



BAM CONSTRUCTION LTD NORTH WEST

NOISE ASSESSMENT

PROPOSED AMBULANCE & FIRE SERVICES RESOURCE CENTRE, WREXHAM

5 July 2012

AEC REPORT: P2567/R1/PES

Prepared by:

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1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been appointed on behalf of BAM Construction Ltd North West to assess noise levels associated with the proposed development of an Ambulance & Fire Services Resource Centre in Wrexham. The assessment has been prepared to accompany a planning application for the scheme, which includes garaging for emergency vehicles, plus vehicle maintenance, bedrooms and general office accommodation.
- 1.2 This report details the noise levels measured on site and discusses the implications on the external building fabric of the station to achieve acceptable internal noise levels and to control potential noise breakout, both from activities and external plant, to the nearest residential accommodation to meet appropriate planning guidance.
- 1.3 Contact was made with Andrew Jordan of the Environmental Health Department of Wrexham County Borough Council to discuss the requirements for assessing potential noise levels associated with the proposed development site. From these discussions, it was agreed that the potential noise issues associated with the development would be:
 - noise breakout from the Ambulance Fleet Maintenance Garage; and
 - noise from mechanical services serving the buildings;and that, based on the predominant noise source in the area being road traffic, baseline noise levels should be measured at the nearest noise sensitive premises during a three hour daytime period, between 1000-1700h, and a two hour night-time period, between 2300-0130h.
- 1.4 The nearest noise sensitive premises were agreed as the housing and Council Offices to the south of the site and the hospital to the north.
- 1.5 Acoustic terminology is presented in brief in Appendix A.

2.0 SITE & DEVELOPMENT DESCRIPTION

- 2.1 A scheme to develop land off Croesnewydd Road, Wrexham, as identified in Figure 1, to provide the Ambulance & Fire Services Resource Centre has been prepared by Nightingale Associates and an illustrative layout is identified in Figure 2.
- 2.2 The site is, at present empty and is located immediately south of the Wrexham Maelor Hospital; the hospital buildings would be at least 120m away. Access to the site would be off Croesnewydd Road to the west, beyond which it is understood that there will be a business park development. To the south of the site there is a housing estate, part of which is still under construction, and the nearest houses would be about 75m from the edge of the proposed site. Also, to the southeast, are the Wrexham County Borough Council offices, which would also be about 75m from the edge of the site.
- 2.3 The proposed location of the main two storey building is identified on Figure 2 and this building would contain a Fire Appliance garage, and make ready bays and garages for Ambulance vehicles. The building would also contain an Ambulance Fleet Maintenance Garage. On the ground floor, there would also be bedrooms and welfare accommodation plus offices and, on the first floor, there would be office accommodation.
- 2.4 It is understood that although the building is to operate on a 24h per day basis, the Ambulance Fleet Maintenance Garage would only be operational during the daytime only. The building services plant would be operational 24h per day.

3.0 NOISE MEASUREMENTS

- 3.1 Noise levels were measured on Tuesday/Wednesday 12/13 June 2012 during the periods identified above. The dominant noise source was confirmed as road traffic on the A483 dual carriageway, about 400m to the northwest of the site, plus occasional local vehicle movements. At night, the background noise level near the hospital was affected by plant serving the hospital building. Full details of all noise measurements are provided in Appendix B, with measurement locations identified on Figure 1.
- 3.2 At the nearest residential premises to the proposed development, daytime ambient noise levels were in the range 49-53dB_{L_{Aeq}} with an average of 51dB_{L_{Aeq}}. These daytime noise levels are similar to those measured at the Council Offices. At night, the ambient noise levels at the nearest housing were in the range 39-46dB_{L_{Aeq}}, where the noise level after 0000h reduced to an average of 41dB_{L_{Aeq}}, and maximum noise levels did not exceed 55dB_{L_{Amax}}. At the hospital boundary, daytime ambient noise levels were in the range 45-48dB_{L_{Aeq}} and at night were 39-41dB_{L_{Aeq}}. Only at the nearest housing were the local vehicle movements included in the measurement, although the construction related vehicles were paused out. At both of the other locations, all local vehicle movements were paused out.
- 3.3 At the nearest residential premises and the Council Offices, daytime background noise levels were in the range 47-48dB_{L_{A90}}. At the hospital boundary, daytime background noise levels were 44dB_{L_{A90}}. At night, the background noise levels at the nearest housing were in the range 37-42dB_{L_{A90}}, similar to the hospital boundary.

4.0 BASIS OF ASSESSMENT

- 4.1 It was agreed with Wrexham County Borough Council that the development would be primarily assessed using the Welsh Government's Technical Advice Note (Wales) 11, 'Noise' (1997) (TAN 11). In addition, guidance in BS 8233:1999 'Sound insulation and noise reduction for buildings – Code of Practice', and World Health Organisation's (WHO) document "Guidelines for Community Noise" has also been used.
- 4.2 With regard to the proposed development, it seems appropriate that the bedrooms should be assessed on the basis of guidance in TAN 11, which in paragraph 7 states "Noise Exposure Categories (NECs) (see Annex A) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources." These are presented in Table 1 in Annex A and are included in Appendix C of this report, where advice is given depending on which NEC the site falls into. Annex A also includes ranges of levels for the NECs relating to different noise sources in Table 2, which is also included in Appendix C of this report.
- 4.3 To avoid confusion, the ambient or average noise level, $L_{Aeq,T}$, as advocated in BS 7445: 1991, is used to describe noise from different sources, and the recommended time periods are 0700-2300, daytime, and 2300-0700, night-time. Values in Table 2, included in Appendix C, refer to noise levels measured on an open site at the position of the proposed dwellings, well away from any existing buildings, i.e. in free-field conditions.
- 4.4 TAN 11 in Annex B states "For established roads it will be sufficient normally to base assessments on the current measured noise level." The Department of Transport's 'Calculation of Road Traffic Noise' (CRTN) is identified as an appropriate document for road traffic noise. Based on TAN 11, the indication is that where noise levels due to road traffic do not exceed 55dB_{L_{Aeq}} during the day and 45dB_{L_{Aeq}} during the night, then no particular noise control measures would be required.
- 4.5 In relation to other parts of the accommodation building, advice on suitable internal noise levels can be found in BS 8233:1999 'Sound insulation and noise reduction for buildings – Code of practice'. BS 8233, in Tables 5 and 6, provides a design range for indoor ambient levels in various types of accommodation. Meeting these levels would also comply with the requirements of BREEAM 2011 Issue Hea 05 and based on the types of accommodation in this building, the

desirable range for internal noise levels are presented in Table 1 below, which is based on the guidance in BS 8233.

Table 1 – Desirable Internal Ambient Noise Levels in Accommodation Based on BS 8233

Criterion	Accommodation	Design Range, dBL _{Aeq}
Reasonable conditions for study and work requiring concentration and listening	Meeting/Teaching rooms	35-40
Reasonable conditions for study and work requiring concentration	Offices/Restroom/Dining	40-50
Reasonable acoustic privacy in shared spaces	Open plan office	45-50
Reasonable industrial working conditions	Ambulance Fleet Maintenance Garage	65-75

- 4.6 WHO guidance identifies that the attenuation of external to internal noise levels provided by a window partially open for ventilation is up to 15dB, which, based on the above, would allow external noise levels of 50-55dBL_{Aeq} at the meeting and teaching rooms before consideration needs to be given to keeping windows closed and mechanically ventilating the rooms for acoustic purposes.
- 4.7 TAN 11 in section B17 states "*The likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS 4142: 1990. Tonal or impulsive characteristics of the noise are likely to increase the scope for complaints and this is taken into account by the "rating level" defined in BS 4142. This "rating level" should be used when stipulating the level of noise that can be permitted. The likelihood of complaints is indicated by the difference between the noise from the new development (expressed in terms of the rating level) and the existing background noise. The Standard states that, 'A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance'. Since background noise levels vary throughout a 24 hour period it will usually be necessary to assess the acceptability of noise levels for separate periods (e.g. day and night) chosen to suit the hours of operation of the proposed development.*" Hence, this would appear to be appropriate for setting allowable noise levels for external plant serving the building and potential noise breakout from the Ambulance Fleet Maintenance Garage. Achieving an overall noise level for plant to not exceed the background noise level at the nearest noise sensitive premises would also comply with the requirements of BREEAM 2011 Issue Pol 05.
- 4.8 Although not part of planning implications, the requirements for internal constructions to achieve appropriate privacy levels and for internal room finishes to control reverberation times in sensitive rooms need to be considered. It is intended to comply with BREEAM Issue 2011 Hea 05 in this respect.
- 4.9 TAN 11 also refers to construction noise and in paragraph B20 states "*Detailed guidance on assessing noise from construction sites can be found in BS 5228, parts 1-4. In particular, Part 1: 1984, "Code of practice for basic information and procedures for noise control" describes a method for predicting noise from construction sites as well as giving general advice.*"
- 4.10 BS 5228 has been updated since 1984 and the latest version was published in 2009. Section 8.4 in the document states: '*All reasonably practicable means should be employed to ensure the protection of local communities and of people on construction sites, from detrimental effects of the noise generated by construction operations. The means employed should be determined by local circumstances and can include the methods described in 8.2 and 8.3*' [Sections 8.2 and 8.3 include various suggested methods for controlling noise, such as good site practice to avoid unnecessary noise, effective plant maintenance and screening].
- 4.11 With regards to assessing the significance of construction noise impacts and providing criteria, different methods are proposed in Annex E of the document. Section E2 discusses the

significance of impacts based on fixed noise limits, as included in the Wilson Committee's advisory leaflet 72, where construction noise levels outside the nearest window of an occupied room closest to the site boundary should not exceed 70dBA in rural, suburban and urban areas away from main roads and 75dBA in urban areas near main roads.

- 4.12 Section E.3.2 provides an assessment method for the threshold of significant effect based on comparing the total noise level, to a listed value. In short, a significant effect has been deemed to occur if the total noise level (dBL_{Aeq}) including construction noise exceeds the threshold level. The table included in section E3 of BS 5228 is reproduced below as Table 2.

Table 2 – Copy of Table E3 from BS 5228 pt 1: Example Threshold of Significant Effect

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00–07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

^{B)} Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

^{C)} Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

^{D)} 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

- 4.13 Paragraph E.3.3 of BS 5228 suggests an assessment based on a 5dB change in noise levels and states: '*Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65dB, 55dB and 45dBL_{Aeq}, from construction noise alone, for the daytime, evening and night time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact.*'
- 4.14 With regards to construction vibration levels, these are discussed in BS 5228 Part 2. The document provides basic methods of vibration control relating to construction sites where work activities/operations generate significant vibration levels, describes the legislative background to vibration control and provides recommendations given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. However, given the distances between the proposed construction operations and the nearest noise sensitive premises, vibration should not be an issue.

5.0 ASSESSMENT OF PROPOSED DEVELOPMENT

External Noise Levels Breaking Into Station Building

- 5.1 Based on the measured data identified in Section 3 above, the noise levels at the Fire & Ambulance Station building would be no greater than 55dBL_{Aeq,16h} during the day and 45dBL_{Aeq,8h} at night. Hence, based on TAN 11, refer Appendix C, this would place the bedrooms in the building in Noise Exposure Category (NEC) A both day and night.
- 5.2 The advice in TAN 11 in relation to NEC A is that "*Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable*". Hence, no particular noise control measures

would be required in the design of the external envelope to the bedrooms and these rooms could be naturally ventilated via opening windows.

- 5.3 With regards to the other accommodation in the building, the lowest desirable noise levels identified in Table 1, above, relate to the meeting and teaching rooms, where 35-40dB_{L_{Aeq}} would be acceptable. As identified in Section 4, above, this would relate to an external noise level of 50-55dB_{L_{Aeq}} via a façade with windows open for ventilation. Hence, since noise levels on the site would be less than 55dB_{L_{Aeq}}, these rooms could be also be naturally ventilated and there would be no onerous requirements for the sound insulation performance of the external building envelope to control external noise breaking in.
- 5.4 Where rooms are being mechanically ventilated, it would be necessary for the building services systems to be designed to meet the internal noise levels stated in Table 1 above. Achieving the above would also comply with BREEAM Hea 05.

Noise Breakout From The Development

- 5.5 The only significant noise sources associated with the development would be activities in the maintenance and workshop areas and building services plant and these are discussed separately below.

Ambulance Fleet Maintenance Garage

- 5.6 To assess the potential noise breakout from the Ambulance Fleet Maintenance Garage, consideration needs to be given to the likely internal noise levels generated within the areas. Based on typical average and maximum noise levels measured in similar type vehicle maintenance areas, internal noise levels would not be expected to exceed the data presented in Table 3 below.

Table 3 – Typical Noise Levels Anticipated In The Vehicle Maintenance Areas

Noise Unit	Noise Level, dB								
	Overall A-weighted	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Average, L _{eq}	84	66	69	72	79	75	75	78	77
Maximum, L _{max}	96	75	83	85	88	91	91	87	77

- 5.7 Taking account of the distance between the building and the nearest noise sensitive premises, including housing, which would be at least 90m distance, and based on the sound insulation of the doors to the Ambulance Fleet Maintenance Garage achieving at least 20dB_{R_w} and the roof 25dB_{R_w}, the ambient noise levels would be less than 45dB_{L_{Aeq}} and the maximum noise levels would be below 55dB_{L_{Amax}}. Even if one of the doors were to be open, the average noise level would be below 50dB_{L_{Aeq}}. However, direct vehicle exhaust extraction systems (flexible hose on a reel) are being provided to each of the Ambulance vehicle maintenance bays and background (low level) extract ventilation is being provided to the Fire Appliance and Ambulance Garages, therefore doors would only need to be opened for access.
- 5.8 The Ambulance Fleet Maintenance Garage would only be operational during the daytime, i.e. 0800 to 1730h. During the day, the background noise levels at the nearest noise sensitive premises were 44-48dB_{L_{A90}}. Based on a BS 4142 assessment, allowing a +5dB noise character correction, the noise levels would be below those where they would be considered to be of “marginal significance”, as such they would be expected to be acceptable at all of the noise sensitive premises.

Mechanical Plant

- 5.9 The building services plant is understood to operate 24h per day, however, the plant would not be expected to operate fully at night-time. The lowest measured night-time background noise level was 37dBL_{A90} at the nearest residential accommodation. Therefore, at night, the design of roof top plant and atmospheric connections to the plantrooms should be based on achieving an overall noise level no greater than 5dB below the background noise level at the nearest residence, i.e. 32dBL_{Aeq}. Achieving this criterion would ensure that noise from mechanical plant, even allowing for a correction to take account of character, would be acceptable based on guidance in BS 4142 and comply with BREEAM Pol 05. During the day, the allowable overall noise level for plant could be increased to 42dBL_{Aeq}.
- 5.10 The above noise limits should also include the pumping station which is proposed in the east of the site.

Other Sources Associated With The Development

Emergency Vehicle Movements

- 5.11 Operation of the Ambulance & Fire Services Resource Centre would typically include emergency call outs and drills. These activities would not be expected to cause a major impact during the day, since the Ambulance & Fire Services Resource Centre entrance is at about 150m from the nearest residences and to some extent shielded by the building. At night, the emergency sirens would not generally be used until vehicles reached the major road network.
- 5.12 There would be no PA (voice) system/tannoy, only a call-out alarm. As such, there would be no noise impact at the nearest noise sensitive premises due to voice systems, and the call-out alarm would only operate during the day.

Car Parking

- 5.13 AEC have previously measured noise level data for car parking and associated manoeuvring at a number of sites including supermarkets and public houses. Based on that data, a vehicle manoeuvring and/or parking would typically generate a noise level of 72dBL_{AE} at 10m. The car park would have in the order of 150 spaces for staff.
- 5.14 Simplistically, during the daytime, based on a "worst case hour" of say 100 movements and based on an average distance of about 110m to the nearest residence, the noise level would be 36dBL_{Aeq,1h} at the nearest residence. Compared to the existing general daytime noise levels of 51dBL_{Aeq} during the day, this would be acceptable.
- 5.15 Although it is unlikely that the number of car parking movements would be significant at night, based on, say, a worst case of 2 vehicle movements in a 5 minute period, the noise level would be 29dBL_{Aeq,5min} at the nearest residence. Compared to the existing lowest night-time noise levels of 41dBL_{Aeq} after 0000h, this would also be acceptable.

Fire Training

- 5.16 There is a fire training house on the development site located about 90m northwest of future housing. Based on data measured during fire training exercises at another site, and included in Appendix B2, the overall noise level over a one hour period, assuming the times stated in Table B4 would be representative of potential activities on this site, would be 35dBL_{Aeq,1h} at the housing. During these exercises, there could be maximum noise levels due to siren operation, which may result in levels of about 73-75dBL_{Amax} at the nearest housing, which would exceed the existing typical maximum noise levels in the area of 60-65dBL_{Amax}. However, the use of this building for training purposes would be expected to be during the daytime and for the limited periods when it could be noisy, noise levels should be acceptable.

Construction Noise

- 5.17 It is understood that during various phases of construction the noisy activities would be:
- earthworks removal using excavators and trucks;
 - piling using a continuous flight auger rig;
 - excavations for pile caps and groundworks using a tracked excavator;
 - steelframe erection using impact wrenches;
 - fixing cladding on the building using TEK guns; and
 - concrete pouring of floor slabs using a concrete pump plus vibrators and power floating.
- 5.18 Based on data included in Appendix C of BS 5228 Part 1, the anticipated typical noise levels for the activities identified above at a distance of 10m are presented in Table 4 below.

Table 4 – Typical Plant Noise Levels at 10m Based On BS 5228

Activity	Plant Types	Noise Level, dBL _{Aeq} , at 10m
Earthmoving	Excavator & truck	80
Piling	Continuous flight auger (CFA) rig	80
Excavation	Tracked excavator	75
	Pneumatic breaker	85-90
Steel Frame Erection	Impact wrench	85
Concrete pouring	Concrete pump	80
	Power float/vibrators	75-85
Cladding fixing	TEK gun	80

- 5.19 Generally, construction operations would be in the order of 100m from the nearest noise sensitive premises. Taking account of the resultant distance attenuation and assumed number of plant items plus the likely operating time during an eight hour day, the resultant noise level at the nearest noise sensitive premises can be calculated. The process is demonstrated in Table 5 below.
- 5.20 The predicted resultant noise levels in Table 5, below, provide an indication of the potential average, L_{Aeq} , noise levels over an eight hour day for most of the construction activities. There may be occasions when two activities occur on the same day, but this would be unlikely to significantly increase the overall noise level. Hence, with the exception of the potential use of a pneumatic breaker during excavation, where the overall noise level could be in the order of $65dBL_{Aeq,8h}$, and concreting activities, where the overall noise level could be $60-65dBL_{Aeq,8h}$ on the days when a concrete pour occurs, noise levels should generally be in the order of $55dBL_{Aeq,8h}$. The above noise levels only take into account soft ground attenuation for those activities that would occur close to the ground and it is likely that either soft ground attenuation or acoustic shielding from local barriers would further reduce the levels in Table 5.

Table 5 – Predictions of Construction Noise Levels at Nearest Noise Sensitive Premises

Activity & Plant item	Noise Level, dBL _{Aeq} @ 10m	No of items	% On time	Correction, dB				Resultant, dBL _{Aeq,8h}
				Distance	No	% On time	Soft ground	
Earthmoving - Excavator & truck	80	2	50	-20	+3	-3	-4	56
Piling - CFA rig	80	1	25	-20	0	-6	0	54
Excavation - Tracked excavator Pneumatic breaker	75	1	25	-20	0	-6	-4	45
	85-90	1	10	-20	0	-10	-4	61-66
Steel frame erection - Impact wrench	85	3	5	-20	+5	-13	0	57
Concreting - Pump Vibrators	80	1	50	-20	0	-3	0	57
	75-85	2	50	-20	+3	-3	0	55-65
Cladding - TEK gun	80	4	3	-20	+6	-15	0	51

5.21 Based on the guidance in BS 5228, as outlined in Section 4 and Table 2, above, since the daytime ambient noise levels are less than 65dBL_{Aeq}, then a noise limit for this area of 65dBL_{Aeq,8h} during the period 0700-1900h would seem appropriate on a weekday and Saturday morning. During the weekday evening, 1900-2300h, and Saturday afternoons and Sundays, a lower limit of 55dBL_{Aeq,8h} would appear to be appropriate. Therefore, noise from all activities should be acceptable during the daytime period during the week and on Saturday mornings. If construction activities were required to take place during more sensitive periods, then use of pneumatic breakers and concreting operations may need to be controlled.

5.22 If there could be plant operating overnight, then a noise limit of 45dBL_{Aeq} at the nearest noise sensitive premises should be considered.

5.23 In general, the construction methods employed must take practical noise control measures into account. It will be necessary for liaison with the Local Authority about the operations and agree limits to be achieved at the nearest residences based on the above guidance. In addition, the local residents should be kept informed of when the noisier activities will occur, including the likely period these particular works will occur for.

6.0 MITIGATION MEASURES

Ambulance & Fire Services Resource Centre Building

6.1 The external noise levels are such that there are no sound insulation requirements for the building to control noise breaking in even to bedrooms and the meeting and teaching rooms and windows could be opened for ventilation purposes. With the exception of the use of Ambulance Fleet Maintenance Garage, there would be no significant general noisy activities associated with the building. Since mechanical ventilation is being provided to this area, doors would only be opened for access.

- 6.2 All other noise associated with the building operation such as car parking should be acceptable. There is the potential for noise during fire training to be higher than the existing noise levels in the area, but this should be acceptable, particularly if sirens are not sounded. Sirens of emergency vehicles would not generally be used at night until vehicles reached the major road network

Mechanical Plant

- 6.3 To achieve appropriate overall noise limits at the nearest noise sensitive premises, the required noise limits for individual items of plant can be determined once the plant details and locations are finalised. To achieve these noise limits noise control in the form of quieter plant selection, attenuators in ducted systems and, possibly, local shielding may be required.

Construction Operations

- 6.4 As identified above, it is likely that the noise due to the majority of construction activities would be acceptable at the nearest noise sensitive premises during the weekday periods. However, it would be necessary to employ appropriate practical noise control methods, liaise with the Local Authority and keep the residents informed of potential noisy activities at more noise sensitive periods.

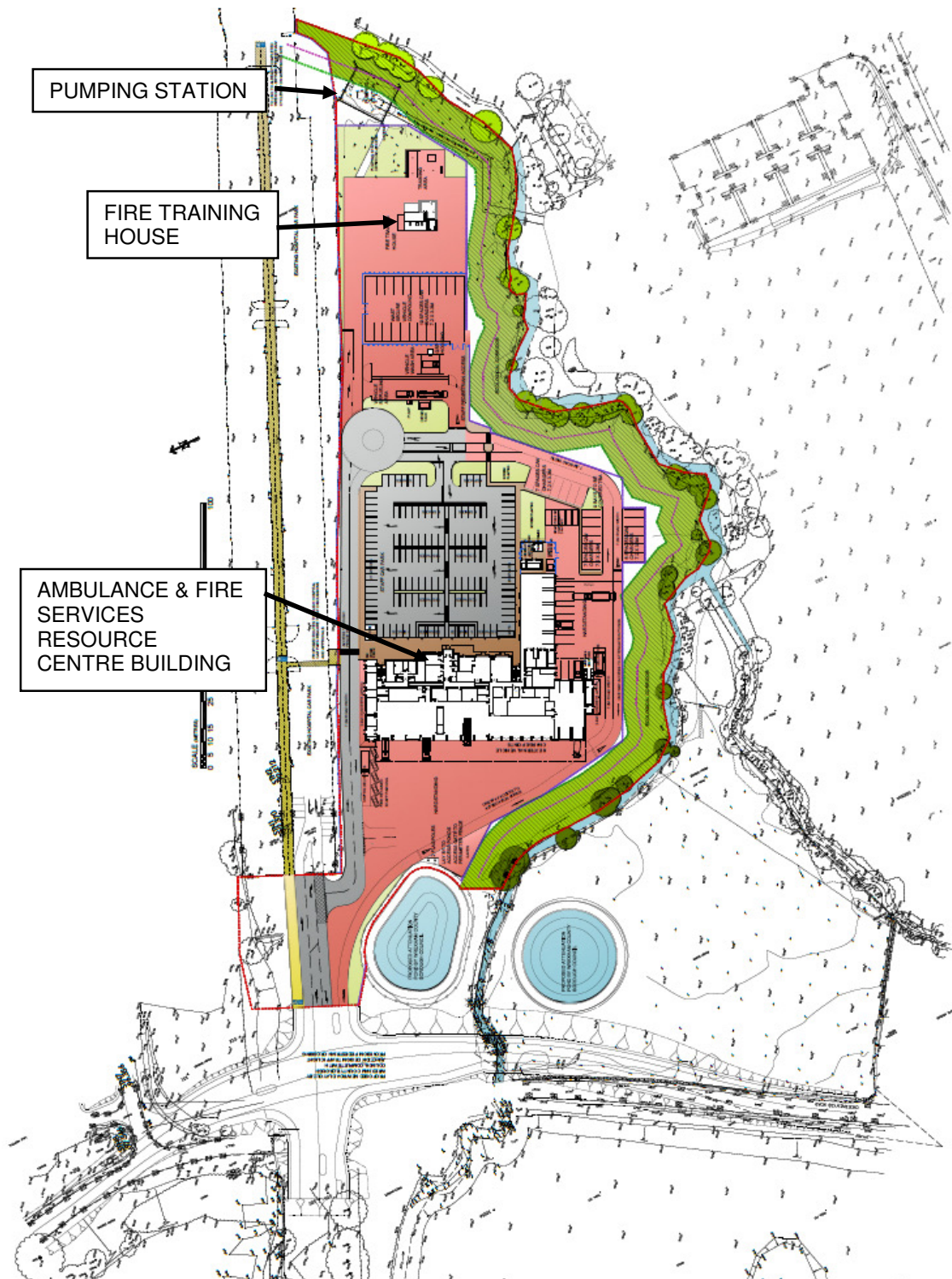
7.0 CONCLUSIONS

- 7.1 AEC has been appointed by BAM Construction Ltd North West to prepare a noise assessment report to accompany a planning application for the proposed development of an Ambulance & Fire Services Resource Centre in Wrexham.
- 7.2 Based on measured noise levels over both representative day and night-time periods, as agreed with Wrexham County Borough Council, it has been determined that the bedrooms, meeting and teaching rooms in the building could be naturally ventilated and still achieve acceptable internal noise levels.
- 7.3 With the exception of potential noise from the Ambulance Fleet Maintenance Garage and mechanical plant serving the development there do not appear to be any major sources associated with the buildings. As such, noise levels associated with the operation of the proposed Ambulance & Fire Services Resource Centre at the nearest noise sensitive premises, which are housing and the Council Offices to the south, and the Wrexham Maelor Hospital to the north, should be acceptable. Consideration should be given to controlling noise levels from any PA system and it is understood that there would be restrictions on the use of emergency sirens at night.
- 7.4 Appropriate noise limits at the nearest noise sensitive premises can be determined for mechanical plant operation.
- 7.5 During construction operations, it has been identified that the general noise levels should be acceptable, however, where noisy activities may occur during noise sensitive periods, it would be necessary to liaise with both the Local Authority and the residents to keep them informed of potentially short duration periods of high noise levels.
- 7.6 Based on the above, appropriate planning conditions can be readily applied to protect the amenity of existing residents in the area, together with the Council Offices and the hospital, and as such, noise should not be considered a determining factor in relation to planning permission.

FIGURE 1 – Proposed Site Location Identifying Noise Monitoring Positions



FIGURE 2 – Proposed Site Layout



APPENDIX A - Acoustic Terminology in Brief

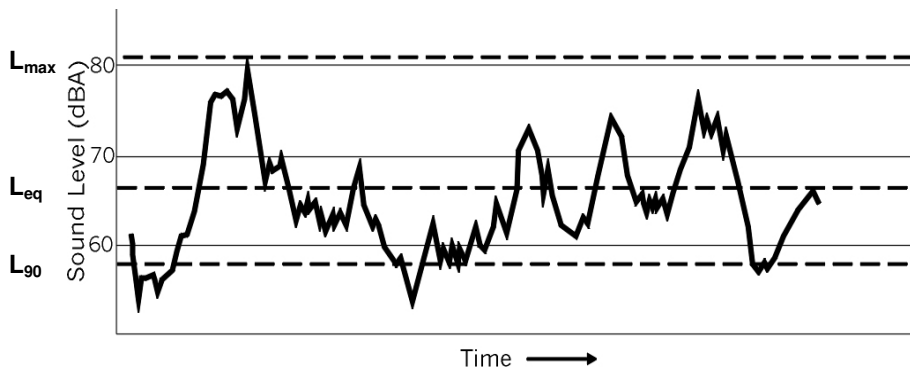
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most noise is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



Example of Sound Level Varying With Time

$L_{Aeq,T}$ The equivalent continuous (A-weighted) sound level. May be thought of as the "average" sound level over a given time, *T*. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level.

L_{A90} The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value used to describe the "background" noise.

L_{Amax} The maximum (A-weighted) sound level during a measurement period.

Free-field Level This refers to the sound level measured outside, away from reflecting surfaces.

R_w Single number rating used to describe the airborne sound insulation properties of a material or building element over the frequency range of typically 100-3150Hz.

APPENDIX B1 – Noise Survey Details

Dates & Times of Survey	Daytime: Tuesday 12 June 2012, 1110 to 1410h Night-time: Tuesday/Wednesday 12/13 June 2012, 2320 to 0120h
Personnel Present	Peter Sacre
Equipment Used	B&K 2260 Real Time Analyser (AEC Kit 2)
Weather Conditions	Daytime: Dry, cloudy with occasional sunny intervals, 17 ⁰ C, calm to light northerly wind Night-time: Dry, overcast, 14 ⁰ C, calm
Measurement Procedure	Noise levels were measured at three locations, identified as A to C on Figure 1 and described below.

A – At 3m from carriageway opposite 62 Bryn Coch.

B – At edge of car park at Wrexham Maelor Hospital.

C – At rear of Wrexham Borough Council Offices (daytime only)

Location A was selected to measure noise levels representative of the nearest residential premises to the site, location B was selected to measure noise levels external to the hospital, and location C was selected to measure noise levels at the Council Offices. Noise level data was recorded primarily in terms of ambient L_{Aeq} and L_{A10} , background, L_{A90} and maximum, L_{Amax} (fast response) typically over 5 to 15 minute periods.

All the measurements were taken at a height of 1.5m above ground and all were free-field measurements.

The sound level analyser, which conforms to BS EN 61672-12003 '*Electro acoustics – sound level meters - Part 1: Specifications*' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration.

Measured Data	A summary of the results are presented in Tables B1 and B2. In addition the octave band frequency data for the lowest background noise levels measured at the nearest housing both day and night are presented in Table B3. Full data is held on file by AEC.
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TABLE B1 – Daytime Noise Levels

Location	Period, h	Noise Level, dB				Comments*
		L _{Aeq}	L _{A10}	L _{Amax,f}	L _{A90}	
A	1112-1117	53.1	54.7	68.1	48.3	2 local cars, birdsong
	1117-1122	52.5	55.0	66.0		1 local car, birdsong
	1122-1127	52.6	55.8	65.5		2 local cars, birdsong, plus distant helicopter
	1236-1241	49.4	51.1	61.7	46.8	1 local car
	1241-1246	54.6	57.2	68.2		1 local car, birds, aircraft affected ambient
	1247-1252	49.6	52.2	57.6		
	1344-1349	49.8	51.6	59.1	47.9	
	1349-1354	50.2	51.6	61.4		1 local car
	1356-1401	51.1	52.8	64.3		1 local car
B	1140-1145	45.8	47.4	58.5	43.3	Occasional distant construction activities
	1146-1151	45.2	46.7	59.2		Occasional distant construction activities
	1300-1305	46.9	48.4	60.3	44.5	
	1305-1310	47.7	49.2	58.2		
C	1217-1222	50.0	51.9	64.6	47.1	Vehicles on Ruthin Road, plus distant aircraft
	1224-1229	50.0	52.3	61.9		Vehicles on Ruthin Road
	1324-1329	49.5	51.4	57.2	47.3	Vehicles on Ruthin Road, plus occasional construction activity
	1331-1336	48.8	49.8	61.2		

* Background and ambient levels were primarily due to traffic on the A483 unless identified otherwise

TABLE B2 – Night-Time Noise Levels

Location	Period, h	Noise Level, dB				Comments
		L _{Aeq}	L _{A10}	L _{Amax,f}	L _{A90}	
A	2326-2331	46.3	48.5	54.9	41.9	Motorcycle on A483
	2331-2336	45.6	47.5	53.9		Motorcycle on A483
	2336-2341	44.2	46.4	53.0		
	0016-0021	40.5	42.2	45.0	39.0	
	0021-0026	41.7	43.7	48.4		Distant train
	0026-0031	43.5	45.8	53.9		
	0102-0107	41.1	43.3	52.8	37.4	Background noise level includes stream flowing
	0107-0112	39.3	41.4	45.6		
	0112-0117	39.6	41.9	46.3		
B	2349-2354	41.2	41.0	49.0	37.5	Background noise includes hospital plant
	2354-2359	39.4	41.5	44.6	36.6	
	0038-0043	39.9	42.5	47.4	36.9	
	0043-0048	40.9	43.1	46.5		
	0048-0053	39.2	40.8	45.0		

* Background and ambient levels were primarily due to traffic on the A483 unless identified otherwise

TABLE B3 – Background Noise Level At Nearest Residential Premises

Location		Background Noise Level, dBL ₉₀								
		Overall A-weighted	At Octave Band Centre Frequency, Hz							
			63	125	250	500	1k	2k	4k	8k
Bryn Coch	Daytime	47	54	46	43	43	44	36	27	21
	Night-time	37	43	35	35	34	33	28	24	<20

APPENDIX B2 – Fire Training Noise Survey Data

Location	Fire Station, Crompton Way, Bolton (refer AEC project P865)		
Date & Time of Survey:	Thursday 13 March 2003	1000 to 1100 hours	
Personnel Present:	Andy Burke, AEC		
Equipment Used:	B & K 2260 Real Time Analyser (AEC Kit 1)		
Weather Conditions:	Dry, 2.5m/s easterly wind, clear, 7°C.		
Measurement Procedure:	Noise levels were measured at 5m from the individual sources and the duration of each activity was noted. Noise levels were measured in terms of L_{Aeq}, and L_{Amax} (fast response). All noise measurements were free field at a height of 1.5m above ground. The sound level analyser, which conforms to BS EN 60651:1994 “Specification for sound level meters” and BS EN 60804:2001 “Integrating-averaging sound level meters” was in calibration and check calibrated before and after the measurement periods using a Bruel & Kjaer type 4231 (94dB) calibrator. There was no significant drift of calibration.		
Measured Data:	Measured levels are presented in Table B4. Full data is held on file by AEC		

TABLE B4 – Noise Levels Relating to the Fire Training

Noise source	Period (Seconds)	Noise Level, dB		Comments
		L_{Aeq}	L_{Amax}	
Fire Engine	6	66	69	@ 5m, reversing, includes reverse alarm
Pumps	24	84	86	@ 5m, running hose wheels
Pumps & hose	54	75	85	@ 5m, pumping water
Pumps & hose	16	75	79	@ 5m, pumping water
Engine siren	11	95	100	@ 5m
Engine siren	10	95	98	@ 5m
Bull horn	6	95	99	@ 5m
Pumping operation	14	82	84	@ 5m

APPENDIX C – TAN 11 Guidance

TABLE 1 - NOISE EXPOSURE CATEGORIES

NEC	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

TABLE 2 - RECOMMENDED NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS NEAR EXISTING NOISE SOURCES

NOISE LEVELS ⁰ CORRESPONDING TO THE NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS L _{Aeq,T} dB				
	NOISE EXPOSURE CATEGORY			
NOISE SOURCE	A	B	C	D
Road traffic				
07.00 – 23.00	<55	55-63	63-72	>72
23.00 – 07.00 ¹	<45	45-57	57-66	>66
Rail traffic				
07.00 – 23.00	<55	55-66	66-74	>74
23.00 – 07.00 ¹	<45	45-59	59-66	>66
Air traffic²				
07.00 – 23.00	<57	57-66	66-72	>72
23.00 – 07.00 ¹	<48	48-57	57-66	>66
Mixed sources³				
07.00 – 23.00	<55	55-63	63-72	>72
23.00 – 07.00 ¹	<45	45-57	57-66	>66

Notes

⁰ **Noise levels:** the noise level(s) (L_{Aeq,T}) used when deciding the NEC of a site should be representative of typical conditions

¹ **Night-time noise levels** (23.0-07.00): sites where individual noise events regularly exceed 82 dB L_{Amax}(S time weighting) several times in any hour should be treated as being in NEC C, regardless of the L_{Aeq,8h} (except where the L_{Aeq,8h} already puts the site in NEC D).

² **Aircraft noise:** daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2dB(A) higher than those of other sources because of ground reflection effects.

³ **Mixed sources:** this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NEC's should only be used where no individual noise source is dominant.