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UTS Book Vault & Storage

Excavation and Construction - Noise and Vibration Management Plan

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1 INTRODUCTION

This document presents a discussion of the processes, which will be followed in order to manage noise and vibration from the excavation and construction of UTS ASRS Building located under Alumni Green on the Broadway Precinct of the UTS City Campus at the corner of Jones and Thomas Streets.

UTS in recognition of their requirement to minimise noise and vibration emissions from the site to adjacent land uses have commissioned this study. The principal objective of this study is to undertake an evaluation of work to be performed during the excavation and construction phase of the project and forecast the potential impact of noise and vibration. The evaluation will be used to formulate and streamline effective regulation and mitigation measures. As a part of this process ongoing testing will be used to evaluate the noise and vibration regulation strategies and ensure that they are effective.

To further ensure compliance with appropriate standards, ongoing monitoring will be instigated as necessary.

The principal issues, which will be addressed in this report, are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Formulation of a strategy for construction to comply with the standards identified in the above point.
- Development of a monitoring program to measure and regulate noise and vibration at all potentially affected locations.

This assessment has been conducted based on plans A220 – A226, A260 – A261 and A210 provided by Hassell Architects and dated 7 March 2011.

2 PROJECT OBJECTIVE

The objective of this management plan is to minimise noise and vibration emissions from the excavation and construction work associated with this project and assist in maintaining a satisfactory environment around the site.

3 SITE DESCRIPTION AND POTENTIALLY EFFECTED PROPERTIES

The ASRS building is an underground building which will be turfed over until final landscaping is undertaken with the completion of the proposed Thomas Street Building. The proposed building will incorporate an automated book storage and retrieval system, associated plant and loading areas to serve the facility and two additional basement levels for UTS general storage.

The building is located to the north of UTS Building 2 which will be refurbished in the future to accommodate the new library when the existing Blake Library is relocated from the Haymarket Precinct. The ASRS building will serves as a book vault for the new library.

The nearest potentially affected receivers are located within the UTS development, and to a lesser extent, the TAFE buildings to the north of the site. It is anticipated that the new student accommodation building located at 718 Harris Street, Ultimo will be occupied by late 2011 and as a result would become a potentially affected residential receiver during the construction phase of the project.

Figure 1 details the site, potentially affected receivers and ambient noise measurement positions.

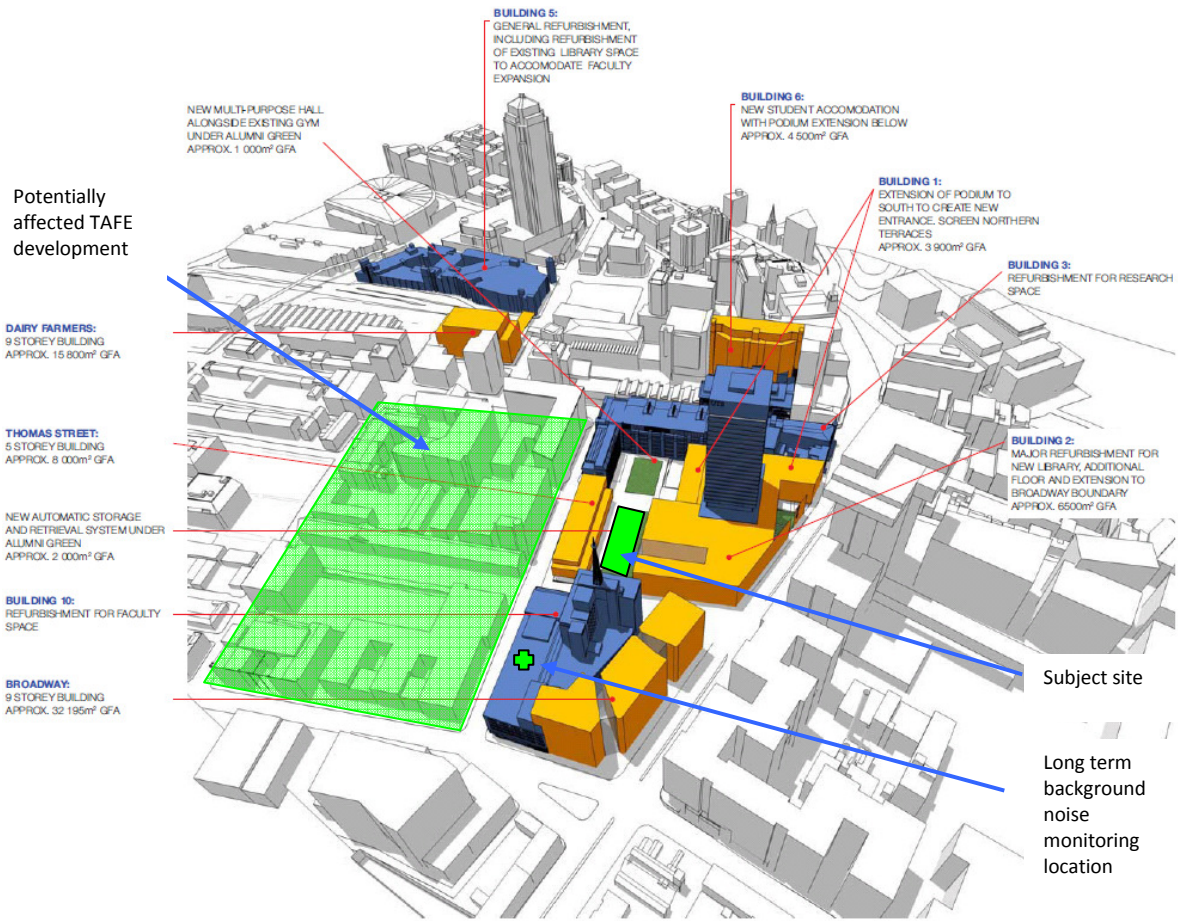


Figure 1 – Site Map

4 HOURS OF WORK

All work would be undertaken during Category 1 hours as defined by the City of Sydney "Construction Hours/Noise Within the Central Business District " (1992), which are:

Table 1 – City of Sydney Council Excavation Noise Criteria

DAY	TIME ZONE	CATEGORY	NOISE EMISSION CRITERIA
Monday to Friday	07:00 to 08:00 08:00 to 19:00	1 1	Background + 5dB(A) Background + 10dB(A)
Saturday	07:00 to 08:00 08:00 to 17:00	1 1	Background + 5dB(A) Background + 10dB(A)

5 NOISE EMISSION CRITERIA

5.1 EXISTING NOISE LEVELS

We note that existing background noise levels in the absence of noise generated from the subject site is based on long term noise monitoring conducted by Acoustic Logic Consultancy Pty Ltd in the vicinity of the subject site (see Figure 1) are as follows:

Table 2 – Existing Rating Background Noise Levels

Time of Day	Existing Rating Background Noise Level dB(A) L_{90}
Daytime (7.00am to 7.00pm)	62*

*This noise level has been determined using noise levels obtained that unaffected by construction noise from the surrounding sites (Broadway Building demolition).

5.2 NOISE CRITERIA

The applicable guidelines and standards are:

- Local Authority - City of Sydney "Construction Hours/Noise Within the Central Business District " (1992) which nominates the following objectives for the proposed hours of excavation:
  - 7am to 8am – background + 5 dB(A)
  - 8am to 7pm – background + 5 dB(A) + 5 dB(A)

- Australian Standard 2436-1981 "Guide to Noise Control on Construction Maintenance and Demolition Site". The requirements stipulated in Section 3 of the standard will be followed.

- Draft DECC Construction Noise and Vibration Guideline

Section 3 of AS 2436 states that care shall be taken in applying criteria that normally would be used to regulate noise emitted from industrial, commercial and residential premises to construction, particularly for those activities which are transitory and of short duration. For the control and regulation of noise from construction sites AS2436 nominates the following:

- That reasonable suitable noise criterion is established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical excavation and construction activities to sensitive receivers.
- If noise levels exceed "background + 5 or 10 dB(A)" noise goal at sensitive receiver locations, investigate and implement all practical and cost effective techniques to limit noise emissions. For commercial receivers, a background + 10 dB(A) criterion has been adopted at all times given that the buildings are expected to be predominantly unoccupied between 7am and 8am and it does not make sense to restrict activity at a time when it would produce minimal impact.
- If the noise goal is still exceeded after applying all practical engineering controls to limit noise emissions investigate management and other techniques to mitigate noise emissions.

5.3 VIBRATION CRITERIA

In the absence of specific vibration criteria from City of Sydney in its DCP, it is proposed to adopt two sets of vibration criteria, namely:

- German Standard DIN 4150-3 (1999-02): *"Structural Vibration – Effects of Vibration on Structures"*; and
- British Standard BS 6472:1992 *"Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*.

The criteria and the application of these Standards are discussed in separate sections below.

5.3.1 German Standard DIN 4150-3 (1999-02)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 3.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 3 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

	TYPE OF STRUCTURE	PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

5.3.2 British Standard BS 6472:1992

British Standard BS 6472:1992 develops criteria relating to levels of building vibration that may be expected to give rise to *"adverse comment"*, in the frequency range most applicable to impacts associated with construction, which is 1 to 80Hz. These threshold values are used as criteria for assessing the loss of amenity and are presented below in Table 4.

Table 4 – BS 6472:1992 Criteria to Avoid *"Adverse Comment"*

Type of Occupancy	Time of Day	Peak Particle Velocity (mms^{-1}) between 1Hz to 80Hz Likely to Cause *"Adverse Comment"*			
		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vertical	Horizontal	Vertical	Horizontal
Residential	Day	0.3 to 0.6	0.8 to 0.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8
Offices	Day	0.6	1.6	18	51
	Night	0.6	1.6	18	51
Workshops	Day	1.2	3.2	18	51
	Night	1.2	3.2	18	51

The limits indicate that people in buildings are significantly less susceptible to horizontal vibration than to vertical vibration. Furthermore, Section 4.1 of BS 6472 notes that situations can exist where vibration magnitudes above those generally corresponding to minimal *"adverse comment"* levels can be tolerated, particularly for temporary disturbances and infrequent and intermittent events such as those associated with construction projects.

6 CONTROL OF CONSTRUCTION NOISE AND VIBRATION

As a part of the noise management plan, a detailed study will be undertaken of each of the proposed activities which will occur as a part of the excavation and construction works on this project. Detailed ameliorative treatments will be determined when an excavation and construction methodology plan is prepared and provided by the engaged contractor.

The execution of this work will facilitate the formulation of noise control strategies for this project.

The flow charts that follow illustrate the process followed to assess excavation and construction activities prior to the start of work on site as well as the ongoing investigation into noise during the construction period.

Chart 1 – Initial Assessment of Procedures

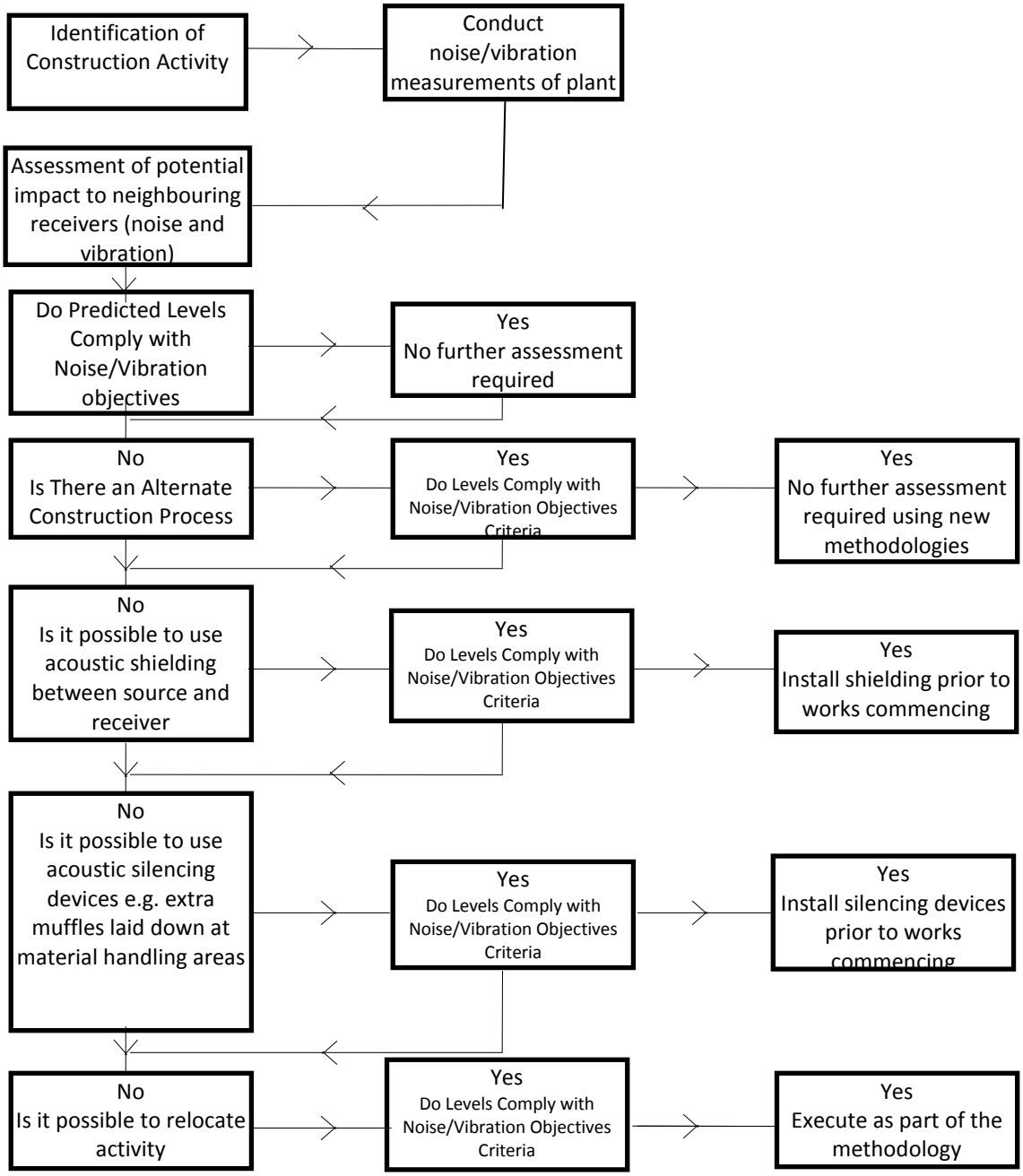
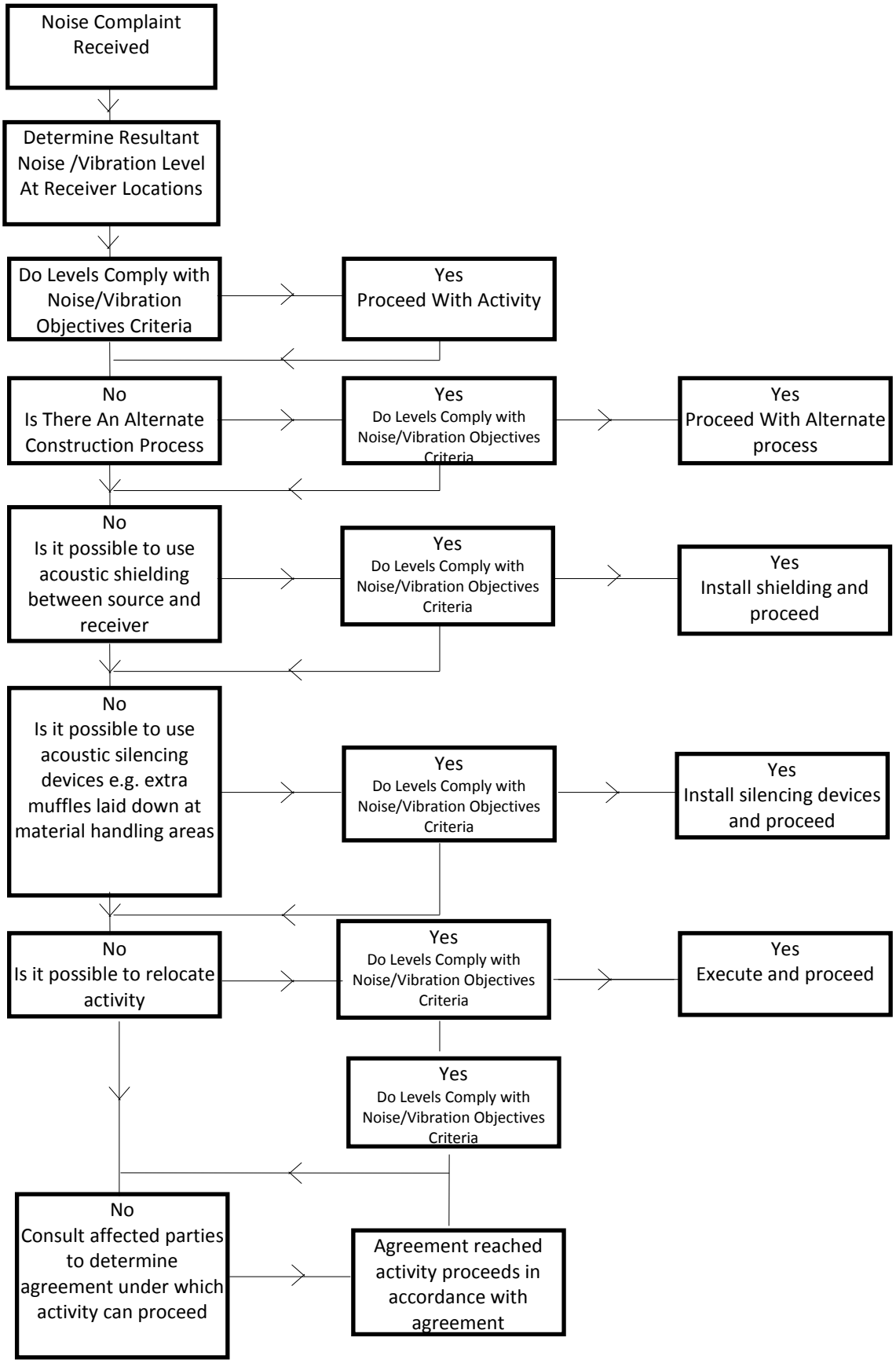


Chart 2 – Ongoing Site Procedures



7 NOISE AND VIBRATION CONTROL METHODS

The determination of appropriate noise control measures will be dependant on the particular activities and construction appliances. This section provides an outline of available methods.

7.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying out this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

7.2 ACOUSTIC BARRIERS

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependant on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

7.3 SILENCING DEVICES

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

7.4 MATERIAL HANDLING

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

7.5 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

7.6 ESTABLISHMENT OF SITE PRACTICES

This involves the formulation of work practices to reduce noise generation. A noise plan will be developed for this project outlining work procedures and methods for minimising noise.

7.7 REGULAR NOISE CHECKS OF EQUIPMENT

To determine the requirement for silencing devices on machinery it is proposed to undertake fortnightly noise check. Noise levels of all machines on site will be measured and if they are found to be higher than nominated for that equipment type, items such as mufflers and engine shrouds will be examined to ensure they are in good working order.

A record of these measurements will be kept on a form similar to that shown in Appendix 1. This measure is expected to maintain noise at constant levels, and prevent any increases.

7.8 NOISE MONITORING

Noise monitoring can be undertaken to determine the effectiveness of measures which are being implemented. The results of monitoring can be used to devise further control measures.

7.9 COMBINATION OF METHODS

In some cases it may be necessary that two or more control measures be implemented to minimise noise.

8 NOISE AND VIBRATION ASSESSMENT

An assessment of the principal sources of noise emission has been undertaken to identify the activities that may produce noise and/or vibration impacts so that appropriate ameliorative measures can be formulated.

8.1 EXCAVATION PHASE

Once the surface layer of soil and existing man made materials is removed, the remainder of the excavation will be in rock. The excavated materials will be loaded onto trucks, which will leave via a route determined between the engaged contractor and Acoustic Logic Consultancy (ALC).

The loudest activity would be the excavation of rock. These alternative rock excavation methods have been investigated:

- Hydraulic hammering - Hydraulic hammering generates the highest noise and vibration levels but is generally the quickest method of rock extraction.
- Rock sawing and ripping - Rock sawing would produce lower noise levels and much lower vibration levels than hammering.
- Line drilling and using rock splitting - Line drilling is an untried technology in general excavation and can therefore not be adopted.

Excavation will be undertaken primarily by ripping. Noise levels produced by the excavation equipment may exceed the noise goals in adjacent UTS buildings when works are undertaken near the boundary of the site, even when quieter excavation methods such as ripping are used.

On site measurements will establish noise/vibration levels at sensitive receivers. If noise levels exceed the criteria then the possibility of reducing noise emission will be investigated and all practical methods should be employed to reduce noise to the target levels in order to preserve the amenity of the nearby occupancies. Given the proximity of the nearest receivers, the most feasible noise mitigation will involve scheduling of noise intensive works at times when the adjacent receivers are not in use/noise sensitive.

Noise impacts outside of the UTS precinct (TAFE building being the closest) are not predicted to exceed City of Sydney construction noise guidelines.

8.2 CONSTRUCTION PHASE

Noise levels generated during the construction phase will be significantly lower than during excavation. Significant vibration is not anticipated to be produced during this phase.

The main noise producing activities will be that attributed to the forming and pouring of the concrete floor slabs, and crane operation. These would be managed by placing the plant as far as practicable from the sensitive receivers. It is expected that the adopted noise guidelines will generally be achieved during this phase except during louder activities such as stripping out of formwork which will occur from time to time.

8.3 VIBRATION MONITORING

Contractor to ensure that the recommended vibration levels are not exceeded at their respective distances.

9 PROPOSED ACTIVITIES OUTSIDE THE APPROVED CONSTRUCTION HOURS

There are currently no proposed activities to occur outside of the standard constructions hours specified by City of Sydney Council, however, there may be instances where it is unavoidable that a concrete pour may take place outside standard construction hours.

10 CONSTRUCTION TIMETABLING, TIME AND DURATION RESTRICTIONS, RESPITE PERIODS AND FREQUENCY

Work on site will be restricted to the hours nominated by the Project Application approval conditions, thereby ensuring compliance with these requirements and minimising impact. Break periods will be arranged where possible to ensure that all contractors have their break at the same time resulting in a quiet site during those periods.

It is also noted that during the excavation stage, due to the nature of possible plant and equipment serving site location, noise emissions will be transitory around the site thereby reducing the extent of noise impact upon receivers.

11 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

11.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management program to work effectively, continuous communication is required between all parties, which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation processes is to:

- Inform and educate the groups about the project and the noise controls being implemented;
- Increase understanding of all acoustic issues related to the project and options available;
- Identify group concerns generated by the project, so that they can be addressed; and
- Ensure that concerned individuals or groups are aware of and have access to the engaged contractor's Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular scheduled meetings will be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

11.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable;

- noise measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

12 CONTINGENCY PLANS

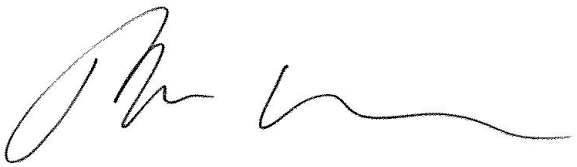
Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process;
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible;
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc where practical; and
4. Selecting alternative equipment/processes where practical.

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form as discussed in Section 11.2 of this report.

Prepared by



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