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Executive Summary

The London Borough of Camden previously instructed Peter Brett Associates LLP (PBA) to undertake a noise assessment of redevelop of Parker House, Covent Garden. The previous assessment considered the existing noise climate at the site, the suitability of the building for the proposed use, and the sound reduction performance requirements of the external building.

This report presents the findings of a more detailed assessment of the demolition and site clearance noise. Refined noise limits are described based on the more detailed analysis of noise climate affecting St Joseph’s School, situated adjacent to the Parker House site with adjoining boundaries. The school is laid out such that all classrooms overlook the playground and the noise of children using the playground is detrimental to the internal teaching environment.

A programme of works and plant details are now available for the proposed demolition and construction at Parker House. The purpose of this assessment is to assess the noise from these activities and plant, specifically in the classrooms at St Joseph’s Primary School. The report also describes the mitigation measures which are proposed to reduce the effects of the work.

Part 1 of British Standard 5228:2009 (BS 5228) sets out a methodology for predicting, assessing and controlling noise levels arising from a wide variety of construction and related activities. Building Bulletin 93 (BB93) details the performance standards as upper limits for internal and external ambient noise levels. For primary school classrooms the upper limit is considered to be 35 dB. However, existing noise levels at St Joseph’s Primary School already exceed 35 dB when the windows are partially open.

An additional noise survey was undertaken on 11th January 2013 to measure noise in the playground at St Joseph’s School and internal noise levels in classrooms when the playground was in use.

The demolition and site clearance noise levels have been predicted to the four classrooms representative of classrooms on the first, second and third floors of the school. The noise levels have been predicted for four scenarios with all mobile demolition equipment (except lorries) on the fifth floor, all on the first floor, all on the ground floor and during site clearance. The results of the internal noise measurements have been used to establish the typical level inside the classrooms whilst the playground is in use so that the predicted demolition and construction noise levels can be added. The predictions use the proposed programme of works, proposed plant and the sound power levels as advised by the demolition contractor and prediction methods provided in BS 5228-1:2009.

An increase in noise levels of less than 3 dB is considered not significant as it is not perceptible to the average person. This criterion is more stringent than that suggested by BS 5228-1:2009. A summary of the predicted demolition and site clearance noise levels to four of the classrooms at St Joseph’s Primary School is provided. This shows that without mitigation the increase in the existing internal noise levels during demolition works is unacceptable in all the classrooms.

In addition to the mitigation measures advised in the original PBA report, polyethylene sheeting (Envirowrap) will be wrapped around the scaffolding to mitigate dust and noise from the demolition works. If the proposed Envirowrap is used around the scaffolding, the noise levels when children are in the playground will not be exceeded, However, when children are not using the playground a significant increase in the internal noise levels (up to 6 dB) is predicted at all floors of the school when the demolition works have reached the first floor. There are other less significant effects. If temporary barriers around individual activities or equipment are used the increase in noise level when the playground is not in use becomes insignificant.

The principles set out in this report with respect to noise limits at the school façade should also be applied when establishing construction methods and management procedures.

This Executive Summary contains an overview of the key findings and conclusions. However, no reliance should be placed on any part of the executive summary until the whole of the report has been read.

# Introduction

## Previous Noise Assessment

* + 1. The London Borough of Camden previously instructed Peter Brett Associates LLP (PBA) to undertake a noise assessment of redevelop of Parker House, Covent Garden to provide 43 residential units, three of which will be social rented.
		2. The previous assessment (‘Parker House, Camden, Noise Assessment’ job reference 27474/003, report reference R001/rev00 dated November 2012) (PBA Nov 12) considered the existing noise climate at the site, the suitability of the building for the proposed use, and the sound reduction performance requirements of the external building. In addition, a qualitative assessment of construction works was undertaken and noise limits suggested as no programme of works or plant details were available for the noise assessment at the time.
		3. The noise survey undertaken for the previous assessment comprised of:
* Position 1: Three daytime and four night-time measurements at a façade position on Parker Street, approximately 1.5 metres from the edge of the road,
* Position 2: One daytime and one night-time measurement at a façade position on Macklin Street opposite the school entrance, 1m from the road,
* Position 3: One daytime measurement in a façade position on a first floor external gangway of the existing Parker House, overlooking the school playground to the rear of the building, and
* Position 4: A 24-hour, free-field measurement on the roof of Parker House.
	+ 1. The 24-hour noise levels at Positions 1 to 3 were approximated using a method similar to the ‘comparative measurement procedure’ set out in paragraph 45 of the ‘Calculation of Road Traffic Noise’, although using LAeq,16h and LAeq,8h instead of LA10,18h.
		2. Following concern from staff at St Joseph’s Primary School about demolition and construction noise exacerbating an already unfavourable noise climate, Arup Acoustics reviewed the PBA report. The conclusion of the review was that a more detailed assessment of construction and demolition noise was required.
		3. This report presents the findings of a more detailed assessment of the demolition and site clearance noise. Refined noise limits are described, based on the more detailed analysis of noise climate affecting St Joseph’s School.

## St Joseph’s Primary School

* + 1. St Joseph’s Primary School is situated adjacent to the Parker House site with the southern boundary of the playground forming the northern boundary of the Parker House site. The buildings are shown in Figure 1 Site Plan.
		2. The playground at St Joseph’s Primary School is not large enough to allow all the classes to use it at the same time. Therefore the infant classes use the playground whilst the juniors are being taught in class and vice versa. When the infants and juniors are in class, the playground is used by the nursery class.
		3. The school is laid out such that all classrooms overlook the playground and the noise of children using the playground is detrimental to the internal teaching environment. It is understood that staff are concerned about demolition and construction noise adding to the noise of children using the playground.

## Detailed Demolition and Construction Noise Assessment

* + 1. A programme of works and plant details are now available for the proposed demolition and construction at Parker House. The purpose of this assessment is to assess the noise from these activities and plant, specifically in the classrooms at St Joseph’s Primary School.
		2. The report also describes the mitigation measures which are proposed to reduce the effects of the work and further mitigation which should be adopted to assist in minimising the effects of the general and some specific activities.

# Policy and Guidance

## Introduction

* + 1. A Glossary of Acoustics Terms is provided in Appendix A.
		2. The PBA Nov 12 report summarises the Policy and Guidance required for the noise assessment of the proposed development. This section summarises the policy and guidance for the assessment of demolition and construction noise.

## British Standard 5228-1:2009 ‘Code of practice for noise and vibration control on construction and open sites Part 1 Noise’

* + 1. Part 1 of British Standard 5228:2009 (BS 5228) sets out a methodology for predicting, assessing and controlling noise levels arising from a wide variety of construction and related activities, and it provides tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.
		2. Noise generated by a demolition and construction site will depend upon a number of variables, the most significant of which are:
* The amount of noise generated by items of plant and equipment being used at the development site, generally expressed as a sound power level,
* The periods of operation of the plant at the development site, known as the ‘on-time’,
* The distance between the noise source and the receptor, known as the ‘stand-off’,
* The attenuation due to ground absorption or barrier screening effects, and
* The reflection of noise due to the presence of hard vertical faces such as walls.
	+ 1. Section 8 of BS 5228 provides methods for controlling noise from construction and demolition sites, Annex C provides sound power levels of typical plant and equipment used for demolition and construction and Annex F provides methods of estimating noise from construction and demolition sites.
		2. In the absence of adequate information at the time, the previous noise assessment used BS 5228-1:2009 to set construction and demolition noise limits.

## British Standard 5228-1:2009 ‘Code of practice for noise and vibration control on construction and open sites Part 2 Vibration’

* + 1. Part 2 of BS 5228 relates to vibration, which may be impulsive, such as that due to hammer-driven piling; transient, such as that due to vehicle movements along a railway; or continuous, such as that due to vibratory driven piling.
		2. Human beings are known to be very sensitive to vibration, the threshold of perception typically being in the peak particle velocity (PPV) range of 0.14mm/s to 0.3mm/s. Vibration above these levels can disturb, startle, cause annoyance or interfere with work activities.
		3. Vibration nuisance is often associated with the assumption that if vibrations can be felt then damage is inevitable. However, considerably greater levels of vibration are required to cause damage to buildings and structures than the threshold of perception in humans.
		4. Annex B of BS 5228-2 provides advice on the human response to construction vibration. For the assessment of construction effects the magnitude descriptors in Table 2.1 (using information from B.1 of BS 5228-2:2009) refers to this advice.

Table 2.1: Table of Human Response to Vibration Magnitude

|  |  |  |
| --- | --- | --- |
| Magnitude | Vibration Level | Description |
| Negligible | 0.14 mms-1 | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| Small | 0.3 mms-1 | Vibration might just be perceptible in residential environments |
| Medium | 1.0 mms-1 | It is likely that vibration at this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents |
| Large | 10 mms-1 | Vibration is likely to be intolerable for any more than a very brief exposure to this level |

* + 1. Section 8 of BS 5228-2 provides methods of control of vibration, Annex C provides measured vibration levels for typical plant used for construction and demolition processes, and Annex E provides ‘Empirical predictors for groundborne vibration arising from mechanized construction works’.

## Building Bulletin 93 ‘Acoustic Design of Schools’, 2003

* + 1. Building Bulletin 93 (BB93) was published by the Department of Education and Skills in 2003 and details the performance standards as upper limits for internal and external ambient noise levels.
		2. Table 1.1 of BB93 provides upper limits for the indoor ambient noise level as LAeq,30min for unoccupied and unfurnished classrooms. For primary school classrooms the upper limit is considered to be 35 dB.
		3. However, existing noise levels at St Joseph’s Primary School already exceed 35 dB when the windows are partially open, therefore this level cannot be achieved with or without demolition noise and is not a suitable assessment level.

# Methodology

## Previous Noise Survey and Assessment

* + 1. The previous noise survey was undertaken between on 27th and 28th September 2012 and was comprised of the following measurements:
* Position 1: Three daytime and four night-time measurements at a façade position on Parker Street, approximately 1.5 metres from the edge of the road,
* Position 2: One daytime and one night-time measurement at a façade position on Macklin Street opposite the school entrance, 1m from the road,
* Position 3: One daytime measurement in a façade position on a first floor external gangway of the existing Parker Street House, overlooking the school playground to the rear of the building, and
* Position 4:A 24-hour, free-field measurement on the roof of Parker House.
	+ 1. The 24-hour noise levels at Positions 1 to 3 were approximated using a method similar to the ‘comparative measurement procedure’ out in the paragraph 45 of the ‘Calculation of Road Traffic Noise’, although using LAeq,16h and LAeq,8h instead of LA10,18h.
		2. These measurements were used with BS 5228-1 to set construction and demolition noise limits to nearby noise sensitive receptors.

## Additional Noise Survey

* + 1. An additional noise survey was undertaken on 11th January 2013 to measure noise in the playground at St Joseph’s School and internal noise levels in classrooms when the playground was in use.
		2. The survey consisted of an unattended measurement in a façade position in the playground and five to ten minute measurements inside the following classrooms:
* Year 1, infant class, first floor
* Year 2, infant class, first floor
* Year 3, junior class, second floor, and
* Year 4, junior class, third floor.
	+ 1. The classrooms for Years 1 to 3 were chosen as they were the smallest classroom, therefore are likely to experience the highest internal noise level. The classroom for Year 4 was chosen as it is the only classroom on the top level of the school.
		2. The measurements were undertaken with the lower section of the classroom windows open as far as they would go, as shown inset in Figure 1.
		3. PBA were advised by one of the members of staff that the noise levels when junior years use the playground seemed higher than when infant years use. Therefore measurements were taken in occupied rooms so that typical infant and junior break times could be measured in affected classrooms.
		4. The exceptions to this were the second measurements in the Year 3 and Year 4 classrooms which were unoccupied apart from two PBA noise equipment operators (and a teaching assistant in the Year 4 classroom).
		5. The break times did not last long enough to measure in all affected classrooms. Originally a 10-minute measurement period was decided, however, during the morning break time it was noticed that the noise levels were quite static, therefore the measurement period was reduced to 5-minutes to allow measurement in more classrooms.
		6. Unfortunately half of the 10-minute measurement in the Year 2 classroom during the first break time and the entire measurement in the same room during the second break time could not be used as the teaching assistant talked during these measurements.

## Prediction of Demolition and Site Clearance Noise Levels

* + 1. The demolition and site clearance noise levels have been predicted to the four classrooms at St Joseph’s Primary School in which measurements were taken. These classrooms are representative of classrooms on the first, second and third floors of the school (infant classes, junior classes and Year 4 respectively).
		2. A SoundPLAN v7.2 noise model of the proposed demolition and site clearance works has been prepared. Appendix B provides a summary of the data used in the noise model, the majority of which was advised by Keltbray, the demolition contractor for the site.
		3. The noise levels have been predicted for four scenarios: all mobile demolition equipment (except lorries) on the fifth floor, all on the first floor, all on the ground floor and during site clearance.
		4. As the front façade of the building (on Parker Street) is being retained, it has been included in the noise model for all scenarios to ensure any reflected noise from the façade to the school is included in the calculations. It has been assumed that the internal surface of the façade is composed of painted brick.
		5. It has been assumed that there will be a maximum of two lorries per hour moving around the site.
		6. Noise from the erection of the façade retention scheme has been assumed to be insignificant to St Joseph’s Primary School as the building envelope will still be intact and will act as a barrier and partial enclosure to the noise.
		7. Construction noise has not been assessed in detail at this stage as there is no construction method statement available. However, noise limits are proposed based on the analysis of the noise levels which are considered reasonable at St Joseph’s School.

## Demolition and Site Preparation Vibration Levels

* + 1. The method of piling for the construction of the proposed development has not been finalised. However, percussive or driven piles may cause vibration noticeable to staff or students at St Joseph’s Primary School.
		2. Unless driven or percussive piling is required, it is unlikely that any of the other proposed methods will cause noticeable vibration to staff or students at St Joseph’s Primary School, therefore a detailed vibration assessment is not considered to be necessary.

## Additional Noise Assessment

* + 1. The results of the internal noise measurements have been used to establish the typical level inside the classrooms whilst the playground is in use so that the predicted demolition and construction noise levels can be added.
		2. The difference between the internal and external noise levels has been used to provide the typical reduction in noise levels with the windows partially open.
		3. It is not intended that the short noise measurements should be used to provide a thorough assessment of the suitability of the internal acoustic environment in the classrooms during playground use or assess the efficacy of the new glazing; they are intended to be used to provide approximate internal noise levels to evaluate whether demolition and construction noise is likely to exacerbate already high noise levels within the classrooms during playground use.
		4. The difference between the internal and external LAeq,T will be influenced by the distance between the children and the measurement locations. However, the distance of the individual children to the internal and external measurement locations varies greatly throughout the measurement period so distance corrections cannot be accurately applied. The external measurement location is in an equivalent location to measuring at the façade of the school, but was selected for safety reasons. The attenuation effect of the windows is therefore taken as the difference between internal and external noise levels.
		5. The demolition and site clearance noise levels have been predicted using the proposed programme of works, proposed plant and the sound power levels as advised by Keltbray, the demolition contractor and prediction methods provided in BS 5228-1:2009.
		6. The results have been compared to the demolition and construction noise limits provided in the previous PBA noise assessment and the measured internal noise levels within the classrooms.
		7. Keltbray have advised that Envirowrap 500AFR-T-AC-D06-08, a polyethylene sheeting, will be wrapped around the scaffolding to mitigate dust and noise from the demolition works. This has been acoustically tested by BAM Nuttall who report overall attenuation of 10.9 dB. The test results are included in Appendix B.
		8. It is acknowledged that the noise measurements will have included noise from children inside the classrooms, however, the children were exceptionally quiet and it is considered that noise from children using the playground is dominant in all measurements except those referenced in paragraph 3.2.8, which have not been used.
		9. The external noise measurement was a façade noise measurement, being placed within 1 m of a brick wall. Therefore 3 dB has been subtracted from the external measurements to calculate the free field noise level.
		10. The internal noise measurements were taken at a distance representative of the nearest pupil to the window or, where this was not possible (for example, because the pupil sat against the wall) the measurement was taken at 1 m from the wall. 3 dB has been subtracted from the measurements to estimate the diffuse internal noise level.
		11. An increase in noise levels of less than 3 dB is considered not significant as it is not perceptible to the average person.

## Limitations

Site Layout

* + 1. Due to the relatively short distances and observation on site, the area containing Parker House and St Joseph’s Primary School has been assumed to be flat.
		2. The layout of the existing buildings has been provided by EC Harris LLP.

Noise Survey

* + 1. It has been assumed that the noise levels measured during the noise survey are representative of the typical noise during playground use.
		2. It has also been assumed that the noise climate during the previous noise survey is representative of the typical noise climate, e.g. traffic was flowing in a typical fashion, there were no greater or fewer aircraft movements etc as there was no evidence to assume otherwise.

Internal Noise Climate

* + 1. The windows were partially opened during the internal noise measurements to represent a typical situation when ventilation is required. The windows were installed during the school summer holiday and have not been opened since, therefore it is considered that using windows opened as far as possible is not typical for the proposed time of year of demolition (beginning of September).
		2. The classrooms were occupied during the internal noise measurements as using unoccupied classrooms would have provided unrepresentatively low noise levels. However, the children were extremely quiet and this scenario represents quiet study.

Plant Noise Levels

* + 1. Spectrum data from table C in BS 5228-1:2009 has been used where items have been specified using this table.
		2. Where spectrum data is not available (for example, items specified using table D of BS 5228-1:2009 or manufacturer’s data) the shape of the spectrum has been chosen using the closest equipment match in table C of BS 5228-1:2009 but the overall LW has been entered into the model using the information provided.

Envirowrap Mitigation

* + 1. Keltbray have provided acoustic test results for the proposed polyethylene sheeting but unfortunately no frequency spectrum data is available. Therefore the overall LAeq,1h has been assessed for the ‘with mitigation’ scenarios and there is the potential that noise levels may be unacceptable in some frequency bands even if the overall LAeq,1h is acceptable.
		2. This will be determined by noise monitoring during the works and additional mitigation will be advised if any octave bands show an unacceptable increase.

# Results

## Previous Noise Survey and Assessment

* + 1. With regard to construction and demolition noise, the previous noise and vibration assessment concluded that it is likely the London Borough of Camden would require working hours of 08:00 to 18:00 hours Monday to Friday, and 08:00 to 13:00 hours on Saturdays.
		2. 70 dB was calculated as an acceptable construction and demolition noise limit for the residential receptors, and it was acknowledged that “it may be appropriate to adopt a lower limit to protect the teaching environment at the school during the construction works” (paragraph 5.1.5 of the PBA Nov 12 report).
		3. A vibration limit of 1.0 mms-1 (PPV) was concluded as being an indicator of potential impact for residential, educational and commercial receptors close to the site.
		4. However, the report also stated that: “The selection of appropriate noise and vibration limits is the responsibility of Camden Council, however, the above suggestions are considered a reasonable starting point”.

## January 2013 Noise Survey

* + 1. A summary of the internal noise survey results and comparison with BB93 internal level of 35 dB (see paragraph 2.4.2) is provided in Table 4.1. When assessing noise of this nature, the frequency spectrum of the noise is important and the full noise survey results (provided in Appendix C), provide the measured octave band frequency spectra. These include the 3 dB correction described in paragraph 3.5.10.

Table 4.1: Results of the St Joseph’s Primary School Noise Survey

| Classroom | Internal LAeq,T (dB) | Difference to BB93 Recommendation (dB) | LAFmax (dB) |
| --- | --- | --- | --- |
| Year 1 (2nd Break Time) | 58 | 23 | 69 |
| Year 2 (1st Break Time) | 61 | 26 | 75 |
| Year 3 (Average) | 57 | 22 | 70 |
| Year 4 (Average) | 54 | 19 | 71 |

* + 1. The average has been calculated as the logarithmic average of the LAeq,T and LZeq,T (the tables in Appendix C) and the arithmetic average of the LAFmax.
		2. Table 4.2 provides the LAeq,T measured in the playground as free-field noise levels with the difference between the internal and external LAeq,T.

Table 4.2: Free-Field Playground LAeq,T

| Classroom of Internal Measurement | Start Time (hh:mm:ss) | External LAeq,T (dB) | Difference with Internal LAeq,T (dB) |
| --- | --- | --- | --- |
|
|  |
| Year 1 | 13:07:14 | 79 | 21 |
| Year 2 | 11:11:50 | 81 | 20 |
| Year 3 | 10:21:26 | 69 | 14 |
| 12:31:44 | 80 | 23 |
| Average | 78 | 18 |
| Year 4 | 10:36:27 | 67 | 13 |
| 12:40:11 | 74 | 21 |
| Average | 72 | 17 |

## Predicted Demolition and Site Preparation Noise Levels

Introduction

* + 1. A draft Outline Demolition Method Statement (MS) has been prepared by Keltbray. Whilst only in its draft stage it provides useful guidance for the programme of works. The demolition work is expected to last about two months.
		2. In addition to the plant that will be used, the MS advises that, for safety reasons, deglazing will be undertaken by breaking the glass using a long scaffold tube. This should only be undertaken once the Envirowrap has been fitted. In addition, to reduce the noise levels, which can be alarming to occupants of nearby buildings, further mitigation in the form of absorptive drapes on the windows is recommended.
		3. Appendix D provides a summary of the predicted demolition and site clearance noise levels to four of the classrooms at St Joseph’s Primary School. The calculations take account of the reflection from hard surfaces of noise sources within 2m of that surface by adding 3dB to the LAeq.

No Mitigation

* + 1. Figures 2 to 5 show the freefield noise levels resulting from the plant and equipment in use for the demolition at each floor and for site clearance,
		2. Table D.1 and Figures 2 to 5 show that without mitigation the increase in the existing internal noise levels during demolition works is unacceptable in all the classrooms. However, site clearance works are shown to be acceptable.

With Envirowrap

* + 1. Table D.2 shows that, if the proposed Envirowrap is used around the scaffolding, the noise levels when children are in the playground will not be exceeded, except when the demolition works have reached the first floor when there is a 1 dB (and therefore insignificant) increase in noise level on the second and third floors of the school.
		2. However, when children are not using the playground:
* A significant increase in the internal noise levels (up to 6 dB) is predicted at all floors of the school when the demolition works have reached the first floor,
* An insignificant increase in the internal noise levels (up to 2 dB) is predicted at all floors when the demolition works have reached the ground floor,
* An insignificant increase in the internal noise levels (up to 1 dB) is predicted on the fourth floor of the school when the demolition works are on the upper floors.
	+ 1. No other stages of the works are predicted to increase the internal noise levels at the school.

With Envirowrap and Temporary Barriers

* + 1. The best method of reducing construction noise further will be to choose the quietest methods or plant available.
		2. For example, the noise modelling results demonstrate that the hand held hammers and excavator with bucket are the most dominant sources of noise to the school. For items such as the hammer which may not have alternatives, temporary barriers at the perimeter of the works can be used.
		3. Only the demolition scenarios with a significant increase in internal noise level due to the works have been analysed in more detail with regard to the effectiveness of temporary barriers. It has been assumed that the barriers are located as shown in Figure 1.
		4. Table D.3 shows that if temporary barriers are used the increase in noise level when the playground is not in use becomes insignificant when the demolition works have reached the first floor except in the Year 4 classroom which shows an increase of up to 4 dB.
		5. It is therefore advised that the use of hand held hammers is limited to the equivalent of only one at a time in the northern most block of Parker House when the demolition reaches the first floor level. This reduces the increase in noise level to 3 dB which is considered to be not significant. Alternative solutions could be considered within the same parameters.

Comparison with previously proposed Demolition Noise Limits

* + 1. The PBA Nov 12 report used the ‘ABC Method’ outlined in BS 5228-1:2009 to offer a construction noise limit of 70 dB to residents. It was acknowledged in this report that “it may be appropriate to adopt a lower limit to protect the teaching environment at the school during the construction works”.
		2. The mitigated construction noise levels are below 70 dB externally to the façade of the building.
		3. BS 5228-1:2009 also suggests that

*“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 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB LAeq, Period, 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.”*

* + 1. It also advises that this is a suitable basis for assessment of construction noise to “buildings in educational use”.
		2. It can therefore be seen that our proposed criteria (where 3 dB is considered to be a significant increase in noise level) is more stringent than that suggested by BS 5228-1:2009.

# Mitigation Measures

## Demolition and Construction Noise and Vibration

* + 1. The mitigation measures outlined in the PBA Nov 12 report should be implemented. The measures advised were:
* Where appropriate, erect a hoarding around the entire perimeter of the site to screen noise from low level sources and/or street level receptors;
* Control off-site parking of construction traffic on the public highway;
* Implement a traffic management system at the site entrance to control traffic movements into and out of the site;
* Minimise disturbance from reversing bleepers through measures such as site layout, provision of screening or use of broadband sound emitting reversing alarms;
* Use of ‘silenced’ plant and equipment where possible;
* Switch off vehicle engines where they are standing for a significant period of time;
* Operate plant at low speeds where possible and incorporate automatic low speed idling;
* Where possible, select electrically driven equipment in preference to internal combustion powered equipment, hydraulic power in preference to pneumatic power, and wheeled plant in preference to tracked plant;
* Maintain all plant properly (keep greased, replace blown silencers, keep saws sharp, replace worn bearings, etc);
* Lower materials rather than drop them;
* Use of temporary screening or enclosures for static noisy plant to reduce noise emissions;
* Use of plant that meets relevant EC Directive standards;
* Ensure all contractors are familiar with the guidance in BS 5228 (Parts 1 and 2) and incorporate it into contract documents;
* Undertake noise and/or vibration measurements during noisy or vibratory works and manage works to acceptable levels.
	+ 1. In addition, this report indicates the necessity to utilise the Envirowrap 500AFR-T-AC-D06-08 polyethylene sheeting and temporary barriers assessed in Section 4.3 to achieve satisfactory noise levels at the school façade.
		2. The details associated with the construction processes are not available, but the principles set out in this report with respect to noise limits at the school façade and the mitigation measures described should be applied when establishing construction methods and management procedures.

# Conclusion

* + 1. A significant increase in internal noise levels at St Joseph’s Primary School is predicted due to unmitigated demolition work at Parker House.
		2. However, with use of Envirowrap polyethylene sheeting around the whole site and temporary barriers around work in the northern most block of Parker House when the works reach first floor level, an increase in noise level is avoided or the increase in noise level is predicted to be 3 dB or below and is therefore considered to be insignificant.
		3. Similar limits in noise level changes at the school façade as a result of the construction works should be used when preparing construction methods and management procedures.

Appendix : Glossary of Acoustics Terms

|  |  |
| --- | --- |
| Ambient Noise | Total encompassing sound in a given situation at a given time, usually composed of sound from many sources far and near. |
| Daytime | Defined in PPG 24 as the period 07:00-23:00 hours. |
| Decibel (dB) | A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 uPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions. |
| dB(A), LAx | Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people’s assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A). |
| LA90,T | The A weighted noise level exceeded for 90% of the measurement period, T. This is defined in BS 4142 as the background noise level. |
| LAE | The sound exposure level – the level of a sound with a period of 1 second that has the same sound energy as the event considered. |
| LAeq,T | The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). LAeq, T is used to describe many noises and can be measured directly with an integrating sound level meter. |
| LAmax, | The highest A weighted noise level recorded during a noise event. The time weighting (slow or fast) should be stated.  |
| Night-time | Defined in PPG 24 as the period 23:00-07:00 hours. |
| Sound Power Level, Lw | An absolute parameter widely used for rating and comparing sound sources. Sound power is a physical property of the source alone, independent of any external or environmental factors[[1]](#footnote-1). |

Appendix : Plant and Envirowrap Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item** | **Height** | **Table reference** | **Item reference** | **No. items** | **% On Time** |
| **Demolition** |
| Tower crane (representative) | Upper floors | C.4 | 38 | 1 | 25 |
| Muck away lorry | Ground level | D.3 | 59 | 10 per day | 25 |
| Hand Held Circular Saw | Upper floors | C.4 | 70 | 2 | 50 |
| Disc cutter/Angel grinder | Upper floors | C.4 | 93 | 1 | 50 |
| 24T excavator with pulveriser | Upper floors | C.1 | 5 | 2 | 75 |
| 24T excavator with hammer | Upper floors | C.1 | 2 | 1 | 75 |
| 45 T excavator with bucket | Upper floors | D.3 | 96 | 1 | 75 |
| Skid Steer Loader | Ground level | D.3 | 84 | 1 | 25 |
| Hand held hammer | Upper floors | D.2 | 15 | 4 | 50 |
| Reciprocating saw | Upper floors | C.4 | 72 | 2 | 50 |
| Electric breaker | Upper floors | N/A | Hilti TE 76 | 3 | 25 |
| Compressor | Upper floors | C.5 | 5 | 1 | 50 |
| Generator | Upper floors | C.4 | 84 | 1 | 80 |
| **Site preparation** |
| Tracked excavator | Ground level | C.2 | 14 | 2 | 75 |
| Tracked excavator (idling) | Ground level | C.2 | 20 | 2 | 25 |
| Dozer | Ground level | C.2 | 12 | 2 | 50 |
| Lorry | Ground level | C.2 | 34 | 1 | 20 |

Appendix : Full Noise Survey Results

Table B.1: Internal Noise Levels and Spectra

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Classroom | Start Time (hh:mm:ss) | Duration (hh:mm:ss) | LAeq,T (dB) | LAFmax (dB) | Octave Band LZeq,T (Hz, dB) |
| 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 |
| Year 1 | 13:07:14 | 0:05:00 | 58 | 69 | 53 | 51 | 49 | 47 | 51 | 56 | 51 | 44 | 31 | 21 |
| Year 2 | 11:11:50 | 0:05:00 | 61 | 75 | 59 | 59 | 55 | 54 | 51 | 53 | 58 | 55 | 48 | 34 |
| Year 3 | 10:21:26 | 0:10:00 | 55 | 72 | 53 | 50 | 51 | 53 | 53 | 51 | 47 | 43 | 37 | 29 |
| 12:31:44 | 0:05:00 | 58 | 69 | 58 | 51 | 49 | 50 | 51 | 55 | 51 | 43 | 30 | 18 |
| Average | 57 | 70 | 56 | 50 | 50 | 52 | 52 | 53 | 49 | 43 | 34 | 26 |
| Year 4 | 10:36:27 | 0:09:23 | 54 | 76 | 53 | 50 | 49 | 51 | 51 | 50 | 47 | 41 | 35 | 25 |
| 12:40:11 | 0:05:00 | 54 | 65 | 52 | 50 | 50 | 49 | 49 | 51 | 45 | 37 | 29 | 21 |
| Average | 54 | 71 | 53 | 50 | 50 | 50 | 50 | 50 | 46 | 40 | 33 | 23 |

Table B.2: Playground Noise Levels and Spectra in the Internal Measurement Periods

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Classroom | Start Time (hh:mm:ss) | Duration (hh:mm:ss) | LAeq,T (dB) | LAFmax (dB) | Octave Band LZeq,T (Hz, dB) |
| 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 |
| Year 1 | 13:07:14 | 0:05:00 | 79 | 93 | 65 | 67 | 64 | 61 | 70 | 76 | 74 | 66 | 54 | 45 |
| Year 2 | 11:11:50 | 0:05:00 | 81 | 100 | 68 | 70 | 69 | 64 | 70 | 77 | 77 | 70 | 57 | 45 |
| Year 3 | 10:21:26 | 0:10:00 | 69 | 87 | 62 | 63 | 57 | 56 | 64 | 66 | 63 | 55 | 46 | 39 |
| 12:31:44 | 0:05:00 | 80 | 94 | 66 | 68 | 64 | 60 | 71 | 76 | 76 | 67 | 55 | 44 |
| Average | 78 | 91 | 65 | 66 | 62 | 58 | 68 | 74 | 73 | 64 | 52 | 42 |
| Year 4 | 10:36:27 | 0:09:23 | 67 | 86 | 63 | 63 | 56 | 55 | 61 | 64 | 60 | 53 | 45 | 40 |
| 12:40:11 | 0:05:00 | 74 | 90 | 62 | 66 | 67 | 61 | 66 | 71 | 69 | 64 | 57 | 50 |
| Average | 72 | 88 | 63 | 65 | 64 | 59 | 64 | 69 | 66 | 61 | 54 | 48 |

Table B.3: Difference between the Internal and External Noise Levels and Spectra

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Classroom | Start Time (hh:mm:ss) | Duration (hh:mm:ss) | LAeq,T (dB) | LAFmax (dB) | Octave Band LZeq,T (Hz, dB) |
| 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| Year 1 | 13:07:14 | 0:05:00 | 21 | 25 | 12 | 16 | 15 | 14 | 19 | 20 | 22 | 22 | 23 | 24 |
| Year 2 | 11:11:50 | 0:05:00 | 20 | 24 | 8 | 11 | 13 | 10 | 19 | 24 | 19 | 15 | 9 | 10 |
| Year 3 | 10:21:26 | 0:10:00 | 14 | 15 | 10 | 13 | 6 | 3 | 11 | 15 | 16 | 11 | 10 | 10 |
| 12:31:44 | 0:05:00 | 23 | 25 | 9 | 17 | 15 | 10 | 19 | 21 | 25 | 25 | 25 | 26 |
| Average | 18 | 20 | 9 | 15 | 11 | 6 | 15 | 18 | 20 | 18 | 17 | 18 |
| Year 4 | 10:36:27 | 0:09:23 | 13 | 10 | 10 | 13 | 8 | 4 | 10 | 14 | 13 | 12 | 10 | 15 |
| 12:40:11 | 0:05:00 | 21 | 25 | 10 | 15 | 17 | 12 | 18 | 20 | 24 | 27 | 28 | 30 |
| Average | 17 | 17 | 10 | 14 | 12 | 8 | 14 | 17 | 19 | 19 | 19 | 22 |

Appendix : Comparison of predicted Demolition and Site Clearance Noise Levels with existing noise at school

D.1.1. The tables below provide detailed information from the modelling to show the change in noise levels as a result of the demolition and site clearance works when compared to the existing noise levels inside the classrooms either with or without children in the playground.

D.1.2. The LIGHT GREY CELLS highlight where there is an increase in noise level of UP TO 3 DB for a predicted internal noise level during demolition (with no children in the playground) compared to the existing internal levels with children using the playground.

D.1.3. The DARK GREY CELLS indicate an increase in noise level of OVER 3 DB for a predicted internal noise level during demolition (with no children in the playground) compare to the existing internal levels with children using the playground.

Table D.1: Predicted Unmitigated Demolition and Site Preparation Noise Levels

| Classroom | LZeq,T (Hz, dB) |
| --- | --- |
| LAeq  (dB) | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| Increase in existing internal noise levels with children in playground due to demolition noise level |
| Demolition on upper floors |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| Demolition on 1st floor |
| 1 | 2 | 0 | 0 | 1 | 1 | 1 | 3 | 8 | 13 |
| 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 | 5 | 11 |
| 3 | 5 | 0 | 1 | 4 | 3 | 4 | 5 | 12 | 15 |
| 4 | 6 | 0 | 1 | 3 | 3 | 4 | 6 | 11 | 11 |
| Demolition on ground floor |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3 | 2 | 0 | 0 | 2 | 1 | 1 | 1 | 5 | 7 |
| 4 | 4 | 0 | 0 | 1 | 2 | 3 | 4 | 7 | 8 |
| Site preparation |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Increase in existing internal noise levels without children in playground due to demolition noise level |
| Demolition on upper floors |
| 1 | 2 | 2 | 4 | 3 | 2 | 2 | 2 | 3 | 4 |
| 2 | 2 | 2 | 4 | 3 | 2 | 2 | 2 | 3 | 4 |
| 3 | 4 | 3 | 6 | 5 | 4 | 3 | 3 | 5 | 6 |
| 4 | 4 | 3 | 7 | 5 | 4 | 4 | 4 | 7 | 7 |
| Demolition on 1st floor |
| 1 | 16 | 5 | 10 | 9 | 10 | 14 | 15 | 21 | 24 |
| 2 | 16 | 5 | 10 | 9 | 10 | 14 | 15 | 21 | 24 |
| 3 | 16 | 6 | 13 | 13 | 13 | 15 | 16 | 21 | 24 |
| 4 | 13 | 5 | 11 | 10 | 10 | 12 | 12 | 18 | 20 |
| Demolition on ground floor |
| 1 | 4 | 4 | 8 | 5 | 4 | 4 | 3 | 5 | 6 |
| 2 | 4 | 4 | 8 | 5 | 4 | 4 | 3 | 5 | 6 |
| 3 | 9 | 5 | 9 | 7 | 7 | 9 | 9 | 13 | 14 |
| 4 | 10 | 3 | 7 | 6 | 7 | 9 | 9 | 14 | 16 |
| Site preparation |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Difference between predicted internal with demolition and no children and existing internal with children in playground |
| Demolition on upper floors |
| 1 | -15 | -24 | -18 | -10 | -14 | -16 | -14 | -11 | -8 |
| 2 | -17 | -27 | -22 | -13 | -13 | -17 | -18 | -15 | -10 |
| 3 | -9 | -22 | -13 | -6 | -9 | -11 | -9 | -4 | -3 |
| 4 | -4 | -20 | -13 | -5 | -5 | -6 | -3 | -1 | -2 |
| Demolition on 1st floor |
| 1 | -1 | -21 | -12 | -4 | -6 | -4 | -1 | 7 | 13 |
| 2 | -4 | -24 | -17 | -7 | -6 | -6 | -4 | 3 | 10 |
| 3 | 4 | -18 | -6 | 3 | 0 | 1 | 4 | 12 | 15 |
| 4 | 5 | -18 | -9 | -1 | 1 | 2 | 5 | 11 | 11 |
| Demolition on ground floor |
| 1 | -13 | -22 | -14 | -7 | -12 | -14 | -13 | -10 | -5 |
| 2 | -15 | -25 | -19 | -11 | -12 | -15 | -17 | -14 | -8 |
| 3 | -3 | -20 | -9 | -3 | -6 | -5 | -4 | 3 | 6 |
| 4 | 2 | -20 | -13 | -5 | -3 | 0 | 2 | 7 | 7 |
| Site preparation |
| 1 | -17 | -26 | -22 | -13 | -16 | -18 | -16 | -14 | -11 |
| 2 | -20 | -34 | -28 | -20 | -16 | -16 | -23 | -25 | -27 |
| 3 | -15 | -25 | -23 | -16 | -17 | -15 | -14 | -13 | -14 |
| 4 | -12 | -25 | -22 | -16 | -14 | -12 | -11 | -10 | -13 |

Table D.2: Predicted Demolition and Site Preparation Noise Levels with Envirowrap

| Classroom | LAeq,T (dB) |
| --- | --- |
| Increase in existing internal noise levels with children in playground due to demolition noise level |
| Demolition on upper floors |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| Demolition on 1st floor |
| 1 | 0 |
| 2 | 0 |
| 3 | 1 |
| 4 | 1 |
| Demolition on ground floor |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| Site preparation |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| Increase in existing internal noise levels without children in playground due to demolition noise level |
| Demolition on upper floors |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 1 |
| Demolition on 1st floor |
| 1 | 6 |
| 2 | 6 |
| 3 | 6 |
| 4 | 4 |
| Demolition on ground floor |
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |
| 4 | 2 |
| Site preparation |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| Difference between predicted internal with demolition and no children and existing internal with children in playground |
| Demolition on upper floors |
| 1 | -17 |
| 2 | -19 |
| 3 | -12 |
| 4 | -8 |
| Demolition on 1st floor |
| 1 | -11 |
| 2 | -13 |
| 3 | -6 |
| 4 | -4 |
| Demolition on ground floor |
| 1 | -16 |
| 2 | -19 |
| 3 | -11 |
| 4 | -6 |
| Site preparation |
| 1 | -17 |
| 2 | -20 |
| 3 | -15 |
| 4 | -12 |

D.1.3. There is no octave band frequency data for the Envirowrap, therefore predictions are based on the overall LAeq,T. It is possible that the LZeq,T will be exceeded in some octave bands, therefore noise monitoring is recommended once demolition begins to establish whether this occurs and remedial action can be taken.

Table D.3: Predicted Demolition and Site Preparation Noise Levels when Demolition Reaches the First Floor with Envirowrap and Temporary Barriers

| Classroom | LAeq,T (dB) |
| --- | --- |
|
|  |
| Increase in existing internal noise levels with children in playground due to demolition noise level  |
| Demolition on 1st floor |
| 1 | 0 |
| 2 | 0 |
| 3 | 1 |
| 4 | 1 |
| Increase in existing internal noise levels without children in playground due to demolition noise level |
| Demolition on 1st floor |
| 1 | 2 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| Difference between predicted internal with demolition and no children and existing internal with children in playground |
| Demolition on 1st floor |
| 1 | -11 |
| 2 | -13 |
| 3 | -6 |
| 4 | -4 |

1. Hassall, JR; Zaveri, K “Acoustic Noise Measurements” Bruel and Kjaer 1988 [↑](#footnote-ref-1)