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Caulton's Field, Deeping St Nicholas, Lincs

Environmental Noise Assessment
For
Trustees of D W Dennis Settlement

15736

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Environmental Noise Assessment

Residential Development – Caulton's Field, Deeping St Nicholas, Lincs

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CONTENTS

1.0 EXECUTIVE SUMMARY

2.0 INTRODUCTION

3.0 INSTRUMENTATION

4.0 NOISE SURVEY

5.0 DISCUSSION

6.0 CONCLUSIONS

FIGURE 1 - LOCATION PLAN

FIGURE 2 - EXISTING SITE LAYOUT PLAN

SITE MASTERPLAN

APPENDIX 1- DATA SHEET

APPENDIX 2- BARRIER CALCULATION

APPENDIX 3- Pilkington Glass Data Sheet

GLOSSARY

1.0 EXECUTIVE SUMMARY

1.1 BSP Consulting has been commissioned by Trustees of D W Dennis Settlement to undertake an environmental noise assessment, in respect of their planning application for a residential development. The location of the site is shown in Figure 1.

1.2 This Environmental Noise Assessment has been prepared in accordance with the Department for Communities and Local Government (DCLG) publication 'National Planning Policy Framework' (NPPF).

1.3 NPPF provides local authorities in England the use of their planning powers to minimise the adverse impact of noise. The recently introduced National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF document replaces Planning Policy Guidance 24: Planning and Noise (3 October 1994).

1.4 The proposed development site is located to the northwest of A1175 Littleworth Drove, Deeping St Nicholas, Lincs. Residential areas are present to the southwest and northeast of the site off Deeping St Nicholas. The site is currently open land. The development proposals consist of the redevelopment of the site as a residential development with vehicular access gained from a new access onto Littleworth Drove.

1.5 All potential noise sources were considered. An initial site inspection identified noise associated with the road traffic noise emanating from A1175 Littleworth Drove, which lies to the east of the site, together with train noise from the existing railway lines which coincide with the western boundary of the site, as the likely dominant noise sources affecting the site. However, further to the northwest of the site (approx. 1.2 km) there are an array of wind turbines, which were also considered with the assessment.
The road traffic produces a moderate/significant amount of noise during most parts of the day and night, with the train noise being more intermittent with around 2-3 services/hour being observed (reducing during night-time periods). The level of the road is relatively consistent to the level of the site along the eastern boundary, which is also consistent with the rail track level along the western boundary. Owing to the proximity of the site to

Littleworth Drove and the adjacent train lines, it was considered that potentially all bedrooms/habitable rooms on the site could be affected (to varying degrees) by noise.

1.6 The site inspection also included a full visual assessment of the entire boundary and immediate surroundings to determine whether any other existing noise sources were present, which may impact on the site. During this inspection, it was considered that any further noise from other sources was limited or at a sufficient distance away not to cause any potential nuisance or noise impact on the site. This included the wind turbines, which due to their distance from the site (1.2km) were inaudible from within the proposed development.

1.7 It was determined that the most applicable method of determining the effects of noise on the site was to establish the location of greatest noise impact. A site walkover was undertaken during which a series of spot readings were taken. This confirmed that noise from Littleworth Drove traffic noise and the train noise adjacent to the western boundary produced the greatest noise sources.

1.8 The location of highest noise impact as shown by the spot readings is shown on Figure 2, with two monitoring position being selected. Existing noise levels were measured at these locations during two 24-hour period thru Wednesday 13th January/Friday 15th January 2016. Both assessments were carried out over 24-hour periods, to ensure that the measured noise levels were representative of the worst-case scenario in noise terms and all current sources would be included in the background noise assessment.

1.9 The assessment shows for monitoring position 1 (adjacent to boundary close to Littleworth Drove, data sheet 1), the existing worst-case LAeq noise levels have been calculated from these results as 64.7dB(A) (LAeq, 16hr) during the daytime period and 58.4dB(A) (LAeq, 8hr) during the night-time period, with the maximum recorded LMax (23:00-07:00) being 74.8dB(A). For monitoring position 2 (adjacent to boundary close to western boundary, data sheet 2), the existing worst-case LAeq noise levels have been calculated from these results as 57.2dB(A) (LAeq, 16hr) during the daytime period and 54.7dB(A) (LAeq, 8hr) during the night-time period, with the maximum recorded LMax (23:00-07:00) being 80.2dB(A).

1.10 The NPPF noise assessment demonstrated that the current noise levels at the eastern and western boundaries of the site (and therefore the closest facade of the nearest dwellings to the source) could be in excess of those values stated within BS8233, for both the daytime & night-time periods. Therefore, further attenuation will be required during both the daytime and night-time periods to ensure acceptable noise levels within the dwellings themselves.

1.11 To ensure that the internal noise levels within any potential dwellings of the development are within those stated by BS8233 for the daytime and night-time periods, suitable protection will be required. Detailed design has yet to occur but suitable attenuation is likely to be readily achieved by the inclusion of ventilation without the need to open the windows.

1.12 For the site's western boundary, recorded L_{Max} values were higher than the 45dB(A) max (internal) permitted by current guidance. To achieve the required attenuation, it is considered that any dwellings be offset from the boundary by around 10m, creating a 'No Build Zone' from the boundary with the railway tracks. Although no such building line restrictions were required along the eastern boundary of the site, some distance offset from the site's eastern boundary is considered both likely and good practice to further protect the sensitive rooms during night-time periods.

1.13 Although a masterplan for the site is yet to be finalized, given the location it is considered likely that the dwellings on the site will benefit from private garden areas. It was considered that in light of the recorded daytime noise levels, additional protection to the affected garden areas would need to be provided. This is proposed to be either the provision of an acoustic barrier or noise barrier (typically a solid close boarded fence with gravel board) of at least 2m in height (above current track level), which has been demonstrated to reduce the noise levels within the garden areas to below those stated under the WHO guidance.

1.14 In conclusion, the site is not considered to be blighted by any specific noise issues, and has noise levels typical to most developments of this type with easily applied design

solutions to mitigate any minor noise issues. It is considered that under the present noise climate and with existing mitigation in place, the site is suitable for the residential use and there is no acoustic reason why the site could not be developed accordingly.

2.0 INTRODUCTION

2.1 BSP Consulting has been commissioned by Trustees of D W Dennis Settlement to undertake an environmental noise assessment, in respect of their planning application for a residential development.

2.2 The proposed development site is located to the northwest of A1175 Littleworth Drove, Deeping St Nicholas, Lincs. Residential areas are present to the southwest and northeast of the site off Deeping St Nicholas. The site is currently open land. The development proposals consist the redevelopment of the site as a residential development with vehicular access gained from a new access onto Littleworth Drove. The existing site layout detailed on Figure 2. An initial site inspection identified noise associated with the road traffic noise emanating from A1175 Littleworth Drove, which lies to the east of the site, together with train noise from the existing railway lines which coincide with the western boundary of the site, as the likely dominant noise sources affecting the site. However, further to the northwest of the site (approx. 1.2 km) there are an array of wind turbines, which were also considered with the assessment.

2.3 All potential noise sources were considered. An initial site inspection identified noise associated with the road traffic noise emanating from Littleworth Drove, together with train noise from the existing railway lines, could potentially impact on all bedrooms/habitable rooms and garden areas on the site.

2.4 The site inspection also included a full visual assessment of the entire boundary and immediate surroundings to determine whether any other existing noise sources were present, which may impact on the facility. During this inspection, it was considered that any noise from other sources was limited or at a sufficient distance away not to cause any potential nuisance or noise impact on the site. This included the wind turbines, which due to their distance from the site (1.2km) were inaudible from within the proposed development.

2.5 This Environmental Noise Assessment has been prepared in accordance with the Department for Communities and Local Government (DCLG) publication ‘National

Planning Policy Framework' (NPPF).

2.6 Therefore, it was determined that the most applicable method of determining the effects of rail & road traffic noise on the site. NPPF provides local authorities in England on the use of their planning powers to minimise the adverse impact of noise. The recently introduced National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF document replaces Planning Policy Guidance 24: Planning and Noise (3 October 1994).

2.7 For residential use, the assessment should cover both daytime and night-time noise. Accordingly, we have undertaken both night-time and daytime assessment in order to fully assess the site. In terms of noise impact, the eastern boundary of the site (closest to Littleworth Drove), together with the sites westerly boundary (closest to the railway track) being of primary concern. However, we assessed the noise levels that emanated from the surrounding area.

2.8 In addition to the assessments discussed above, a further assessment of the site carried out in accordance with 'BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings' was also undertaken to ensure the noise levels stated within the code are not exceeded. BS 8233:2014 "Guidance on sound insulation and noise reduction for buildings", amongst many other matters, has incorporated the WHO guidance (old and new) into its section 7.6.

3.0 INSTRUMENTATION

3.1 Free-field noise levels were measured at a height of 1.5 metres above the ground using the following Norsonic integrating sound level metre and microphone:

Description	Model Type	Serial Number
Norsonic Sound Level Meter	Nor-118	31497
Acoustic Calibrator	Nor-1251	29215

3.2 The equipment was operated according to the manufacturer's instructions and calibrated before and after use, using the above portable acoustic calibrator, with no significant drifting occurring (not more than 0.5 dB).

4.0 NOISE SURVEY

4.1 The noise surveys were carried out during both the daytime and night-time periods in accordance with the appropriate methodology for a NPPF assessment. A series of readings were taken throughout the period to ensure that the measured noise levels were representative of the worst case scenario in noise terms. The survey was carried out thru Wednesday 13th January/Friday 15th January 2016. The weather was dry and clear during the monitoring period with conditions remaining calm. Temperatures varied from around 7 -10 degrees in the daytime periods falling to around 4 -7 degrees during the night-time.

4.2 It was determined that the most applicable method of determining the effects of noise on the site was to establish the location of greatest noise impact. A site walkover was undertaken during which a series of spot readings were taken (see 4.4). This confirmed that noise generated by Littleworth Drove and the railway running adjacent to the western boundary were the greatest noise sources. No further noise sources were identified in the surrounding area that would adversely impact the proposed development of the site.

4.3 The results of the NPPF noise survey are shown on data 1 in Appendix 1. Due to the sites proximity to Littleworth Drove & railway lines and its uniformity in terms of level and alignment, two monitoring position were used to establish the existing noise environment for these areas of the site. For monitoring position 1 (adjacent to boundary close to Littleworth Drove, data sheet 1), the existing worst-case LAeq noise levels have been calculated from these results as 64.7dB(A) (LAeq, 16hr) during the daytime period and 58.4dB(A) (LAeq, 8hr) during the night-time period. With the maximum recorded LMax (23:00-07:00) being 74.6dB(A). For monitoring position 2 (adjacent to western boundary close to railway lines, data sheet 2), the existing worst-case LAeq noise levels have been calculated from these results as 57.2dB(A) (LAeq, 16hr) during the daytime period and 54.7dB(A) (LAeq, 8hr) during the night-time period. With the maximum recorded LMax (23:00-07:00) being 80.2dB(A). In addition to the hourly LAeq, LMax and LA90 readings, a full set of octave band analysis for positions 1 and 2 are detailed within data sheet 1.

4.4 Spot reading were taken at two further locations around the site (Position 3 & 4), which recorded the following 15min LAeq, 52.3dB(A) and 54.6dB(A), respectively. These were all taken during the 15:00-16:00 period on the 14th and are typically 7dB(A) below the readings recorded at Position 1 & 2. This confirms that the readings taken at Positions 1 and 2 are robust in assessing these areas of the site most affected by noise. These spot readings also suggest that noise from either source diminishes very quickly away from the source.

4.5 The obtained data was also used in the BS 8233 assessment to ensure internal noise levels comply with those stated as being a reasonable design range were obtained. These results, together with the NPPF assessment are discussed in detail in the following sections, with the results of the NPPF noise survey shown on data sheet 1 in Appendix 1.

5.0 DISCUSSION

5.1 This Environmental Noise Assessment has been prepared in accordance with the Department for Communities and Local Government (DCLG) publication 'National Planning Policy Framework' (NPPF).

5.2 NPPF provides local authorities in England on the use of their planning powers to minimise the adverse impact of noise. The recently introduced National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF document replaces Planning Policy Guidance 24: Planning and Noise (3 October 1994).

5.3 Paragraph 123 of NPPF relates to the consideration of noise impact for planning purposes and states;

123. Planning policies and decisions should aim to:

• Avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;

• Mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;

• Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established[28]; and

• Identify and protect areas of tranquility which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

[27] See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

[28] Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.

Noise Policy Statement for England

5.4 The Government's policy on noise is set out in the Noise Policy Statement for England. It sets out the long term vision of promoting good health and a good quality of life

through the management of noise. The NPSE should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. The NPSE does not apply to noise in the workplace (occupational noise).

5.5 The long term vision is to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

5.6 The long term vision is supported by the following aims;
Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:
• Avoid significant adverse impacts health and quality of life;
• Mitigate and minimise adverse impacts on health and quality of life
• Where possible, contribute to the improvement of health and quality of life

5.7 The NPSE also states;
There are several key phrases within the NPSE aims and these are discussed below.
"Significant adverse" and "adverse"

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL. No Observed Effect Level
This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL. Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected. Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL. Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

Noise Design Criteria

5.8 As the NPPF or NPSE do not specify any objective noise criteria, BSP' suggested internal ambient noise level design criteria for the purpose of this assessment has been based on 'BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings'. This can be considered as appropriately assessing the potential noise impact with regard to toxicology concepts in line with the principles of the NPPF and NPSE. Hence, if a development meets the recommendations of BS8233 and any associated local authority noise requirements, it can be considered as being below the level where there is no detectable adverse effect on health and quality of life due to noise, and this meets the NOEL (No Observed Effect Level) set out in the NPSE.

The BS8233 recommended criteria for internal ambient noise levels are shown in Table 1 below:

Criteria	Typical Situation	Design range L_{AeqT}, dB	
		Daytime 07:00-23:00	**Night-time 23:00-07:00**
Reasonable resting/sleeping conditions	Living rooms	35	-
	Bedrooms*	35	30

For the purposes of this assessment, BSP propose the following noise criteria for control of external noise:
• Living rooms (0700-2300 hours): 35dB LAeq
• Bedrooms (2300-0700 hours): 30dB LAeq
(individual noise events in bedrooms should not normally exceed 45dB LAFmax (2300-0700))

5.10 In addition, World Health Organisation (WHO) guidelines recommend 'general daytime outdoor noise levels of less than 55dB LAeq(16hour) are desirable'.

5.11 Appropriate acoustic design measures for the new dwellings to satisfy these criteria are set out below in this section of the report.

5.12 For the eastern boundary of the site (Littleworth Drove), it can be seen from the results of the assessment shown in Appendix 1 Data Sheet 1 details that the noise levels for position 1 are 64.7dB(A) during the daytime period with a night-time noise level of 58.4dB(A). For the western boundary of the site (railway tracks), it can be seen from the results of the assessment shown in Appendix 1 Data Sheet 2 that the noise levels for position 2 are 57.2dB(A) during the daytime period with a night-time noise level of 54.7dB(A).

5.13 Monitoring position 1 & 2 were considered the nearest location garden areas or plot facades could be located on the site in relation to the noise sources (Littleworth Drove & Western Boundary). For these parts of the site, the assessment has shown that the proposed location of the nearest dwelling is positioned in an area where noise levels

could be potentially above those discussed above, for the daytime period during a typical weekday.

5.14 Although a masterplan for the site is yet to be finalized, given the location it is considered likely that the dwellings on the site will benefit from private garden areas. It was considered that in light of the recorded daytime noise levels, additional protection to the affected garden areas would need to be provided. This is proposed to be either the provision of an acoustic barrier or noise barrier (typically a solid close boarded fence with gravel board) of at least 2m in height (above track level), which has been demonstrated to reduce the noise levels within the garden areas to below those stated under the WHO guidance (see barrier calculation in Appendix 2).

5.15 In order to control impact of the external noise climate on the proposed development the following outline specifications are advised. These are based on the calculation method defined in BS8233 using the measured noise data and stated noise design criteria.

5.16 As final construction information is not available at the time of writing, calculations are based on typical room dimensions and glazing areas. Therefore, recommendations should be checked once final detailed information becomes available. Alternative combinations of glazing and ventilation to that outlined above may also provide suitable acoustic performance. All proposals should be checked at the detailed design stage to ensure suitable acoustic performance.

External Walls & Roof

5.17 For the purposes of the assessment the building envelope is assumed to be of cavity brick/blockwork construction, e.g. with a brickwork outer leaf and a solid blockwork inner leaf. If an alternative construction is proposed for the building envelope the specification should be checked by an acoustic consultant to ensure suitable acoustic performance is achieved.

5.18 The roof construction details can affect the level of sound insulation provided by the building envelope. For the purposes of the calculations in this section a traditional

tile/slate roof with a plasterboard ceiling and mineral wool insulation above the ceiling has been assumed.

Glazing & Ventilation

5.19 The following suggested glazing and ventilation combinations are advised for the scheme.

Bedrooms: Standard thermal double glazing, e.g. two panes of 6mm glass separated by a 12mm cavity (or equivalent). Window head trickle vents of minimum Dn,e,w 29dB. (N.B. if a greater number of vents are used the acoustic performance of each vent may need to be increased). Ceilings to top floor rooms to comprise minimum 2 x 12.5mm plasterboard.

Living rooms: Standard thermal double glazing, e.g. two panes of 6mm glass separated by a 12mm cavity (or equivalent). Window head trickle vents of minimum Dn,e,w 29dB. See Pilkington Glass Data Sheet (Appendix 3).

The trickle vents to allow adequate ventilation without the need to open the windows. A typical reduction in level of around 25-30dB(A) could be easily be expected. This level of mitigation would result in acceptable internal noise levels for the units closest to the noise source as demonstrated below.

5.20 To mitigate against road traffic noise during the daytime/night-time periods and to ensure that noise sensitive areas (living rooms/bedrooms) within the dwellings are protected. The above treatment (or similar approved) should be adopted. A typical reduction in level of around 30dB(A) could be easily be expected which is more than adequate to attenuate the recorded levels i.e. 64.7dB(A) – 30 dB(A) = 34.7(A) for the living room & 58.4dB(A) – 30 dB(A) = 28.4dB(A) for the bedrooms. This level of mitigation would result in acceptable internal noise levels for both the units closest to the noise source. Additionally, for the sites western boundary, L_{Max} (23:00-07:00) being 80.2dB(A)-30 dB(A) = 50.4dB(A), which is above the 45dB(A) max. However, these readings were obtained along the site boundary with the railway tracks, which is approximately 5m from the source. Clearly, building lines will be offset from this boundary. Typically, a

doubling of distance equates to a 6dB(A) reduction in noise, therefore allowing for a 10m 'No Build Zone' from the boundary with the railway tracks, would equate in a further 6dB(A) reduction, resulting in an internal L_{Max} level of 44.4dB(A). 10m would typically equate to the length of a garden area, with the first line of buildings located 10m from the site boundary.

The L_{max} levels along the sites eastern boundary are significantly less that those recorded along the western boundary, this being due to the lack of any activity on the adjacent site during the night-time periods (which is apparent from the readings). The maximum recorded L_{max} being 74.6dB(A)-30dB(A) = 44.6dB(A) for the bedrooms, which is below the 45dB(A) max. However, some distance offset from the sites eastern boundary is considered both likely and good practice to further protect the sensitive rooms during night-time periods.

6.0 CONCLUSIONS

6.1 BSP Consulting has been commissioned by Trustees of D W Dennis Settlement to undertake an environmental noise assessment, in respect of their planning application for a residential development. The proposed development site is located to the northwest of A1175 Littleworth Drove, Deeping St Nicholas, Lincs. Residential areas are present to the southwest and northeast of the site off Deeping St Nicholas. The site is currently open land. The proposals consist of the redevelopment of the site as a residential development with vehicular access gained from a new access onto Littleworth Drove.

6.2 This Environmental Noise Assessment has been prepared in accordance with the Department for Communities and Local Government (DCLG) publication 'National Planning Policy Framework' (NPPF).

6.3 It was determined that the most applicable method of determining the effects of the road traffic noise and rail traffic noise on the site. NPPF provides local authorities in England on the use of their planning powers to minimise the adverse impact of noise. The recently introduced National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF document replaces Planning Policy Guidance 24: Planning and Noise (3 October 1994).

6.4 All potential noise sources were considered. An initial site inspection identified noise associated with the road traffic noise emanating from Littleworth Drove, which lies to the east of the site, together with rail traffic noise from the tracks to the west of the site, as the likely dominant noise sources affecting the site. moderate/significant amount of noise during most parts of the day and night, with the train noise being more intermittent with around 2-3 services/hour being observed (although reducing during the night-time period). The level of the road is relatively consistent to the level of the site along the eastern boundary, which is also consistent with the rail track level along the western boundary. Owing to the proximity of the site to Littleworth Drove and the adjacent train lines, it was considered that potentially all bedrooms/habitable rooms on the site could be affected (to varying degrees) by noise.

6.5 In order to ensure that the assessment is representative of the noise climate affecting the site, it was established that a 24 hour noise survey should be carried. The survey was carried out over two 24-hour periods of Wednesday 13th January/Friday 15th January 2016 in the daytime and night-time periods. A site walkover was undertaken during which a series of spot readings were taken. This confirmed the area of the site closest to Littleworth Drove & the railway tracks were the most onerous in noise terms. Existing noise levels were measured during two full 24-hour periods to ensure that the measured noise levels were representative of the worst-case scenario in noise terms.

6.6 The spot readings were taken at two further locations around the site, to establish the noise environment for the entire site. These confirmed that the readings taken at Position 1 & 2 were robust in assessing the area of the site most affected by noise. These spot readings also suggest that noise from the adjacent road traffic noise & rail traffic noise diminishes very quickly away from the source.

6.7 The NPPF noise assessment demonstrated that the current noise levels at the eastern and western boundaries of the site (and therefore the closest facade of the nearest dwellings to the source) could be in excess of those values stated within BS8233, for both the daytime & night-time periods. Therefore, further attenuation will be required during both the daytime and night-time periods to ensure acceptable noise levels within the dwellings themselves.

6.8 To ensure that the internal noise levels within any potential dwellings of the development are within those stated by BS8233 for the daytime and night-time periods, suitable protection will be required. Detailed design has yet to occur but suitable protection (see section 5.0) including ventilation without the need to open the windows, should be installed. Typically, a reduction in level of around 30dB(A) could easily be expected which is more than adequate to attenuate the recorded levels. This level of mitigation would result in acceptable internal noise levels for residential use for both the daytime and night-time periods.

6.9 Additionally, for the site's western boundary, L_{Max} (23:00-07:00) being 80.2dB(A)-30 dB(A) = 50.4dB(A), which is above the 45dB(A) max. However, these readings were obtained along the site boundary with the railway tracks, which is approximately 5m from the source. Clearly, building lines will be offset from this boundary. Typically, a doubling of distance equates to a 6dB(A) reduction in noise, therefore allowing for a 10m 'No Build Zone' from the boundary with the railway tracks, would equate in a further 6dB(A) reduction, resulting in an internal L_{Max} level of 44.4dB(A). 10m would typically equate to the length of a garden area, with the first line of buildings located 10m from the site boundary.

The L_{max} levels along the eastern boundary are significantly less than those recorded along the western boundary, this being due to the lack of any activity on the adjacent site during the night-time periods (which is apparent from the readings). The maximum recorded L_{max} being 74.6dB(A)-30dB(A) = 44.6dB(A) for the bedrooms, which is below the 45dB(A) max. However, some distance offset from the site's eastern boundary is considered both likely and good practice to further protect the sensitive rooms during night-time periods.

6.10 Although a masterplan for the site is yet to be finalized, given the location it is considered likely that the dwellings on the site will benefit from private garden areas. It was considered that in light of the recorded daytime noise levels, additional protection to the affected garden areas would need to be provided. This is proposed to be either the provision of an acoustic barrier or noise barrier (typically a solid close boarded fence with gravel board) of at least 2m in height, which has been demonstrated to reduce the noise levels within the garden areas to below those stated under the WHO guidance.

6.11 A full visual assessment of the entire site boundary was also undertaken to determine whether any other existing noise sources were present, which may impact on the residents of the proposed development. It was concluded that any further noise from other sources was limited or at a sufficient distance away not to cause any potential nuisance or noise impact on the site. This included the wind turbines, which due to their distance from the site (1.2km) were inaudible from within the proposed development.

6.12 In conclusion, the site is not considered to be blighted by any significant noise issues, with noise levels typical to most developments of this type, and with appropriate design methods to mitigate any minor noise issues. It is considered that under the present noise climate and with the above mitigation in place, the site is suitable for residential development with no acoustic reason why the site could not be developed.

For and on behalf of BSP Consulting

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FIGURES 1 & 2

SITE LOCATION

EXISTING SITE LAYOUT

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A4

0 10 20 30 40

Millimetres At Original Drawing Size



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Drawing Status

FOR INFORMATION

Client

Trustees of D W Dennis Settlement

Project Title

Caulton's Field,
Deeping St Nicholas, Lincs

Drawing Title

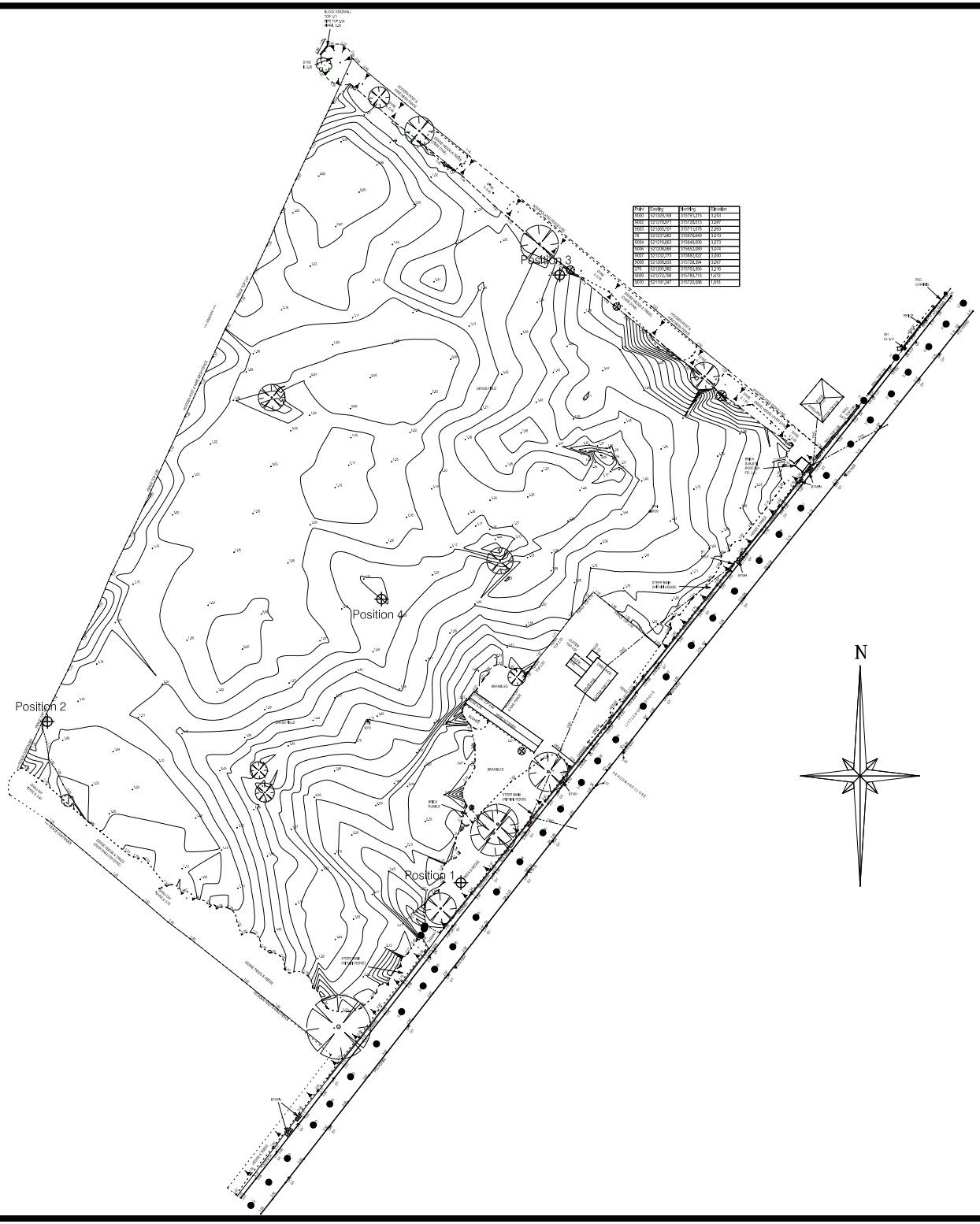
Site Location Plan

Drawn By:	JAD	Checked By:	MWR	Scale:	NTS
Project Engineer:	JAD	Approved By:	JAD	Date:	Jan 16

Drawing Number:

Figure 1

Revision:



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A4

0 10 20 30 40

Millimetres At Original Drawing Size

Rev.	Description	Date.	Drawn	Appr.

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Drawing Status

FOR INFORMATION

Client

Trustees of D W Dennis Settlement

Project Title

Caulton's Field,
Deeping St Nicholas, Lincs

Drawing Title

Existing Site Layout &
Monitoring Position

Drawn By:	JAD	Checked By:	MWR	Scale:	NTS
Project Engineer:	JAD	Approved By:	JAD	Date:	Jan 16

Drawing Number:

Figure 2

Revision:

APPENDIX 1
Data Sheets

Caulton's Field, Deeping St Nicholas, Lincs
Environmental Noise Measurement Results

APPENDIX 1-Data Sheet 1 Position 1 (Eastern Boundary A1175 Littleworth Drove)
MEASURED NOISE LEVELS IN dB(A)
HOURLY Laeq,1hr & Lmax

Period	Time	Noise Level dB(A)13-14/01/16			Octave Band Analysis									Noise Rating
		LAeq	Lmax	LA90	31.5Hz	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
	07:00 - 08:00	66.5	74.1	46.9	54	59.3	53.1	51	52.9	59.7	55.3	48.6	45.8	59.7
	08:00 - 09:00	66.8	72.8	49.2	55.7	63	55	53.5	54.4	60.3	55.1	46.9	43.7	60.3
	09:00 - 10:00	64.4	72.4	45.1	56.8	62.2	55.8	54.4	53.7	57.6	51.9	43.7	40.4	57.6
	10:00 - 11:00	63	72.4	44.8	60.6	61.3	53.5	51.1	52.4	56.3	50.5	43.5	41	56.3
	11:00 - 12:00	64.2	72.8	52	69.3	64.1	57.2	54.5	54.5	57.3	51	44.1	41.7	57.3
D	12:00 - 13:00	66.4	72.5	58.6	75.5	70.6	62.7	60.1	57.9	57.7	52.4	48.9	47.6	55.1
A	13:00 - 14:00	68.9	72.1	62.2	73.9	70.4	67.2	66.6	62	55.8	54.9	51	52.7	58.9
Y	14:00 - 15:00	65.2	70.3	59.2	65.3	65.3	64.7	63.9	58.2	50.5	52	46.1	46	55.4
T	15:00 - 16:00	64.3	71.1	45.7	53.6	58.4	56.3	51.4	52.8	58.2	52	42.3	39.3	58.2
I	16:00 - 17:00	65	71.1	47	53.2	62.3	55.7	51.8	53.1	59	52.6	42.6	37.9	59
M	17:00 - 18:00	65.1	73.5	46.2	53.9	59.5	53.2	52.1	52.1	59.4	52.6	42	37	59.4
E	18:00 - 19:00	63.7	74.8	42.9	50.4	58.7	54.3	49.8	50.5	57.9	51.4	40.8	35.6	57.9
	19:00 - 20:00	61.7	72.9	39.8	47	55.5	53	47.7	48.8	55.9	49.4	38.6	33.6	55.9
	20:00 - 21:00	60.2	72.5	34.7	46.2	53.9	47.5	45.6	46.5	52.1	48.1	37.2	31.3	52.1
	21:00 - 22:00	60.9	71.9	36.5	48	56.8	53.6	47.5	47.8	55	48.6	37.9	32.2	32.2
	22:00 - 23:00	58.5	71.4	34	45.6	53.6	45.5	43.2	44.2	52.5	46.8	36.8	32.8	52.5
Average Daytime L_{Aeq}														
T	23:00 - 00:00	57	73.8	29.6	44	48.8	43.5	41	43.5	50.4	45.5	39.3	37.4	50.4
I	00:00 - 01:00	55.7	74.6	27.2	50.2	51.9	48.8	39.9	43.3	48.8	43.6	39.7	38.1	48.8
M	01:00 - 02:00	54.7	70.8	25.4	47.8	57.2	45.3	40.2	42.4	47.5	42.2	38.6	36	47.5
E	02:00 - 03:00	53.5	69.7	25.1	47.5	54.3	44.3	37.7	41.4	46.8	41.5	37.3	33.7	46.8
	03:00 - 04:00	55.9	72.7	26.8	48.3	54.4	46.9	40.7	44.3	49.3	43.7	38.2	37.3	49.3
	04:00 - 05:00	57.1	72.5	28.9	49.9	53.9	46.2	44.5	45	50.4	45.4	39.5	37.3	50.4
	05:00 - 06:00	60.3	73.5	31.5	51	58.5	50.8	47	48.4	53.7	48.2	40.2	36.7	53.7
	06:00 - 07:00	63.4	74.5	39.4	49.8	58	51.3	48.1	50.5	56.9	51.8	44.2	41.4	56.9
Average Night-time L_{Aeq}														

Insulating glass units 6 mm / (6 - 16 mm) / 6 mm Attenuation			20	18	28	38	34	38	
	Daytime	13:00-14:00	47.2	48.6	34	17.8	20.9	13	NR40
	Night-time	06:00-07:00	31.3	30.1	22.5	18.9	17.8	6.2	NR20

Mean $L_{eq,t} = 10\log\{(10^{L1/10}+10^{L2/10}+10^{L3/10}\ldots\ldots)/N\}$

Day-time $L_{eq,16hr} = 64.7$

Night-time $L_{eq,8hr} = 58.4$

Caulton's Field, Deeping St Nicholas, Lincs
Environmental Noise Measurement Results

APPENDIX 1-Data Sheet 2 Position 2 (Western Boundary Railway Tracks)
MEASURED NOISE LEVELS IN dB(A)
HOURLY Laeq,1hr & Lmax

Period	Time	Noise Level dB(A)14-15/01/16			Octave Band Analysis									Noise Rating
		LAeq	Lmax	LA90	31.5Hz	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
	07:00 - 08:00	55	85.4	39.5	50.7	50.8	42.3	35.6	44.9	47.5	45.4	36	28.7	48.4
	08:00 - 09:00	54.9	85.5	41.5	55.8	51.5	43.3	36.2	44.9	47.4	44.5	35.3	29.2	47.5
	09:00 - 10:00	53.2	81.9	40.4	58	53.2	47.5	46.2	41.4	44.3	44.7	36.1	30.9	47.7
	10:00 - 11:00	52.3	80.5	40.2	59.9	52.5	45.2	34.7	42.8	45.1	42.3	32.9	29.7	45.3
	11:00 - 12:00	55.9	86.2	37.4	55.4	51.1	43	35.1	44.6	47.5	46	37.4	31	49
D	12:00 - 13:00	59.5	84.5	39	62	55.3	49.3	43.7	50.5	51.1	50.3	40.2	35	53.3
A	13:00 - 14:00	58.2	86.9	38.2	60	54.9	51.3	43.7	49.3	49.8	46.6	41.6	36.2	49.8
Y	14:00 - 15:00	58.6	84.5	36.5	56.1	54.7	51.9	42.4	48.6	49.7	49	41.7	35.2	59.8
T	15:00 - 16:00	60.5	84.7	48.9	74.3	67.7	57.4	49.6	50.8	51.3	48.3	43.4	42.6	51.3
I	16:00 - 17:00	57.9	78.2	49.4	75.2	68.7	57.7	49.1	49	48.3	43.5	40.1	42.6	48.7
M	17:00 - 18:00	56.8	83.5	48.3	72.6	65.5	54.1	46.3	48.2	48.8	43.2	38.8	41	48.8
E	18:00 - 19:00	61.1	84.2	48.2	72.8	65.8	55.8	48.1	52.3	53.4	49.9	42.3	42.1	53.4
	19:00 - 20:00	56.5	71.7	49.1	74.4	67.7	56.6	48.3	47.9	46.2	40.8	38.8	42.6	48.7
	20:00 - 21:00	56.3	82.4	47.2	72.6	65.2	53.6	45.9	47.6	47.9	42.6	38.7	41	47.9
	21:00 - 22:00	54.5	84.1	43.6	70.2	62.4	50.8	43.2	45.2	46.5	43.3	36.2	38.7	46.5
	22:00 - 23:00	42.4	55.5	37.6	59.5	49.9	42.6	33.3	34.8	32.6	25.3	25	30.4	37.4
Average Daytime L_{Aeq}														
T	23:00 - 00:00	37.8	46.7	34.4	49.5	43	35.6	29.1	30.9	28.7	21.1	20	25	32
I	00:00 - 01:00	37	47.5	33.2	48.4	42.2	35.9	28.5	30.3	27.4	20.1	20.5	24.3	31.3
M	01:00 - 02:00	38.4	46.7	35.6	51.7	47.5	37.1	30.4	32	27	20.8	22.2	25.9	32.9
E	02:00 - 03:00	60.5	85.3	33.8	54.4	54.7	52.3	43.2	51	51.6	49.6	44.1	37.3	52.6
	03:00 - 04:00	55.8	81	33.6	51.7	51.9	49.2	38.1	43.6	44.8	45.7	42.3	37.2	48.7
	04:00 - 05:00	56.2	80.2	32.4	58.7	54.4	54.2	42.1	47.1	47.2	43.9	41.1	33.4	47.2
	05:00 - 06:00	55.3	82.7	34.6	53	53.8	46.1	39.6	43.8	44.5	44.8	40.1	34.6	47.8
	06:00 - 07:00	49	79.3	36.5	49.7	48	39	30.5	39.2	41.8	39	29	22.8	42
Average Night-time L_{Aeq}														

Insulating glass units 6 mm / (6 - 16 mm) / 6 mm Attenuation			20	18	28	38	34	38	
	Daytime	18:00-19:00	35.8	30.1	24.3	15.4	15.9	4.3	NR20
	Night-time	02:00-03:00	32.3	25.2	23	13.6	15.6	6.1	NR20

Mean $L_{eq,t} = 10\log\{(10^{L1/10}+10^{L2/10}+10^{L3/10}\ldots\ldots)/N\}$

Day-time $L_{eq,16hr} = 51.2$
Night-time $L_{eq,8hr} = 54.7$

APPENDIX 2
Barrier Calculation

Suite B, Floor 3, 24 DeMontfort Street
Leicester. LE1 7GB

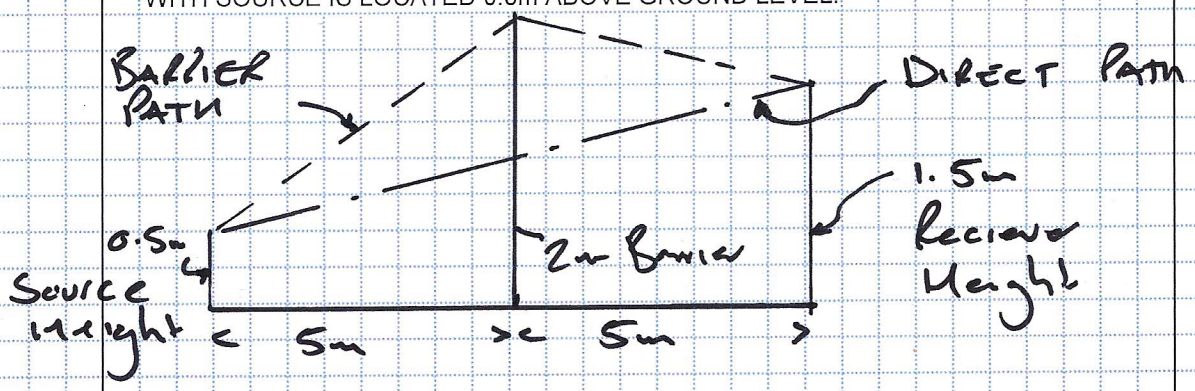
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Project:	Caulton's Field, Deeping St Nicholas, Lincs
Project No:	15736
Sheet No:	1 **Rev:**
Date:	Jan-16
Section of Project:	Barrier Calcs

Ref	Calculations	Output

Noise Barrier Calculations

WESTERN SECTION OF THE SITE, ASSUMING WORST CASE LOCATION IN NOISE WHERE THE EXISTING SITE LEVELS ARE LEVEL WITH RAILWAY TRACKS, WITH SOURCE IS LOCATED 0.5m ABOVE GROUND LEVEL.



Direct Path: $\sqrt{(10^2 + 1^2)} = 10.050m$

Barrier Path: $\sqrt{((5^2 + 1.5^{2)} + \sqrt{(5^2 + 0.5^{2))}} =$

5.220m + 5.025m = 10.245m

This therefore results in a path difference of:

10.245 - 10.050 = 0.195m

Therefore in accordance with Table 9b of CRTN, this path difference would result in a barrier attenuation of: 10.6dB(A)

Therefore:

64.7 - 10.6 = 54.1 dB(A) < 55dB(A) Therefore complies with BS8233.

Checked:	Approved:

APPENDIX 3
Pilkington Glass Data Sheet

CI/SfB (31) R08 (P2)
June 2014

PILKINGTON

NSG GROUP



Pilkington **Optiphon**™
Laminated Glass for noise control



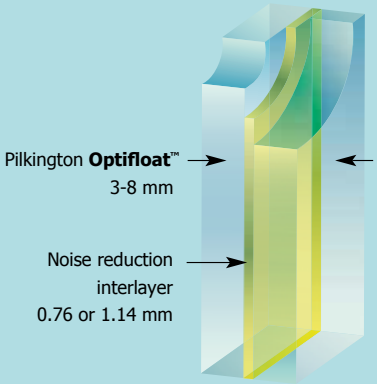
Pilkington **Optiphon**™

Laminated glass for superior noise insulation

Pilkington **Optiphon**™ is the ideal choice of glass in situations where there is excess noise from road, rail or air traffic, or various other sources, for example factories or nightclubs.

Pilkington **Optiphon**™ is a high quality acoustic laminated glass incorporating a special PVB (PolyVinyl Butyral) interlayer. It offers excellent noise reduction without compromising on light transmittance or impact performance.

The desired acoustic performance can be achieved through combining various thicknesses of glass with a PVB interlayer. With a large variety of product combinations, Pilkington **Optiphon**™ offers the opportunity to achieve specific noise reduction requirements.



Note: Pilkington **Optiphon**™ can also be manufactured with other products, including coated glass



Benefits

- Special PVB interlayer for enhanced sound insulation performance
- A thinner and lighter glass for the equivalent acoustic performance
- Available in jumbo and lehr end sizes
- All products achieve at least safety class 1(B)1 (EN 12600) and are available to meet security glass grades contained in EN 356
- A high acoustic performance can be achieved when used in Insulating Glass Units (IGUs)
- Can also be used to improve noise insulation in a triple glazing construction

Pilkington **Optiphon**™ can be combined with other Pilkington products for a multi-functional noise-reduction single glazing or IGU providing additional benefits, such as:

- Thermal insulation with Pilkington **K Glass**™ / Pilkington **Optitherm**™ (coating in position 3 in IGU)
- Solar control with Pilkington **Suncool**™ (coating in position 2 in IGU)
- Self-cleaning with Pilkington **Activ**™ (coating in position 1 in IGU)



Technical Definitions

Sound Reduction Index

R_w is the weighted sound reduction, in decibels, which incorporates a correction for the ear's response.

C and C_{tr} are the spectrum adjustments, which are the values added to R_w to take account of the characteristics of particular sound spectra. Typical noise sources for each spectrum adaptation terms are given below.

Relevant spectrum adaptation term C

Type of noise source:

- Living activities (talking, music, radio, TV)
- Children playing
- Railway traffic at medium and high speed
- Jet aircraft, short distance away
- Motorway traffic >50 mph
- Factories emitting mainly medium and high frequency noise.

Relevant spectrum adaptation term C_{tr}

Type of noise source:

- Urban road traffic
- Railway traffic at low speeds
- Aircraft, propeller driven
- Jet aircraft, long distance away
- Disco music
- Factory emitting mainly low and medium frequency noise.



Sound insulation data for standard products

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
4 mm Float Glass	17	20	26	32	33	26	29 (-2; -3)	29	27	26
6 mm Float Glass	18	23	30	35	27	32	31 (-2; -3)	31	29	28
8 mm Float Glass	20	24	29	34	29	37	32 (-2; -3)	32	30	29
10 mm Float Glass	23	26	32	31	32	39	33 (-2; -3)	33	31	30
12 mm Float Glass	27	29	31	32	38	47	34 (0; -2)	34	34	32
6 mm Laminated Glass	20	23	29	34	32	38	32 (-1; -3)	32	31	29
8 mm Laminated Glass	20	25	32	35	34	42	33 (-1; -3)	33	32	30
10 mm Laminated Glass	24	26	33	33	35	44	34 (-1; -3)	34	33	31
12 mm Laminated Glass	24	27	33	32	37	46	35 (-1; -3)	35	34	32
Insulating glass units										
4 mm / (6 - 16 mm) / 4 mm	21	17	25	35	37	31	29 (-1; -4)	29	28	25
6 mm / (6 - 16 mm) / 4 mm	21	20	26	38	37	39	32 (-2; -4)	32	30	28
6 mm / (6 - 16 mm) / 6 mm	20	18	28	38	34	38	31 (-1; -4)	31	30	27
8 mm / (6 - 16 mm) / 4 mm	22	21	28	38	40	47	33 (-1; -4)	33	32	29
8 mm / (6 - 16 mm) / 6 mm	20	21	33	40	36	48	35 (-2; -6)	35	33	29
10 mm / (6 - 16 mm) / 4 mm	24	21	32	37	42	43	35 (-2; -5)	35	33	30
10 mm / (6 - 16 mm) / 6 mm	24	24	32	37	37	44	35 (-1; -3)	35	34	32
6 mm / (6 - 16 mm) / 6 mm Laminated	20	19	30	39	37	46	33 (-2; -5)	33	31	28
6 mm / (6 - 16 mm) / 10 mm Laminated	24	25	33	39	40	49	37 (-1; -5)	37	36	32

The above are generally accepted values for generic products taken from EN 12758. They are conservative values that can be used in the absence of measured data.

Data for laminated glass is based on pvb interlayers (excluding acoustic pvb interlayers). Glass thickness for laminated glass excludes interlayer thickness.

Data can be adopted for air or argon gas-filled cavities

R_w = Weighted sound reduction. This scale allows for the response of the human ear and could be used for determining a suitable product to reduce noise such as voices.

C = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from music, radio, tv, high speed traffic and other medium to high frequencies.

C_{tr} = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from urban road traffic, disco music and other noises with a large component of low frequencies.

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CE

CE marking confirms that a product complies with its relevant harmonised European Norm.
The Declaration of Performance for each product, including declared values, can be found at www.pilkington.com/CE

NSG GROUP

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Pilkington **Optiphon**™

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
6.8 mm Pilkington **Optiphon**™	26	27	31	36	40	39	36 (-1; -4)	36	35	32
8.8 mm Pilkington **Optiphon**™	24	28	34	38	37	43	37 (-1; -4)	37	36	33
9.1 mm Pilkington **Optiphon**™	26	29	34	38	38	43	37 (-1; -3)	37	36	34
12.8 mm Pilkington **Optiphon**™	30	32	37	39	41	51	39 (0; -2)	39	39	37
13.1 mm Pilkington **Optiphon**™	30	33	37	40	41	50	40 (0; -2)	40	40	38
Insulating glass units										
6 mm / 16 mm argon / 6.8 mm Pilkington **Optiphon**™	22	27	35	42	41	48	38 (-2; -5)	38	36	33
6 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon**™	24	26	40	48	46	54	41 (-3; -7)	41	38	34
8 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	24	29	41	47	47	55	43 (-3; -7)	43	40	36
10 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	29	33	44	46	49	57	45 (-2; -5)	45	43	40
8.8 mm Pilkington **Optiphon**™ / 16 mm argon / 12.8 mm Pilkington **Optiphon**™	26	36	46	50	52	63	47 (-2; -7)	47	45	40
9.1 mm Pilkington **Optiphon**™ / 20 mm argon / 13.1 mm Pilkington **Optiphon**™	29	39	49	52	55	63	50 (-3; -8)	50	47	42

Measurements undertaken in accordance with BS EN ISO 10140 and R_w (C; C_{tr}) determined in accordance with BS EN ISO 717-1
For insulating glass units, there is little difference in the sound insulation for cavity widths in the range 6 to 16 mm
Pendulum body impact resistance to BS EN 12600 for all Pilkington **Optiphon**™ is Class 1 (B) 1
To achieve low U values in insulating glass units, Pilkington **Optiphon**™ can be combined with low emissivity glass from the Pilkington **K Glass**™ or Pilkington **Optitherm**™ ranges
To calculate performance data for Pilkington products, please use our Spectrum online calculator at www.pilkington.co.uk/spectrum
For glass combinations to achieve an R_w value higher than 50 dB, please contact us for more details

This publication provides only a general description of the products. Further, more detailed, information may be obtained from your local supplier of Pilkington products. It is the responsibility of the user to ensure that the use of these products is appropriate for any particular application and that such use complies with all relevant legislation, standards, codes of practice and other requirements. To the fullest extent permitted by applicable laws, Nippon Sheet Glass Co. Ltd. and its subsidiary companies disclaim all liability for any error in or omission from this publication and for all consequences of relying on it. Pilkington "Optiphon", "Optitherm", "K Glass", "Activ" and "Suncool" are trademarks owned by Nippon Sheet Glass Co. Ltd, or a subsidiary thereof.

CE

CE marking confirms that a product complies with its relevant harmonised European Norm.
The Declaration of Performance for each product, including declared values, can be found at www.pilkington.com/CE

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GLOSSARY

1. The human ear responds to sound in an approximately logarithmic manner and the logarithmic decibel (dB) scale is used to measure and assess sound. The human ear does not respond equally to sounds at different frequencies. It is more sensitive at the mid-frequency range than it is at the lower and higher frequencies. Therefore, when measuring sound a weighting network, known as >A-weighting= is applied to the frequency spectrum to take account of this differing sensitivity. This unit is termed dB (A).

2. The L_{Aeq} equivalent continuous sound level, is the sound level of a steady sound having the same energy as a fluctuating sound over a specified measuring period. This may be as short as 1 second or as long as 24 hours when used to assess the noise level at a specified location.

3. The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

4. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A - Typical sound levels found in the environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of pain