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GOOD PRACTICE CASE STUDY OF MANAGING CONSTRUCTION NOISE IN CENTRAL LONDON

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This paper presents a case study of managing construction noise of a recent large infrastructure project in central London, and the route to achieve award for management of noise and vibration from construction sites. Good practice in effective planning, prediction, mitigation and management, and compliance monitoring are the key elements to minimise the potential effects and discussed in the paper. Site examples are also provided.
Keywords: construction noise, prediction, management, urban environment

1. Introduction

London has been home to some of the largest construction developments in the UK in the past two decades. The most recent such project is Thames Tideway Tunnel ("Tideway"), which is a nationally important infrastructure project for the construction of a 25 km tunnel running mostly under the tidal section of the River Thames through central London. It will provide capture, storage and conveyance of almost all the combined raw sewage and rainwater discharges that currently overflow into the river. The construction of the project requires 25 construction sites, with periods of 24 hour working required during the tunnelling phase at some of these sites.

Another example is the Crossrail project, which is Europe's largest construction project. The Crossrail route runs over 100km from Reading and Heathrow in the west, through new tunnels under central London to Shenfield and Abbey Wood in the east. There are 40 Crossrail stations including 10 new stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, Canary Wharf, Custom House, Woolwich and Abbey Wood inside central London.

Many of these projects have been undertaken in central London with locations in close proximity to neighbouring properties sensitive to noise and vibration. These urban locations present significant challenges as effectiveness of tradition mitigations such as noise barriers are reduced due to the high rise building in the city centre.

This paper discusses key elements of good practice measures in controlling construction noise and vibration including early effective planning, noise prediction, mitigation and management, and compliance monitoring.

2. Construction noise assessment in the UK

2.1 Legal framework

The main legal provisions controlling noise from worksites are contained in the Control of Pollution Act 1974 (CoPA) [1]. It sets out the legal framework for managing construction noise and vibration. The underlying legal principle of controlling noise and vibration on site is that the activities should be undertaken in a manner which demonstrates that Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act 1974, is being adopted at all times.

The CoPA provides two mechanisms to managing construction noise and vibration on worksites. The first, under Section 60 of the Act, is a reactive mechanism that enables Local Authorities to serve a Section 60 Notice, which can include controls on working hours and methods of works to be used and specify onsite mitigation. The site must then be operated under the constraints of the notice (subject to appeal) which can lead to delays and associated costs.

The second, under Section 61 of the Act, is a proactive mechanism which enables the contractor to submit a Section 61 consent application for approval 28 days prior to the commencement of construction. The application should detail, among other things, the construction activities, working hours and measures to be employed to demonstrate that best practicable means is being adopted at all times to minimise noise and vibration on site. If the works are undertaken in a manner compliant with a consented Section 61 application, then the local authority cannot serve a Section 60 Notice and therefore the contractor can have more certainty in the programme. There are abundance of existing guidance on preparation of section 61 applications should the reader be interested. This paper focused on the principles of controlling construction noise and vibration.

2.2 Assessment methodology

UK construction noise is assessed following guidance set out in British Standard 5228:2009+A2014 [2]. This document has been continually developed and improved since the Wilson report [3]. Enforcement of noise pollution from construction sites is through the Control of Pollution Act 1976.

BS5228 assesses construction noise differently to noise of an industrial or commercial nature (which is addressed instead by British Standard BS4142:2014[4]).

As construction noise is required to be assessed in EIA, it is often necessary to consider the significance of construction noise effects on human receptors and the local environment. The 2009 edition (amended in 2014) of the Standard introduces three example methods for assessing the significance of construction noise in Annex E (Informative):

- Potential significance based on fixed noise limits:
  - This method suggests fixed noise limits for “rural, suburban and urban areas away from busy roads” (e.g. 70 dBA between 07:00 and 19:00) and a 5 dB higher limit for “urban areas near main roads in heavy industrial areas”.
- Potential significance based on noise change:
  - The ABC method:
    - Places the receptor in a category (A, B or C) depending in the baseline sound level, and from this derives the level at which a potentially significant effect could occur.
  - The 5 dB(A) change method:
    - Noise levels generated by site activities are deemed to be potentially significant if the total noise exceeds the baseline level by 5 dB or more (subject to lower cut-off values) and where the duration will be for a month or more.

In addition the standard also gives examples of thresholds (“trigger levels”) that could be used to determine eligibility for sound insulation or temporary rehousing. These are widely applied as shown in the standard, unless the baseline is already higher than the trigger level. If the baseline level exceeds the trigger level(in the absence of construction noise) then the ambient noise level shall be used as the construction noise level required to trigger insulation and the ambient noise level +5dB shall be used as the noise insulation trigger level and +10dB for the temporary re-housing trigger level.

To adequately assess the construction noise, it is essential that robust sound baseline is established and accurate predictions of construction noise are undertaken. The baseline sound levels established at the planning stage may have changed over the time.

3. Construction noise management – a case study

This section presents a case study for a Crossrail Station in central London. The project is delivering a new underground station and a ticket hall, with a second integrated ticket hall. The authors of this paper and their colleagues provided technical support and input on all noise and vibration issues associated with the project.

3.1 Site location and challenges

The construction site located at the heart of the West End, a very busy shopping area, and surround by sensitive buildings including recording studios, theatres for film classification, language school, residential and commercial properties.

The site is regulated under the Crossrail Environmental Commitment, Special Case Undertakings and Assurances, shared use of the work site and on the critical delivery path.

3.2 Early planning

The management and control of noise arising from construction activity is most effective if it is considered at an early stage in the design and planning of the works. It is recommended during the design phase that the constructability of any proposals considers, among other things, the practicality of employing measures that can be incorporated to minimise noise and vibration levels. All those with responsibility for the work are encouraged to consider the steps that will be used to minimise noise and vibration from works, including the design and formulation of the contract requirements.

In many cases, simple measures can be highly effective if properly planned at the design stage. For example, the provision of electrical power on site can be used to avoid the later use of noisy generators. Demolishing structures in a manner which means that any structure providing screening to neighbouring properties remains in place as long as practicable, thus minimising the noise level at that neighbouring property.

In controlling the noise from construction sites the choice of plant (i.e. controlling noise and vibration at source) and breaking the path of noise to the receiver through the introduction of hoardings / acoustic barriers / layout design etc., are the primary considerations which need to be planned early on in the development process. The hours of work also need to be considered in order to mitigate the effects of the noise and vibration on sensitive receptors.

Risk assessment approach could be adopted to enable initial identification of the overall noise and vibration risk associated with the site and the proposed works, and to assist the contractor in assessing the level of noise and vibration control required. The risk assessment can be based on the locality the proposed works:

- Programme duration.
- Proximity of nearest sensitive receptors.
- Ambient noise level.
- Working hours.
- Particular noisy works such as breaking and piling.

3.3 Noise prediction to inform section 61 process

Construction noise and vibration assessments started 12 month prior to the start of the construction works, and becomes integrated process for the preparation and delivery of Section 61 applications. This enables

BS 5228-1 provides guidance concerning methods of predicting construction noise and assessing its impact on those exposed to it. Annex F of BS 5228 provides methods for estimating noise from site, and the general approach to the prediction of site noise is shown in Figure F.1 of the BS 5228-1 and reproduced in Figure 1 below.

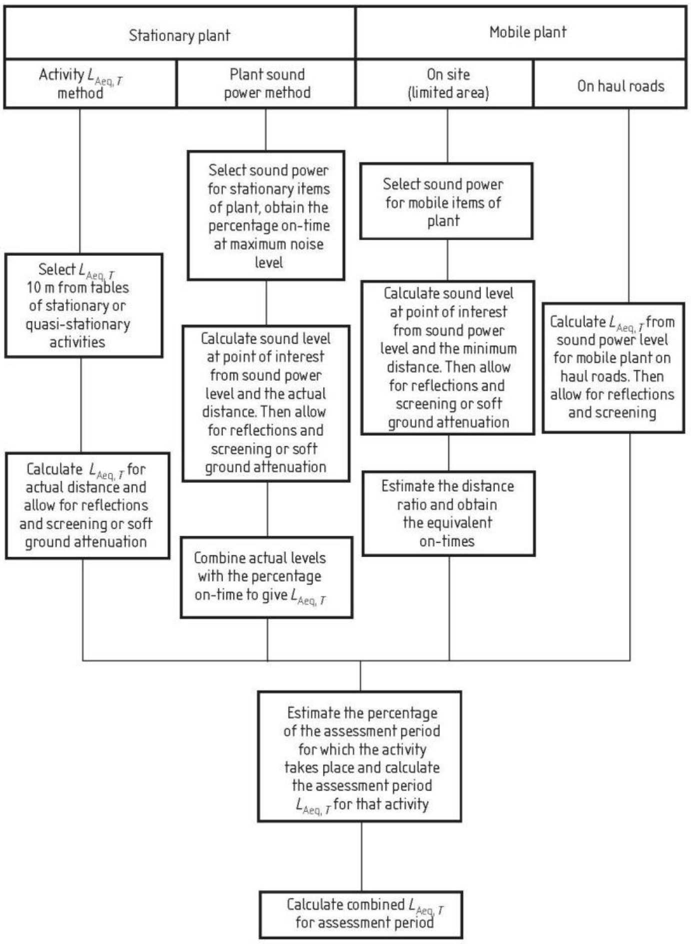

Figure 1: BS 5228-1 general approach to the prediction of construction site noise.

In order to calculate the construction noise, the following information is required

- L_{ea} or L_{wA} of the plant
- Operating time, T_t (as a proportion of the assessment period T)
- Distance to receptors, R or d_{min}
- Traverse length (for moving plant), l_{tr}
- Screening, site hoarding or topography
- % Soft ground (as a fraction of 1)

Noise data used for the calculation can be sourced from manufacturer, previous measurements or BS 5228 Annex C and D, with Annex D gives historic data tables taken from the 1997 edition of BS 5228.

3.4 Noise Monitoring

Monitoring may include either physical measurement or observational on-site monitoring. Noise monitoring of construction activities have been undertaken for a variety of different reasons.

- Demonstrating compliance: noise monitoring is often a requirement of the Section 61 process, or other agreements, in order to compare actual noise levels with predictions or consented levels and ensure legal or other compliance. Compliance monitoring can include measurement at noise-sensitive receptors, proxy locations or determination of plant sound power levels.
- Pro-active management of noise: monitoring may be undertaken in conjunction with site visual inspections/walkovers to determine whether Best Practicable Means (BPM) is being employed.
- Complaint investigation: noise monitoring may be instigated as a result of a complaint, or multiple complaints being received. The type of monitoring employed is generally specifically tailored to the nature of the complaint.
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Monitoring of noise from construction sites can be carried out using a range of different instruments depending upon the time over which the measurements need to be made. If the measurements are to be made over a short period, a handheld sound level meter would be suitable. If the measurements need to be made over a longer period, an outdoor environmental measurement kit may be needed. Modern noise monitoring system includes continuously logging equipment accessible through telemetry. This will allow remote access to the monitoring data. We have used three noise monitors and two vibration monitors for this project at each of the ticket hall site. Figure 2 below shows an example of construction noise monitoring.

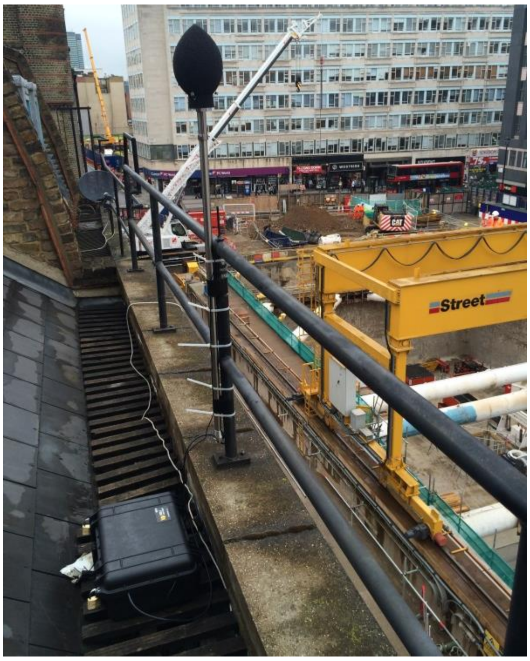

Figure 2: Example of construction noise monitoring

Effective and timely reporting is essential if monitoring is to be used to minimise noise levels and mitigate the effects of the noise. There is little point in gathering reams of data if it is not regularly reviewed and reported. As the noise and vibration monitors will collect noise data on a continuous basis, information can be collected and reported to interested parties at any time, although as a minimum, weekly noise and vibration reports will be produced. Figure 3 shows typical daily monitoring result graph showing variation in noise levels through the day.

The noise and vibration reports have been used for the following:

- verify whether all Best Practicable Means are adopted to control noise and vibration levels.
- compare measured noise levels against the predicted noise levels.

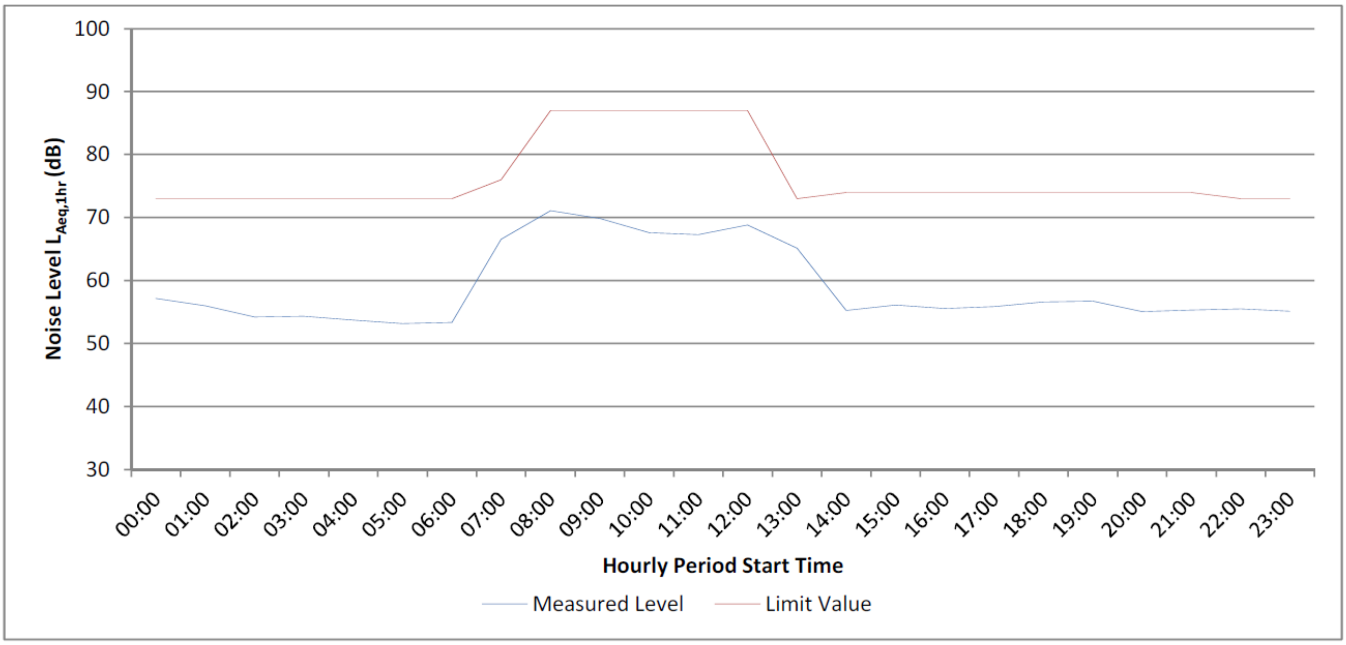

Figure 3: Typical daily monitoring result graph showing variation in noise levels through the day

- log any noise or vibration nonconformities including nature, status, corrective and preventive actions and potential for statutory intervention.
- status on any environmental noise and vibration complaints.
- progress / changes in programme work requirements and associated noise impacts.
- any actions or interventions undertaken by enforcement organisations
- summaries of any noise and vibration inspections and attended monitoring results

A variety of “live” unattended noise monitoring systems provide immediate alerts to site personnel if noise trigger levels have been exceeded or are likely to be exceeded. This allows the rapid pro-active management of site activities and the resulting noise generation.

AECOM’s leading technology innovation is its global, cross industry focus on using SMART (Self Monitoring Analysis and Reporting Technologies) to remotely monitor client data and capture information. A screenshot of the system is shown in Figure 4 below.

Figure 4: AECOM SMART noise and vibration monitoring system.

4. Conclusions

The Control of Pollution Act 1974 sets out the legal framework for managing construction noise and vibration, and British Standards 5228-1 provides guidance concerning methods of predicting and measuring noise and assessing its impact. Case study demonstrates simple measures can be highly effective if properly planned at early design stage of the project and optimal construction noise control can be achieved with combination of accurate noise prediction, management of noise on site, compliance monitoring and effective community liaison.

REFERENCES

1 Her Majesty's Stationery Office, *Control of Pollution Act*, (1974).

2 HMSO, (1990); *Environmental Protection Act*, (1990).

3 British Standards Limited, *BS 5228 Code of Practice for noise and vibration control on construction and open sites - Part 1: Noise*, London, (2014).

4 HMSO, *Committee on the problem of noise, Final Report Command Paper 2056*, London, (1963).

5 British Standards Limited, *BS 4142 Methods for rating and assessing industrial and commercial sound*, London, (2014).