

A color calibration bar consisting of ten squares arranged in two rows of five. The top row contains three dark squares followed by two light squares. The bottom row contains three dark squares followed by two light squares. The squares are used for color and density calibration in printing.

ST JOSEPH'S
BOGNOR REGIS

Acoustic Assessment
Report

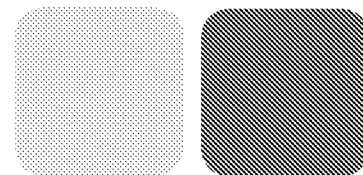
7726/AAR-Rev.4

Prepared: 8 January 2018

Revision Number: 4

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Acoustic Assessment Report



ST JOSEPH'S

BOGNOR REGIS

REPORT 7726/AAR-Rev.4

Prepared: 8 January 2018

Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	5 December 2016	Callum Brewer	Russell Richardson
1	Amendments to Sections 5.0 and 7.0	8 December 2016	Callum Brewer	Russell Richardson
2	Amendments to Noise Mitigation Measures	14 December 2016	Callum Brewer	Russell Richardson
3	Amendments as per teams comments	16 December 2016	Callum Brewer	Russell Richardson
4	Assessment to reflect proposed amendments to layouts	8 January 2018	Callum Brewer	Russell Richardson

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

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RBA ACOUSTICS
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1.0 INTRODUCTION

It is proposed that the existing buildings located at St. Joseph's, Essex House (1-2 Walton Road) and Blackbird Cottage in Bognor Regis are to be refurbished. The existing buildings were previously in use as a care home with ancillary accommodation.

It is understood that the previous 90 bed scheme has now been approved by the Local Authority. It has been requested that an acoustic assessment be carried out to assess the noise impact on neighbouring noise-sensitive properties due to the proposed increase of capacity and minor adjustment of layouts to the original scheme, which also includes the introduction of two communal rooms. This assessment includes noise breakout from residents (staff) as well as noise impact of the proposed shuttle bus service.

The proposed development will provide a total of 102 bed spaces for Butlin's staff and an on-site manager's accommodation, to replace on-site staff accommodation which would be lost as a result of major redevelopment of the current Butlin's site. It is also proposed that a shuttle bus service transferring staff between St. Joseph's and Butlin's will run during the day.

RBA Acoustics has previously undertaken measurements of the prevailing noise conditions at the site as a datum against which the noise impact can be assessed. This report presents the results of the noise measurements, proposed noise criteria and provides the required assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

Monitoring of the prevailing background noise levels was undertaken over the following period:

Wednesday 16 to Thursday 17 November 2016

During the survey periods the weather conditions were generally appropriate for the noise measurement exercise, it being dry with light winds. It was noted that light rain was prevalent in the morning of Thursday 17 November 2016, however it is considered that the measurement data was not significantly compromised because of this.

Measurements were made of the LA_{90} , LA_{max} and LA_{eq} noise levels over sample periods of 15 minutes duration.

2.2 Measurement Locations

Measurement Position 1 - Albert Road

Measurements were undertaken with the microphone positioned 1m outside a first floor window of the St. Joseph's building, overlooking Albert Road. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the west of the site. The prevailing noise climate was noted to be reasonably quiet despite being located within close proximity to road traffic on Albert Road. The results of the measurements at this position were subject to façade-reflections.

Measurement Position 2 - Walton Road

Measurements were undertaken with the microphone positioned 1m outside a first floor window of the St. Joseph's building, overlooking Walton Road. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the north of the site. The prevailing noise climate was noted to be reasonably quiet despite being located within close proximity to road traffic on Walton Road. The results of the measurements at this position were subject to façade-reflections.

Measurement Position 3 - Blackbird Cottage (south)

Measurements were undertaken with the microphone positioned 1m outside a first floor window of Blackbird Cottage. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the south of the site which are located to the rear of the neighbouring properties located on The Esplanade. The prevailing noise climate was noted to be quiet. The results of the measurements at this position were subject to façade-reflections.

Measurement Position 4 - Blackbird Cottage (north)

Measurements were undertaken with the microphone positioned 1m outside a first floor window of Blackbird Cottage. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the east, located to the rear of the neighbouring properties located on Walton Avenue. The prevailing noise climate was noted to be quiet. The results of the measurements at this position were subject to façade-reflections.

The measurement positions are detailed on the attached Site Plan 7726/SP1 and Photographs 7726/P1-P4.

2.3 Instrumentation

The following equipment was used for the measurements.

Table 7726/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406262	471261961	17 March 2017
Norsonic Pre Amplifier	1209	20487		
Norsonic ½" Microphone	1225	225566		
Norsonic Sound Calibrator	1251	34429	CAL 022-2015-5348	20 May 2017
Norsonic Type 1 Sound Level Meter	Nor140	1406258	471264946	17 March 2017
Norsonic Pre Amplifier	1209	20490		
Norsonic ½" Microphone	1225	225526		
Norsonic Sound Calibrator	1251	34397	CAL 022-2015-5252	9 April 2017
Norsonic Type 1 Sound Level Meter	Nor140	1406255	471219046	3 March 2017
Norsonic Pre Amplifier	1209	20491		
Norsonic ½" Microphone	1225	225529		
Norsonic Sound Calibrator	1251	34391	CAL 022-2015-5246	9 April 2017
01dB A&V Type 1 Sound Level Meter	Black Solo 01	60610	02401/2	21 October 2017
01dB A&V Pre Amplifier	PRE 21 S	13676		
Gras ½" Microphone	MCE 212	153683		
01dB-Stell Calibrator	Cal 21	50441/910	02401/1	19 October 2017

The sound level meters were calibrated both prior to and on completion of the survey with no calibration drifts observed.

3.0 RESULTS

The noise levels at the measurement positions are shown as time-histories on the attached Graphs 7726/G1-G8

The typical $LA_{90,15min}$ and the period averaged LA_{eq} measured noise levels are summarised below. The minimum $LA_{90,15min}$ have also been shown. It should be noted that the measured $LA_{eq,period}$ noise levels shown have been façade-corrected with a -3dB correction.

Table 7726/T2 – Façade-Corrected Measured $LA_{eq,period}$ Levels

Measurement Position	Average $LA_{eq,period}$ Noise Level (dB)		
	Daytime (07:00 – 19:00 hours)	Evening (19:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Position 1 – Albert Road*	56	46	44
Position 2 – Walton Road*	49	43	39
Position 3 – Blackbird Cottage (south)*	51	42	41
Position 4 – Blackbird Cottage (north)*	46	37	36

*Measured levels have been façade-reflection corrected

Table 7726/T3 – Measured Typical $LA_{90,15min}$ Levels

Measurement Position	Typical $LA_{90,15min}$ Background Noise Level (dB)		
	Daytime (07:00 – 19:00 hours)	Evening (19:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Position 1 – Albert Road	46	41	40
Position 2 – Walton Road	42	36	35
Position 3 – Blackbird Cottage (south)	44	39	39
Position 4 – Blackbird Cottage (north)	39	33	33

Table 7726/T4 – Measured Minimum $LA_{90,15min}$ Levels

Measurement Position	Minimum $LA_{90,15min}$ Background Noise Level (dB)		
	Daytime (07:00 – 19:00 hours)	Evening (19:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Position 1 – Albert Road	43	40	37
Position 2 – Walton Road	41	36	33
Position 3 – Blackbird Cottage (south)	43	39	35
Position 4 – Blackbird Cottage (north)	38	33	30

4.0 CRITERIA

When assessing the subjective impact of any new proposal it is important to consider the specific circumstances of the site. The characteristics of the various sources must therefore be considered in addition to factors common to all noise impact assessments such as noise from the proposal and the existing noise level comparisons.

4.1 World Health Organisation - Guidelines for Community Noise

The document describes guideline levels that are "essentially values for the onset of health effects from noise exposure".

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure. The following is an extract from the Table 4.1: Guideline values for community noise in specific environments, as stated in the document.

Table 7726/T5 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	L_{Amax} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

We have used the 'sleep disturbance' criteria stated above as the basis of our assessment.

4.2 Guidelines on Noise Impact Assessment (IEMA)

When assessing the subjective impact of any new proposal it is important to consider the specific circumstances of the site. The characteristics of the various sources must therefore be considered in addition to factors common to all noise impact assessments such as noise from the proposal and the existing background noise level comparisons.

In assessing the impact of specific noise sources such as those anticipated at this development it is typical to compare the average noise level (L_{Aeq}) of the noise source with the existing measured L_{Aeq} noise level. The first part of our analysis is therefore based upon this comparison.

The consultation draft of the joint Institute of Acoustics (IOA) and Institute of Environmental Management and Assessment (IEMA) document "Guidelines on Noise Impact Assessment" gives guidance as to how basic noise changes may be categorised. This document recognises that each situation encountered is likely to be different and that there is no single set of subjective assessment criteria that would apply to all situations. The categorisation shown in Table 7726/T6 therefore takes this as its basis, with changes made as appropriate to reflect the site's own circumstances, as defined in the guidelines.

Table 7726/T6 – IEMA Assessment Criteria

Noise Change (dBA)	Critical Health Effect(s)
0	No Impact
0.1 – 1.9	Negligible Impact
2.0 – 3.9	Slight Impact
4.0 – 6.9	Significant Impact
7.0 – 9.9	Substantial Impact
10.0 and above	Severe Impact

In addition to the comparison of L_{Aeq} noise levels before and after the proposed development, it is important to understand the potential subjective effect of such changes in the noise level. Table 7726/T7 compares the subjective response of typical subjects to variations in sound pressure level.

Table 7726/T7 – IEMA Subjective Response

Changes in Sound Level (dB)	Change in Power		Change in Apparent Loudness
	Decrease	Increase	
3	1/2	2	Just Perceptible
5	1/3	3	Clearly Noticeable
10	1/10	10	Half or Twice as Loud
20	1/100	100	Much Quieter or Louder

4.3 Proposed Noise Criteria

We understand that no specific noise limits or criteria have been set by Arun District Council's Environmental Health department. However it has been requested that all potential sources of noise disturbance be considered and that a noise management plan be produced in order to prevent potential noise disturbance to the neighbouring residential properties. Factors which have been taken into account include the following:

- Associated noise produced by the proposed shuttle bus service which will be transferring staff to and from the residence to the Butlin's resort throughout the daytime periods
- Speech breakout noise from kitchens, bedrooms and communal rooms
- Speech from the rear outdoor smoking area

Taking into account the above we have therefore based the assessment criteria on the following:

Predicted $L_{Aeq,period}$ noise levels from speech should generally not exceed the existing typical background $L_{A90,15min}$ levels specified in Table 7726/T3. The predicted shuttlebus movement noise should generally not exceed the existing period averaged $L_{Aeq,period}$ levels specified in Table 7726/T2 by more than 3dB in order to prevent significant noise impact.

5.0 NOISE IMPACT ASSESSMENT

5.1 Location of Nearest Residential Windows

The following noise-sensitive receptors have been used for the assessment, these receptors being considered the potentially worst-affected noise-sensitive properties.

Speech Breakout from Windows

- Romley, Albert Road (west façade) – Approximately 20m from St Joseph's
- Allestree Court, Walton Road (north façade) – Approximately 18m from Essex House
- Walton House, Walton Avenue (east façade) – Approximately 11m from Blackbird Cottage
- Pearlfishers, Walton Avenue (east façade) – Approximately 18m from Blackbird Cottage
- Esplanade Grande (south façade) – Approximately 18m from Blackbird Cottage
- Las Arenas, Albert Road (south façade) – Approximately 2m from St Joseph's

Speech from Outdoor Smoking Area

- Las Arenas, Albert Road (eastern site boundary) – Approximately 11m from rear smoking area
- Pearlfishers, Walton Avenue (western site boundary) – Approximately 24m from rear smoking area
- Esplanade Grande (southern site boundary) – Approximately 40m from rear smoking area

The assessment locations and smoking area shown on the attached Site Plan 7726/SP1.

5.3 Amendments to Kitchen and Bedroom Layouts

We have reviewed the proposed amendments to the original scheme which are detailed in email correspondence from Randell Design on 22 November 2017, and we can confirm that the reconfigurations to the Kitchen and Bedroom layouts will result in no or negligible noise impact compared to the original scheme.

5.4 Shuttle Bus Movement Assumptions

We understand the shuttle bus serving St Joseph's would include pick-ups/drop-offs at another Butlin's staff residential facility, Ashley House, for which RBA Acoustics undertook a similar noise impact assessment (RBA Acoustics Acoustic Assessment Report 7252/AAR refers). Our assessment has, therefore, taken the same timetable and vehicle details (hybrid powered or electric) as was proposed for Ashley House as its basis.

Our analyses of the shuttle bus noise impact are based on information from our internal database detailed in the attached Appendix B. An online roster system will be utilised to coordinate pick-up and drop-off times to ensure that no unnecessary journeys are made. Notwithstanding this, it is expected that use of the shuttle bus service from St Joseph's residents will be less than from Ashley House due to the St Joseph's residence being located within a five minute walk away from Butlin's.

The following assumptions have been used in the shuttle bus noise prediction. It should be noted that due to the unavailability of noise data for a hybrid powered bus, noise levels for a diesel light goods vehicle have been used in this assessment, therefore actual levels are expected to be lower than those stated in our predictions.

- *Two passbys (vehicle arriving and leaving)*
- *Passenger door opening for passengers to board and then shut.*
- *A single manoeuvre within the front driveway*
- *The vehicle will run every half hour on average*
- *The service will run between 07:00-10:00 and 16:00-23:30 hours*

Our calculation method for predicting noise levels from the shuttle bus at the nearest residential windows is summarised below:

- Source term LAE / $L_{Amax,t}$ for a non-hybrid light goods vehicle
- Duration of pick up or drop off event
- Line-of-sight acoustic screening [5dB]
- 20LogR distance attenuation

5.5 Assumptions for Speech Noise Breakout (from Kitchens, Bedrooms and the Communal Areas)

The following assumptions have been used in the resident noise breakout prediction from kitchens, bedrooms and communal areas:

Bedrooms and Kitchens

- *Up to 4 residents conversing at normal speech level in a kitchen or bedroom with one window open.*

The 'worst case', i.e. closest, windows have been assessed in each case.

Communal Rooms S3.01 and RM E2.08

- *Up to 25 residents conversing at raised speech level in S3.01*
- *Up to 10 residents conversing at raised speech level in E2.08*

The 'worst case', i.e. closest, windows have been assessed in each case.

Our calculation method for predicting levels of potential breakout noise at the nearest residential windows is summarised below:

- Source term L_w
- Reverberant sound power to reverberant sound pressure level (assuming absorption typically expected in each room type)
- SRI of opened window
- Area of window loss
- Reverberant to free-field correction
- Acoustic screening
- 20logR distance attenuation

5.6 Assumptions for Speech Noise from Outdoor Smoking Area

The following assumptions have been used in the resident noise prediction from the rear outdoor smoking area:

- Up to 2 residents conversing at normal speech level. The 'worst case', i.e. closest, windows have been assessed
- Acoustic screening loss caused by solid walls located on the south and west sides of smoking shelter (50% of total wall area). See Site Plan 7726/SP3 for details
- Smoking shelter is to have a solid roof

5.7 Predicted Levels of Speech Noise Breakout

Table 7726/T8 details the predicted levels of speech breakout from bedrooms, kitchens and the smoking area at the nearest noise-sensitive windows.

Table 7726/T8 – Predicted Speech Levels at Nearest Receiver Windows

Receiver	Predicted Noise Levels At Nearest Receiver Window <i>L_{Aeq,period}</i> (dB)		Existing Typical Night-time <i>L_{A90,15mins}</i> Background Noise Level (dB)
	Speech Breakout Noise	Speech Noise from Smoking Shelter	
Romley (west façade)	25	<i>Negligible</i>	40
Allestree Court (north façade)	23	<i>Negligible</i>	35
Walton House (east façade)	31	<30	39
Pearlfishers (east façade)	24	<30	33
Esplanade Grande (south façade)	23	<30	39
Las Arenas (south façade)	41	40	39

A worst-case assessment shows that the speech *L_{Aeq,period}* exceeds the existing typical night-time *L_{A90,15mins}* by up to 2dB at the south façade (Las Arenas). It should be noted that the above levels are calculated prior to the noise mitigation measures detailed in Section 7.0 being employed.

Table 7726/T9 details the predicted levels of speech breakout from the proposed communal areas.

Table 7726/T9 – Predicted Speech Levels at Nearest Receiver Windows

Receiver	Predicted Noise Levels At Nearest Receiver Window $L_{Aeq,period}$ (dB)		Existing Typical Night-time $L_{Aeq,10min}$ Background Noise Level (dB)
	Speech Breakout from Communal Area S3.01	Speech Breakout from Communal Area E2.08	
Romley (west façade)	36	<i>Negligible</i>	40
Allestree Court or Wellesley Court (north façade)	34	35	35
Walton House (east façade)	<30	39	39
Pearlfishers (east façade)	<30	<33	33
Esplanade Grande (south façade)	<30	<30	39
Las Arenas (south façade)	38	<33	39

A worst-case assessment shows that the speech $L_{Aeq,period}$ should not exceed the existing typical night-time $L_{A90,15mins}$.

5.8 Predicted Levels of Shuttle Bus Movement Noise

Table 7726/T10 details the predicted noise levels produced by shuttle bus movements at the nearest noise-sensitive windows (Las Arenas).

Table 7726/T10 – Predicted Shuttle Bus Movement Noise at Nearest Receiver Windows

Receiver	Predicted $L_{Aeq,1hour}$ Sound Pressure Levels At Nearest Receiver Window $L_{Aeq,period}$ (dB)	Existing Average Night-time $L_{Aeq,period}$ Noise Level (dB)
Las Arenas (south façade)	52	44
Romley (west façade)	37	44

A worst-case assessment shows that the existing night-time $L_{Aeq,1hour}$ will increase by up to 7-8dB between 21:00-23:30 hours and to increase by 6dB for the remainder of the day, with the proposed minibus schedule. However these levels are expected to be lower in reality due to the quieter noise levels produced by the proposed hybrid/electric vehicle.

It should be noted that the above levels are calculated prior to the noise mitigation measures detailed in Section 7.0 being employed.

6.0 INTERNAL SOUND INSULATION

6.1 Separating Wall between Ground Floor and First Floor of Essex House to 3 Walton Road

Randell Design Group have advised that the existing party wall between Essex House and Walton House is a masonry construction. Further details, e.g. solid or cavity construction, are not currently available, although a site inspection indicates the party wall is a minimum of 300mm thick. On this basis it is highly likely the minimum requirements of the current Building Regulations (45 dB and 43 dB $D_{nT,w} + C_w$ for new-build and conversions, respectively) would be achieved with some comfort.

We therefore suggest this should be considered acceptable for residential use, as proposed.

6.2 Separating Floor between Third Floor of Essex House to First Floor of 3 Walton Road

Randell Design Group have advised that the party floor separating the Managers Flat E2.10 (belonging to Essex House/St. Josephs) and First Floor flat below (formally 3 Walton Road), has the same construction as a floor elsewhere in the building which has been tested (by others) for its airborne and impact sound insulation. The tests show that the build-up meets the minimum performance requirements to satisfy building control and Approved Document E. We have also been informed that the floor finish of the Managers Flat E2.10 is to be carpeted.

With the above in mind, providing the construction of this party floor is the same as the floor which has been previously tested, we would suggest this should be considered acceptable for residential use, as proposed.

7.0 NOISE MITIGATION MEASURES

As a result of the noise impact assessment, RBA Acoustics has produced the following conclusions which should be incorporated into the noise management plan. This includes additional suggestions received from other members of the team:

- *Use of the rear garden / smoking shelter will be restricted to 2 people at a time between 22:00 to 07:00 hours and St Joseph residents are encouraged to keep conversation to a minimum during these times. This is in order to prevent potential noise disturbance to residents to the rear of Las Arenas, located approximately 11m away from the smoking area. Signage will be used to instruct this and will be overseen by site management.*
- *The windows, including rooflights, belonging to the 4No. rooms located on the south facing elevation of St. Joseph's, which overlook Las Arenas (see Site Plan 7726/SP5), are required to be sealed shut. This is in order to prevent potential disturbance from noise breakout to Las Arenas.*
- *The use of the entrance located on Walton Avenue should be restricted between 19:00 – 07:00 hours. This is in order to prevent potential noise disturbance to Pearlfishers and Walton House as both of their First and Ground Floor windows overlook the entrance. During the restricted hours, residents are advised to use the remaining entrances located on Walton Road and Albert Road.*
- *The use of the conservatory located in the rear garden area should be restricted between 19:00 – 08:00 hours. This is in order to prevent potential noise disturbance to the rear of Las Arenas and Esplanade Grande.*
- *The shuttle bus will operate between the hours of 07:00-10:00 and 18:00-23:30. In order to reduce noise disturbance caused by shuttle bus movement, a low noise (hybrid or electric powered) vehicle will be used. Drivers will be instructed to switch off the engine during pick-up and drop-off. St. Joseph's residents are required to wait indoors and not to wait outside for the shuttle bus between 19:00-07:00 hours. Signage will be used to instruct this. No more than three visits per hour to St. Joseph's are to be made. An online booking system will be in place to ensure no unnecessary trips between the two sites; shuttle bus trips will be monitored and adjusted as required.*
- *An acoustic barrier approximately 2m high, and 5m in length, will be installed to the southern boundary of the driveway in order to provide acoustic screening to Las Arenas, the location of this is detailed in Site Plan 7726/SP4. The barrier shall be formed of a solid material with a minimum surface density of 10kg/m². Typical examples of suitable materials include 18mm marine plywood or 10mm cement particle board.*
- *Both communal rooms S3.01 and E2.08 can be used 24 hours a day / 7 days a week providing they are well managed and have a noise management plan in place. Loud electronically amplified music should not be allowed in these spaces and signage should be displayed requesting residents not to shout and to keep raised speech minimal, particularly if the rooms are at high capacity.*

Tables 7726/T11 and T12 show the calculated levels providing the above noise mitigation measures are employed.

Table 7726/T11 – Predicted Speech Levels at Nearest Receiver Windows

Receiver	Predicted Noise Levels At Nearest Receiver Window $L_{Aeq,period}$ (dB)		Existing Typical Night-time $L_{Aeq,1hr,night}$ Background Noise Level (dB)
	Speech Breakout Noise	Speech Noise from Smoking Shelter	
Las Arenas (south façade)	<i>Negligible</i>	35	39

This assessment shows that the speech $L_{Aeq,period}$ would not exceed the existing typical night-time $L_{A90,15mins}$.

Table 7726/T12 – Predicted Shuttle Bus Movement Noise at Nearest Receiver Windows

Receiver	Predicted $L_{Aeq,1hour}$ Sound Pressure Levels At Nearest Receiver Window $L_{Aeq,period}$ (dB)	Existing Average Night-time $L_{Aeq,period}$ Noise Level (dB)
Las Arenas (south façade)	46	44

A worst-case assessment shows that the existing night-time $L_{Aeq,1hour}$ will increase by up to 4-5dB between 21:00-23:30 hours and to increase by 3dB for the remainder of the day, with the proposed minibus schedule. However these levels are expected to be lower in reality due to the quieter noise levels produced by the proposed hybrid/electric vehicle.

We have been informed by the transport consultant, Systra, that there will not be a requirement to increase the number/frequency of shuttle bus trips due the increase of capacity of the amended scheme. As such there should be no additional noise impact to the original proposals, with regards to vehicular movements.

8.0 CONCLUSIONS

Measurements of the existing background noise levels at St Joseph's, Bognor Regis have been undertaken. The results of the measurements have been used in order to determine the required criteria for noise impact caused by St Joseph's resident noise breakout as well as the movements of the proposed shuttle bus.

An analysis has been undertaken to calculate the likely noise impact from the proposed development to nearby noise-sensitive receptors situated around the development site using a number of worst-case assumptions and scenarios.

The results of the assessment indicate that the potential noise impact of the redevelopment of St Joseph's will be minimal and should not adversely affect nearby residents providing the mitigation measures stated in the proposed noise management plan are employed.

As such we suggest the planning application should not be refused on the basis of adverse noise impact.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10} , L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Noise Data Used In the Assessment.

Table 7726/T13 – Noise Data Used for Shuttle Bus Assessment

Noise Source	$L_{Aeq,10min}$ (dBI)	SEL (dBI)	L_{max} (dBI)	Distance (m)	Event Time (secs)
Car Door Slamming at 3m	64	64	72	3	1
Non-hybrid Light Goods Vehicle Passby	75	79	88	3	25
Non-hybrid LGV Manoeuvre	-	89	88	3	1

Table 7726/T14 – Noise Data Used for Speech Noise Breakout Assessment

Noise Source	Sound Power Level (dBI) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Normal Voice	45	55	65	69	63	56	50	45
Raised Voice	48	59	70	75	72	64	57	48
Loud Voice	52	63	72	80	80	73	66	55
Shouted Voice	52	63	73	84	89	82	75	64

Appendix C – CDM Considerations

The following hazard pertinent to our methods of noise mitigation have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	P		L	S	R
Acoustic Screen / Smoking Shelter	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower / lifting gear	1	4	4

L: Likelihood

S: Severity

R: Rating

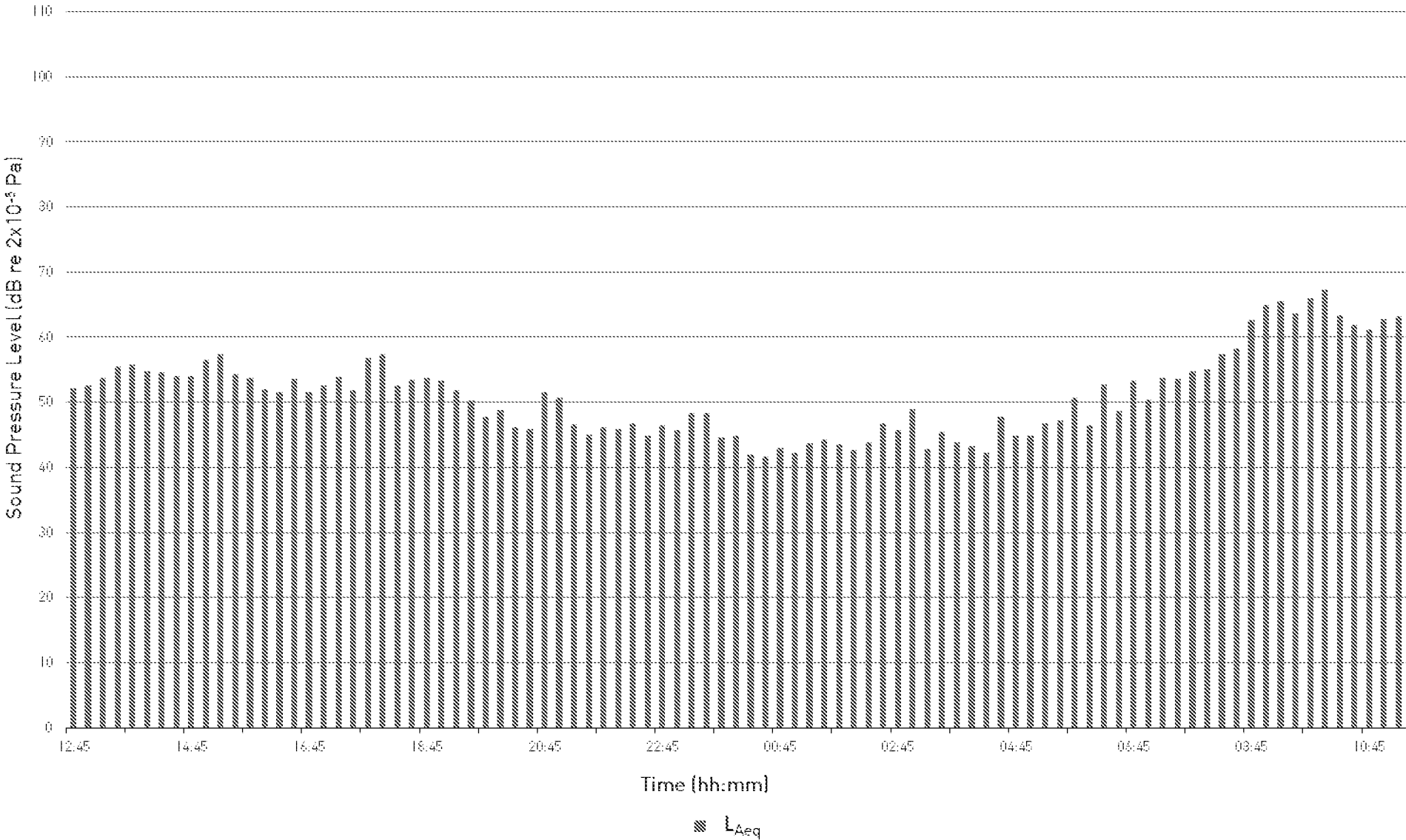
St Joseph's, Bognor Regis

L_{Aeq} Time History

Measurement Position 1, Wednesday 16th November to Thursday 17th November 2016



Graph 7726/01

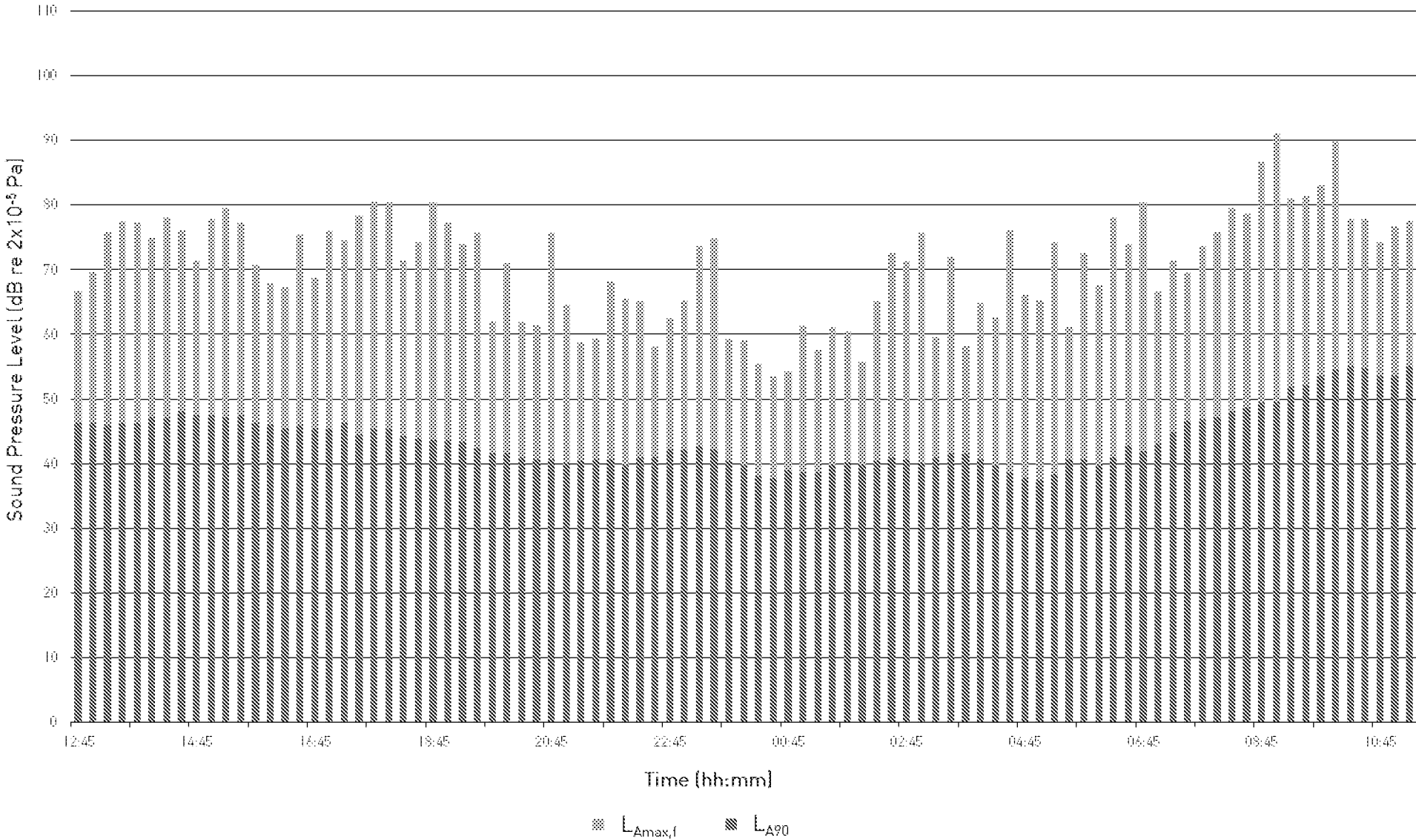


St Joseph's, Bognor Regis
 $L_{Amax,f}$ and L_{A90} Time History



Measurement Position 1, Wednesday 16th November to Thursday 17th November 2016

Graph 7726/G2



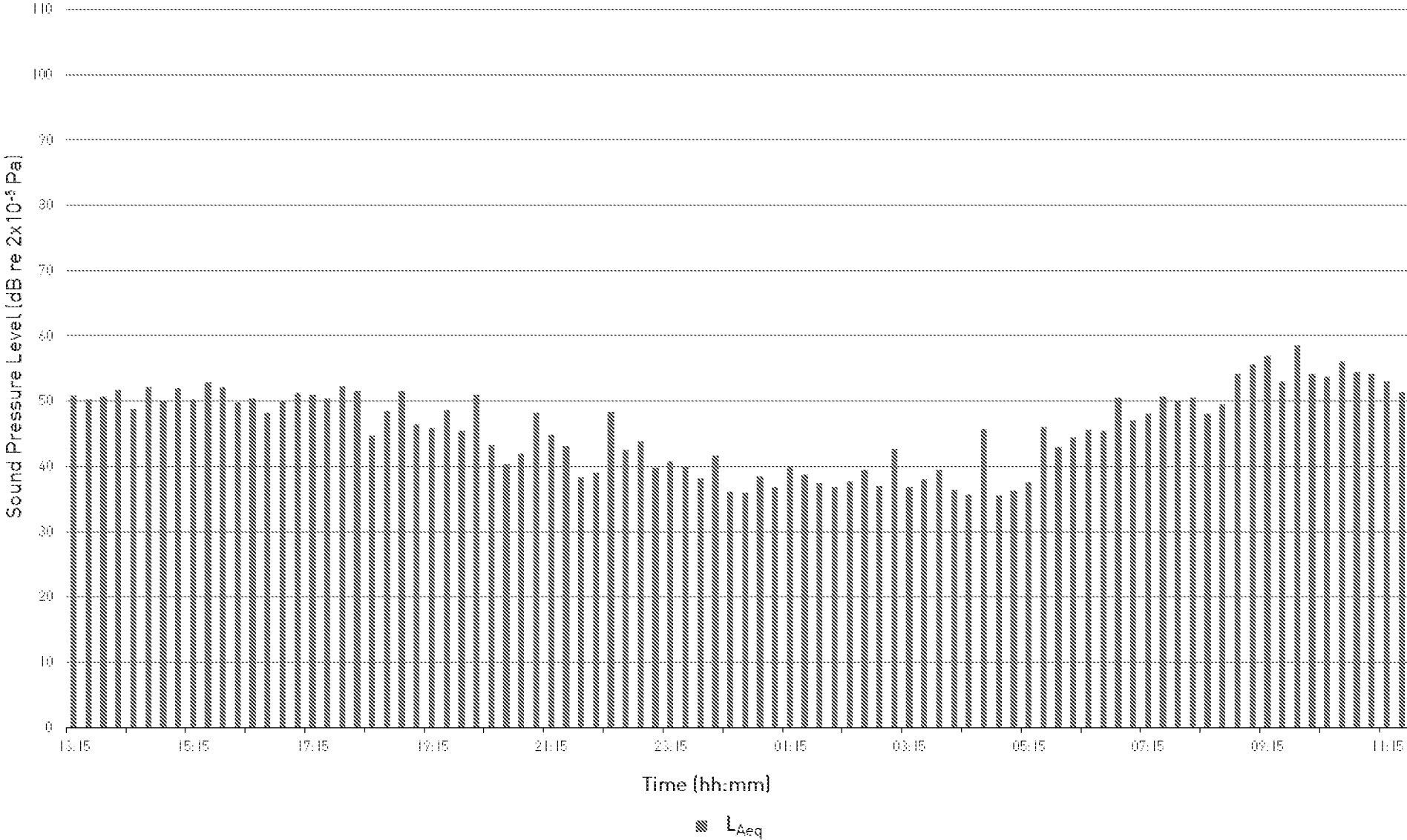
St Joseph's, Bognor Regis

L_{Aeq} Time History

Measurement Position 2, Wednesday 16th November to Thursday 17th November 2016



Graph 7726/03

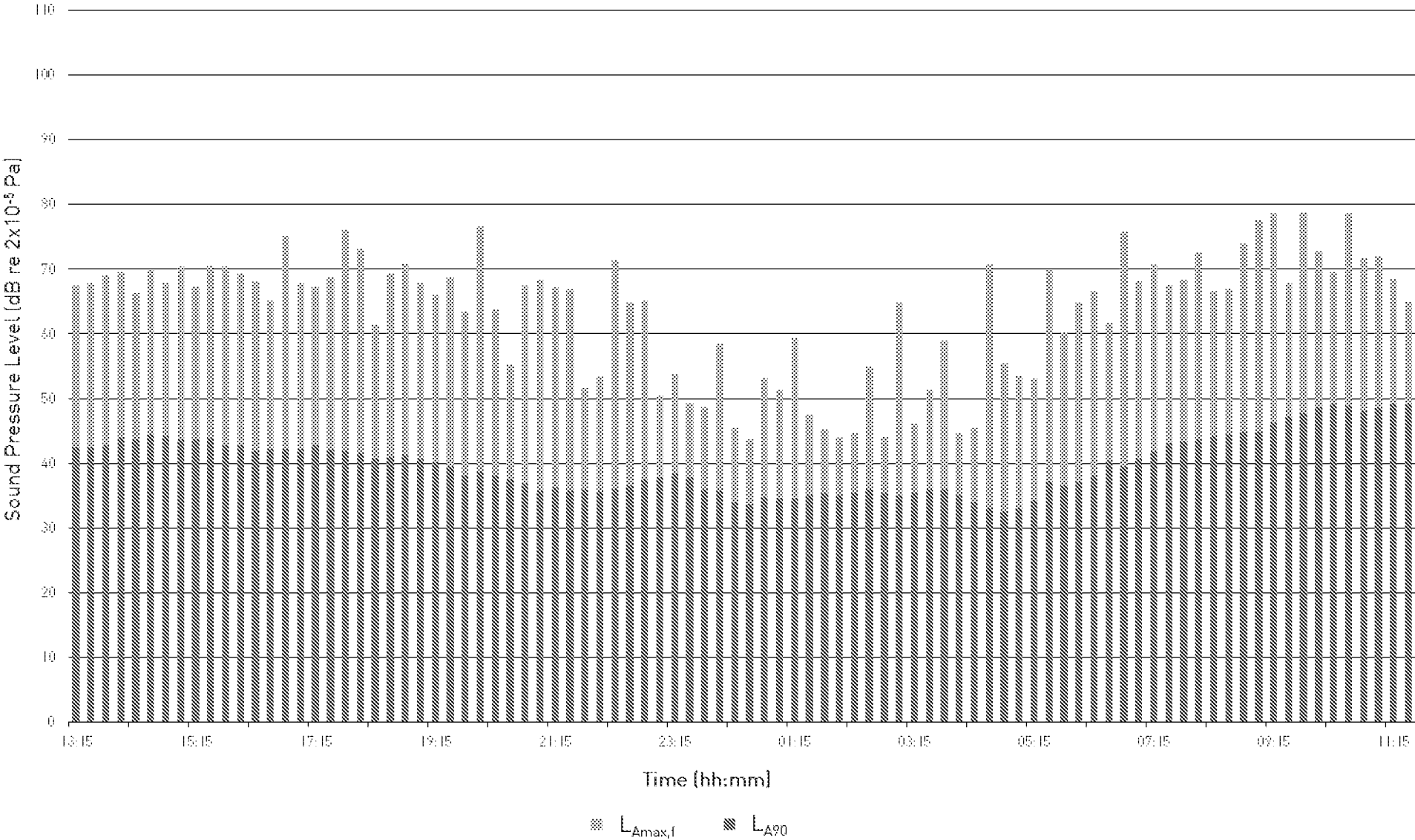


St Joseph's, Bognor Regis
 $L_{Amax,f}$ and L_{A90} Time History



Measurement Position 2, Wednesday 16th November to Thursday 17th November 2016

Graph 7726/G4



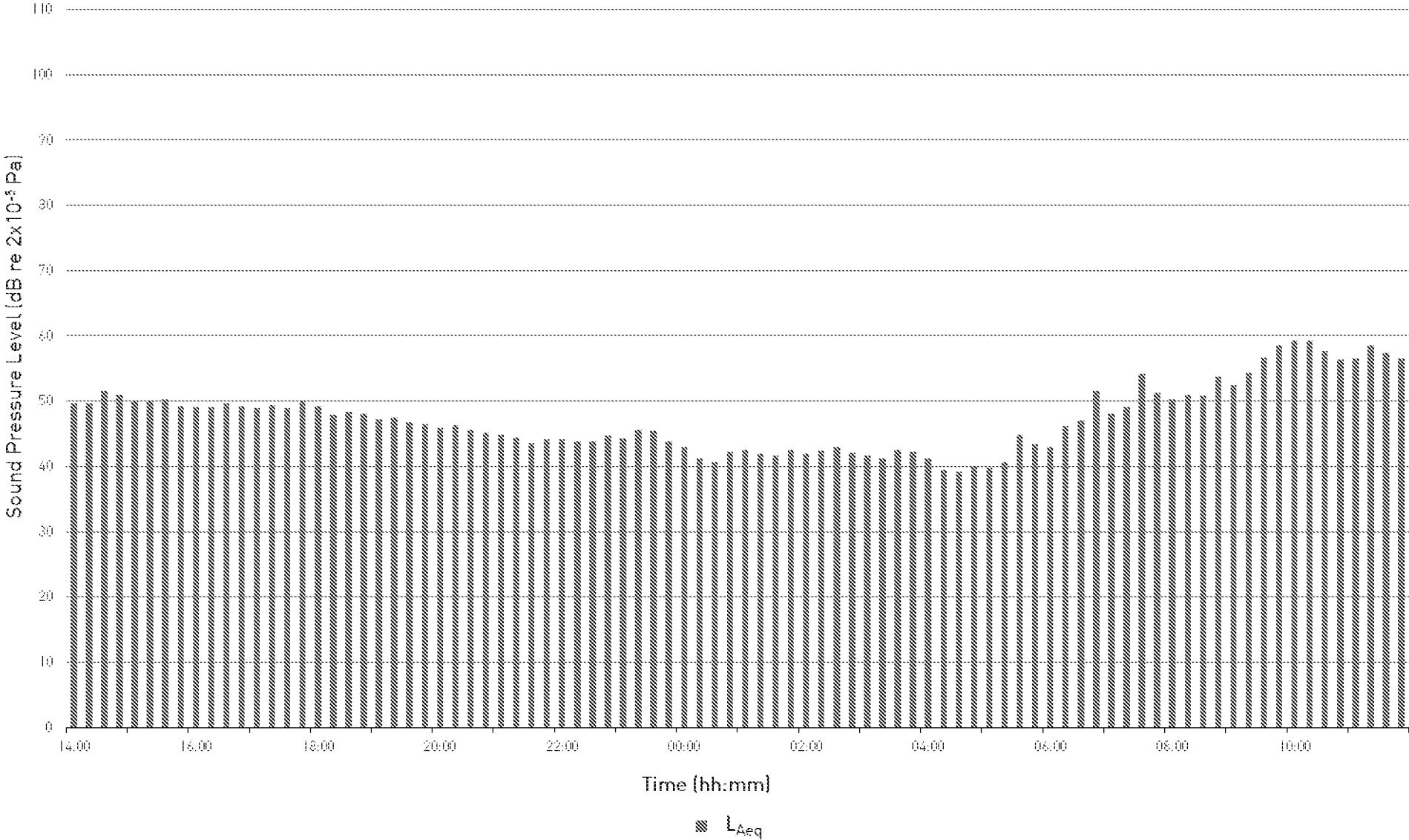
St Joseph's, Bognor Regis

L_{Aeq} Time History

Measurement Position 3, Wednesday 16th November to Thursday 17th November 2016



Graph 7726/05

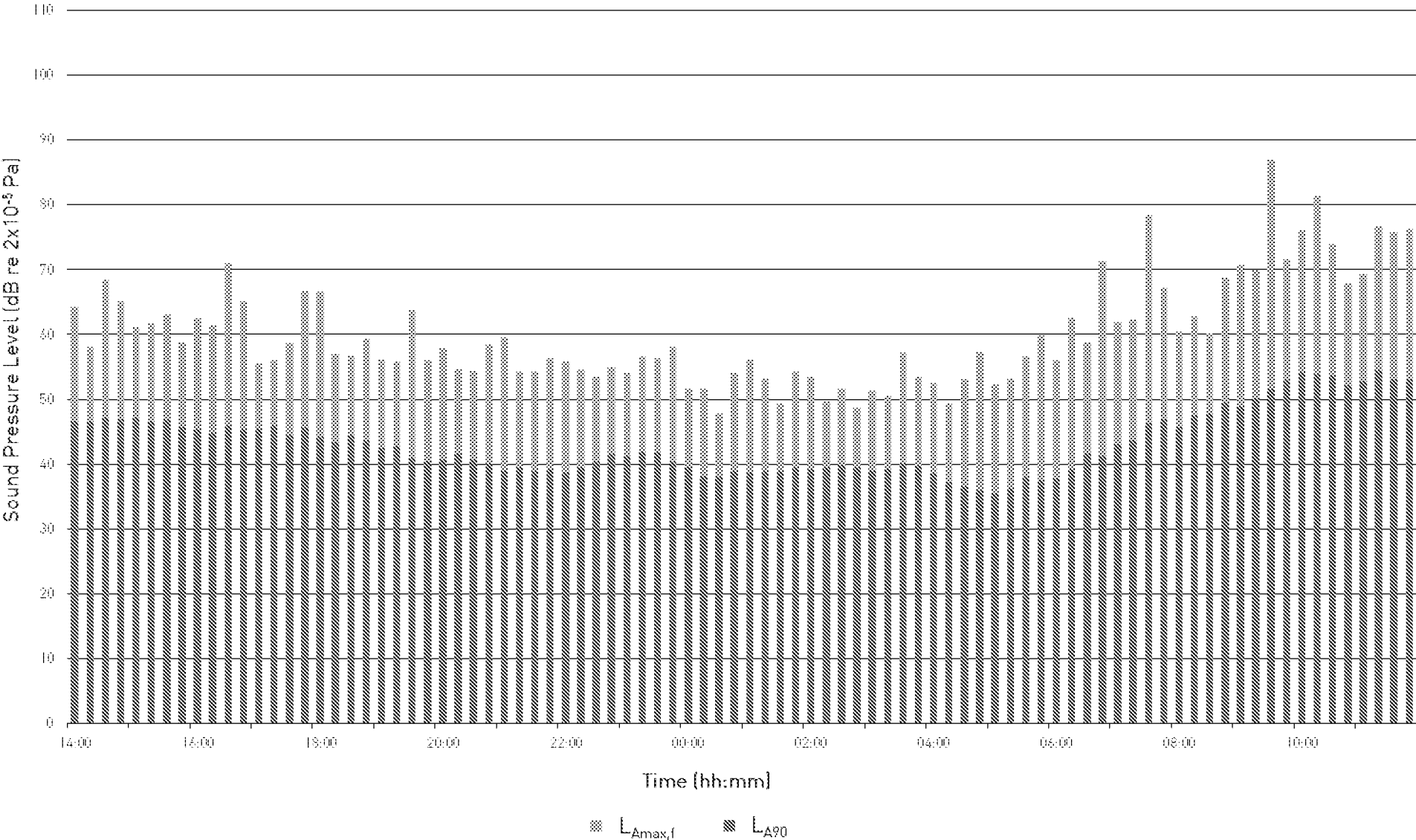


St Joseph's, Bognor Regis
 $L_{Amax,f}$ and L_{A90} Time History



Measurement Position 3, Wednesday 16th November to Thursday 17th November 2016

Graph 7726/06



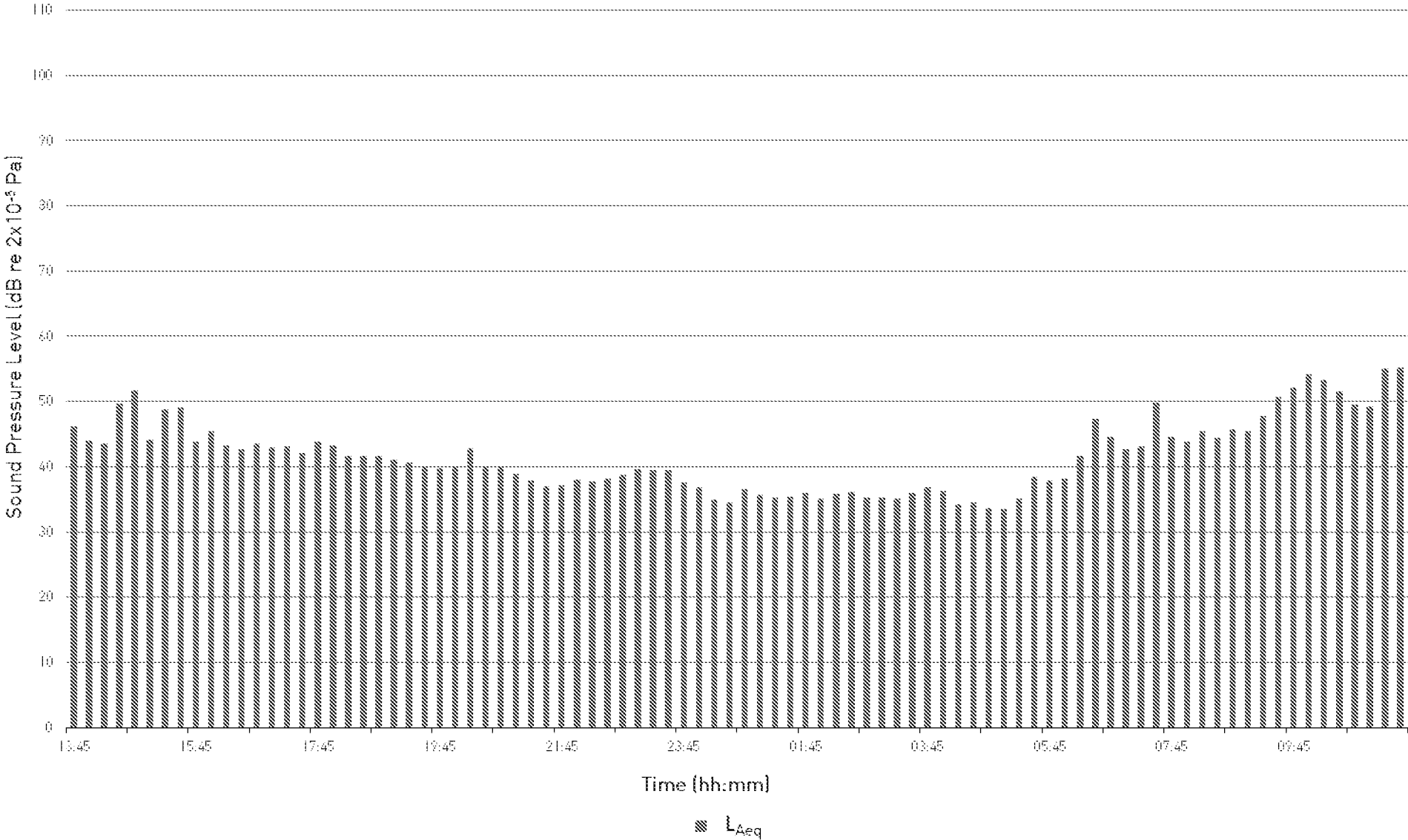
St Joseph's, Bognor Regis

L_{Aeq} Time History

Measurement Position 4, Wednesday 16th November to Thursday 17th November 2016



Graph 7726/07

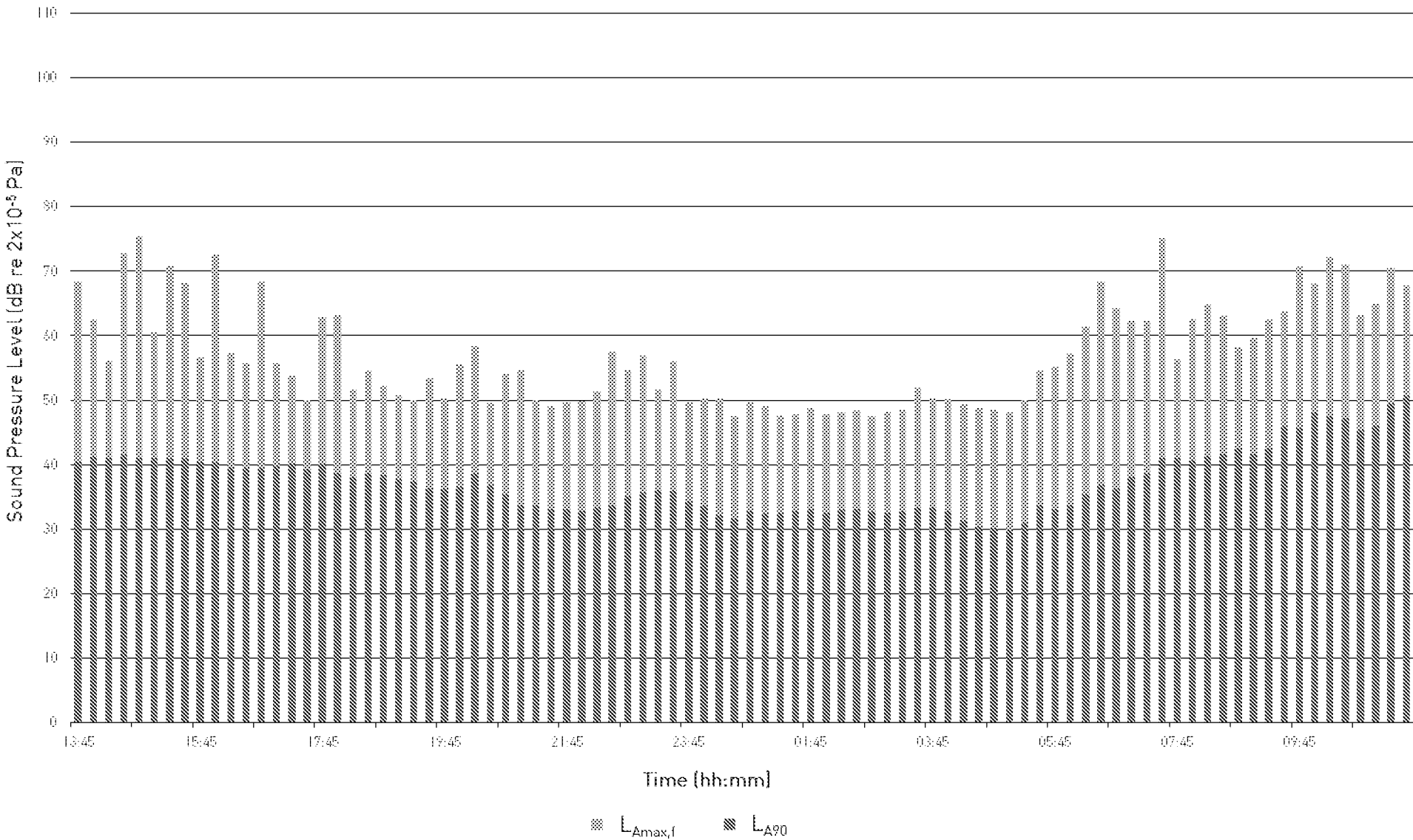


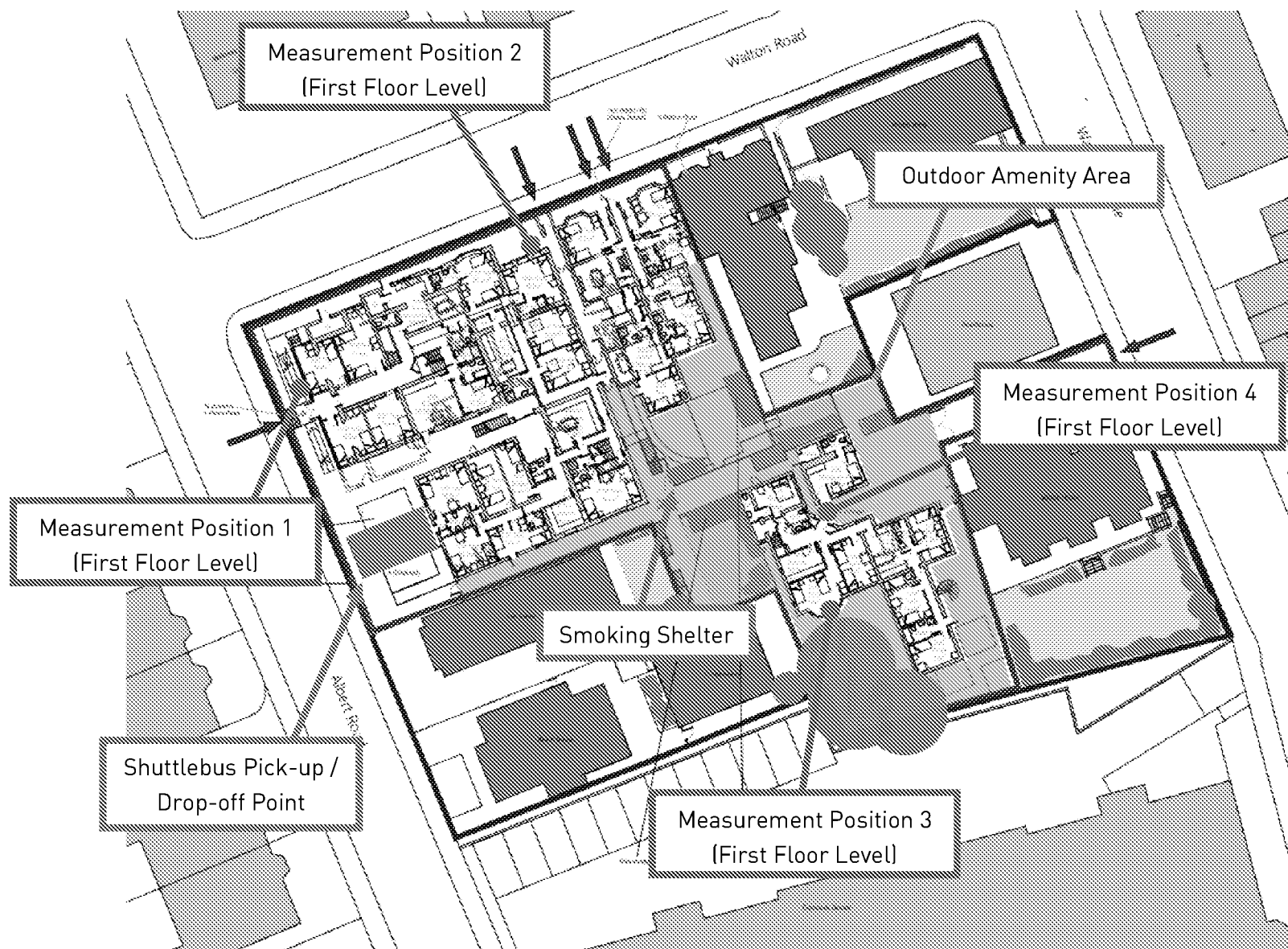
St Joseph's, Bognor Regis
 $L_{Amax,f}$ and L_{A90} Time History



Measurement Position 4, Wednesday 16th November to Thursday 17th November 2016

Graph 7726/08





St Joseph's, Bognor Regis

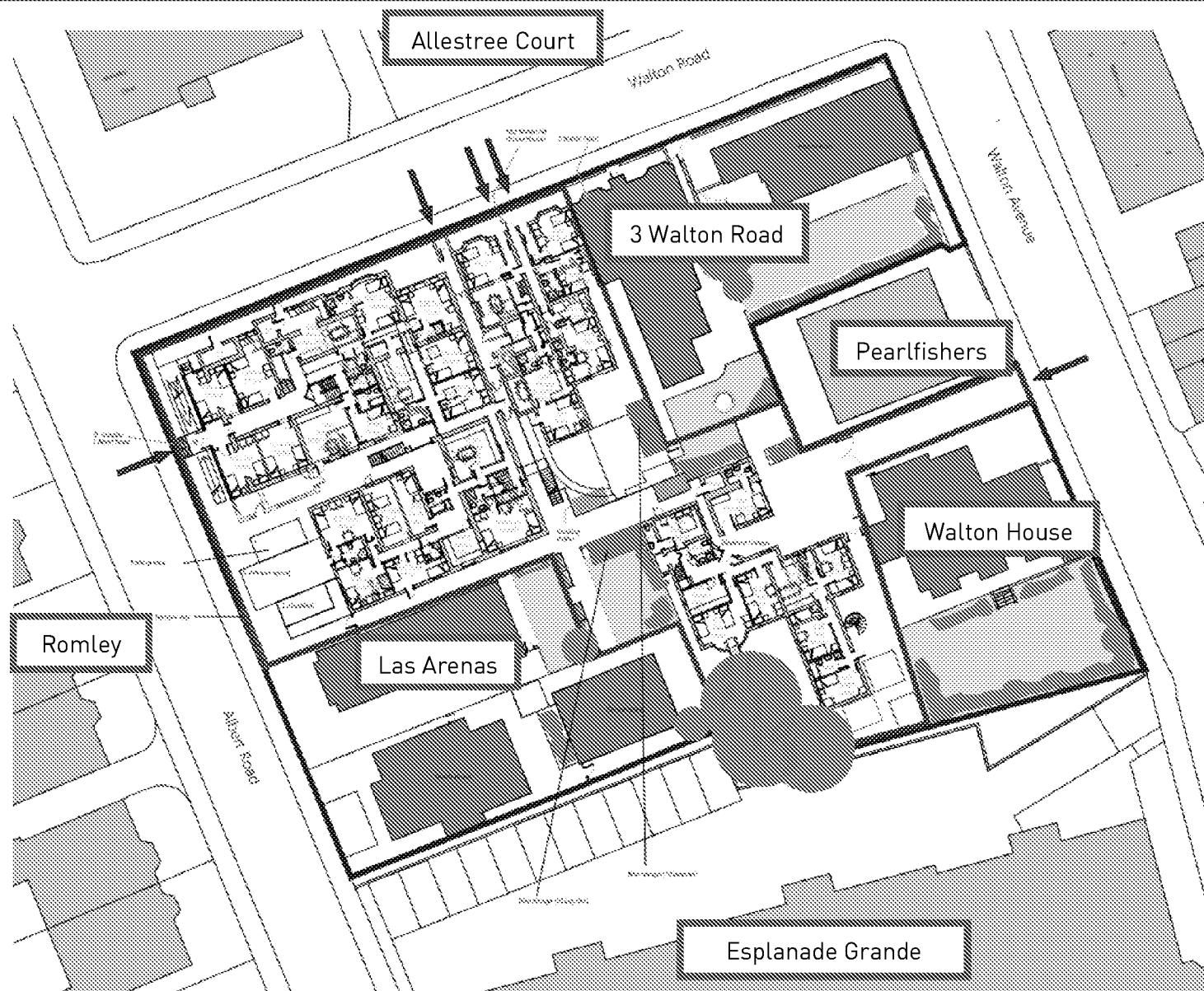
Site Plan Showing Locations of Measurement

Positions 1-4

Site Plan 7726/SP1

8 January 2018

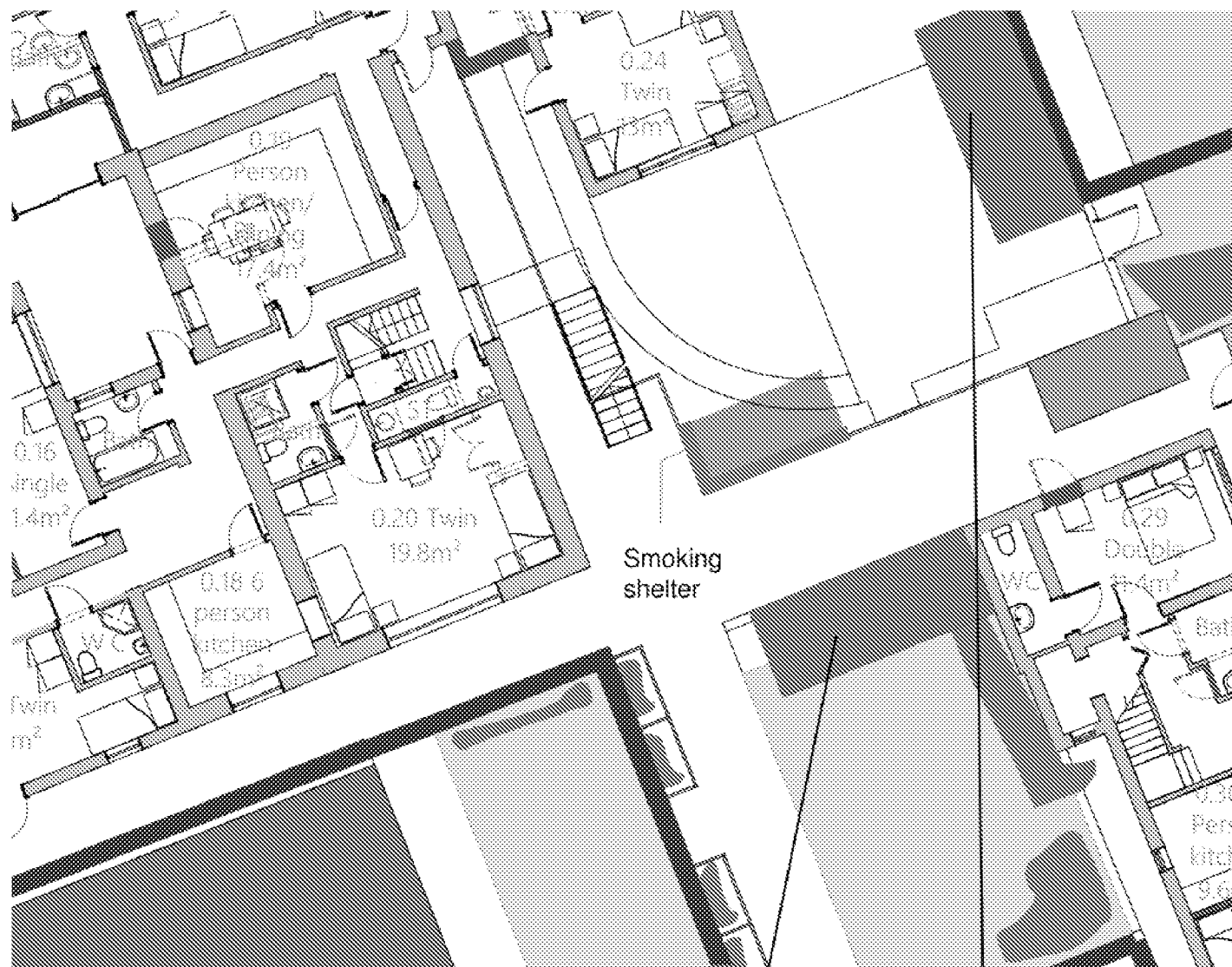
Not to scale



St Joseph's, Bognor Regis
Site Plan Showing Nearest Receptors

Site Plan 7726/SP2
8 January 2018
Not to scale





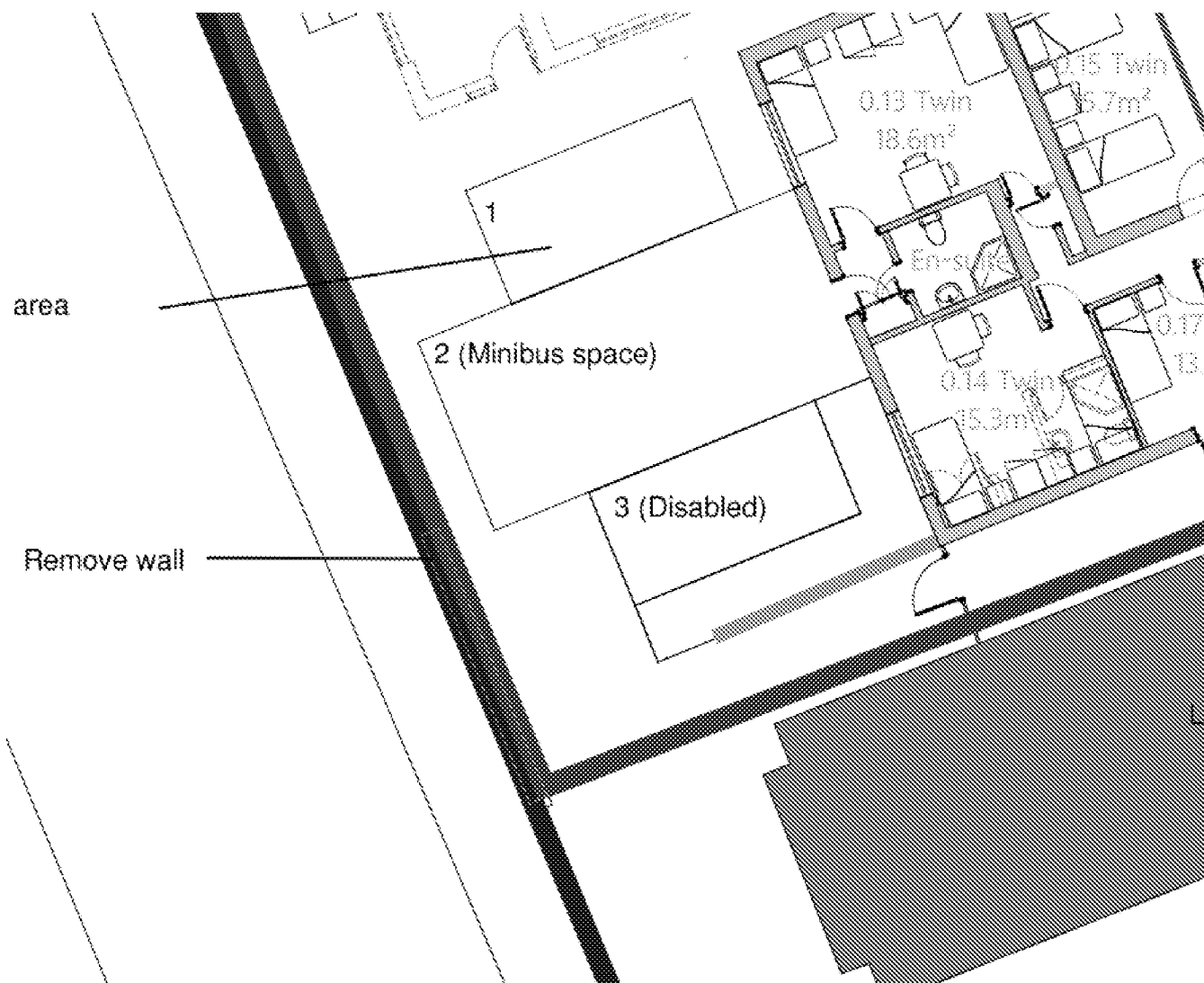
St Joseph's, Bognor Regis

Site Plan Showing Solid Wall Locations of Smoking
Shelter

Site Plan 7726/SP3

8 January 2018

Not to scale



Key	
Acoustic Barrier	
Location	

St Joseph's, Bognor Regis

Site Plan Showing Location of Acoustic Barrier for
Shuttle Bus

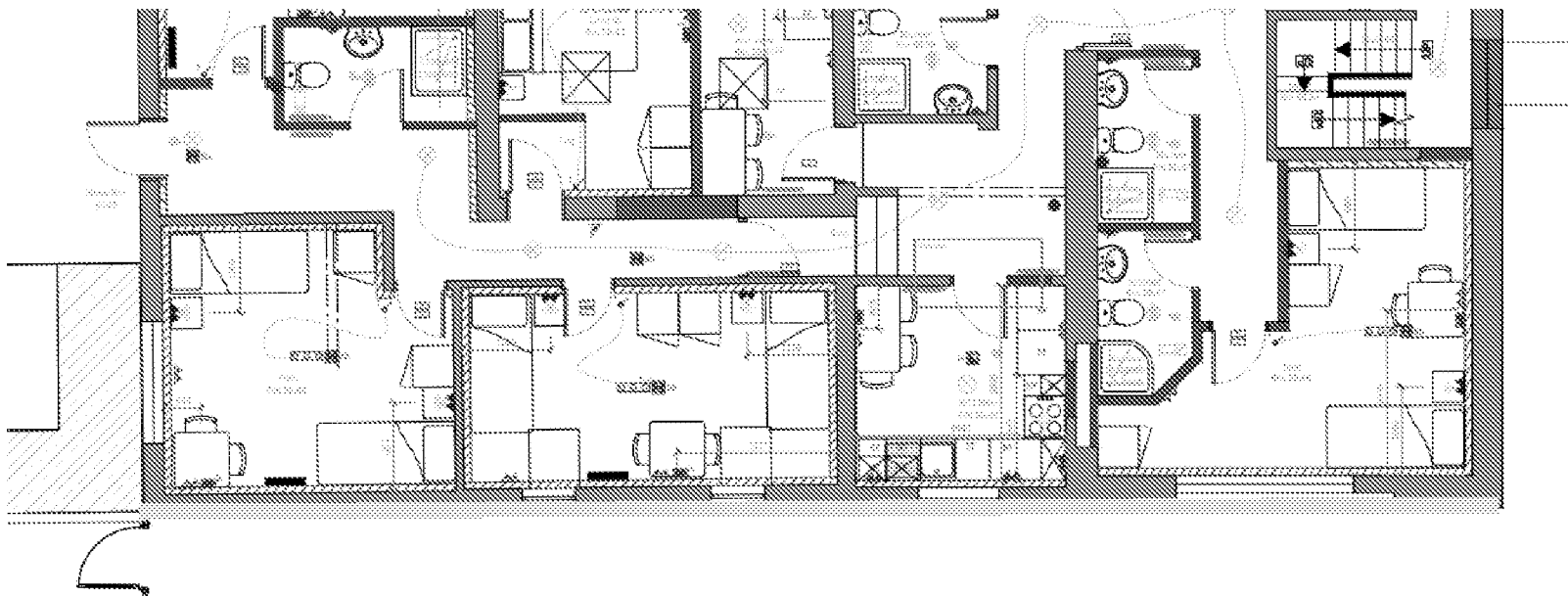
Site Plan 7726/SP4

8 January 2018

Not to scale



Key	
Elevations where windows require sealing:	



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 Site Plan Showing Elevations Which Require
 Sealed Windows

Site Plan 7726/SP5
 8 January 2018
 Not to scale





St Joseph's, Bognor Regis
Photograph of Measurement Position 1

Photograph 7726/P1
8 January 2018



St Joseph's, Bognor Regis

Photograph of Measurement Position 2

Photograph 7726/P2

8 January 2018



St Joseph's, Bognor Regis
Photograph of Measurement Position 3

Photograph 7726/P3
8 January 2018



St Joseph's, Bognor Regis
Photograph of Measurement Position 4

Photograph 7726/P4
8 January 2018

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