South industrial Monopile Facility
Construction Noise Assessment

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1. Introduction

Hilson Moran has been appointed by South Tees Development Corporation in relation to the proposed development of the South Industrial Monopile Facility to undertake an assessment of the impact of noise from construction works on nearby commercial receptors.

Following submission of Environmental Statement to Redcar and Cleveland Borough Council (RCBC) in July 2020, the Council identified that additional assessment of construction noise impact on commercial receptors is required.

This report outlines effects of predicted construction noise from the proposed development on the nearest commercial receptors and provides recommendations on appropriate construction strategies and control measures to mitigate any potential significant effects.

1.1. Site Description

The site is located on the south bank of the river Tees within the South industrial Zone. It is bounded from the south by a railway line, with an industrial area further to the south and to the west of the site. To the west of the site there is an industrial area that will be developed as part of the South Industrial Zone. Site location and boundary can be seen in Figure 1.1.

1.2. Noise Sensitive Receptors

Two commercial receptors, listed in Table 1.1, were identified for this assessment as being nearest to the site boundary. Location of these receptors can be seen in Figure 1.1.

Table 1.1: Commercial receptors

Receptor	Name/Address	Approximate distance to the site boundary (m)
1	South Tees Business Centre, Ridley Street, Middlesbrough, TS10 1TD	510
2	Trigiene and Metador Offices, John Boyle Rd, Middlesbrough, TS6 6TY	350

Both receptors have been classified as medium sensitivity receptors based on the criteria presented in Table 1.1.2 below.

Table 1.1.2: Receptor sensitivity criteria

Sensitivity	Criteria	Examples of Receptors
Low	Receptors where distraction or disturbance from noise is minimal	Factories and working environments during the daytime Sports grounds where spectator noise is a normal part of the event
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Restaurants Sports grounds where spectator noise is not a normal part of the event and

		where quiet conditions are necessary (e.g. golf or tennis)
High	Receptors where occupants or activities are particularly susceptible to noise	Residential units Quiet outdoor areas used for recreation Schools Hospitals/residential care homes Religious institutions

Figure 1.1: Commercial receptor and site location

2. Standards and Legislation

2.1. The Control of Pollution Act 1974

- The Control of Pollution Act 1974 (CoPA) requires that 'Best Practicable Means' (as defined in Section 72 of CoPA) are adopted to control construction noise on any given site. CoPA makes reference to advice within BS 5228 Noise and Vibration Control on Construction and Open Sites as comprising best practicable means.
- Section 60 and Section 61 of the CoPA provide the main legislation regarding demolition and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted.
- Section 61 of the CoPA provides a means for applying for prior consent to carry out noise-generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.

2.2. Noise Policy Statement for England (2010)

The Noise Policy Statement for England (NPSE) sets out a strategic vision for the management of noise issues. Two key policies are:

- Policy 1.2: 'The Government recognises that the effective management of noise requires a co-ordinated and long-term approach that encompasses many aspects of modern society.
- Policy 1.3: 'The aim of this document is to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.'

The long-term vision of the policy to 'promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development' is supported by three aims:

- 'avoid significant adverse impacts on health and quality of life';
- 'mitigate and minimise adverse impacts on health and quality of life'; and
- 'where possible, contribute to the improvements of health and quality of life'.

Within the aims stated above there are several key phrases that lead to additional concepts now considered in the assessment of noise impact, their definitions are detailed below:

- NOEL – No Observed Effect Level (This is the level below which no effect can be detected);
- LOAEL – Lowest Observed Adverse Effect Level (This is the level above which adverse effects on health and quality of life can be detected); and
- SOAEL – Significant Observed Adverse Effect Level (This is the level above which significant adverse effects on health and quality of life occur)

There are no pre-defined levels for these effect levels as it is acknowledged that they will be different for different sources, different receptors and at different times.

2.3. British Standard 8233:2014

BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' offers guidance on indoor and outdoor ambient noise levels.

BS 8233:2014 provides general guidance for typical noise levels for acoustic privacy in shared spaces and also refers to other guidance for acoustic conditions of offices.

BS 8233 criteria for ambient noise level relevant to commercial use are set out in Table 2.1.

Table 2.1: Ambient noise level criteria for office use

Room Use	Criteria, $L_{Aeq,T}$
Open Plan offices	45-50 [1]
Meeting rooms	35-45

Notes: [1] BS8233 recommended range where privacy is important

Note 7 in paragraph 7.7.2 further added that "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved".

2.4. British Standard 5228:2009+A1:2014

BS 5228 *'Noise and Vibration Control on Construction and Open Sites'* provides a 'best practice' guide for noise and vibration control and includes Sound Power Level (L_w) data for individual plant as well as a calculation method for noise from construction activities. It also provides guidance on the human response to vibration.

BS 5228 provides guidance on acceptable levels of construction noise within Annex E and provides example criteria for the assessment of significance of construction noise effects. One of the potential suggested sets of criteria within BS 5228 refers to the Department of the Environment (DoE) Leaflet AL72: Noise Control on Building Sites from 1976.

The leaflet states that, during the daytime period, the noise level outside the nearest occupied room of a residential property or office should not exceed the values presented in Table 2.2.

Table 2.2: Department of Environment guidelines for construction noise

Environment	Recommended Daytime Façade Noise Level ($L_{Aeq,T}$ dB)
Urban areas close to main roads	75
Rural, suburban and urban areas away from main traffic and industrial noise sources areas	70

BS 5228 also proposes additional methods: 'ABC method' and '5dB(A) change method', which define the thresholds at building facades on the basis of existing noise levels.

'ABC method' is mainly aimed for assessment of construction noise impact at residential properties. According to '5dB(A) change method': "*Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site 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 $L_{Aeq,T}$ from site 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 effect.".* The '5dB(A) change method' is generally applicable to residential and non-residential receptors that may be identified as sensitive to noise, such as hotels, hospitals, and buildings of educational and religious use. The Standard does not suggest that this criterion is typically applicable to commercial office buildings, as discussed herein. However, in doing so, the assessment approach can be considered to be inherently conservative.

2.5. Liaison with Local Council

Following consultation with the RCBC by email on 18th March 2022 it was agreed that the noise level change method as dictated by BS 5228 will be used. It was also said that BS 8233 internal noise levels for office use will be used, adding a correction from outside to inside assuming windows are closed. These levels will be then compared to the noise levels at the receptor caused by the construction. The suitability of our baseline noise monitoring locations and chosen commercial receptors for assessment were also confirmed by RCBC during consultation.

3. Assessment Methodology

3.1. Baseline Survey

The original baseline noise levels submitted as part of the ES were based on predictive methods due to attended noise survey not being practical during COVID restrictions and were used to quantify prevailing noise levels at nearby residential properties (as opposed to commercial premises). It was not considered appropriate to reuse this data for the purpose of this assessment and a repeated baseline noise survey was undertaken by Hilson Moran.

Baseline noise monitoring was undertaken between 17th and 22nd March 2022 to characterise the noise environment at locations representative of commercial receptors nearest to the proposed development. Noise monitoring was undertaken in accordance with best practice as specified within BS 7445-1: 2003 *'Description and Measurement of Environmental Noise'.*

3.1.1. Monitoring locations

Long-term (mostly unattended) monitoring was used to establish representative ambient noise level in the area near to the identified commercial receptors. Long-term monitoring position LT1 was installed in the vicinity of Trigiene and Matador offices, with the meter located approximately 2.5m above ground level by the receptor boundary fence.

Monitoring location is presented in Figure 3.1 along with the locations of the commercial receptors assessed.

Measurements were undertaken more than 1.5 away from hard surfaces to remove the influence of strong acoustic reflections. On the basis of the above, the chosen monitoring position is considered representative of commercial receptor locations nearest to the proposed works. Consequently, if noise at these receptors are controlled to acceptable levels, adequate protection from construction noise would also be provided to commercial receptors located further away from the site.

Figure 3.1: Monitoring Locations

3.1.2. Survey equipment

Measurements were undertaken using sound level meter (SLM) meeting the requirements of BS EN 61672-1:2013 to Class 1 level. All equipment held current calibration certificates, traceable to UK and International Standards, available on request. An onsite check of the reference level was undertaken with a field calibrator immediately before and after the survey with no significant (> ±0.4 dB) changes noted in the calibration level. Details of the measurement equipment are given in Table 3.1.

Table 3.1: Measurement equipment details

Equipment Type	Manufacturer	Type	Serial Number
Class 1 Sound Level Meter	Norsonic	Nor140	1406563
Class 1 Sound Calibrator	Norsonic	Nor1251	34675

3.1.3. Noise sources

Existing noise sources at the monitoring position LT1 at the time of the survey consisted of nearby and distant construction works, distant industrial activity and road traffic noise.

The measurement period coincided with the start of the enabling works and demolition related activity on the site during weekdays. This was likely to affect the measured noise levels such that they would be unrepresentative of the pre-construction baseline. Therefore, for this assessment, weekend only noise data have been used to establish the baseline noise levels. Typically, noise levels during the weekend are likely to be lower than on a typical workday and consequently this will represent a more conservative approach in this assessment.

3.1.4. Weather conditions

Weather conditions logged between 17th and 22nd March 2022 were considered suitable (within the limits specified in BS 7445-2) for noise monitoring purposes, with ambient temperatures recorded between 14 and -2°C, no precipitation was noted, and wind speeds were < 5 m/s. It was partly cloudy on installation and collection.

3.1.5. Uncertainty in acoustic measurements

Inevitably, there is a degree of uncertainty in measured noise levels. Contributory factors to this uncertainty include tolerances in instrumentation readings, meteorological conditions, and the inherent variation in the acoustic environment during the course of a day, and beyond, as the noise sources influencing a given location vary. Every effort has been made to limit uncertainty in the measurements reported. Measures taken to limit uncertainty include:

- Undertaking surveys with appropriately qualified and trained acoustics engineers.
- Use of measurement equipment calibrated to appropriate standards by accredited bodies and checked on site using calibrated reference sound sources.
- Following best practice methodology for environmental noise measurement set out in BS 7445.
- Measuring under appropriate meteorological conditions.

3.2. Construction Noise Emissions

The following section describes the assessment method applied to predict impact of construction noise on the identified commercial receptors. Assumptions and data on which the prediction has been based are also presented below.

3.2.1. Method

To assess the potential for likely significant effects of noise from demolition and construction works on existing commercial receptors surrounding the site, the '5dB change method' provided in BS 5228-1:2009+A1:2014 has been used. This method defines effects on receptors to be potentially significant if the total noise at the time of construction exceeds the pre-construction ambient noise by 5dB or more. This is subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively.

BS 5228-1 states that the prediction method is valid up to a distance of 300m, due to increasing influence of meteorological effects on noise propagation beyond that point. All commercial receptors considered in this assessment are located further than 300m from the site, however the assessment is still considered valid despite small prediction uncertainty.

The predicted noise levels at identified commercial receptors have been calculated by considering the individual source levels from plant and equipment items, the number of plant operating at any one time, proportion of time for which each item is expected to operate, the distance to the receptors and any intervening screening.

3.2.2. Data and assumptions

The demolition and construction programme is anticipated to be undertaken over the course of approximately 24 months between July 2022 and June 2024. According to the information provided, the amount of the equipment carrying out works on the site - and therefore the site's noise-generating potential - is anticipated to be the greatest in February 2022. This scenario has been used to provide a worst-case assessment.

The assessment assumes construction work will be carried out 24 hours a day, 7 days a week, as is understood to be consented by the extant planning permission. Although night-time construction works will be permitted, due to operational nature of the commercial receptors assessed, daytime hours only are the subject of this assessment.

Information has been provided on anticipated construction plant and equipment along with the programme of works. Due to the practical limitations in predicting the programme and exact scheduling of construction and demolition works, some assumptions have been made to account for the worst-case scenario:

- Each plant and equipment item has been assumed to operate for 100% of the time during which it is on site.
- Sources have been assumed to be positioned at the shortest possible distance to each receptor (at the site boundary).
- As 24-hour construction activity is assumed, however, to account for daytime analysis only, numbers of anticipated equipment items have been reduced by 1/3rd.

Equipment source terms and noise emissions levels have been taken from BS 5228-1 for relevant corresponding items. Details of the plant and equipment items, used as a basis of prediction are shown in Table 3.2.

Table 3.2: Equipment numbers and noise level data used

Programme Item	BS 5228-1:2009+A1:2014 Item	Number of items	Noise level, dB(A) at 10m (single item)
Pile Rig	Backhoe mounted hydraulic breaker	6	88
Crane	Mobile telescopic crane (80t)	16	77
Boom Lift	Lorry with lifting boom	19	77

Scissor Lift	Diesel scissor lift	4	70
Excavator	Tracked excavator (22 tonne)	5	78
Dump Truck	Articulated dump truck	5	81
Concrete Truck	Concrete mixer truck (discharging) and concrete pump (pumping)	18	75

3.2.3. BS 8233:2014 calculations

Internal noise levels have been calculated and assessed based on BS 8233 recommendations for office us. The internal levels have been calculated from predicted construction noise levels at the receptor façade adding a correction from outside to inside assuming windows are closed. Due to limited information on receptors the following assumptions have been made:

- Standard masonry cavity wall construction has been assumed.
- Standard double glazed window units have been assumed.
- It has been assumed that internal office space has hard suspended ceiling.
- Calculations have been made to account for a standard private office (5 x 5m)

The predicted internal noise levels have been then assessed against the criteria for open plan offices and meeting rooms in BS 8233.

3.2.4. Construction Vibration

Due to distance between the site and the receptors being greater than 100m – and therefore out of BS 5228-2 vibration prediction range calculation method - the level of vibration as a result of the proposed construction and demolition works is predicted to be well below levels at which there is a risk of building damage or disturbance to occupants. Therefore, assessment of construction vibration has been scoped out.

5. Results

5.1. Baseline Survey Results

Table 5.1 presents a summary of the noise monitoring results. A detailed data time history graph, and a photograph of the measurement set up are presented in Appendices A and B.

Table 5.1: Long-term Monitoring Results

Start date	Reference period	L_{Aeq} (dB) [2]	L_{Amax} (dB)	L_{A90} (dB) [3]
Thursday 17/03/2022	Day (12:30-23:00) [1]	57	96	53
	Night (23:00-07:00)	50	91	41
Friday 18/03/2022	Day (07:00-23:00)	57	91	47
	Night (23:00-07:00)	45	78	42
Saturday 19/03/2022	Day (07:00-23:00)	51	78	45
	Night (23:00-07:00)	44	66	41
Sunday 20/03/2022	Day (07:00-23:00)	49	97	42
	Night (23:00-07:00)	48	77	42
Monday 21/03/2022	Day (07:00-23:00)	63	92	48
	Night (23:00-07:00)	50	85	38
Tuesday 22/03/2022	Day (12:30-23:00) [1]	58	89	48

Notes: [1] Measurement period is shortened due to equipment installation and collection times. [2] Calculated as a logarithmic average of relevant 15-minute samples over the associated period. [3] Representative $L_{A90,T}$ calculated as the most of relevant 15-minute samples over the associated period.

As described in section 3.1.3, the Saturday and Sunday only data was used to establish the background sound level as this would warrant a more conservative approach due to construction work noise affecting the weekday data. Logarithmic average of weekend ambient noise levels of 42dB L_{Aeq} was used as a representative ambient noise level in this assessment.

5.2. Construction Noise Assessment

Summary of the predicted construction noise levels at each receptor is presented in Table 5.2 along with measured ambient noise levels and assessment criteria. Summary of the predicted internal noise levels in each office receptor is presented in Table 5.3.

Table 5.2: Summary of construction noise prediction

Receptor	Assessment period	Averageme asured ambient noise level, $dB_{LAeq, T}$	Highest predicted construction noise level, $dB_{LAeq, T}$ (façade)	Level above ambient noise, dB	Lower cut-off threshold for assessment period	Potential significant effect
South Tees Business Centre	Daytime (07:00-23:00)	50	57	6	65	None
Trigiene and Metador Offices	Daytime (07:00-23:00)	50	61	11	65	None

Table 5.3: Summary of internal noise level prediction

Receptor	Predicted internal noise levels from construction noise, $dB_{LAeq, T}$	Within BS 8233:2014 range for meeting rooms	Within BS 8233:2014 range for open plan offices
South Tees Business Centre	37.8	YES	BELOW
Trigiene and Metador Offices	39.8	YES	BELOW

The predicted highest construction noise level at South Tees Business Centre is 57$dB_{LAeq, 8h}$ and 61$dBL_{Aeq, 8h}$ at Trigiene and Metador offices. These levels fall below the lower cut-off construction noise threshold of 65dB, despite being more than 5dB above the pre-construction ambient noise level. Therefore, the effects at the nearest commercial receptors would not be significant.

Based on BS-8233:2014 recommendations, internal noise levels at the receptors with closed windows are expected to be within the range recommended for meeting rooms and below the range for open plan offices. Therefore, no significant effect of noise from construction on acoustic comfort of commercial receptor occupants is envisaged. This is based on assumptions of typical enclosed office finishes and dimensions, and a glazing sound reduction performance representative of a typical thermal double glazing.

Despite the receptors being located more than 300m, any small uncertainty would not be likely to change the assessment result. Furthermore, the assessment source terms and assumptions are considered conservative and represent an absolute worst-case scenario and noise levels resultant from construction works from the proposed development are anticipated to be lower than predicted for majority of the work's duration.

6. Conclusions

The predicted highest construction noise levels at the commercial receptors are below the BS 5228-1 '5dB change method' lower threshold of 65 dB L_{Aeq}. The internal noise levels in the commercial receptors are expected to be within or below the BS 8233 recommended ranges for office spaces. The effects at identified nearest commercial receptors to the proposed development during the construction works are therefore predicted to be negligible.

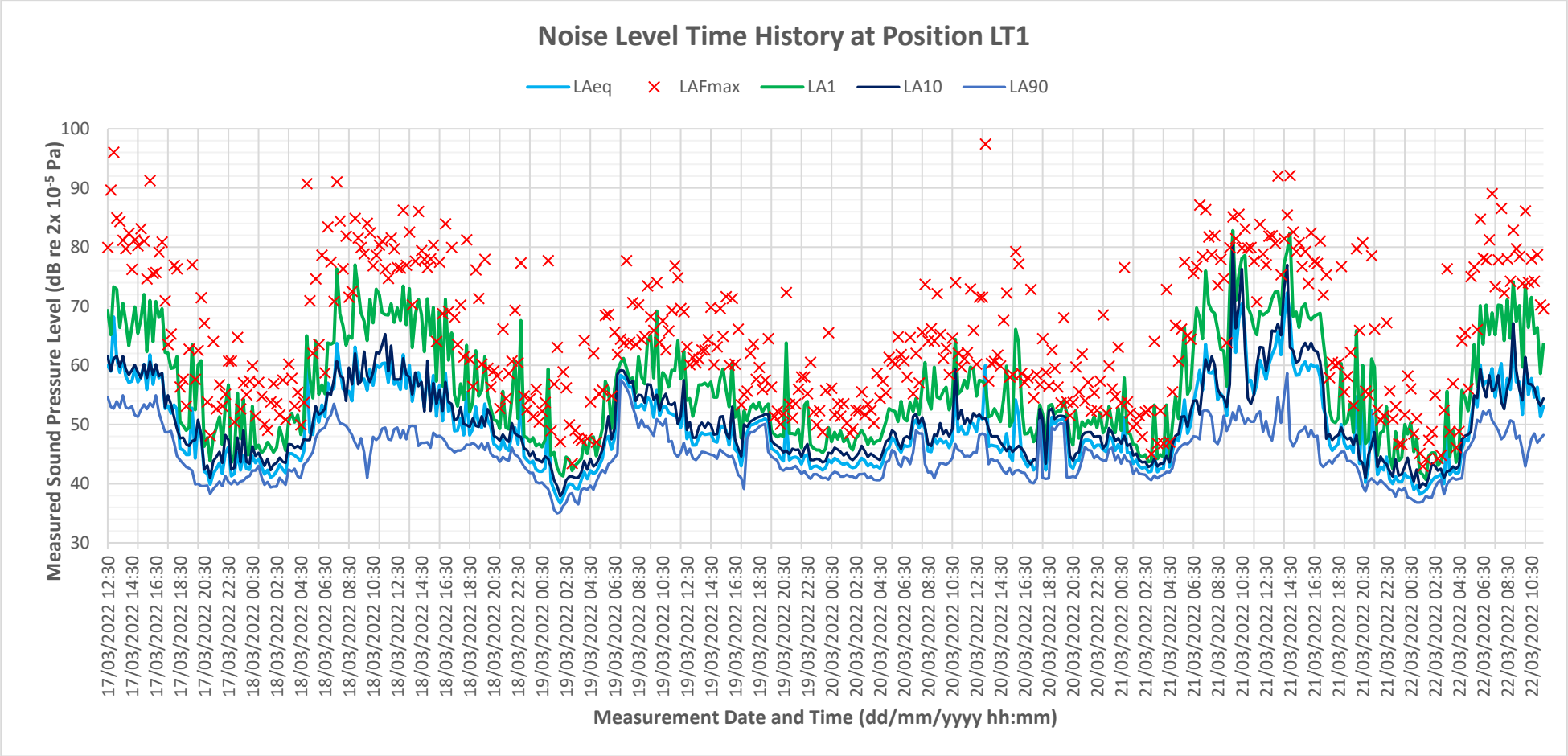
Nevertheless, the contractor should ensure they follow best practicable means where possible to ensure that impacts to nearby businesses are kept to minimum. Control of construction noise and vibration is typically achieved by implementing "best practicable means" as defined in Section 72 of the Control of Pollution Act 1974 (p.92) as "reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications".

Typical mitigation measures included as part of "best practicable means", relevant to the proposed works include:

- the use of inherently quieter construction and demolition methods where appropriate, including the selection of quieter plant and equipment, ensuring they are maintained in good working order, and are used in accordance with the manufacturers' instructions.
- informing all nearby noise-sensitive receptors in advance of any construction or demolition works. A site contact telephone number should be provided to local residents, and the contact should liaise with the residents where possible to maintain good rapport.
- inform all site employees and site visitors of the location of nearby noise and vibration sensitive locations.
- using concrete bored piling instead of hammer drop or vibratory piling.
- employment of screening through the use of enclosures or noise barriers.
- appropriate phasing of construction and demolition works.
- positioning directional noise sources away from sensitive receptors.

Appendix A: Long-term Measurement Data

Figure A.1



Appendix B: Monitoring Location Photos

Figure B.1: Long-term monitoring set up