MARSHALL DAY Acoustics

6 Gipps Street
Collingwood 3066 Victoria Australia
T: +613 9416 1855 F: +613 9416 1231
melbourne@marshallday.com
www.marshallday.com
A.C.N. 006 675 403

Reference: EV 001 2011239
Date: 11 July 2011

IN THE MATTER of the Victorian Civil & Administrative Tribunal Planning List Reference No. P 1053/2011

AND

IN THE MATTER of an application to develop a block of land at 18 Brahe Place, East Melbourne for an apartment building

STATEMENT OF EVIDENCE BY TIMOTHY MICHAEL MARKS

INTRODUCTION

1.1 My name is TIMOTHY MICHAEL MARKS. I am an Associate Director of Marshall Day Acoustics (MDA). My curriculum vitae is attached in Appendix A.

1.2 I have been engaged by Mr Andrew Swanson to provide a noise impact report, a corresponding Statement of Evidence and give evidence at VCAT for a development at 18 Brahe Place and 6-12 Garden Avenue East Melbourne. The building which is to be the subject of acoustic assessment is proposed to be built on 18 Brahe Place.

1.3 I confirm that MDA have produced the attached Report No. R01 001 2011239 entitled *Residential Development Brahe Place, Noise Impact Planning Assessment* dated 11 July 2011and as the reviewer, I adopt the findings and contents of this report as evidence for submission to the Tribunal to support the application to grant a permit for the subject development.

1.4 In preparing this evidence, I have reviewed relevant documentation, performed a site inspection, reviewed acoustic calculations and relevant documents and directed other staff members to perform noise surveys.

I have made all the enquiries that I believe are desirable and appropriate and confirm that no matters of significance which I regard as relevant have to my knowledge been withheld from the Tribunal.



Timothy Marks
Associate Director

Marshall Day Acoustics
6 Gipps Street
Collingwood Vic 3066

11 July 2011

SUMMARY OF EXPERIENCE AND PROJECT DETAILS

NAME AND ADDRESS

My name is TIMOTHY MICHAEL MARKS. I am an Associate Director with the acoustic consulting practice of Marshall Day Acoustics Pty Ltd which is located at 6 Gipps Street, Collingwood, 3066.

QUALIFICATIONS AND EXPERTISE

I am a professionally qualified mechanical engineer who has specialised in acoustics since graduation with honours from Monash University in 1974. I hold a Master's Degree in Sound and Vibration from Southampton University and have had extensive experience in preparing noise impact reports for residential housing estates, power stations, convenience stores, commercial and mixed use industrial developments and rail and traffic studies. My curriculum vitae is attached

AREA OF EXPERTISE

For the past 32 years I have worked in the field of acoustics, noise and vibration measurement and control as a consultant and manufacturer. I am the immediate past Chairman of the Australian Association of Acoustic Consultants (AAAC).

EXPERTISE TO PREPARE THIS REPORT

I have been involved in environmental noise impact assessments for major projects such as new roads, public infrastructure and mixed use commercial developments, music and sports centres and smaller developments such as residential estates, service stations, sporting venues, convenience stores, manual carwash developments, childcare centres, restaurants, wineries, pubs and night clubs.

INSTRUCTIONS WHICH DEFINED THE SCOPE OF THIS REPORT

I have been engaged by Mr Andrew Swanson to provide an acoustic report on any noise associated with the proposed new residential development at 18 Brahe Place, East Melbourne.

FACTS, MATTERS AND ASSUMPTIONS RELIED UPON

In the course of my investigations I have:

Reviewed relevant documentation and plans
Visited the site
Reviewed acoustic calculations.

DOCUMENTS TAKEN INTO ACCOUNT

The following documents have been referred to:

1. Mattingley Courtney Architects Plans TP1-TP6 dated June 2011
2. *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1)
3. NSW EPA Environmental Criteria for Road Traffic Noise May 1999
4. EPA Victoria Publication 1254 *Noise Control Guidelines* October 2008
5. AS2107-2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*
6. NSW interim Guideline for the assessment of Noise from Rail Infrastructure
7. AS3671-1989 *Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*
8. EPA (Residential Noise) Regulations 2008.
9. Copies of Statement of Grounds; extracts
10. MDA Memo dated 24 November 2006 – *Klaus car stacking system noise measurements*

IDENTITY OF PERSONS UNDERTAKING THIS WORK

I prepared this report with the assistance of the following staff at Marshall Day Acoustics:

Staff member	Title	Tasks
Stephen Dobson	Senior Consultant	Calculations, report preparation
Nick Peters	Consultant	Site surveys

SUMMARY OF OPINIONS

A summary of opinions is provided in Section 11.0 of the MDA report attached to this statement.

APPENDIX A

CURRICULUM VITAE – TIMOTHY MICHAEL MARKS

Name:	Timothy Michael Marks
Address:	6 Gipps Street Collingwood, Victoria, 3066, Australia
Qualifications:	
B.Eng(Hons)	Bachelor of Engineering, Mechanical Engineering Monash University, Melbourne (1974)
MIE Aust	Member Institution of Engineers, Australia
CPEng	Chartered Professional Engineer, Reg No 144303
MAAS	Member of the Australian Acoustical Society
M.Sc	Master of Science, Southampton University, U.K. (1979)
Experience:	
1996 - Present	Director, Marshall Day Acoustics, Melbourne, Australia.
1986 - 1995	Managing Director NAP (Australia) Pty Ltd, trading as NAP Silentflo. Established a $10M business with up to 60 staff and offices in Melbourne, Sydney, Singapore and Hong Kong. The company manufactured and supplied specialist noise control products for engineering, architectural, building, commercial and industrial projects. Extensive experience in project management, design, field work and practical noise and vibration control. Major projects included: the Bank of China Building-Hong Kong, Melbourne Central, BHP Mini Mill-Sydney, Katherine Power Station-NT, SECWA Dampier/Bunbury pipeline, Sydney Harbour Tunnel and Loy Yang Power Station ID Fan Silencers. The business was sold to NAP Silentflo (Aust) Pty Ltd in December 1995.

1980 - 1986 General Manager	BTR Nylex Group, BTR Silentflo Pty Ltd. This company manufactured industrial silencing equipment which included: exhaust systems and automotive mufflers for OEMs such as Mercedes Benz, International and Ford. Actively involved in product development, design, testing and research and development. Established the Silentflo range as the pre-eminent noise control supplier in Australia. Achievements at this company included the introduction of quality assurance to AS 3902, proper job costing and product launches. Projects undertaken included: Victorian Arts Centre, MRT Singapore, Williamstown Dockyard, CAC Jet Engine Test Cell.
1979 Postgraduate degree	M.Sc Southampton University. Thesis: Vibration of aircraft fuselage structures and sound transmission at structural resonant frequencies. Winner of E J Richards Prize (ISVR, 1980).
1975 - 1978	Associate Director of Vipac and Partners. Worked as a consulting engineer dealing in noise surveys, project noise control, design work, laboratory and NATA testing of automotive, industrial and mechanical services components, feasibility studies, town planning, expert witness, lecturing and other general acoustic, aerodynamic, thermodynamic and vibration consulting activities.
1970 - 1974	Graduate Mechanical Engineer, Honours Degree, Monash University, Victoria.

APPENDIX B

REPORT NO. R01 001 2011239

6 Gipps Street
Collingwood 3066 Victoria Australia
T: +613 9416 1855 F: +613 9416 1231
melbourne@marshallday.com
www.marshallday.com
A.C.N. 006 675 403

REPORT No.: R01 001 2011239ML

PROJECT: RESIDENTIAL DEVELOPMENT BRAHE PLACE
NOISE IMPACT PLANNING ASSESSMENT

CLIENT Mr Andrew Swanson
42 Dover Street
Flemington VIC 3031

ATTENTION: Mr Andrew Swanson

DATE: 11 July 2011

MARSHALL DAY ACOUSTICS



Stephen Dobson
Senior Consultant

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION 1

2.0 DESCRIPTION OF PROPOSED DEVELOPMENT 1

3.0 NOISE ISSUES 2

3.1 Noise affecting the development 2
3.2 Potential noise emissions from the development 2
3.3 Relevant noise legislation/guidelines 3

4.0 BACKGROUND NOISE LEVELS 3

5.0 ASSESSMENT CRITERIA FOR NOISE INTRUSION 4

5.1 Traffic noise 4
5.2 Sleep disturbance 5
5.3 Railway noise outside dwelling 6

6.0 ASSESSMENT CRITERIA FOR NOISE EMISSIONS 6

6.1 Mechanical services noise legislation SEPP N-1 6
6.2 Residential mechanical services noise EPA regulation 7

7.0 RAILWAY NOISE SURVEY RESULTS 9

8.0 RAILWAY NOISE PREDICTIONS 9

9.0 BUILDING ENVELOPE DESIGN 10

9.1 Glazing and lightweight facade construction 10
9.2 External wall construction 11

10.0 ENVIRONMENTAL NOISE EMISSIONS 12

10.1 Equipment noise sources 12
10.2 SEPP N-1 assessment 14
10.3 EPA guidelines noise assessment 15
10.4 Sleep disturbance assessment 15

11.0 CONCLUSIONS 16

APPENDIX A ACOUSTIC TERMINOLOGY

APPENDIX B SITE LAYOUT & ARCHITECTURAL DRAWINGS

APPENDIX C SITE SURVEY MEASUREMENT POSITIONS AND RESULTS

DOCUMENT STATUS

Revision	Purpose	Date delivered	Reviewed by
-	Issued as draft	7 July 2011	TMM
R01	Issued to Client	11 July 2011	SJD

Disclaimer
Reports produced by Marshall Day Acoustics Pty Ltd are prepared based on the Client's objective and are based on a specific scope, conditions and limitations, as agreed between Marshall Day Acoustics and the Client. Information and/or report(s) prepared by Marshall Day Acoustics may not be suitable for uses other than the original intended objective. No parties other than the Client should use any information and/or report(s) without first conferring with Marshall Day Acoustics.

Copyright
The concepts and information contained in this document are the property of Marshall Day Acoustics Pty Ltd. Use or copying of this document in whole or in part without the written permission of Marshall Day Acoustics constitutes an infringement of copyright. Information shall not be assigned to a third party without prior consent.

1.0 INTRODUCTION

Marshall Day Acoustics Pty Ltd (MDA) has been appointed by Mr Andrew Swanson to assess environmental noise impacts relating to a proposed residential apartment development to be located at 18 Brahe Place and 6-12 Garden Avenue East Melbourne. The building which is to be the subject of acoustic assessment is proposed to be built on 18 Brahe Place. The developer intends to construct a four story complex of 8 residential tenancies at the East Melbourne site, which adjoins a Melbourne metropolitan railway line.

One of the aims of this assessment is to review the current architectural design with respect to environmental noise from the adjoining railway line. As part of the assessment, MDA has conducted noise monitoring and surveys at the site. Acoustic terminology used throughout this report is included as Appendix A.

2.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The development site is bounded by existing residential properties to the north and to the west and by the Hurstbridge & Epping railway line in a cutting to the southeast. Car access to the site is via a driveway from Brahe Place at the northeast end of the site. Pedestrian entry shall occur via a pathway extending through 6-12 Garden Avenue to the east. Apart from the adjacent railway line, the nearest noise sources are Hoddle Street approximately 70m to the east and Wellington Parade (including tram line) 40m to the south. The site is zoned Residential Zone (R1Z) and is currently utilised as a car park.

The railway line carries Epping/Hurstbridge-line electric passenger trains scheduled throughout day and night-time, seven days per week. Trams operate along Wellington Parade seven days per week, typically early morning to late at night. An aerial photograph of the site is shown in Figure 1 below.



Figure 1: Outline of proposed development site

We have based our assessment on architectural drawings prepared by Mattingley Courtney Pty Ltd, Drawing Nos. 1289 TP1 to TP4 dated June 2011, copies of which are provided in Appendix B.

The proposed apartment complex comprises a ground level 8 car garage (4x2-car stackers) with 8 residential tenancies rising three stories above. During peak hours, we are advised traffic generation rate is typically about one tenth of the total daily. As a result, the average rate of stacker operation during peak hour is estimated at 1.6 operations per hour. For our assessment we have elected to assume two stacker operations occur in any one half hour period. The garage doorway security gate shall be positioned on the railway side of the building allowing car entry and exit onto a proposed access way which then provides access to Brahe Place. The train tracks are located a further 10 to 15m (in plan view) from the building facade.

The proposed building is brick construction comprising residential apartments with living / lounge room sliding glass door access to balconies. One of the top level apartments has balcony access via the bedroom. The architectural design specifies aluminium framed double glazing (DGU) around the full perimeter of the building envelope for both residential and common areas. The rooftop area shall accommodate grouped installations of residential A/C unit condensers.

3.0 NOISE ISSUES

3.1 Noise affecting the development

The proposed residential development will be subjected to noise intrusion from the following environmental sources:

- Railway noise from the adjacent train line
- Traffic noise along Hoddle Street / Wellington Parade.

External environmental noise intrusion is considered in this assessment to guide the design of the building envelope.

3.2 Potential noise emissions from the development

Noise from the proposed development has the potential to affect existing residential dwellings in the area as follows:

- Mechanical services noise from the development
- Car stacker operations.

Environmental noise emissions are addressed in this assessment to guide the design of the development to protect the surrounding environment.

3.3 Relevant noise legislation/guidelines

Table 1 details the relevant legislation or guidelines applicable for the assessment of potential noise impacts at 18 Brahe Place.

Table 1
Potential noise impacts at 18 Brahe Place

Potential noise impact	Source of assessment criteria	Status
Noise intrusion into development		
Railway trains	NSW interim guideline	Discretionary
	VCAT precedent	Commonly used
Vehicle traffic	AS2107	Accepted guideline
Noise emission from development		
Car stacker and commercial mechanical services noise	VIC EPA SEPP N-1	Legislation
Residential mechanical services noise	Victorian EPA Noise Control Guidelines	Publication 1254
	Environment Protection (Residential Noise) Regulations 2008	Regulation

Noise from the proposed development has the potential to affect other existing residential dwellings in the area. As the development incorporates common area (Body Corporate controlled area) installation of mechanical services plant, the effects of these services on existing neighboring residences and the future residences within the development are assessable under SEPP N-1. This assessment process requires the determination of noise limits, which take into consideration the existing background noise levels at the site.

The following acoustic issues, outside the scope of this assessment, would be considered separately, during future detailed design phases:

- Sound insulation design to BCA (Building Code of Australia) and AAAC (Association of Australian Acoustical Consultants) standards
- Noise emission associated with construction.

4.0 BACKGROUND NOISE LEVELS

Marshall Day Acoustics conducted background noise monitoring at the East Melbourne site in good weather conditions, with no rain and little wind as summarised in Table 2.

Table 2
Background noise levels, L_{90} per SEPP N-1 assessment methodology

EPA designated period	Day	Time	Average over time period*
Day	Monday to Friday	0700-1800hrs (7:00am-6:00pm)	49
	Saturday	0700-1300hrs (7:00am-1:00pm)	
Evening	Monday to Friday	1800-2200hrs (6:00pm-10:00pm)	48
	Saturday	1300-1800hrs (1:00pm-6:00pm)	
	Sunday, public holidays	0700-1800hrs (7:00am-6:00pm)	
Night	Monday to Sunday	2200-0700hrs (10:00pm-7:00am)	45

*monitoring conducted at the 18 Brahe Place East Melbourne site between 29 Jun 2011 & 30 Jun 2011

The resulting noise limits calculated in accordance with SEPP N-1 are derived in Section 6.1.

5.0 ASSESSMENT CRITERIA FOR NOISE INTRUSION

For the assessment of external noise intrusion into a building, the criteria differs depending on the source. In this case, the proposed building is to be located in the vicinity of road traffic (including trams) and directly adjacent to train noise sources. The criteria for such assessments differ as follows:

- The criteria for traffic noise is usually based on the average (equivalent continuous) noise measured over a given time period.

- The criteria for rail related noise is based on maximum noise level occurring during the brief period of train passage.

Details of these criteria and corresponding discussion is presented in the following Sections 5.1 and 5.2.

5.1 Traffic noise

The relevant standard for the assessment of traffic noise intrusion is Australian Standard AS3671-1989 *Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*. This standard refers to the criteria of AS 2107 to assess traffic noise for various building usages. For residential buildings affected by major roads (not highways) Australian Standard AS2107-2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors* recommends the indoor sound levels detailed in Table 3, applicable to semi-continuous noise sources such as traffic and building services.

Table 3
Recommended indoor sound levels: AS2107

Type of space	Recommended noise level for houses and apartments near major roads, L_{eq}
Sleeping areas	30-40dBA
Living areas	35-45dBA
Common areas (foyer, lift lobby, shops etc)	45-55dBA

The intrusion of external noise sources such as traffic may be compared to the recommended levels of Table 3.

5.2 Sleep disturbance

Studies have shown that periodic noise from railway is less intrusive than continuous road traffic noise, however, a document published in May 1999 by the NSW EPA entitled *Environmental Criteria for Road Traffic Noise* has compared a number of sleep disturbance criteria and concluded the following:

- *"Maximum internal noise levels below 50-55dBA are unlikely to cause awakening reactions";*
- *"One or two noise events per night, with maximum internal noise levels of 65-70dBA are not likely to affect health and wellbeing significantly."*

Australian Standard AS2107-2000: *Acoustics - Recommended design sound levels and reverberation times for building interiors* provides guidelines for internal noise levels from noise sources such as traffic, based on an L_{eq} measurement. The standard recognises that the particular use of a room will influence the required criteria and allows for a noise level which is 5dB higher in living areas than in bedrooms.

A precedent has been set in the Victorian Civil and Administrative Tribunal regarding the acceptable internal noise levels for residences adjacent to railway lines (VCAT Reference No. P2470/2003). In this case, a decision to grant a permit was made on the basis that the L_{max} noise level of trains was not to exceed 55dBA in bedrooms and 60dBA in living areas. This is the same as the criteria nominated above.

For our assessment, based on consideration of the above information, it is proposed to use the following internal criteria for train noise:

- Maximum internal noise levels (L_{max}) of trains should not exceed 55dBA in bedroom areas and 60dBA in living room areas.

As a result, a rail noise criteria of L_{max} 55dBA in bedrooms and L_{max} 60dBA in living areas shall be used in this assessment.

5.3 Railway noise outside dwelling

At this stage, there are no policies or guidelines for control of environmental railway noise in Victoria. However, NSW and Queensland have published guidelines for railway noise.

The now superseded *NSW EPA Environmental Noise Control Manual* gives a maximum acceptable level of L_{max} 85dBA outside a dwelling. This is generally used when designing for new rail corridors adjacent to existing residential areas.

The *NSW Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* provides the following noise trigger levels for new rail developments or redevelopment of existing rail lines adjacent to residential land uses:

Development	Day (7am-10pm)	Night (10pm-7am)
New rail development	60dBA L_{eq}15hr 80dBA L_{max}	55dBA L_{eq}9hr 80dBA L_{max}
Redevelopment of existing rail line	65dBA L_{eq}15hr 85dBA L_{max}	60dBA L_{eq}9hr 85dBA L_{max}

The noise trigger levels represent external levels of noise that trigger the need for an assessment of the potential noise impacts from rail infrastructure projects.

The Queensland Code of Practice-Railway Noise Management (November 2007) requires that external noise levels not exceed:

- 65dBA L_{eq}24hr
- 87dBA L_{max}

The criteria contained in the Queensland Rail *Code of Practice – Railway Noise Management*, have been used for several years and have formal status. The NSW criteria are interim.

If the external limit of 85dBA as recommended by the NSW Interim Guidelines, then this requires a facade noise reduction of up to 30dB in order to achieve internal levels of L_{max} 55dBA in bedroom areas.

6.0 ASSESSMENT CRITERIA FOR NOISE EMISSIONS

6.1 Mechanical services noise legislation SEPP N-1

Within the Melbourne metropolitan area, noise from air-conditioning and mechanical equipment on commercial premises is governed by *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1).

The assessment of noise emission under SEPP N-1 is based on the calculation of a noise limit at a receiver position, taking into account a zoning noise level derived from the land-use in the surrounding area and the background noise level.

Once a noise limit is established, the noise level (L_{eq}) due to the commercial industrial activity is measured or predicted. If necessary, the L_{eq} noise level is adjusted for noise character to give the effective noise level (L_{eff}). Should the L_{eff} noise level be in excess of the noise limit, then remedial action is required.
SEPP N-1 separates the day into three different time periods – day, evening and night with associated noise criteria dependent on background noise and relative land zoning. These time periods are detailed in Table 4.

Table 4
SEPP N-1 time periods

Period	Day of week	Time period
Day	Monday-Friday	0700-1800hrs
	Saturday	0700-1300hrs
Evening	Monday-Friday	1800-2200hrs
	Saturday	1300-2200hrs
	Sunday	0700-2200hrs
Night	Monday-Sunday	2200-0700hrs

Taking into consideration the measured background noise level results from Table 2, the resulting noise limits determined in accordance with SEPP N-1 are derived below in Table 5.

Table 5
Time periods and noise limits for the East Melbourne area

Period	Day of week	Start time	End time	Background level, L_{90}	Zoning level	Noise limit
Day	Monday-Friday	0700hrs	1800hrs	49	54	55
	Saturday	0700hrs	1300hrs			
Evening	Monday-Friday	1800hrs	2200hrs	48	48	51
	Saturday	1300hrs	2200hrs			
	Sunday, Public holidays	0700hrs	2200hrs			
Night	Monday-Sunday	2200hrs	0700hrs	45	43	48

Noise emissions from the proposed development, including any fixed plant on site, shall be assessed relative to the noise limits specified in Table 5 at the nearest noise sensitive receptor. We have identified two closest noise sensitive receptors as the residences at 6 & 12 Garden Avenue East Melbourne. These noise limits shall also apply to any apartments in the development itself as they are in the same locale, and at comparable distances from any equipment noise sources.

6.2 Residential mechanical services noise EPA regulation

Noise from fixed domestic plant associated with residential apartments must comply with the requirements of the *Environment Protection (Residential Noise) Regulations 2008* which sets out provisions for control of noise from domestic appliances including

motorized equipment, electric power equipment, domestic air-conditioning plant, swimming pool pumps and musical equipment, whether amplified or not.

The regulation does not prescribe noise limits for the equipment, but it does prescribe allowable hours of operation for the purposes of determining whether noise is unreasonable at residential premises under Section 48A(5) of the Environment Protection Act 1970.

Group 3 of the schedule, which includes domestic air-conditioners and domestic heating equipment, prescribes applicable hours of operation as follows:

- Monday to Friday: before 0700hrs and after 2200hrs
- Weekends and Public Holidays: before 0900hrs and after 2200hrs.

The *Environment Protection (Residential Noise) Regulations 2008* is the relevant legislation regarding residential noise in the State of Victoria.

It is not always practical to turn off air-conditioning units during the night-time hours. If noise was inaudible inside any residence, then the requirements of Section 48A (5) of the Environment Protection Act would be achieved. This is consistent with Clause 1 of EPA Publication 1254 which provides recommended noise limits for fixed domestic plant.

Noise from plant equipment specific to each apartment such as outdoor condenser units installed on individual balconies should be designed to comply with the requirements provided in EPA publication 1254, Noise Control Guidelines.

The guidelines state the following:

Day and evening operation

Where noise from any fixed domestic plant occurs beyond the residential boundary of the residential premises on which the plant is situated, the intrusive noise shall not exceed the background noise level by more than 5dBA at the measurement.

Night operation

Noise from fixed domestic plant must not be audible within a habitable room of any other residence (regardless of whether any door or window giving access to the room is open) during prohibited hours prescribed by the Environment Protection (Residential Noise) Regulations 2008. The following prohibited hours apply to air conditioners, swimming pool and spa pumps and ducted heating systems and the like:

10:00pm-7:00am Monday to Friday
10:00pm-9:00am Weekends and Public Holidays.

7.0 RAILWAY NOISE SURVEY RESULTS

MDA conducted attended noise measurements at the subject site on 28 June 2011, between 1200-1430hrs (12:00pm-2:00pm). At a location to the south of the site, 18 different rail related events were measured and itemised. Traffic noise (including trams) measurements were also conducted within the boundary of the site. The measurement positions are illustrated in Appendix C, Figure C1.

The specific events which were identified and recorded are as follows:

- City inbound and outbound passenger trains passing the site
- Horns and miscellaneous events relating to passenger trains
- Traffic noise in the surrounding area.

Measurements were carried out using a B&K 2250 Precision Sound Level Meter which was calibrated prior to and after the survey. No drift in calibration level was observed. Conditions during our survey were mild and fine, with little or no wind.
A sample of the maximum (L_{max}) and average (L_{eq}) overall noise levels for all the individual events measured during the survey are presented in Table 6. The complete set of measurement data for all events is presented in Appendix C, Figure C2.

Table 6
Measured train and traffic noise levels

Condition	L_{max} dBA	L_{eq} dBA
Train passage measured at rim of cutting (position per Appendix C)		
Passenger electric track 1 outbound	82- 86	
Passenger electric track 2 inbound	79 - 83	
Train toot or horn	87 - 97	
Maximum 95 Percentile (*per NSW Interim Guidelines*)	92	
Traffic on surrounding roads (15 min L_{eq})		57

Subjectively, the sound from the inbound and outbound passenger trains was predominantly due to the passage of train wheels over track irregularities when passing at normal speeds past the site.

8.0 RAILWAY NOISE PREDICTIONS

The measured levels in Table 6 have been utilised to predict noise at the façade of the proposed building. The apartments with facades facing southeast overlook the railway cutting will incorporate outdoor area balconies with sliding door access. Table 7 shows the predicted noise levels at these façades. For lower level apartments the cutting provides some shielding and attenuation of some rail noise.

Table 7
Predicted external rail noise level at external facades L_{max} dBA

Most affected apartments	L_{max} dBA	
	Train passage	Nominated external noise criteria
South east facing facade of building		
Apartments 2 & 3*	69	87 (Queensland Rail Code assessment guideline)
Apartments 5 & 6	75	
Apartments 7 & 8	69	

*note the interrupted line of sight due to rail cutting offers noise benefit for Apartments 2 & 3

For the critical southeast facing balcony areas, the predicted external noise levels are lower compared to the assessment guideline for external noise recommended by the Queensland Rail Code of Practice. The levels are also such that selection of appropriate building facade and glazing elements will enable internal rail noise criteria to be achieved.

9.0 BUILDING ENVELOPE DESIGN

9.1 Glazing and lightweight facade construction

The expected noise level at the facade determines the construction required to adequately attenuate noise. The predicted external noise levels in Table 8 have been used in conjunction with the nominated design criteria in Section 5.0 to develop the acoustic requirements of the proposed development.

Options such as laminated or double glass, facade acoustic seals, insulated roof treatment, etc, would normally be considered in the acoustic design of a building envelope to ensure the internal design criteria are achieved.

The glazing treatments proposed in Table 8 below, for the facades most critically overlooking the railway, will enable compliance with both the maximum noise level (L_{max}) for sleep disturbance due to trains and the average (L_{eq}) noise criteria for traffic noise.

Table 8
Glazing type recommended options for critically aligned rooms

Critical case assessment *Southeast facing facades*	Room type	Single Glazing Option	Double Glazing Option
Apartment 2	Lounge/living	6.76 laminate	5/25/5
Apartment 3	Lounge/living	6.76 laminate	5/25/5
	Bedroom	6.76 laminate	5/25/5
Apartment 5	Lounge/living	10.76 laminate	6/12/10
Apartment 6	Lounge/living	10.76 laminate	6/12/10
	Bedroom	10.76 laminate	6/12/10
Apartment 7	Bedroom	6.76 laminate	5/25/5
Apartment 8	Lounge/living	6.76 laminate	5/25/5
	Bedroom	6.76 laminate	5/25/5

For interiors, the windows must be closed for compliance with criteria. Therefore, to compliment the above recommendations, the design and installation of the glazing (including doorways) must feature good sealing to ensure facade sound insulation is not de-rated by flanking.

For top floor rooms, it is necessary for the roof to provide a level of sound reduction (R_w) at least equal to that provided by the following construction in order that these amenities will comply with the required noise criteria:

- 0.8mm steel sheet roof decking
- Ceiling suspension system consisting of steel or timber joists giving a total air space of 250mm
- One layer of 13mm thick plasterboard
- There must be minimum 75mm thick sound absorptive material (14-18kg/m^3) in the ceiling cavity.

We note that the current architectural design specifies a roof level common area with a 150mm masonry floor slab, which will easily satisfy the above sound reduction criterion.

9.2 External wall construction

At this stage, we have performed preliminary calculations based on the site layout drawings provided; an example of a suitable external wall construction on the most exposed façade is as follows:

- Double row brick (220mm)
- 20mm air gap
- 70mm timber stud (75mm thick fibreglass 14-18kg/m^3 or 100mm thick polyester 8-10kg/m^3)

- 1 layer 13mm fire rated plasterboard or similar.

These treatments are provided to be indicative only and there are a multitude of options available. MDA will be able to provide a number of external wall options as the design progresses, if required.

10.0 ENVIRONMENTAL NOISE EMISSIONS

10.1 Equipment noise sources

At this stage, noise levels of the mechanical plant have been estimated according to typical product installed at residential developments, in this case the roof top air-conditioning condensers and the mechanical car stacker units.

Noise level of the equipment proposed for use at the development is presented in Table 9. These sound power levels have been sourced from MDA noise source database and product manufacturer specifications.

Table 9
Sound power levels of dB re 10^{-12} W mechanical equipment

Description	Octave band centre frequency							
	63	125	250	500	1k	2k	4k	Hz
Residential A/C units (2 off)*	78	76	75	74	73	75	70	dBW
Car stacker unit (2 off)**	81	74	68	66	68	70	69	dBW

*Carrier Comfort Series condenser units (external)
** Klaus Multiparking system: one car lift operation duration assumed to be 60 seconds

A typical best practice feature for residential A/C condenser units at buildings similar to the Brahe Place development would provide no direct line-of-sight of exposed plant from closest neighbouring residences, by shielding or screening of the units.

Referring to the architectural layouts presented in Appendix B, the rooftop common area is planned to accommodate the residential A/C condenser units grouped behind a 1m high perimeter of concrete planter boxes as illustrated in Figure 3 following.

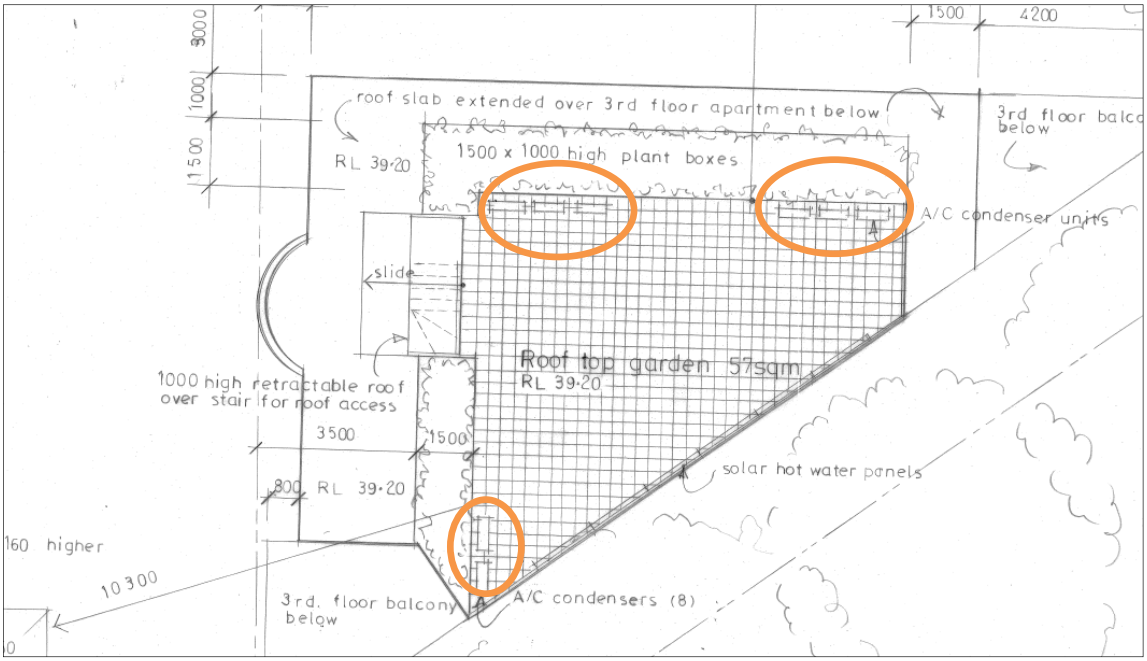


Figure 3: Mechanical services plant area

Referring also to the architectural layouts in Appendix B, the car stacker units are planned to be fully enclosed within the ground level garage as illustrated in Figure 4 with the garage doorway opening facing towards the railway side of the site.

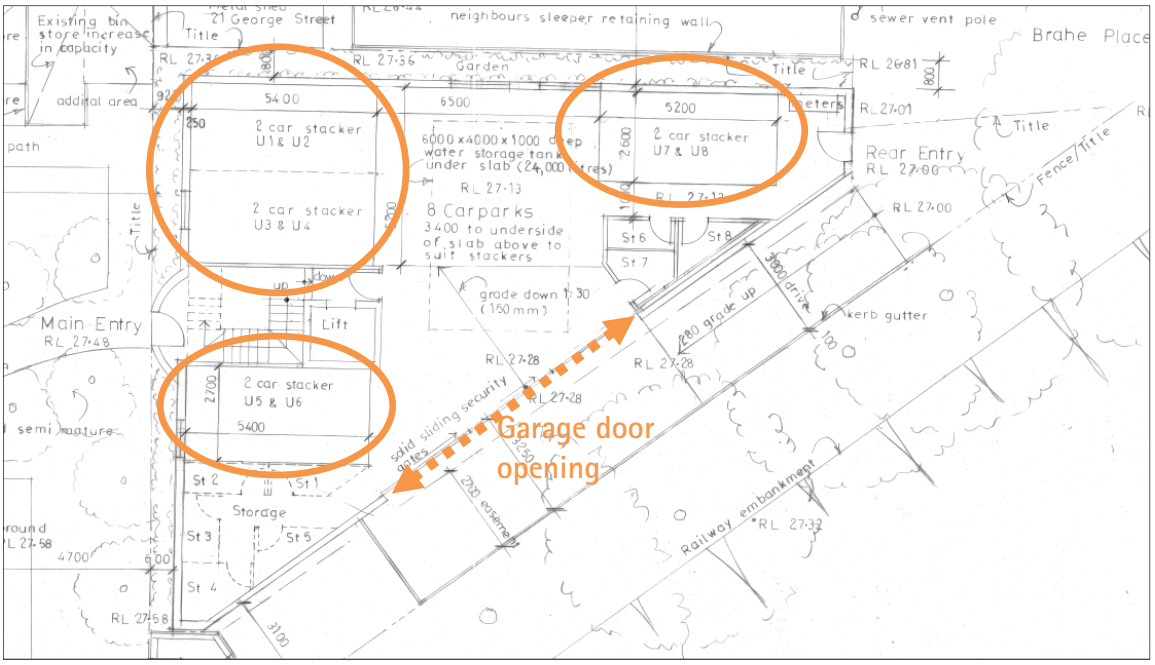


Figure 4: Mechanical car stacker units

Based on the nominated equipment sound power levels (Table 9) and considering the distance to the nearest residential properties, the noise levels at the nearest noise sensitive dwellings, including a critical case assessment of Apartment 7 in the development itself, have been calculated. The results are presented in Table 10.

Table 10
Equipment noise levels predicted at nearest residential facade, L_{eq} dBA

Source of noise	Future Apartment 7 Balcony bedroom facade	Existing 6 Garden Ave facade predicted noise level	Existing 12 Garden Ave facade predicted noise level
All 8 residential A/C units operating	37	43	41
Car stacker noise during operation *	41	36	34

*note predictions assume the garage door is completely open

10.2 SEPP N-1 assessment

The SEPP N-1 assessment requires that the effective noise level of all commercial equipment comply with the relevant limits. The effective noise level is the corrected L_{eq} of the noise source or sources adjusted over a 30 minute period as presented in Tables 11 to 13.

Table 11
Effective noise at Apartment 7 balcony bedroom facade, L_{eq} dBA

Source of noise from development	Noise level (dBA)	SEPP N-1 Corrections				SEPP N-1 Effective noise level
		Duration	Inter-mittency	Impulsive-ness	Tonality	
All Residential A/C units	37	-	-	-	-	37
Car stacker units operation	41	-12	-	-	+5	34

Table 12
Effective noise at 6 Garden Avenue nearest facade, L_{eq} dBA

Source of noise from development	Noise level (dBA)	SEPP N-1 Corrections				SEPP N-1 Effective noise level
		Duration	Inter-mittency	Impulsive-ness	Tonality	
All Residential A/C units	43	-	-	-	-	43
Car stacker units operation	36	-12	-	-	+5	29

Table 13
Effective noise at 12 Garden Avenue nearest facade, L_{eq} dBA

Source of noise from development	Noise level (dBA)	SEPP N-1 Corrections				SEPP N-1 Effective noise level
		Duration	Inter-mittency	Impulsive-ness	Tonality	
All Residential A/C units	41	-	-	-	-	41
Car stacker units operation	34	-12	-	-	+5	27

In the case of the car stacker we have assumed a 60sec operation for 2 car stackers per half hour period.

For the equipment under review, it is understood normal hours of operation also includes night time operation. In this case the following table (Table 14) itemises the assessment relative to the applicable SEPP N-1 noise limit.

Table 14
SEPP N-1 assessment of predicted effective noise levels, L_{eq} dBA

Noise sensitive receptor	Overall Effective Noise Level	SEPP N-1 night time limit	Complies
Apartment 7	39	48	Yes
6 Garden Avenue	43	48	Yes
12 Garden Avenue	41	48	Yes

*All Residential A/C units operating & 2 x car stacker unit operations per half hour period

Table 14 demonstrates that the effective noise level emanating from the equipment items at the nearest noise sensitive receptors will comply with the relevant SEPP N-1 criteria at all times.

10.3 EPA guidelines noise assessment

Utilising the calculated noise levels in Table 10, the overall noise at the nearest existing and future residential receivers from all mechanical services equipment is predicted to be 45dBA or lower. In the case of daytime and evening operation, this level achieves the requirement to *not exceed the background noise level by more than 5dBA* by a significant margin.

In the event of night time operation, overall condenser and car stacker noise must not be audible within a habitable room of any other residence regardless of whether any door or window giving access to the room is open. In this case, making an allowance of 10dB reduction in the case of an open window, the predicted level is 35dBA or lower which is similar to the measured background level at the site (45dBA outdoors) and hence is likely to be inaudible indoors.

10.4 Sleep disturbance assessment

Operation of the car stacker has the potential to cause sleep disturbance in the surrounding environment. Table 10 details the noise level of the car stacker predicted at the nearest residential receivers, including those of the development itself. Noise from this equipment is predicted to comply with the NSW EPA sleep disturbance criteria.

11.0 CONCLUSIONS

For external noise intrusion into the proposed development at 18 Brahe Place, East Melbourne, the inclusion of the recommended building envelope treatments as specified in Table 8 is predicted to provide a satisfactory internal amenity within critically oriented apartments.

Other apartments that do not face towards the railway line will not require such extensive acoustic treatment. The requirements for these apartments can be determined as part of the detailed design for the project. These proposed treatments fall within acceptable conventional residential design requirements and are consistent with the currently specified double glazing design for the full perimeter of the building.

This review of environmental noise emissions from the proposed development based on the current architectural design indicates that mechanical services associated with the development such as the roof top condenser units and car stacker will meet the SEPP N-1 night-time noise limit of 48dBA at nearby residences and affected apartments within the development.

Any additional mechanical services equipment which may be specified for the project in the detailed design phase would also be required to comply with the SEPP N-1 night-time noise limit of 48dBA at nearby residences and affected apartments within the development.

APPENDIX A

ACOUSTIC TERMINOLOGY

dB	Decibel. A scale referring to noise or vibration may commonly be expressed in decibel level.
dBA	Unit of overall noise level, in A-weighted decibels. The A-weighting approximates the average human response over the entire frequency range.
L_{eq}	Continuous or semi-continuous noise levels are described in terms of the equivalent continuous sound level (L_{eq}). This is the constant sound level over a stated time period which is equivalent in total sound energy to the time-varying sound level measured over the same time period. This is commonly referred to as the average noise level and is generally measured in dBA.
L_{max}	The maximum noise level (L_{max}) is defined as the highest noise level which occurs during any noise event occurring over a particular time period. This is generally measured in dBA.
R_w	Weighted sound reduction, which is a measure of the acoustic effectiveness of a building partition, door or other building element in blocking noise transmission from one side of the element to the other. This value is the result of measurements in acoustic laboratories in accordance with the relevant Australian Standards. The higher the R_w the better the acoustic performance.

APPENDIX B

SITE LAYOUT AND ARCHITECTURAL DRAWINGS

GEORGE STREET

footpath

HODDLE STREET

BRAHE PLACE

No. 1093 2 storey home

No. 1091 2 storey home

No. 1089 2 storey home

No. 1087 2 storey home

No. 1085 Apartments 2 storey

No 29

3 storey Apartment

balcony

3 storey Apartments

37.35 ridge

33.23 eaves

Private open space

10900

2700 ht brick wall

No. 21-27 2 storey Apartments

verandah

hw

No. 17 single storey Doctors rooms

No. 19 single storey home

d

verandah

2 storey

single storey

2 M. high palings

garage

court

roller door

concrete open car parking

2 storey Apartments

d hw w

open stair

gravel carpark

19700

not fenced

9200

gl. garage

open concrete carpark

sewer vent

gl. shed

E 3

bike shed bins

open stair

No. 12 3 storey Apartments

38.28 ridge

new path

27.48 ground

9300

Title

Carpark

Title

ENTRY

Title

No. 18 Brahe Place Proposed 4 storey Apartments.

• ground level carpark

• 3 levels apartment over

store

3100

10 M. high Peppercorn trees

Carriage Way Easement

Existing path

37.51 parapet

ENTRY

Security gates

Common Property

Sight line position 1700 high

47 240

ex. path

New subdivision

37.64 parapet

400

store

2700

3600

E 1

RAILWAY CUTTING

39.04 ridge

27.58 ground

No. 6 3 storey Apartments

t dry No. 6-12

E 1

29300

open stair

GARDEN AVENUE

37.92 top of wall

No. 2-4 3 storey Apartments

28800

Top of building 40.42

No. 12 2 storey Office Wellington Parade

0 5 10 15 20 M

Scale 1:200 at A1 Size

ISSUED TO	REVISIONS	DATE
PLANNING	B PERMIT APPLICATION	10-12-10
PLANNING	C AMENDED APPLICATION	20-8-11
PLANNING	D AMENDED APPLICATION	19-12-12
VCAT	VC VCAT AMENDED PLANS	21-6-11

North

© COPYRIGHT 2009

NOTES
1. Contractors must verify all dimensions and levels before commencing any work.
2. Obtain the Architect's written approval before commencing any work involving shop drawings and variations.
3. Drawings must not be scaled. Large scale drawings shall take preference to small scale.

DRAWINGS: Site Plan

DRAWN | CHECKED

PROJECT: Proposed New Apartments
18 Brahe Place East Melbourne
For: Andrew Swanson

Mattingley Courtney Pty Ltd.
ARCHITECTS A.C.N. 006 522 998 A.B.N. 44 576 452 728
PO Box 403, Mont Albert Victoria 3127. Telephone (03) 9890 1255 Facsimile (03) 9890 0888

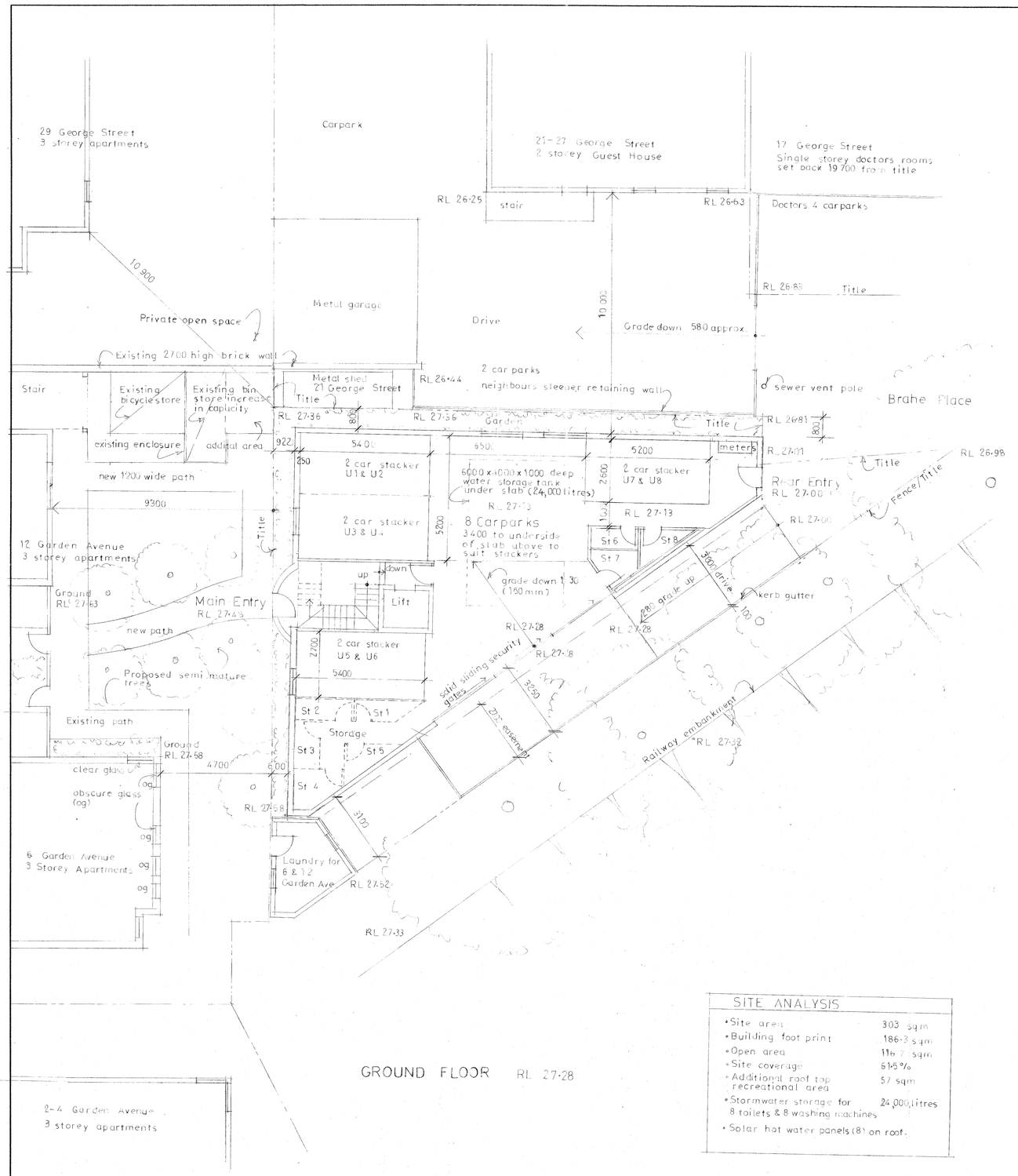
DRG.No 1289-TP 1

SHEET 1 OF 5

SCALE 1:200

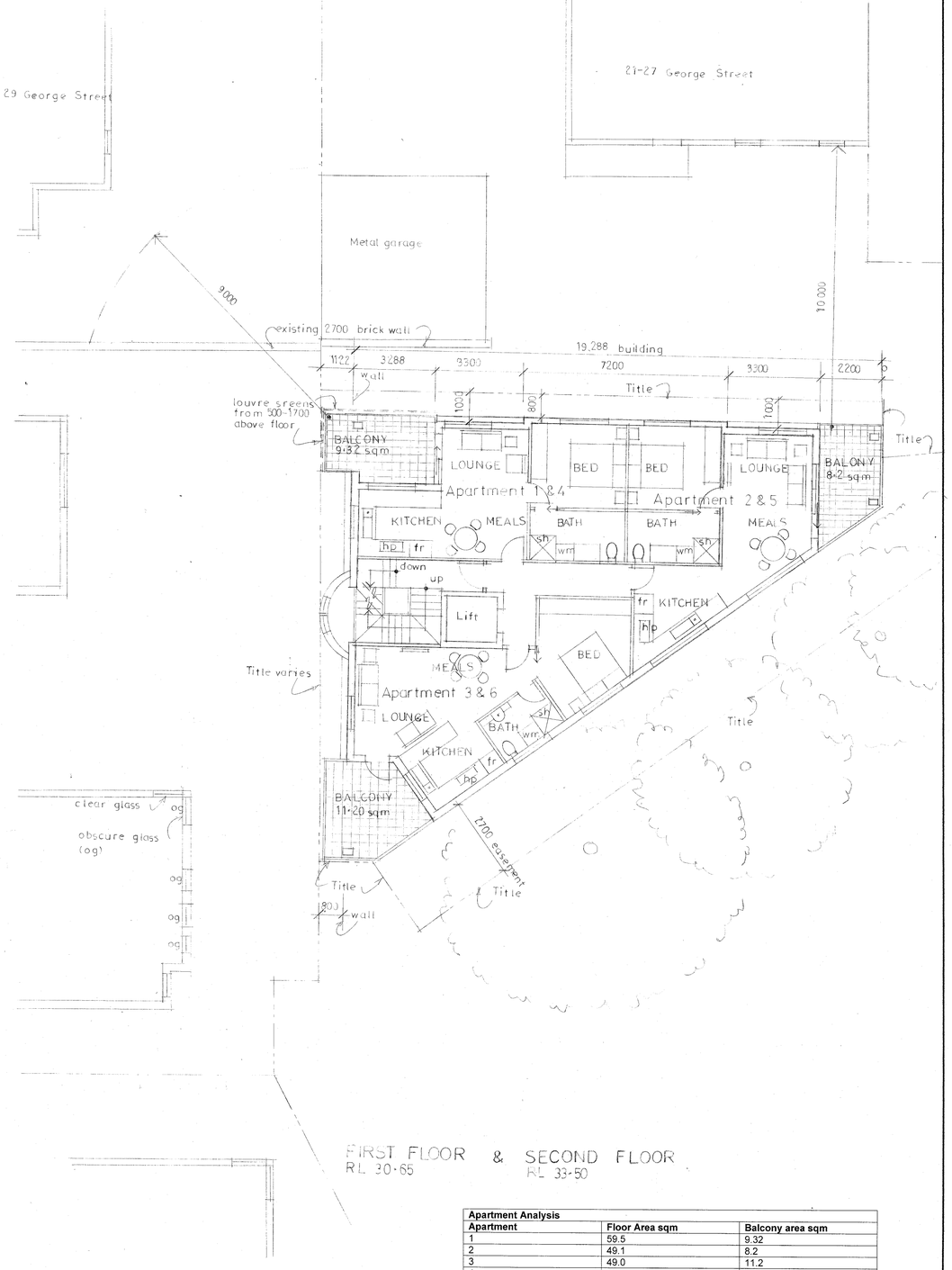
DATE June '11

REV VC



GROUND FLOOR RL 27·28

SITE ANALYSIS	
• Site area	303 sqm
• Building foot print	186·3 sqm
• Open area	116·7 sqm
• Site coverage	61·5 %
• Additional roof top recreational area	57 sqm
• Stormwater storage for 8 toilets & 8 washing machines	24,000 litres
• Solar hot water panels (8) on roof.	



FIRST FLOOR & SECOND FLOOR
RL 30·65 RL 33·50

Apartment Analysis		
Apartment	**Floor Area sqm**	**Balcony area sqm**
1	59.5	9.32
2	49.1	8.2
3	49.0	11.2
4	59.5	9.32
5	49.1	8.2
6	49.0	11.2
7	55.6	10.0
8	53.5	10.4

0 5 10 M
Scale 1:100 at A1 size & 1:200 at A3

ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS
VCAT	VC VCAT AMENDED PLANS	21-6-11					

North

© COPYRIGHT 2009

NOTES
1. Contractors must verify all dimensions and levels before commencing any work.
2. Obtain the Architect's written approval before commencing any work involving shop drawings and variations.
3. Drawings must not be scaled. Large scale drawings shall take preference to small scale.

DRAWINGS: Plans
DRAWN
CHECKED

PROJECT: Proposed New Apartments
18 Brahe Place East Melbourne
For: Andrew Swanson

Mattingley Courtney Pty Ltd.
ARCHITECTS A.C.N. 006 522 998 A.B.N. 44 576 452 728
PO Box 403, Mont Albert Victoria 3127. Telephone (03) 9899 1255 Facsimile (03) 9899 0888

DRG.No 1289-TP 2
SHEET 2 OF 6
SCALE 1:100
DATE June 11
REV VC

29 George Street

21-27 George Street

Ridge RL 37·35 = 1880
lower than 18 Brahe Place

29 George Street

21-27 George St

Exposed roof mounted air conditioner compressors (12)

Title

1122

wall

19 500

15 300

4200

Title

3000 set back

800

second floor roof slab below

1000

Title

part balcony below

3000

Title

10 000

12 Garden Avenue

Apartment 7

sk BATH wm fr KITCHEN MEALS LOUNGE BED

hp

Balcony 10 sqm

down up to roof

Lift

BED

sh

Title

5200

pant wm KITCHEN LOUNGE

Apartment 8

hp fr

2700

10 530

Balcony 10·4 sqm

14 030

22 450

clea glass

4800

obscure glass (og)

6 Garden Avenue

og

og

og

og

3510

Title

800 wall

9200

2-4 Garden Avenue

THIRD FLOOR RL 36·35

12 Garden Avenue

Ridge RL 38·28 = 920
lower than 18 Brahe Place

Parapet RL 37·81 = 1690
lower than 18 Brahe Place

1500

20 410

Title

1122

3000 set back

1000

1500

roof slab extended over 3rd floor apartment below

RL 39·20

1500 x 1000 high plant boxes

3rd floor balcony below

A/C condenser units

slide

1000 high retractable roof over stair for roof access

Roof top garden 575sqm
RL 39·20

3500

1500

800 RL 39·20

solar hot water panels

Chimney RL 39·36 = 160 higher

10 300

Parapet RL 37·64 = 1560
Lower than 18 Brahe Place

Ridge RL 39·03 = 170 lower

6 Garden Avenue

3rd. floor balcony below

A/C condensers (8)

Title

2700

10 metre high Peppercorn trees

ROOF TOP GARDEN RL 39·20

Parapet RL 37·92

Roof top RL 40·42 = 1220
higher than 18 Brahe Place

2-4 Garden Avenue

0 5 10 M

Scale 1:100 at A1 size & 1:200 at A3

ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS
VCAT	VC VCAT AMENDED PLANS	21-6-11					

North

© COPYRIGHT 2009

NOTES
1. Contractors must verify all dimensions and levels before commencing any work.
2. Obtain the Architect's written approval before commencing any work involving shop drawings and variations.
3. Drawings must not be scaled. Large scale drawings shall take preference to small scale.

DRAWINGS

DRAWN Plans

CHECKED

PROJECT
Proposed New Apartments
18 Brahe Place East Melbourne
For: Andrew Swanson

Mattingley Courtney Pty Ltd.
ARCHITECTS A.C.N. 006 522 998 A.B.N. 44 576 452 728
PO Box 403, Mont Albert Victoria 3127. Telephone (03) 9899 1255 Facsimile (03) 9899 0888

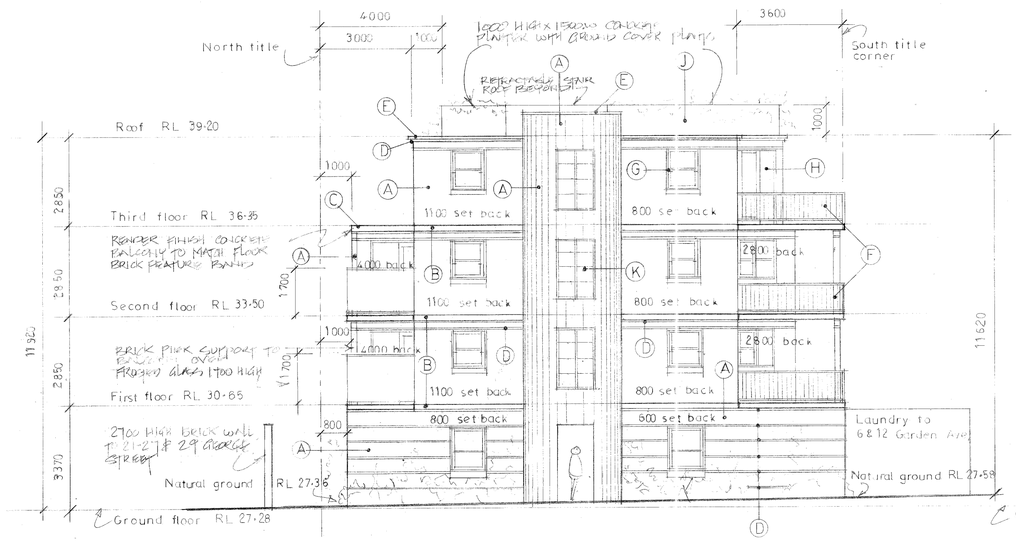
DRG.No 1289-TP3

SHEET 3 OF 6

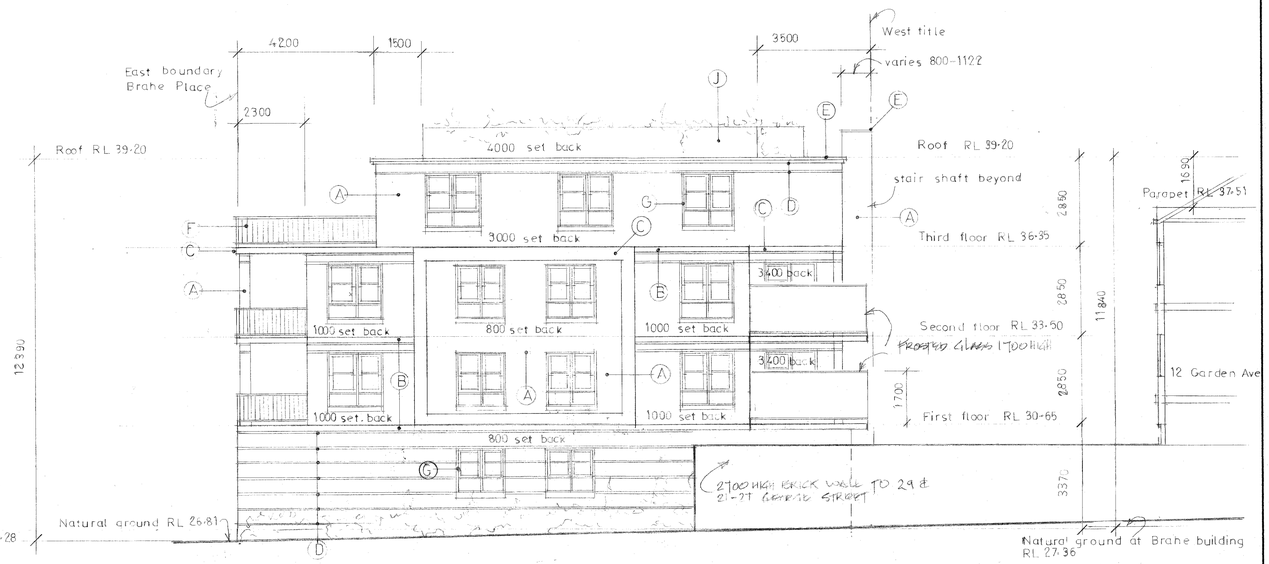
SCALE 1:100

DATE June 11

REV VC

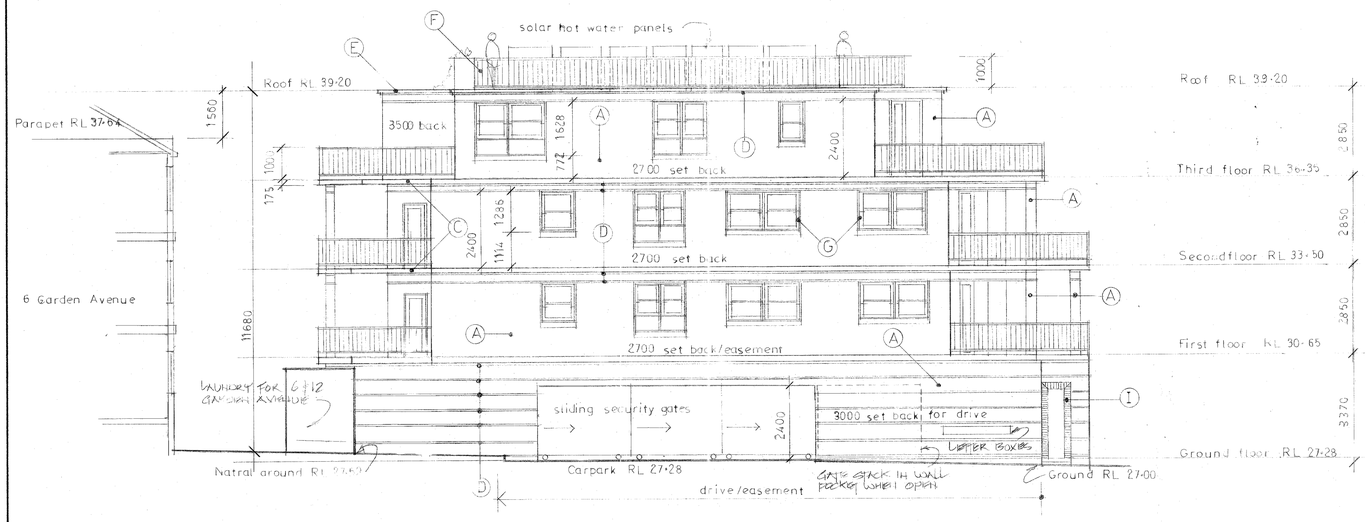


WEST ELEVATION Garden Avenue View



NORTH ELEVATION View from rear of George Street Properties

MATERIALS & FINISHES LEGEND	
A	Boral Escura 'Red' bricks for main body of walls.
B	Boral Nuvo 'Melot' feature brick band 2 bricks high at floor level
C	Render finished concrete to match B above
D	Boral Escura 'Choc Tan' Single brown trim brick band
E	Boral Escura 'Cinnamon' top capping single brick band
F	Black powder coated balustrade 1000 high & 120 spacing between 20 diameter balusters
G	White powder coated aluminium double hung windows all double glazed
H	White powder coated aluminium sliding doors all double glazed
I	Boral Escura 'Cinnamon' 50 mm high feature brick door surround to Brahe Place entry
J	Render finished concrete planters to match A above
K	White powder coated aluminium windows with 4 glazing bars and all double glazed to stair shaft.



SOUTH ELEVATION View from railway obscured by large peppercorn trees



EAST ELEVATION View from Brahe Place

0 5 10 M
Scale 1:100 at A1 & 1:200 at A3

ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS	DATE	ISSUED TO	REVISIONS
VCAT	VC VCAT AMENDED PLANS	21-6-11					

North

© COPYRIGHT 2009

NOTES
1. Contractors must verify all dimensions and levels before commencing any work.
2. Obtain the Architect's written approval before commencing any work involving shop drawings and variations.
3. Drawings must not be scaled. Large scale drawings shall take preference to small scale.

DRAWINGS Elevations
DRAWN
CHECKED

PROJECT
Proposed New Apartments
18 Brahe Place East Melbourne
For: Andrew Swanson

Mattingley Courtney Pty Ltd.
ARCHITECTS A.C.N. 006 522 098 A.B.N. 44 576 452 728
PO Box 403, Mont Albert Victoria 3127. Telephone (03) 9890 1255 Facsimile (03) 9890 0858

DRG.No 1289-TP4
SHEET 4 OF 5
SCALE 1:100
DATE June 11
REV VC

APPENDIX C

NOISE MEASUREMENT POSITIONS AND RESULTS

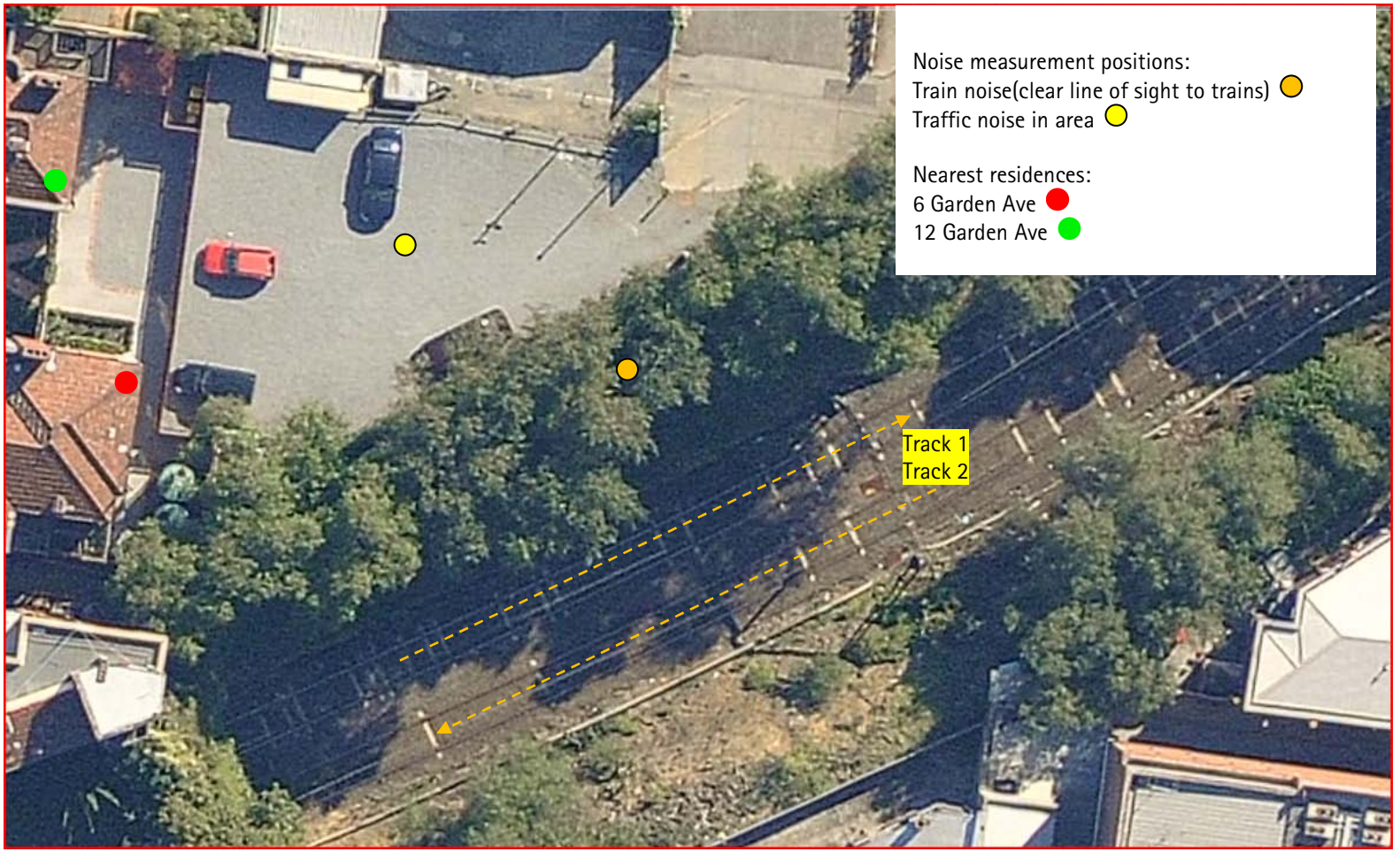


Figure C1 Survey measurement and residential receptor positions

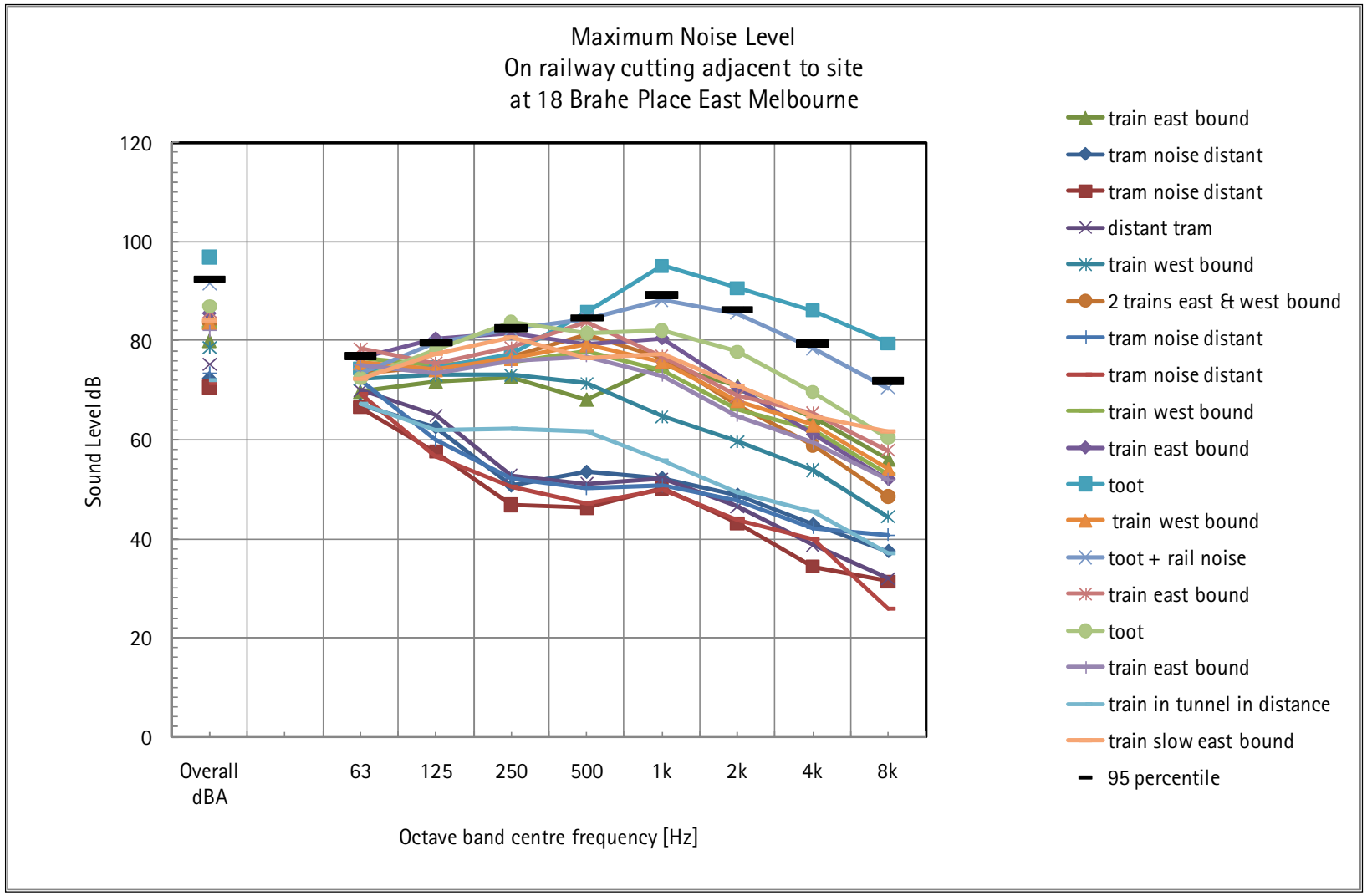


Figure C2 Measured noise levels