



Construction Noise & Vibration Management Plan

The Mercantile Hotel, The Rocks, NSW

Client:
Redwood & Co.

21 December 2017





Head Office
 Suite 9
 38-46 Albany St
 St Leonards 2065

Postal Address
 PO Box 270
 Neutral Bay 2089

T 02 9908 1270
F 02 9908 1271
E info@acousticdynamics.com.au
W www.acousticdynamics.com.au

ABN: 36 105 797 715


| | |
|---------|--|
| Client | Redwood & Co. |
| Contact | Mr Matthew Bennett & Mr Matthew Zarate |
| Address | 5/153 Beauchamp Road, MATRAVILLE NSW 2036 |
| Phone | 02 9283 0860 |
| Email | matt@redwoodandco.com.au |

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| Document | Revision | Date | Prepared | Checked | Approved |
|--------------------|----------|------------------|----------|---------|---|
| 4142R001.JC.170727 | 0 | 1 December 2017 | JC | RH | RH |
| 4142R001.JC.171213 | 1 | 13 December 2017 | JC | RH | RH |
| 4142R001.JC.171221 | 2 | 21 December 2017 | JC | RH |  |
| | | | | | |

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GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined in Section 2 below.

NOISE DESCRIPTORS

L_{eq} – The sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period.

L_{Aeq(15 min)} – The A-weighted equivalent continuous sound level over a 15 minute period.

L_{A90} – The A-weighted noise level that has been exceeded for 90% of the measurement duration.

dB – Decibels. The fundamental unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB(SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

1 INTRODUCTION

1.1 SUMMARY

Acoustic Dynamics is engaged by Redwood & Co. to assess and, where required, make recommendations to reduce and manage the noise and vibration impact at the nearest potentially affected receivers resulting from the demolition, excavation and construction works, and associated activities, for the proposed development at The Mercantile Hotel, 25-27 George Street, The Rocks.

The proposal is for the renovation of The Mercantile Hotel, with alterations to all floors of the building.

This report presents the relevant construction noise and vibration emission objectives, construction noise and vibration prediction calculations, an impact assessment and recommendations for mitigation and management measures to be implemented, to minimise the potential for adverse impact at the nearest potentially affected receivers, resulting from excavation and construction works.

This report is prepared in accordance with the requirements and guidelines of City of Sydney Council, the NSW Environment Protection Authority (EPA), and relevant Australian Standards.

1.2 LOCATION OF PROPOSED DEVELOPMENT

The subject excavation and construction works will be undertaken at 25-27 George Street, The Rocks, NSW.

The subject site has two road frontages, with the eastern boundary direct to George Street, and the western boundary direct to Gloucester Walk. The nearest sensitive residential receivers to the subject site are in the Sirius building, a multi-storey residential building to the west. Commercial receivers are located to the north, east, and south, with a shared wall existing between the subject site and 29 George Street, The Rocks.

The proposed development is shown in the Location Map & Drawings presented within **Appendix A**.

Based on information provided by the proponent, Acoustic Dynamics advises that demolition works would occur over 10-11 weeks, excavation works over 3-4 weeks, and construction works to occur for 7-8 months, during the daytime hours only.

Acoustic Dynamics is advised that use of noise generating equipment during the proposed works will be undertaken between the following operating hours, as shown in **Table 1.1**.

Table 1.1 Operating Hours of Noise Generating Equipment

| Activity | Permitted Work Hours |
|--|---|
| All building, demolition and site work, including site deliveries (except as detailed below) | <ul style="list-style-type: none"> Monday to Friday – 7:00am to 5:00pm Saturday – 7:00am to 3:00pm Sunday & public holidays – No work permitted |
| Excavating of rock, use of jack-hammers, pile-drivers or the like | <ul style="list-style-type: none"> Monday to Friday – 8:00am to 5:00pm Saturday – No work permitted Sunday & public holidays – No work permitted |
| Additional requirements for all development (except for single residential dwellings) | <ul style="list-style-type: none"> Saturdays and Sundays where the preceding Friday and/or the following Monday is a public holiday – No work permitted |

2 ASSESSMENT CRITERIA AND STANDARDS

2.1 ASSESSMENT CRITERIA

The following sections outline the relevant construction noise emission criteria and conditions applicable to the works.

2.2 CITY OF SYDNEY COUNCIL CRITERIA

2.2.1 STANDARD CITY OF SYDNEY ACOUSTIC CONDITIONS

“SCHEDULE 1B

PRIOR TO CONSTRUCTION CERTIFICATE/COMMENCEMENT OF WORK/HEALTH AND BUILDING

(28) DEMOLITION, EXCAVATION AND CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

A site specific noise management plan shall be submitted to the Council for comment and approval prior to issue of any Construction Certificate.

The Plan must be prepared by a suitably qualified person who possesses the qualifications to render them eligible for membership of the Australian Acoustic Society, Institution of Engineers Australia or the Australian Association of Acoustic Consultants.

The plan must include but not be limited to the following:-

- (a) identification of noise sensitive receivers near to the site.*

- (b) A prediction as to the level of noise impact likely to affect the nearest noise sensitive receivers from the use and proposed number of high noise intrusive appliances intended to be operated onsite. A statement should also be submitted outlining whether or not predicted noise levels will comply with the noise criteria stated within the City of Sydney Construction Hours /Noise Code of Practice 1992 for the typical construction hours of 07.30am to 5.30pm. Where resultant site noise levels are likely to be in exceedance of this noise criteria then a suitable proposal must be given as to the duration and frequency of respite periods that will be afforded to the occupiers of neighbouring property.*
- (c) A representative background noise measurement (LA90, 15 minute) should be submitted, assessed in the vicinity of any potentially affected receiver locations and measured in accordance with AS 1055:1.2. 1997.*
- (d) Confirmation of the level of community consultation that has/is and will be undertaken with Building Managers/ occupiers of the main adjoining noise sensitive properties likely to be most affected by site works and the operation of plant/machinery particularly during the demolition and excavation phases.*
- (e) Confirmation of noise monitoring methodology that is to be undertaken during the main stages of work at neighbouring noise sensitive properties in order to keep complaints to a minimum and to ensure that noise from site works complies with the noise criteria contained within City's Construction Noise Code.*
- (f) What course of action will be undertaken following receipt of a complaint concerning offensive noise.*
- (g) Details of any noise mitigation measures that have been outlined by an acoustic consultant or otherwise that will be deployed on site to reduce noise impacts on the occupiers of neighbouring noise sensitive property to a minimum.*
- (h) What plant and equipment is to be used on site, the level of sound mitigation measures to be undertaken in each case and the criteria adopted in their selection taking into account the likely noise impacts on the occupiers of neighbouring property and other less intrusive technologies available*

SCHEDULE 1C

DURING CONSTRUCTION/PRIOR TO OCCUPATION/COMPLETION

(60) HOURS OF WORK AND NOISE – OUTSIDE CBD

The hours of construction and work on the development must be as follows:

- (a) All work, including building/demolition and excavation work, and activities in the vicinity of the site generating noise associated with preparation for the commencement of work (e.g. loading and unloading of goods, transferring of tools etc) in connection with the proposed development must only be carried out*

between the hours of 7.30am and 5.30pm on Mondays to Fridays, inclusive, and 7.30am and 3.30pm on Saturdays, with safety inspections being permitted at 7.00am on work days, and no work must be carried out on Sundays or public holidays.

- (b) All work, including demolition, excavation and building work must comply with the City of Sydney Code of Practice for Construction Hours/Noise 1992 and Australian Standard 2436 -1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.*

Note: The City of Sydney Code of Practice for Construction Hours/Noise 1992 allows extended working hours subject to the approval of an application in accordance with the Code and under Section 96 of the Environmental Planning and Assessment Act 1979.

(64) USE OF HIGH NOISE EMISSION APPLIANCES / PLANT

- (a) The operation of high noise emission appliances, plant and/or machinery such as pile – drivers, rock breakers and hydraulic hammers and those which are not listed in Groups B, C, D, E or F of Schedule 1 of the City of Sydney Code of Practice for Construction Hours/Noise 1992 and Australian Standard 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites is restricted to the hours of (EHO to specify hours)*
- (b) All reasonable and feasible steps must be undertaken to ensure that the work, including demolition, excavation and building complies with the City of Sydney Code of Practice for Construction Hours/Noise 1992 and Australian Standard 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites.*

(65) NOTIFICATION OF EXCAVATION WORKS OR USE OF HIGH NOISE EMISSION APPLIANCES/PLANT

The immediately adjoining neighbours must be given a minimum of 48 hours' notice that excavation, shoring or underpinning works or use of high noise emission appliances / plant are about to commence."

2.3 AUSTRALIAN STANDARDS

Acoustic Dynamics has conducted a review of relevant Australian Standards in relation to the subject development. The following details this review.

2.3.1 AS2436 “GUIDE TO NOISE CONTROL ON CONSTRUCTION ... SITES”

Australian Standard 2436-2010: “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites” provides guidance on noise control in respect of engineering construction, maintenance and demolition works, including guidance in investigation and identification of noise sources, measurement of sound, and its assessment, with a view to planning of measures for noise control.

Acoustic Dynamics advises that AS 2436 contains the following information relating to appropriate noise emission goals for construction sites:

“3.2 NOISE AND VIBRATION IMPACTS ON THE COMMUNITY

Whether or not noise from a construction, maintenance or demolition site is likely to constitute a problem depends upon a number of considerations, such as –

- (a) existing background noise level;*
- (b) distance between the site and the areas likely to be affected by the construction noise;*
- (c) nature of buildings and the activity therein, where the noise is likely to be heard;*
- (d) the likely duration of construction, maintenance and demolition operations and the hours during which the above operations will be carried out (whether during the day, night or weekends);*
- (e) the nature of the noise, e.g. audible pure tone components and impulsive character; and*
- (f) the number of items of major plant and equipment being utilized simultaneously on the site for their cumulative impact.*

Some construction or demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration.”

Acoustic Dynamics advises that determination of appropriate noise emission goals for the proposed works in accordance with the EPA’s guidelines will satisfy the recommendations and guidelines detailed within AS 2436.

We advise that assessment of the proposed works, detailed within this document, has been carried out in accordance with the information and guidelines detailed within AS 2436.

2.4 CITY OF SYDNEY CODE OF PRACTICE 1992

In this section, the relevant noise emission criteria and conditions applicable to the works are outlined, based on *The City of Sydney Code of Practice Construction Hours/Noise 1992*.

The Code provides a guideline to permit construction work during all hours of the day, seven days a week subject to compliance with noise criteria, and will allow construction to be planned and undertaken without affecting the amenity of residents, commercial operators, tourists and other city users.

Acoustic Dynamics advises that the most appropriate methodology for the assessment of noise emission from the proposed works is a quantitative assessment, to ensure noise emission from the works is minimised.

Acoustic Dynamics has determined the daytime background noise environment at the nearest residential receivers, as referred to in the EPA's ICNG. The results of previous background noise monitoring in the area are presented in **Table 2.1**.

Table 2.1 Measured Ambient Noise Environment

| Location | Period | Measured Noise Levels [dB] ¹ |
|-----------------|----------------------|---|
| | | RBL (L _{A90}) |
| Gloucester Walk | Daytime ² | 58 |

Note: 1) Measured noise levels are ambient, and do not include any subject works or associated activities.

2) Works at the site are expected to take place within the "Category 1 Hours" Monday to Friday 7am to 7pm and Saturday 7am to 5pm.

Based on the measured background noise environment, **Table 2.2** presents the construction noise emission management levels/objectives, as detailed in the *City of Sydney Construction Hours / Noise Code of Practice 1992*, for the nearest residential and commercial receivers:

Table 2.2 Site Specific Construction Noise Objectives (Nearest Affected Receivers)

| Receiver | Time of Day (Category 1 Hours) ¹ | City of Sydney Noise Criteria (L _{Aeq} (15 min)) | Site specific construction noise emission goals L _{Aeq} (15 min) [dB] |
|--|---|---|---|
| Residential & Commercial Receivers | Monday to Friday 7am to 8am; and Saturday 7am to 8am | Noise affected RBL + 5 dB | 63 |
| | Monday to Friday 8am to 7pm; and Saturday 8am to 5pm | Noise affected RBL + 5 dB + 5 dB | 68 |

Note: 1) Works at the site are expected to take place within the "Category 1 Hours" Monday to Friday 7am to 5pm and Saturday 7am to 3pm.

Based on the information contained within the *City of Sydney Construction Hours / Noise Code of Practice 1992*, Acoustic Dynamics recommends that noise emission from the proposed works achieves the following noise emission goal, when possible:

- At all residential and commercial receivers (Monday to Saturday 7am to 8am): $L_{Aeq, 15minute} \leq 63 \text{ dB}$.
- At all residential and commercial receivers (Monday to Friday 8am to 7pm; and Saturday 8am to 5pm): $L_{Aeq, 15minute} \leq 68 \text{ dB}$.

Note should be made that as night-time works are not expected to occur, the assessment of sleep disturbance is not warranted.

Table 2.2 Site Specific Construction Noise Objectives (Nearest Affected Receivers)

| Receiver | Time of Day | EPA Management Level ($L_{Aeq} (15 \text{ min})$) | Site specific construction noise emission goals $L_{Aeq} (15 \text{ min})$ [dB] |
|-----------------------|---|---|--|
| Residential Receivers | Recommended Standard Hours: Monday to Friday 7am to 5pm Saturday 8am to 5pm No work on Sundays or Public Holidays | Noise affected RBL + 10 dB | 68 |
| | | Highly noise affected 75 dB | 75 |
| | Outside Recommended Standard Hours | Noise affected RBL + 5 dB | 63 |

Note: 1) Works at the site are expected to take place within the recommended standard hours of 7am to 5pm Monday to Friday and 7am to 3pm Saturday.

Based on the information contained within the EPA's ICNG, Acoustic Dynamics recommends that noise emission from the proposed works achieves the following noise emission goal, when possible:

- At all residential receivers: $L_{Aeq, 15minute} \leq 68 \text{ dB}$;

Note should be made that as night-time works are not expected to occur, the assessment of sleep disturbance is not warranted.

2.5 CONSTRUCTION VIBRATION CRITERIA

Vibration emission can be assessed for its potential to cause disturbance to humans, but more critically, in the case of short term vibration emission for excavation and construction works, for structural and cosmetic damage to buildings and structures adjacent to the subject works. As such, Acoustic Dynamics provides detail on both **Human Comfort** and **Structural and Cosmetic Damage** criteria below.

Human Comfort

Criteria for assessment of the effects of vibration on human comfort are set out in British Standard 6472-1992. Methods and criteria prescribed by BS6472 are used to set “preferred” and “maximum” vibration levels in the document *Assessing Vibration: A technical guideline* produced by the NSW EPA.

Acceptable values of human exposure to continuous vibration, such as that associated with underground drilling, are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous and impulsive vibration acceleration is set out in **Table 2.3**.

Table 2.3 Preferred and Maximum Weighted RMS Values for Continuous Vibration

| Receiver Location | Assessment Period | Acceleration 1 to 80 Hz [m/s ²] | | | |
|--|-----------------------|---|----------------|----------------|----------------|
| | | Preferred Values | | Maximum Values | |
| | | z- axis | x- and y- axes | z- axis | x- and y- axes |
| Residences | Daytime | 0.010 | 0.0071 | 0.020 | 0.014 |
| | Night-time | 0.007 | 0.005 | 0.014 | 0.010 |
| Offices, schools, educational institutions and places of worship | Daytime or Night-time | 0.020 | 0.017 | 0.040 | 0.028 |

For intermittent construction vibration within residences, the “preferred” daytime criterion is a Vibration Dose Value (VDV) of 0.2 m/s^{1.75}. In the case of intermittent vibration within offices, schools, educational institutions and places of worship when in use, the “preferred” criterion is a Vibration Dose Value (VDV) of 0.4 m/s^{1.75}. (Calculation of VDV requires knowledge of the number of events in the relevant time period).

Cosmetic and Structural Damage Criteria

In terms of the most recent relevant vibration damage criteria, British Standard 7385:Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2 - Guide to damage levels from ground-borne vibration” represents a definitive standard against which the likelihood of building damage from ground vibration can be assessed.

Although there is a lack of reliable data on the threshold of vibration-induced damage in buildings both in countries where national standards already exist and in the UK, BS 7385:Part 2 has been developed from an extensive review of UK data, relevant national and international documents and other published data.

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum

risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

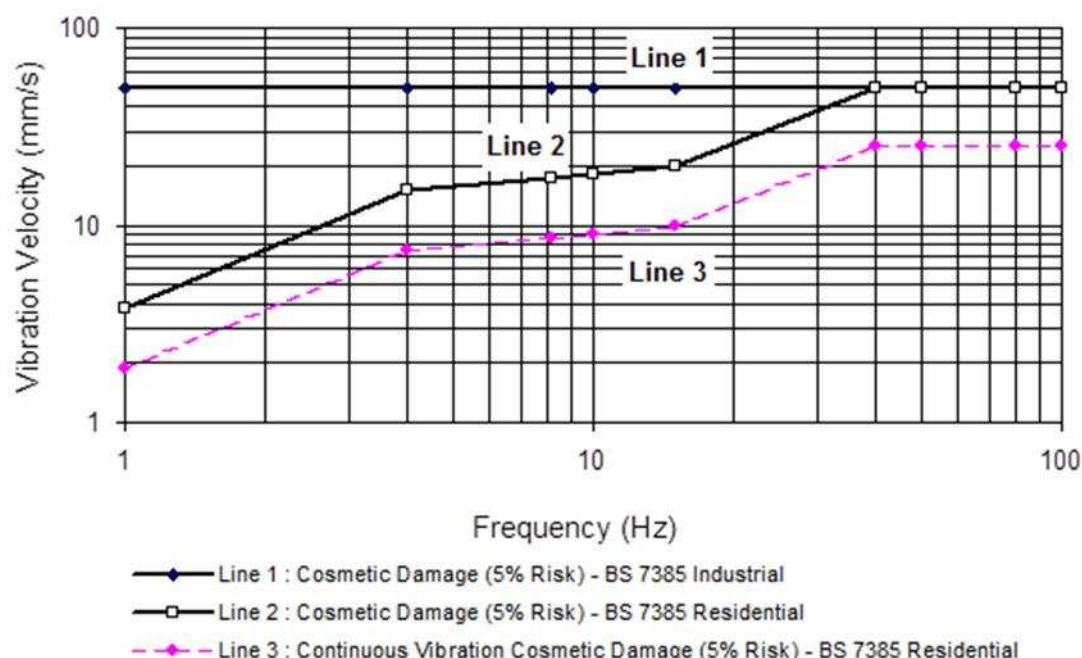
Sources of vibration, which are considered in the standard, include blasting (carried out during mineral extraction or construction excavation), excavation, piling (sheet, bored, contiguous), ground treatments (eg. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The guide values from this standard for transient vibration judged to result in a minimal risk of cosmetic damage to residential buildings and industrial buildings are presented numerically in **Table 2.4** and graphically in **Figure 2.1**.

Table 2.4 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

| Line | Type of Building | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|------|--|--|---|
| | | 4 Hz to 15 Hz | 15 Hz and above |
| 1 | Reinforced or framed structures Industrial and heavy commercial buildings | 50 mm/s at 4 Hz and above | |
| 2 | Unreinforced or light framed structures residential or light commercial type buildings | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |

Figure 2.1 Graph of Transient Vibration Guide Values for Cosmetic Damage



In relation to guide values for continuous vibration relating to cosmetic damage, the standard states that the guide values in **Table 2.4** relate predominantly to transient vibration, which does not give rise the resonant responses in structures, and to low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at lower frequencies where lower guide values

apply, then the guide values in **Table 2.4** may need to be reduced by up to 50%, as is the case with continuous vibration from rock breaking.

The standard goes on to state that minor damage is possible at vibration magnitudes, which are greater than twice those given in **Table 2.4**, and major damage to a building structure may occur at values greater than four times the tabulated values.

It is noteworthy that in addition to the guideline values presented in **Table 2.4**, the standard also states the following:

“Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.”

Note is made that **cosmetic damage** to buildings occurs at vibration levels significantly lower than those causing **structural damage**.

- British Standard 7385 indicates a 5% risk of **cosmetic damage** to commercial/industrial buildings at 50 mm/s from transient vibration and at 25 mm/s from continuous vibration; and
- British Standard 7385 indicates a 5% risk of **cosmetic damage** to residential and light framed structures at 15 mm/s at 4 Hz from transient vibration and at 7.5 mm/s at 4 Hz from continuous vibration.

In view of the foregoing, the following **conservative** site assessment control limits could be adopted for the purposes of monitoring and evaluating the measured vibration levels from the excavation works, should this be required:

Residential and Multi Use Light Framed Structures Adjacent to Proposed Works:

- All buildings and structures adjacent to works – 5.0 mm/s peak component particle velocity (site control level); and
- All buildings and structures adjacent to works – 10.0 mm/s peak component particle velocity (site limit).

3 PROCEDURES AND IMPLEMENTATION

3.1 INSTRUMENTATION & MEASUREMENT STANDARDS

Acoustic Dynamics' sound pressure measurements and monitoring were conducted in general accordance with Australian Standard 1055.1–1997, *“Acoustics - Description and Measurement of Environmental Noise. Part 1: General Procedures”* and were carried out using precision sound level meters conforming to the requirements of IEC 61672-2002 *“Electroacoustics: Sound Level Meters – Part 1: Specifications”*.

The reference levels were checked prior to and after the measurements and remained within acceptable limits.

The prevailing weather conditions during the measurements were generally calm and did not influence the noise measurements taken.

4 METHODOLOGY FOR EMISSION PREDICTION AND ASSESSMENT

Acoustic Dynamics understands that the following items of noise emitting equipment and machinery are likely to be used during the excavation and construction works on site:

Excavation (Around 3 weeks duration)

- Pneumatic Hammers;
- Saws;
- Grinders;
- Other hand-held tools; and
- Trucks (for removal of materials).

Demolition (Around 10 weeks duration)

- Pneumatic Hammers;
- Saws;
- Grinders;
- Other hand-held tools; and
- Trucks (for removal of materials).

Construction (Around 7 months duration)

- Hammers;
- Saws;
- Grinders;
- Drills;
- Mud/cement mixers;
- Kanga hammers
- Nail guns;
- Compressors;
- Mobile cranes;
- Concrete trucks/pumps;
- Vehicle movements, including:
 - Trucks (for delivery of materials);
 - Trades; and
- Other typical building tools/equipment.

Accordingly, assessment of the operation of above items requires calculation of their noise emission levels to nearby potentially affected receiver locations.

Acoustic Dynamics has conducted operator-attended noise monitoring of similar/equivalent equipment at various other sites on numerous occasions. Based on previous operator-attended surveys of similar activities and equipment, prediction calculations have been undertaken to

predict the noise impact at adjacent receiver locations, resulting from the proposed works, in accordance with the information and guidelines detailed in AS 2436 and the relevant EPA documents.

In our noise prediction calculations and modelling, the noise emission contribution from the above items of equipment has been incorporated into the prediction calculations and modelling along with various loss factors, including:

- Losses due to distance and ground topography;
- Airborne noise losses;
- Losses due to direction;
- Acoustic shielding.

5 NOISE & VIBRATION EMISSION PREDICTION AND ASSESSMENT

In this section Acoustic Dynamics provides an assessment of noise emission from proposed excavation and construction works at the subject site.

Acoustic Dynamics advises that the project is likely to be undertaken in three main stages:

- Demolition;
- Excavation; and
- Construction.

Acoustic Dynamics understands that demolition and excavation works would then be undertaken over a period of 13 weeks. Construction works would then be undertaken and may last for a period of around 7-8 months.

5.1 NOISE EMISSION PREDICTION CALCULATIONS AND MODELLING

Acoustic Dynamics has performed prediction calculations and determined maximum L_{Aeq} noise emission levels at adjacent receiver locations, resulting from proposed demolition, excavation and construction activities, including use of the tools and equipment listed in section 5.

For the purpose of noise assessment, the likely maximum “at source” noise levels (a-weighted sound pressure levels at 1 metre) have been used as detailed below.

Demolition and Excavation

- Hammers – 85 dB;
- Saws – 101 dB;
- Grinders – 80 dB
- Hand-held and electric tools – 94 dB; and
- Trucks (for removal of materials) – 90 dB.

Construction

- Hammers – 85 dB;
- Saws – 101 dB;

- Grinders – 80 dB;
- Drills – 80 dB;
- Mud/cement mixers – 100 dB;
- Nail guns – 85 dB;
- Compressors – 92 dB;
- Kanga hammers – 103 dB;
- Concrete trucks/pumps – 95 dB;
- Vehicle movements including:
 - Trucks (for delivery of materials) – 90 dB;
 - Trades – N/A; and
 - Other hand-held and electric tools – 94 dB.

The results from Acoustic Dynamics' noise prediction calculations and modelling are presented in **Table 5.1** below, and represent calculated **maximum** received noise emission levels resulting from the use/operation of the highest noise emitting items listed above.

Note should be made that the highest noise emitting items of plant and equipment are unlikely to be used for long durations.

Note should be made that the predicted noise levels presented in **Table 5.1** below, are the **maximum** predicted L_{Aeq} noise levels at the nearest boundaries of the listed properties, resulting from proposed excavation and construction works at the subject site. Typically, received L_{Aeq} noise emission levels would be expected to be lower than these during the majority of the excavation and construction works. Significantly lower noise levels than those presented in the table would also be expected within (inside) the nearby dwellings.

Table 5.1 Maximum Demolition, Excavation and Construction Works Noise Emission and Criteria

| Receiver Location | Stage of Works | Predicted Range of L_{Aeq} Noise Levels ¹ [dB] | EPA L_{Aeq} Noise Management Levels [dB] | | Achieves EPA Guidelines? | |
|------------------------------------|----------------|---|--|-----------------------|--------------------------|-----------------------|
| | | | Noise Affected | Highly Noise Affected | Noise Affected | Highly Noise Affected |
| Sirius Building | Demolition | 59-79 | 68 | 75 | Yes | Yes |
| | Excavation | 46-66 | | | No | No |
| | Construction | 62-80 | | | Yes | Yes |
| Commercial Receiver (23 George St) | Demolition | 57-71 | 68 | 75 | Yes | No |
| | Excavation | 44-58 | | | No | No |
| | Construction | 60-74 | | | Yes | No |
| Commercial Receiver (29 George St) | Demolition | 55-87 | 68 | 75 | Yes | Yes |
| | Excavation | 42-74 | | | Yes | No |
| | Construction | 58-90 | | | Yes | Yes |

| Receiver Location | Stage of Works | Predicted Range of L_{Aeq} Noise Levels ¹ [dB] | EPA L_{Aeq} Noise Management Levels [dB] | | Achieves EPA Guidelines? | |
|-------------------------------------|----------------|---|--|-----------------------|--------------------------|-----------------------|
| | | | Noise Affected | Highly Noise Affected | Noise Affected | Highly Noise Affected |
| Commercial Receiver (31 George St) | Demolition | 53-71 | 68 | 75 | Yes | No |
| | Excavation | 40-58 | | | No | No |
| | Construction | 56-75 | | | Yes | Yes |
| Commercial Receivers (70 George St) | Demolition | 41-68 | 68 | 75 | No | No |
| | Excavation | 44-55 | | | No | No |
| | Construction | 60-71 | | | Yes | No |
| Commercial Receivers (84 George St) | Demolition | 40-68 | 68 | 75 | No | No |
| | Excavation | 43-55 | | | No | No |
| | Construction | 59-71 | | | Yes | No |

Note: 1) Calculated noise level at nearest residential boundary or nearest exposed facade.
 2) Instances considered "highly noise affected" will be infrequent, and are unlikely to unreasonably disturb the adjoining dwellings.

5.2 NOISE EMISSION ASSESSMENT

The predicted noise emission levels presented in **Table 5.1** above indicate L_{Aeq} noise emission associated with the proposed demolition, construction and excavation works will exceed the relevant 'Noise Affected' construction noise management level of $L_{Aeq(15minute)}$ 46 dB at all the nearest residential boundaries. It should be noted that The Sirius Building is the only residential receiver located near the proposed works with fewer than 5 units currently occupied. The occupants are expected to vacate the property prior to works beginning. As such the assessment to residential receivers is only precautionary, should the building not be fully vacated by the time works have begun.

At the neighbouring residential premises with shared boundaries, the predicted L_{Aeq} noise emission associated with the proposed construction works would not likely comply with the relevant 'Highly Noise Affected' construction noise management level of $L_{Aeq(15minute)}$ 75 dB. However, at all other residential receivers, the predicted L_{Aeq} noise emission associated with the proposed works likely to comply with the relevant 'Highly Noise Affected' construction noise management level of $L_{Aeq(15minute)}$ 75 dB.

Although not considered acoustically significant because of the short duration and nature of construction activities, the magnitude of the predicted exceedance may lead to complaint and appropriate strategies should be developed for management of noise emission and community liaison.

To ensure that construction noise emission levels from the proposed works are kept to a minimum, Acoustic Dynamics provides recommendations for feasible and reasonable noise

mitigation and management, which should be incorporated into the noise management plan for the proposed demolition, excavation and construction works.

5.3 VIBRATION EMISSION PREDICTION CALCULATIONS AND MODELLING

Acoustic Dynamics has been advised that mechanical excavation methods will be utilised, and based on this information advises that this excavation methodology is likely to result in minimal perceivable vibration levels (human comfort) at nearby/adjacent residential dwellings.

Acoustic Dynamics advises that where rock is to be removed from the site, excavation should incorporate the use of saw cuts in rock to enable smaller, rather than large, rock-breakers to be used to break the rock away from the saw cut.

Such sawing has been shown to produce significantly lower vibration levels and substantially reduce the potential for structural (or even cosmetic) damage to adjacent buildings and structures.

Acoustic Dynamics has predicted likely vibration levels at the nearest potentially affected adjacent receiver locations. Acoustic Dynamics' prediction calculation results are presented in **Table 5.2** below.

Table 5.2 Predicted Excavation Works Vibration Emission Levels and Criteria

| Location | Receiver Location | Predicted Vibration Levels (PPV) ¹ | 5% Risk of Cosmetic Damage Criterion | Likely to Comply? |
|----------------------------|------------------------------------|---|--------------------------------------|-------------------|
| 29 George St, The Rocks | Commercial receivers to East | <1 mm/s | 7.5mm | Yes |
| 31 George St, The Rocks | Residential receivers to North | <1 mm/s | 7.5mm | Yes |
| Sirius Building, The Rocks | Residential receivers to Northwest | <3 mm/s | 7.5mm | Yes |
| 23 George St, The Rocks | Residential receivers to West | <1 mm/s | 7.5mm | Yes |
| 70 George St, The Rocks | Residential receivers to West | <1 mm/s | 7.5mm | Yes |
| 84 George St, The Rocks | Residential receivers to West | <1 mm/s | 7.5mm | Yes |

Note: 1) Predicted received peak component particle velocity (PPV) at structure.

Acoustic Dynamics advises that predicted vibration emission levels, resulting from the proposed works are well below structural damage criteria presented within **Section 3.5** of this report.

6 DISCUSSION AND RECOMMENDATIONS

Further to the predicted noise emission levels presented in **Section 5**, Acoustic Dynamics advises that measures are required to minimise and manage noise emission and impact from the proposed excavation and construction works at the subject site.

Acoustic Dynamics recommends that the use of noise generating equipment during the proposed works at 25-27 George Street, The Rocks, only be carried out during the following construction hours:

- Monday to Friday 7:00am to 5:00pm; and
- Saturdays 7:00am to 3:00pm.

Additionally, any rock-breaking activity should only be carried out during the following hours:

- 9:00am – 5:00pm on weekdays (Monday to Friday) only.

Acoustic Dynamics recommends the following measures be implemented to minimise and manage noise and vibration emission from the subject demolition, excavation and construction:

1. Noise & vibration induction of all site staff – including the explanation of noise and vibration control and minimisation and a discussion of project specific reduction strategies;
2. Implementation of an appropriate community liaison procedure – including a noise and vibration management and noise and vibration complaint procedure and continual liaison with nearby potentially affected receivers;
3. Implementation of a vibration monitoring and reporting programme (during excavation works to protect the adjacent building and Gloucester Walk – to protect the interest of all parties or should complaints arise);
4. The use of temporary noise barriers around particularly noisy activities (where feasible and reasonable);
5. Use of quietest available equipment and lowest vibration generating equipment for works (where feasible and reasonable);
6. Where excavation of rock is required, an appropriate excavation methodology should be adopted:
 - Use of saw cuts in rock around the external perimeter of any excavation works, and wherever feasible, to enable smaller rock-breaker to be used to remove the remaining rock;

- Use of hand held jackhammers for rock-breaking activities within 5m of adjacent structures;
 - i. No use of small rock-breakers within 5m of adjacent structures;
 - ii. No use of large rock-breakers within 10m of adjacent structures;
- 7. Where there is any risk of damage, a dilapidation survey of adjacent buildings and structures should be completed prior to the commencement of any excavation works;
- 8. Implementation of periods of respite, where highly intensive activities produce loud noise (ie greater than 75 dB(A) at nearby residences) to minimise disturbance on nearby receivers; and
- 9. Should trucks or other vehicles be required to be on site for longer than five minutes, Acoustic Dynamics advises that engines should be switched off for the duration.

The following sections provide detail about the various measures listed above and how they are to be incorporated into the noise management procedures for the proposed works.

6.1 NOISE AND VIBRATION INDUCTION OF ALL SITE STAFF

Acoustic Dynamics recommends all site staff be inducted, ensuring each person is aware of the noise and vibration management and mitigation procedures applicable to the site and subject site works.

6.2 IMPLEMENTATION OF COMMUNITY LIASON PROCEDURE

Acoustic Dynamics recommends implementation of an appropriate community liaison procedure, including a noise management and complaint procedure, and continual liaison with the nearby potentially affected receivers. The following should be carried out by the proponent:

- A sign is to be located near the entry to the site with 24 hour contact details (mobile phone numbers and email addresses for receipt of complaints);
- A detailed (physical) log of all complaints relating to noise is to be kept on site. Such a log should including details of:
 - i. the address of the complainant;
 - ii. the date and time of the complaint;
 - iii. the date and time the subject noise was heard;
 - iv. a description of the activities being undertaken at the time of the subject complain;
 - v. a contact telephone number for the complainant; and
 - vi. detail of the person who fielded and logged the complaint;
 - vii. the signature of the project manager or site foreman confirming the complaint has reached an appropriate level of responsibility;
 - viii. detail of the action taken to respond to the complaint and the timing of this response; and
 - ix. the signature of the project manager or site foreman signing off confirmation that the complaint has been appropriately addressed.

NB: Note is made that should the complaint require the services of an independent consultant to investigate or conduct measurements, such services shall be engaged promptly and dates and times of contact with such a consultant shall be maintained/detailed within the complaints log.

6.3 USE OF TEMPORARY NOISE BARRIERS

Where feasible and reasonable, Acoustic Dynamics recommends the use of temporary noise barriers around the boundaries of the site during external works, and covering openings (windows/doors) in the facade during internal works, to assist with reducing noise emission during high noise generating activities. A suitable, temporary noise barrier is likely to:

- Contain **no gaps** along the surface area of the screen, and be **close fitting (ie within 30mm) to the ground** (to prevent the transmission of noise below the barrier); and
- The temporary noise barrier(s) should provide a minimum surface density of **14 kg/m²**, and contain **no gaps** along the surface of the barrier(s).
 - i. 25mm thick marine plywood; or
 - ii. A minimum 9mm thick compressed fibros-cement sheeting; or
 - iii. Other suitable material (minimum surface density of **14 kg/m²**); and
- Design of supports of any temporary noise barrier(s) must be verified by a suitably qualified person to ensure sufficient structural and wind loading support is provided.

6.4 USE OF QUIETEST AVAILABLE EQUIPMENT FOR WORKS

Acoustic Dynamics recommends that plant and equipment used during the proposed works be selected to ensure that the quietest available equipment will be used.

As indicated within **Section 6.3**, Acoustic Dynamics will carry out operator-attended noise measurements of site equipment and operations (as required/requested), to ensure quietest techniques and equipment are being used for the subject works.

6.5 AN APPROPRIATE EXCAVATION METHODOLOGY

Where excavation of rock is required, the excavation methodology should incorporate the use of saw cuts in the rock wherever feasible to enable smaller rock-breakers to be used to remove the rock. Such sawing has been shown to produce significantly lower vibration levels and substantially reduce the potential for structural (or even cosmetic) damage to adjacent buildings and structures.

In addition, Acoustic Dynamics recommends the following:

- Use of hand held jackhammers for rock-breaking activities **within 5m** of adjacent structures;
- No use of small rock-breakers **within 5m** of adjacent structures; and
- No use of large rock-breakers **within 10m** of adjacent structures.

6.6 PREPARATION OF A DILAPIDATION SURVEY OF ADJACENT BUILDINGS AND STRUCTURES

Where there is any risk of damage, a detailed dilapidation survey of adjacent buildings and structures completed prior to the commencement of any excavation works would provide an appropriate reference condition, against which post works inspections can be compared.

6.7 PROVISION OF RESPITE PERIODS DURING INTENSIVE ACTIVITIES

Where there is potential for receivers to be affected by sustained high noise levels (ie greater than $L_{Aeq(15\text{minute})}$ 75 dB at nearby residences), periods of respite are to be provided. Such respite may include provisions:

1. Not to commence such noisy activities prior to 8:00am;
2. Not to undertake such noisy activities after 4:30pm; and
3. Not to undertake such noisy activities for any sustained period greater than 3 hours without a minimum 30-minute period of respite.

7 CONCLUSION

Acoustic Dynamics has undertaken a quantitative assessment of the noise impact at the nearest potentially affected receivers resulting from the excavation and construction works and associated activities, for the proposed works at 25-27 George Street, The Rocks in accordance with the requirements of the development consent conditions, City of Sydney Council, the NSW EPA's guidelines and relevant Australian Standards.

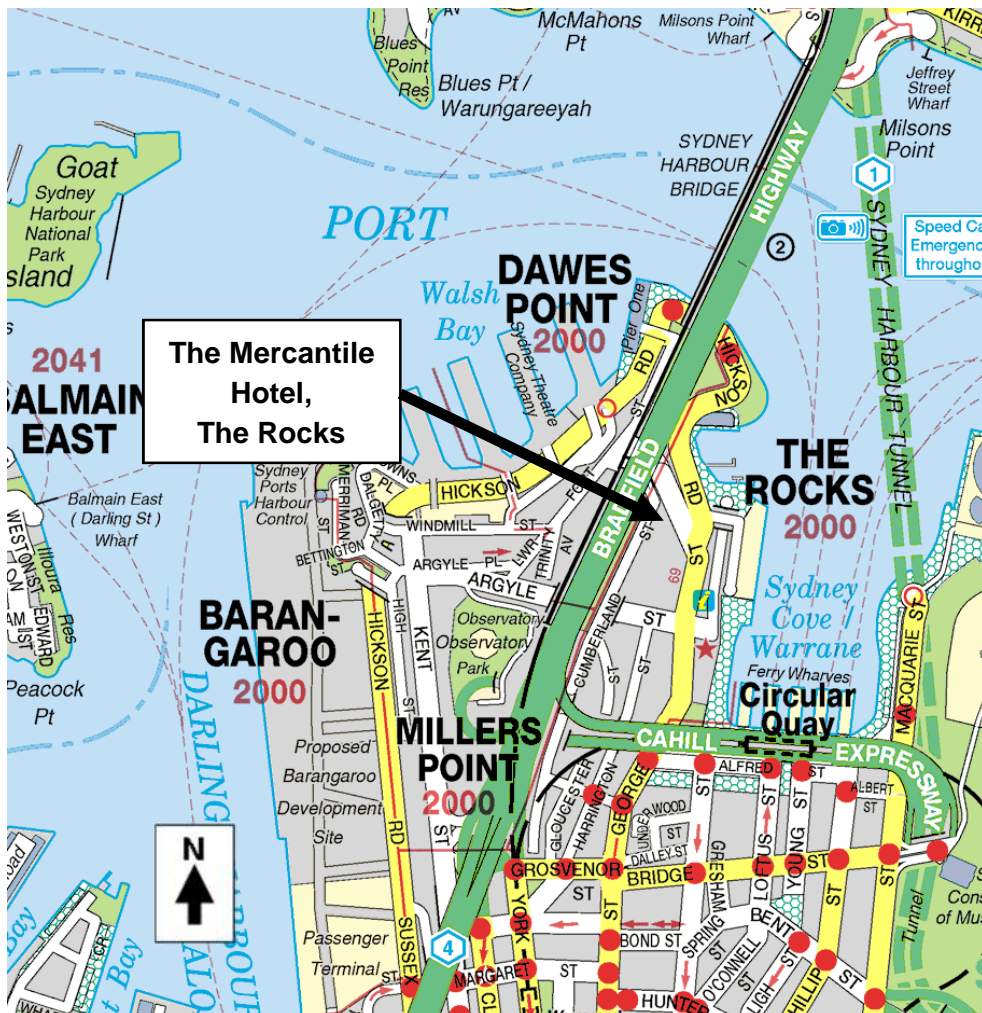
Although high levels of noise are likely to be infrequent, the magnitude of the predicted noise exceedances above the construction noise goals (determined in accordance with the EPA's ICNG) may lead to complaint (adverse comment) and appropriate strategies should be developed for management of noise emission and community liaison.

Acoustic Dynamics advises that implementation of the recommendations contained in section 6 of this report will assist with the mitigation and management of noise emission from demolition, excavation and construction activities at the subject development site.

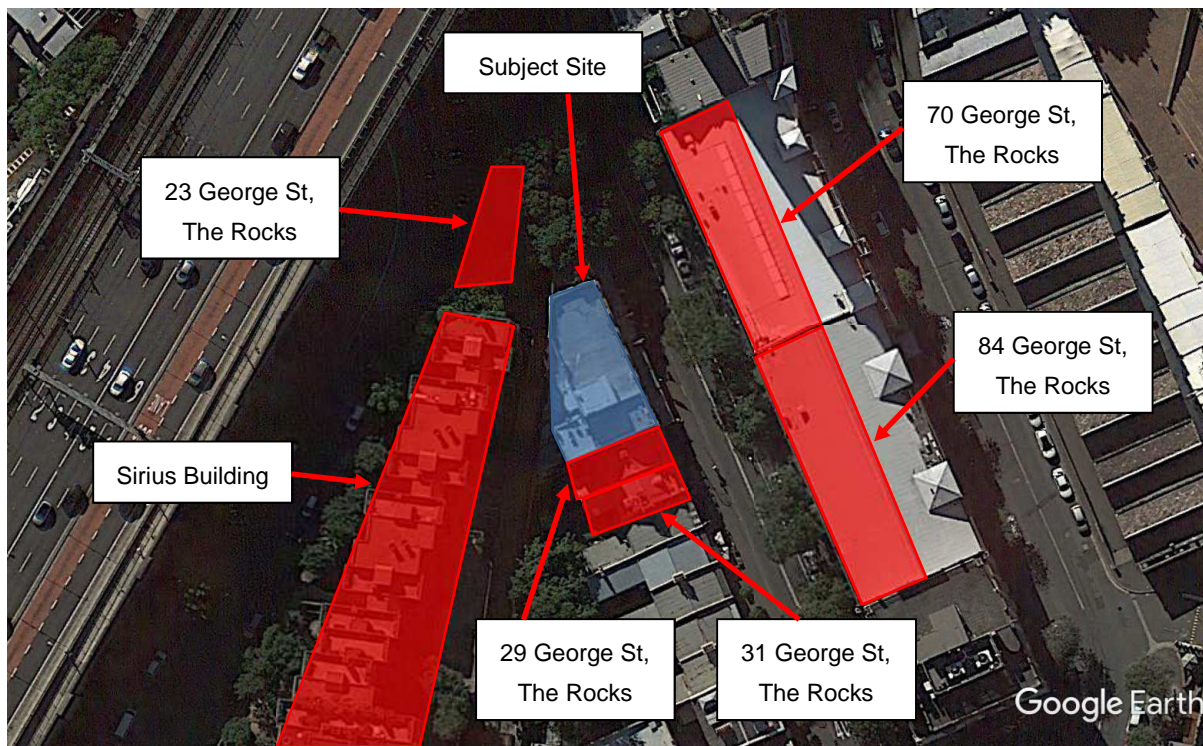
Should further information be required relating to this report please contact Acoustic Dynamics on 02 9908 1270.

APPENDIX A – LOCATION MAP, AERIAL PHOTO & DRAWINGS

A.1 LOCATION MAP

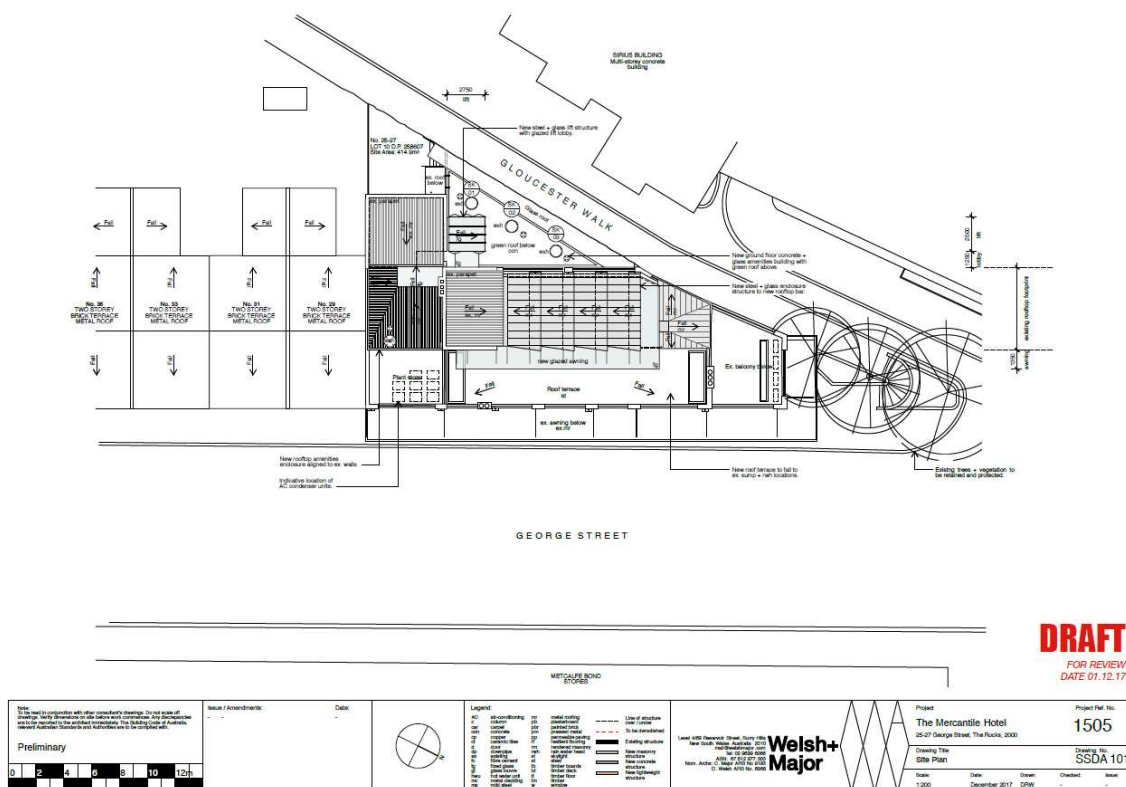


A.2 AERIAL PHOTO

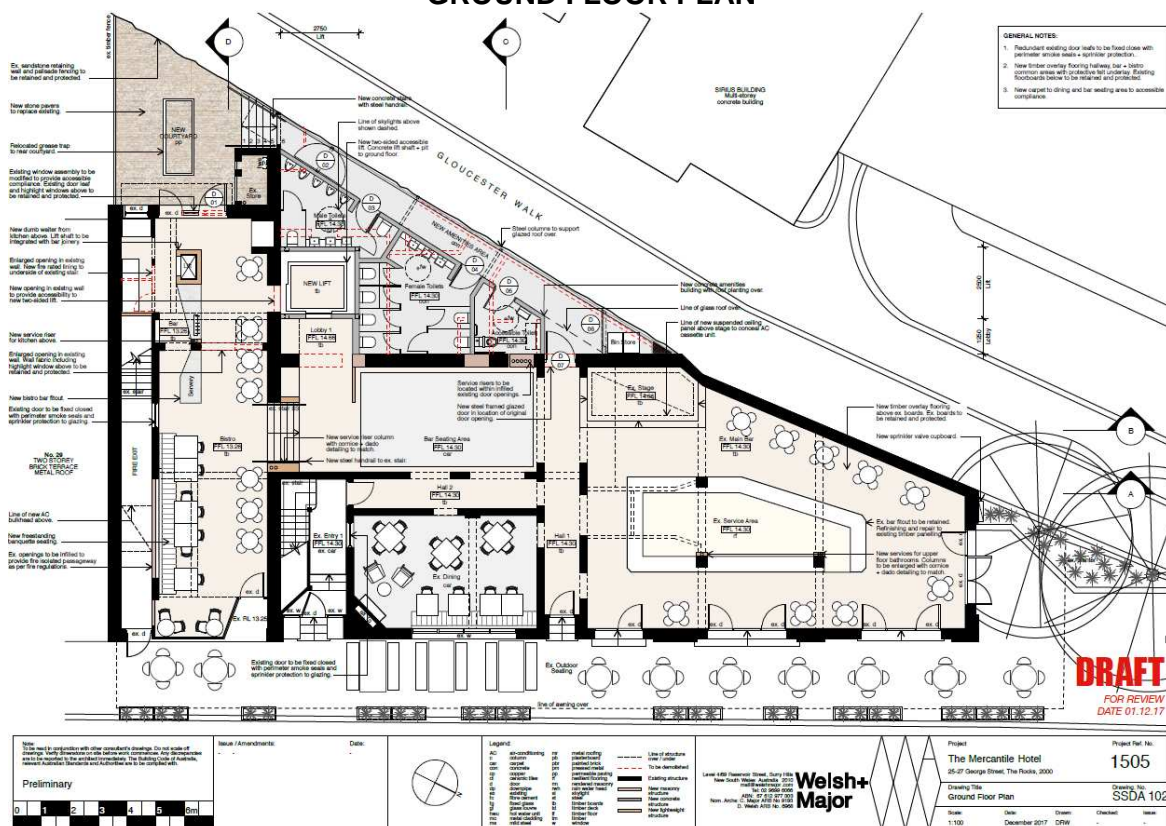


A.3 DRAWINGS

SITE PLAN



GROUND FLOOR PLAN



FIRST FLOOR PLAN

