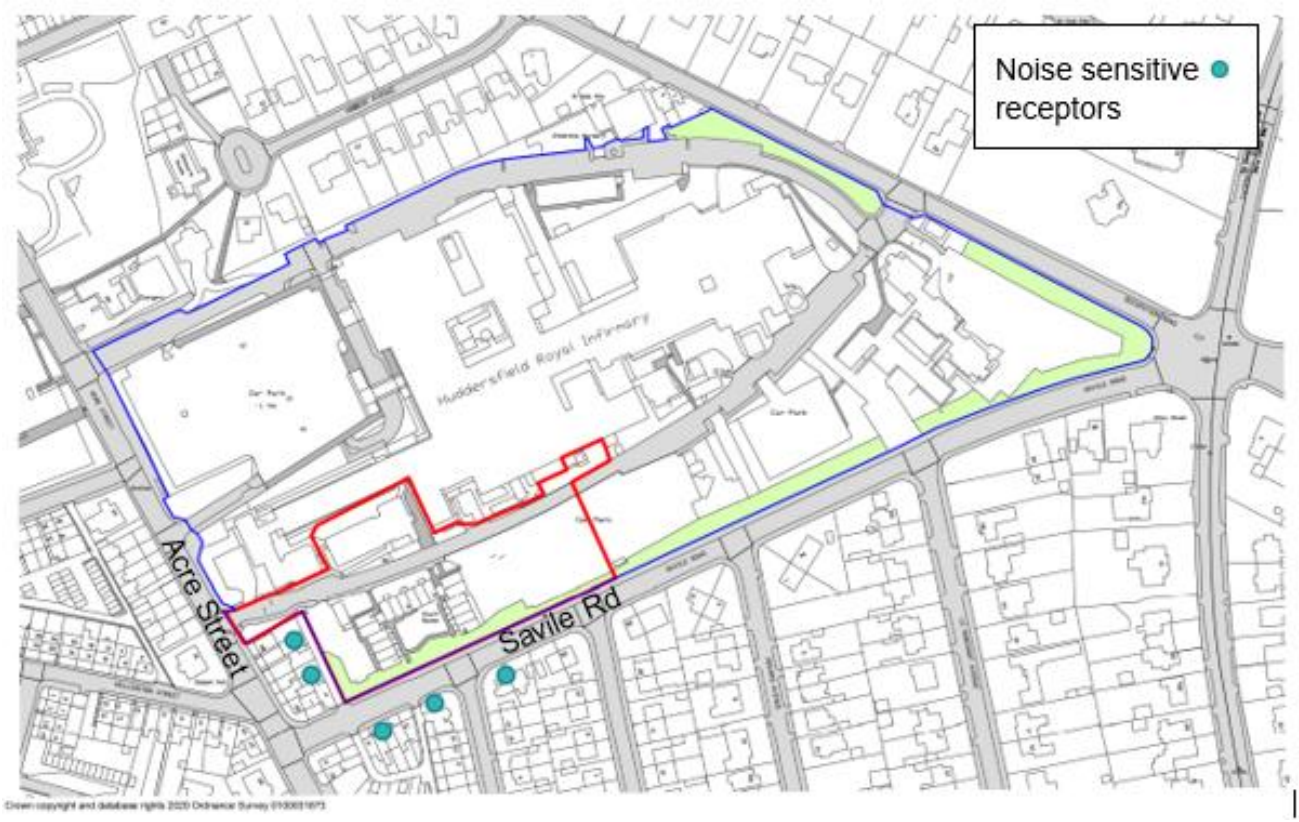
As stated in Section 2.3.4 of the Noise Impact Assessment report the rating level $L_{Ar,Tr}$ as defined in BS4142:2014+A1 2019[1] for building services plant should not exceed 5 dB below the prevailing background sound level. The measured night time prevailing background sound level in the vicinity of the nearest noise sensitive receptors on Savile Road and Acre Street with facades facing the proposed Accident and Emergency Department was $L_{A90,T}$ 36 dB free-field, therefore building services plant rating levels, including any acoustic character penalties should not exceed $L_{Ar,Tr}$ 31 dB free-field at these receptors. The existing hospital location plan and surrounding area showing the nearest noise sensitive receptors, and the red line boundary of the proposed Accident and Emergency Department are shown in **Figure 1.1**.

The new building services plant with the potential to exceed these noise levels are the four AHU's to be located within a roof top plant room on the proposed new Accident and Emergency Department, and the two ASHP's to be located adjacent to the roof top plant room. The proposed new Accident and Emergency Department roof plan showing the roof top plant room and the proposed location of the ASHP's is shown in Figure 1.2.

[1] BRITISH STANDARDS INSTITUTION, BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

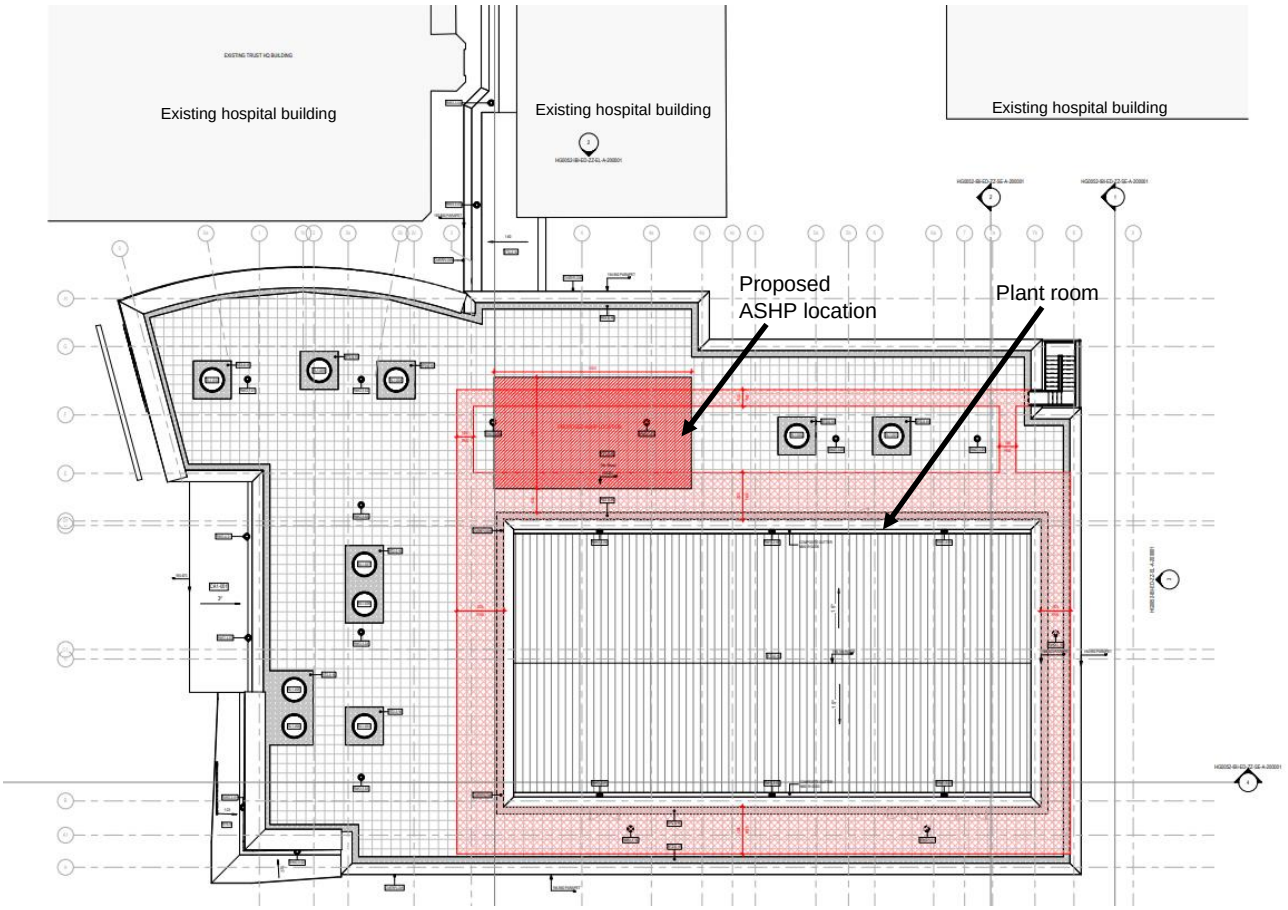
Using noise source data provided by the manufacturer (Mitsubishi) for the ASHPs fitted with the noise attenuators specified in Table 1.1, the noise levels were assessed using the methodology described in BS 4142:2014+A1:2019 to predict the resultant rating level at the nearest sensitive receptors located at residences on Savile Road to the South and residences with rear facing facades on Acre Street to the West. The predicted resultant rating level at the nearest sensitive receptor was below $L_{Ar,Tr}$ 31 dB free-field – satisfying the requirement (note – in the prediction no penalty has been added to the rating level because the sound is not considered to be impulsive, tonal or intermittent as assessed at the receptor location).

Figure 1.1: Huddersfield Royal Infirmary location plan



Source: Annotated excerpt from Architects drawing HG0052-IBI-ED-XX-PL-A-100004

Figure 1.2: Proposed Accident and Emergency Department roof plan



Source: Annotated excerpt from Architects drawing HG0052-IBI-ED-XX-PL-A-240001_P01

Table 1.1: Acoustic source data of ASHP fitted with noise attenuator – Sound pressure level at 10m freefield

Octave band sound pressure level @10m, dB							
63Hz	125Hz	250	500	1KHz	2KHz	4KHz	8KHz
56	43	44	41	37	29	24	20

Source: Acoustic data for Mitsubushi ASHP ERACS-Q-GOS/XL-CA-E 1062 fitted with Allaway Acoustics attenuator AA206S provided by supplier Mitsubushi Electric.

Predictions have also been undertaken for residences on Savile Road of noise break-out from the inlet side of the roof top plant room AHUs situated on the elevation facing Saville Road, cumulative with the break-out from the ASHP's. However, this was not required for residences on Acre Street because these receptors are not affected by noise breakout from the plant room AHU inlets and outlets due to their location. Manufacturer's noise data for the AHUs is presented in Table 1.2.

Table 1.2: Acoustic source data of AHU's – in-duct sound power level

Octave band sound power level dB								
AHU	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
1	78	75	85	85	89	83	79	76
2	78	75	85	86	91	86	82	80
3	81	78	88	89	90	90	86	81
4	77	77	88	86	86	85	81	75

Source: Acoustic data provided by manufacturer Fredshaw & Co.

The noise break-out predictions are based upon the plant layouts shown in Building Services Engineers drawing HG0052-MMD—ED-RF-DR-M-500000_P01.

The predictions have determined that the required Rating Level of $L_{Ar,Tr}$ 31 dB at the nearest residences on Savile Road can be achieved if AHU inlet attenuators are provided with the minimum insertion loss as detailed in Table 1.3. The predicted rating level from the AHU inlets in isolation with these insertion losses applied was $L_{Ar,Tr,}$ 20 dB (note - the minimum insertion loss is specified to ensure the cumulative noise rating level of both the ASHP's and the AHU's operating simultaneously does not exceed L_{A90} 31 dB free-field at the receptors).

Table 1.3: AHU attenuator minimum insertion loss requirement

Octave band attenuation dB							
63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
2	7	13	18	24	26	24	21

The combined cumulative noise break-out at the nearest residential receptors of the ASHP's and the AHU's operating simultaneously was predicted to be below $L_{Ar,Tr}$ 31 dB free-field which satisfies the noise criterion of 5 dB below the prevailing background noise level.

Existing hospital buildings

As stated in Section 2.3.2 of the Noise Impact Assessment report, HTM-08-01[2] provides comprehensive advice and guidance on acoustic design for healthcare facilities. Table 1 of HTM-08-01 provides maximum criteria for noise intrusion from external sources into the clinical setting in terms of $L_{Aeq,1hour}$. For open clinical areas in Emergency Departments the relevant criterion is 45 dB $L_{Aeq,1hour}$. Small office type spaces including small treatment rooms and consulting rooms have the criterion 40 dB $L_{Aeq,1hour,}$ and for wards at night there is an $L_{Aeq,\ 1hour}$ 35 dB criterion. Less stringent criteria are applied for circulation and ancillary spaces such as toilets and washrooms. Table 2 of HTM-08-01 provides internal ambient noise criteria for building services in terms of the noise rating (NR) curve. This includes intrusion of external plant noise from adjacent hospital buildings.

To achieve the criteria it is recommended the sound levels from the proposed new hospital plant at the façade of new and existing hospital buildings utilising natural ventilation do not exceed 45 dB $L_{Aeq,1hour}$; this is because it is generally accepted a partially open window provides a reduction in noise of 10 – 15 dB.

[2] DEPARTMENT OF HEALTH, 2013. Specialist Services Health Technical Memorandum 08 – 01: Acoustics

Calculations have been undertaken to predict the noise levels from the ASHP's at the façade of the nearest existing hospital buildings to the north of the proposed Accident and Emergency Department shown in **Figure 1.1**, the predicted noise levels are below the recommended 45 dB $L_{Aeq,1hour}$ satisfying the criteria.

Predictions have also been undertaken to assess the noise levels at the existing hospital façade from the ASHP's cumulative with the break-out from the AHU outlets. The predictions have determined that the recommended 45 dB $L_{Aeq,1hour}$ criteria at the hospital facade can be achieved if the AHU outlet attenuators are provided with the minimum insertion loss as detailed in Table 1.3.