RIVERVIEW PROJECTS (ACT) PTY LTD

GINNINDERRY NEIGHBOURHOOD 1

OVERARCHING NOISE MANAGEMENT PLAN

SEPTEMBER 2018

Ginninderry

wsp

Question today
Imagine tomorrow
Create for the future

Ginninderry Neighbourhood 1
Overarching Noise Management Plan

Riverview Projects (ACT) Pty Ltd

WSP
Level 1, 121 Marcus Clarke Street
Canberra ACT 2601
PO Box 1551
Canberra ACT 2600

Tel: +61 2 6201 9600
Fax: +61 2 6201 9666
wsp.com

REV	DATE	DETAILS
2	4 September 2018	Revised issue to account for road pavement change and to include stage 1 and stage 2 (i.e. all blocks affected by the arterial road along Neighbourhood 1).

	NAME	DATE	SIGNATURE
Prepared by:	Zhang Lai	4 September 2018	
Reviewed by:	Jamie Hladky	4 September 2018	
Approved by:	Jamie Hladky	4 September 2018	

TABLE OF CONTENTS

EXECUTIVE SUMMARY

WSP Australia Pty Ltd has prepared an overarching Noise Management Plan (NMP) suitable for inclusion in the Development Application (DA) of the residential blocks located adjacent to the arterial road within Stage 1 of the Ginninderry development.

The assessment has been prepared in reference to the planning requirements of the Single Dwelling Housing Development Code and Multi Unit Housing Development Code.

The purpose of this report is to provide information for land purchasers to guide the selection of façade glazing with respect to meeting the road traffic noise intrusion requirements of these codes. Following this guidance does not guarantee Development Application Approval, and further detailed assessment may be required on a site-by-site basis. Information is provided for costing and selection purposes only.

The primary objectives of this NMP are to:

- Predict and assess the likely road traffic noise levels impacting on the future building façade of developments adjacent to the arterial road in Stage 1.
- Provide indicative acoustic building envelope construction requirements that respond to these road traffic noise levels.

Three dimensional computer noise modelling has been undertaken based on the appropriate input parameters, which resulted in prediction of the likely future road traffic noise levels impacting on the façade of the future dwellings adjacent to the arterial road.

Indicative building envelope construction requirements have been recommended in order to meet the internal noise level goals as discussed in Section 2.

Implementation of the suggested construction (subject to detailed design) is expected to allow the proposed development at the residential blocks adjacent to the arterial road to meet the current planning requirements.

Recommended minimum façade glazing requirements are tabulated on a block-by-block basis in Appendix A.

1 INTRODUCTION

WSP Australia Pty Ltd has been commissioned by Riverview Projects (ACT) Pty Ltd to prepare an overarching Noise Management Plan for Neighbourhood One of the Ginninderry estate.

In accordance to the Single Dwelling Housing Development Code (SDHDC) and the Multi Unit Housing Development Code (MUHDC), a NMP and noise assessment is required to be prepared for any land blocks located adjacent to an arterial road carrying road traffic of 12,000 and above.

The proposed development location is presented in Figure 1.1. A road noise assessment was previously conducted as part of the preparation of the Estate Development Plan (WSP report reference *2303672PA-ACG-R-1 Rev0* dated 29 April 2016). The 3-dimensional road noise model used for the EDP study will serve as the basis of the assessment for this NMP.

The primary objectives of this NMP are to:

- Predict and assess the likely road traffic noise levels impacting on the future building façade of the development adjacent to the arterial road in Stage 1.
- Provide indicative building envelope construction requirements.

The purpose of this report is to provide information for land purchasers to guide the selection of façade glazing with respect to meeting the road traffic noise intrusion requirements of these codes. Following this guidance does not guarantee Development Application Approval, and further detailed assessment may be required on a site-by-site basis. Information is provided for costing and selection purposes only.

Figure 1.1 Aerial photograph indicating the location of the proposed development

2 PLANNING REQUIREMENTS

The relevant noise criteria applicable to the project site have been established in accordance with the following documents:

- Single Dwelling Housing Development Code
- Multi Unit Housing Development Code

With regard to potential noise intrusion to the proposed residential development, Rule 42 of the SDHDC and Rule 67 of the MUHDC states that:

> Where a block has one or more of the following characteristics:
>
> **1** identified in a precinct code as being potentially affected by noise from external sources
>
> **2** **adjacent to a road carrying or forecast to carry traffic volumes greater than 12,000 vehicles per day**
>
> **3** located in a commercial zone
>
> **4** adjacent to a commercial or industrial zone
>
> dwellings should be constructed to comply with the relevant sections of all of the following:
>
> - AS/NZS 2107:2000 – Acoustics – Recommended design sound levels and reverberation times for building interiors (the relevant satisfactory recommended interior design sound level)
> - AS/NZS 3671 – Acoustics – Road Traffic Noise Intrusion Building Siting and Design
>
> For other than road traffic noise, compliance with this rule is demonstrated by a noise management plan prepared by a member of the Australian Acoustical Society with experience in the assessment of noise, and endorsed by the EPA. For other than road traffic noise, the noise level immediately adjacent to the dwelling is assumed to be the relevant noise zone standard specified in the ACT Environment Protection Regulation 2005.
>
> For road traffic noise, compliance with this rule is demonstrated by an acoustic assessment and noise management plan, prepared by a member of the Australian Acoustical Society with experience in the assessment of road traffic noise, and endorsed by the Transport Planning & Projects Section in EPSDD.

The proposed Ginninderry arterial road was predicted to carry up to 29,000 vehicles per day. As emboldened in the quotation above, this triggers a road traffic noise assessment under relevant rules by being identified as being located adjacent to a major road corridor.

It should be noted that AS2107:2000 currently referenced in the SDHDC and MUHDC has been superseded by a revised issue dated 2016. The older version was however referenced in this NMP as per required by the MUHDC.

2.1 ROAD TRAFFIC NOISE INTRUSION

The recommended and maximum internal noise levels for residential developments, in accordance with AS/NZS 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS2107), are listed in Table 2.1.

AS2107 uses the L_{Aeq} descriptor, which describes a steady state sound level of equivalent energy to the time varying noise level over a given period. The time period used for assessment purposes should be representative of the time period that the building will be in use.

This assessment will use the highest $L_{Aeq\text{-}15min}$ measurements for daytime (7 am to 10 pm) and night time (10 pm to 7 am) as the basis for assessing living areas and bedrooms respectively. The attended measurements are considered to be conservative indications of road traffic noise levels likely to impact the proposed development.

The sound transmission loss performance of the façade of the development shall be designed to achieve the recommended internal noise levels shown in Table 2.1.

Table 2.1 AS2107 Recommended design sound levels (dB L_{Aeq})

OCCUPANCY TYPES	AS2107 SATISFACTORY DESIGN SOUND LEVEL		PROPOSED PROJECT ASSESSMENT LEVEL
	RECOMMENDED	MAXIMUM	
Sleeping areas[1]	30 dBA	40 dBA	≤35 dB L_{Aeq-9h} (night time)
Living areas[1]	35 dBA	45 dBA	≤40 dB $L_{Aeq-15h}$ (daytime)

(1) Based on recommended design targets for the category of *Houses and apartments near major road*.

AS 3671:1989 *Acoustics – Road traffic noise intrusion – Building siting and construction* (AS3671) is concerned with road traffic noise intrusion to buildings near to major roads. AS3671 provides guidelines for determining necessary building envelope constructions to achieve the internal noise levels recommended in AS2107.

Table 2.2 outlines the recommended building construction categories required to achieve satisfactory internal noise levels for a residential building, as per AS2107 (see Table 2.1). This is a guideline only, and the actual reduction afforded will depend upon the frequency content of the noise. Where significant low frequency noise is evident, the guidelines in AS3671 may not be sufficient.

Table 2.2 AS3671 residential building construction categories

BUILDING TYPE	RESIDENTIAL BUILDING CONSTRUCTION CATEGORY			
	Category 1	Category 2	Category 3	Category 4
External road traffic noise level, dB L_{Aeq}	≤45	>45 ≤60	>60 ≤75	>75
Most onerous proposed project assessment level, dB L_{Aeq}	Sleeping areas ≤35	Sleeping areas ≤35	Sleeping areas ≤35	Sleeping areas ≤35
Resulting necessary Traffic Noise Reduction (TNR)	≤10	>10 ≤25	>25 ≤35	>40

According to AS3671, the categories referenced in Table 2.2 are:

- Category 1 – Standard construction: openings including open windows may comprise up to 10% of the exposed façade.
- Category 2 – Standard construction except for lightweight elements or all glass facades (both of which require acoustic advice). Windows, doors and other openings should be closed.
- Category 3 – Special construction as advised in the Standard. Windows, doors and other openings should be closed.
- Category 4 – Special acoustic advice should be sought.

Following noise predictions for this project, all of the development blocks assessed (see Appendix A) were found to be either **Category 2 or 3**, requiring closable windows and a degree of acoustic consultancy support in final glazing selections.

3 ROAD NOISE MODELLING APPROACH

As the proposed arterial road is currently not operational and that the forecasted traffic volume will not be realised until the entire Ginninderry development becomes fully occupied, the noise intrusion assessment is entirely based on noise prediction. All predictions were carried out using the Calculation of Road Traffic Noise (CoRTN) algorithm (UK Department of Environment Welsh Office 1988).

Based on information provided by Calibre Consulting during preparation of the EDP, the list of information that contributed to the establishment of the noise model and execution of the noise predictions are briefly summarised in Table 3.1.

Table 3.1 Noise model parameters used

ITEM	DESCRIPTION
3-dimensional ground topography data for the future design ground level of the assessment area	Provided by Calibre Consulting
CAD drawings indicating currently proposed layout of the subdivision	
CAD drawings indicating the centrelines of the proposed arterial road	
Indicative dwelling site plans and floor plans	Provided by Riverview Projects. All buildings will be setback from the road fronting boundary by ≥4 m and from the side boundaries by ≥1.5 m. All buildings to be up to two stories high.
Traffic volume and mix forecast along the proposed arterial road	Based on an extract from the traffic assessment report completed by AECOM dated 1 December 2015 and email advice dated 21 January 2016
Sign-posted speed limit	60 km/hr
Design year for noise assessment purposes	Year 2041
Road pavement type	Dense graded asphalt
Daily traffic volume (24-hour)	15,000 to 29,000 dependent on location of the road sections
Percentage of 18-hour volume over 24-hour volume	95%
Percentage of heavy vehicles (including bus and truck traffic)	Up to 4%
Correction factor to account for potential façade reflection at 1 m in front of building façade	+2.5 dB
Noise model correction factor	-3.7 dB[1]

(1) This is an ACT Government-assigned correction factor for CoRTN algorithm to suit local ACT conditions. This correction factor has typically been found to be applicable in the ACT based on noise model validation processes conducted for various past road projects in the ACT.

4 ROAD NOISE ASSESSMENT

Based on the modelling parameters presented above, the predicted road traffic noise levels are presented in Table A.1 in Appendix A.

Corresponding façade wall and glazing recommendations are described in Section 4.1. As the minimum glazing requirements vary slightly from block to block these are also tabulated in Table A.1 for clarity.

4.1 RECOMMENDED MINIMUM CONSTRUCTIONS

From the predicted noise levels for each development block presented in Table A.1, the predicted noise levels ranges are:

- Day time – 61 to 67 dB $L_{Aeq,\ 15hour}$ (a range of 4 dB)
- Night time – 58 to 64 dB $L_{Aeq,\ 9hour}$ (a range of 4 dB)

This results in minimum constructions as set out below.

4.1.1 GLAZING

The following recommendations for glazing are applicable for façades that have direct and partial frontage to the arterial road. This means that an occupant inside the space would have direct line of sight to the road. For façades that face away from the arterial road, standard glazing constructions without specific sound insulation requirements would be suitable. This means that for each final block configuration, the actual position of side and rear windows would need to be reviewed. This will be particularly important for corner blocks or end terraces.

The following construction recommendations are provided to suit the predicted external noise levels:

- If day time noise level (see Appendix A) is L_{Aeq} ≤63 dB:
  - Living area – glazing meeting ≥30 dB R_w (e.g. ≥6 mm standard float glass, or any double glazing)
- If day time noise level (see Appendix A) is L_{Aeq} ≤65 dB:
  - Living area – glazing meeting ≥32 dB R_w (e.g. ≥6.38 mm laminated glass, or double glazing that makes use of ≥6 mm panes – e.g. 6 / 12 / 6 double glazing.)
- If day time noise level (see Appendix A) is L_{Aeq} ≤67 dB:
  - Living area – glazing meeting ≥32 dB R_w (e.g. ≥10.38 mm laminated glass, or double glazing that makes use of ≥10 mm panes – e.g. 10 / 12 / 6 double glazing.)
- If night time noise level (see Appendix A) is L_{Aeq} ≤60 dB:
  - Sleeping area – glazing meeting ≥32 dB R_w (e.g. ≥6.38 mm laminated glass, or double glazing that makes use of ≥6 mm panes – e.g. 6 / 12 / 6 double glazing.)
- If night time noise level (see Appendix A) is L_{Aeq} ≤62 dB:
  - Sleeping area – glazing meeting ≥34 dB R_w (e.g. ≥10.38 mm laminated glass, or double glazing that makes use of ≥10 mm panes – e.g. 10 / 12 / 6 double glazing.)
- If night time noise level (see Appendix A) is L_{Aeq} ≤64 dB:
  - Sleeping area – glazing meeting ≥36 dB R_w (e.g. ≥12.38 mm laminated glass, or double glazing that makes use of ≥10.38 mm laminated panes – e.g. 10.38 lam / 12 / 6 double glazing.)

The above advice gives minimum sound reduction performances for glazing, and typical constructions that are normally capable of meeting these performances. It is normally the case that thicker or laminated glazing (for example as may be

selected for thermal performance) will provide higher acoustic performance, and this will be acceptable if this is verified to be the case for the final selection.
The assessment conducted assumed a glazing area of up to 6 m^2. If actual glazing area used is larger than this assumption, further review and assessment will be required.

4.1.2 WALLS

In general, a well-mortared brick veneer or any masonry construction is acoustically suitable on this development without further recommendations.

If lightweight cladding is used on the façade with direct and partial frontage to the arterial road the following typical minimum constructions would provide adequate façade sound insulation to meet the internal noise levels given in Table 2.1:

- External cladding
  - ≥ 8 mm compressed fibre cement board (or boards of total surface mass ≥12 kg/m^2), or
  - ≥ 60 mm expanded polystyrene foam (NRG Greenboard or equivalent), with ≥ 10 mm thick concrete render on the external facing
- Insulated cavity
  - ≥ 90 mm frame fully filled with fibrous acoustic insulation (≥14 kg/m^3)
- Internal cladding
  - ≥ 2 layers of 13 mm standard core plasterboard (or other boards of surface mass ≥8.5 kg/m^2 each layer)

For other areas, a similar lightweight construction as above is suitable but with a single layer of plasterboard for the internal lining.

It should be noted that there are a wide range of equivalent lightweight constructions that would provide similar façade sound insulation. Final constructions should be reviewed by an acoustic consultant as design progresses.

4.1.3 VENTILATION

It is assumed that openable windows will be the principal form of ventilation for these sites. All noise assessment has been undertaken assuming that windows can be closed by the occupant.

If permanently open in-wall passive ventilation is pursued for these buildings, the associated reduction in overall composite façade sound insulation performance should be reviewed by an acoustic consultant at the design stage.

5 CONCLUSION

WSP Australia has prepared an overarching Noise Management Plan (NMP) suitable for inclusion in the Development Application (DA) of the residential blocks located adjacent to the arterial road within Neighbourhood 1 of the Ginninderry development.

The assessment has been prepared in reference to the planning requirements of the Single Dwelling Housing Development Code and Multi Unit Housing Development Code.

The primary objectives of this NMP are to:

- Predict and assess the likely road traffic noise levels impacting on the future building façade of developments adjacent to the arterial road in Ginninderry Neighbourhood 1.
- Provide indicative building envelope construction requirements for these developments.

Three-dimensional computer noise modelling has been undertaken based on the appropriate input parameters, which resulted in prediction of the likely future road traffic noise levels impacting on the façade of the future dwellings adjacent to the arterial road.

Indicative building envelope construction requirements have been recommended in order to meet the internal noise level goals as discussed in Section 2. Implementation of the suggested constructions (subject to detailed design) are expected to allow the proposed development at the residential blocks adjacent to the arterial road to meet the current planning requirements.

Recommended minimum façade glazing requirements are tabulated on a block-by-block basis in Appendix A.

APPENDIX A

PREDICTED ROAD TRAFFIC NOISE LEVELS AND ASSOCIATED GLAZING PERFORMANCES

Table A.1 summarises the predicted facade sound pressure level for each development block during the day and night time periods, and gives associated minimum glazing performance requirements as well as typical selections that are normally capable of meeting these requirements:

- Glazing combination **Type A**
  - Living area – glazing meeting ≥30 dB R_w (e.g. ≥6 mm standard float glass, or any double glazing)
  - Sleeping area – glazing meeting ≥32 dB R_w (e.g. ≥6.38 mm laminated glass, or double glazing that makes use of ≥6 mm panes – e.g. 6 / 12 / 6 double glazing.)
- Glazing combination **Type B**
  - Living area – glazing meeting ≥32 dB R_w (e.g. ≥6.38 mm laminated glass, or double glazing that makes use of ≥6 mm panes – e.g. 6 / 12 / 6 double glazing.)
  - Sleeping area – glazing meeting ≥34 dB R_w (e.g. ≥10.38 mm laminated glass, or double glazing that makes use of ≥10 mm panes – e.g. 10 / 12 / 6 double glazing.)
- Glazing combination **Type C**
  - Living area – glazing meeting ≥34 dB R_w (e.g. ≥6.38 mm laminated glass, or double glazing that makes use of ≥6 mm panes – e.g. 6 / 12 / 6 double glazing.)
  - Sleeping area – glazing meeting ≥36 dB R_w (e.g. ≥12.38 mm laminated glass, or double glazing that makes use of ≥10.38 mm panes – e.g. 10.38 / 12 / 6 double glazing.)

Table A.1 Predicted road traffic façade noise levels and associated minimum glazing requirements

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
Stage 1				
R01 AZ - a	Ground	64	61	Type B
R01 AZ - a	First	66	63	Type C
R02 AZ - o, m, n	Ground	64	61	Type B
R02 AZ - o, m, n	First	65	62	Type B
R03 AZ - l, k	Ground	64	61	Type B
R03 AZ - l, k	First	65	62	Type B
R04 AZ - f to i	Ground	64	61	Type B
R04 AZ - f to i	First	65	62	Type B
R05 AY - a	Ground	64	61	Type B
R05 AY - a	First	65	62	Type B
R06 AU - a	Ground	65	62	Type B
R06 AU - a	First	67	64	Type C
R07 AS - a, b	Ground	64	61	Type B
R07 AS - a, b	First	66	63	Type C
R08 AS - c, d	Ground	64	61	Type B
R08 AS - c, d	First	66	63	Type C
R09 AS - e, f, g	Ground	64	61	Type B
R09 AS - e, f, g	First	66	63	Type C
R10 AS - h to n	Ground	64	61	Type B
R10 AS - h to n	First	66	63	Type C
R11 AS - o	Ground	64	61	Type B
R11 AS - o	First	66	63	Type C
R12 AS - p	Ground	64	61	Type B
R12 AS - p	First	66	63	Type C
R13 AS - q	Ground	64	61	Type B
R13 AS - q	First	66	63	Type C
R14 AS - r	Ground	64	61	Type B
R14 AS - r	First	66	63	Type C

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R15 AI - j	Ground	65	62	Type B
R15 AI - j	First	66	63	Type C
R16 AI - i	Ground	64	61	Type B
R16 AI - i	First	66	63	Type C
R17 AI - h	Ground	64	61	Type B
R17 AI - h	First	66	63	Type C
R18 AI - g	Ground	64	61	Type B
R18 AI - g	First	66	63	Type C
R19 AF - a	Ground	63	60	Type A
R19 AF - a	First	66	63	Type C
R19 AI - f	Ground	64	61	Type B
R19 AI - f	First	66	63	Type C
R20 AF - b	Ground	64	61	Type B
R20 AF - b	First	66	63	Type C
R21 AF - c	Ground	64	61	Type B
R21 AF - c	First	66	63	Type C
R22 AG - a	Ground	63	60	Type A
R22 AG - a	First	66	63	Type C
R23 AG - b	Ground	63	60	Type A
R23 AG - b	First	66	63	Type C
R24 AG - c	Ground	63	60	Type A
R24 AG - c	First	65	62	Type B
R25 AG - d	Ground	63	60	Type A
R25 AG - d	First	65	62	Type B
R26 AG - e	Ground	63	60	Type A
R26 AG - e	First	65	62	Type B
R27 AG - g	Ground	63	60	Type A
R27 AG - g	First	65	62	Type B
R27 AG - h	Ground	63	60	Type A
R27 AG - h	First	65	62	Type B

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R28 AG - i	Ground	63	60	Type A
R28 AG - i	First	65	62	Type B
R29 AG - j	Ground	63	60	Type A
R29 AG - j	First	65	62	Type B
R30 AA - b	Ground	63	60	Type A
R30 AA - b	First	66	63	Type C
R31 AA - c	Ground	64	61	Type B
R31 AA - c	First	66	63	Type C
R32 AA - d	Ground	64	61	Type B
R32 AA - d	First	66	63	Type C
R33 AA - e	Ground	64	61	Type B
R33 AA - e	First	66	63	Type C
R34 AA - f	Ground	64	61	Type B
R34 AA - f	First	66	63	Type C
R35 AA - h	Ground	63	60	Type A
R35 AA - h	First	66	63	Type C
R36 BK - a	Ground	64	61	Type B
R36 BK - a	First	66	63	Type C
R37 BK - b	Ground	64	61	Type B
R37 BK - b	First	66	63	Type C
R38 BK - d	Ground	64	61	Type B
R38 BK - d	First	66	63	Type C
R39 BK - e	Ground	64	61	Type B
R39 BK - e	First	66	63	Type C
R40 BK - f	Ground	64	61	Type B
R40 BK - f	First	66	63	Type C
R41 BK - g	Ground	64	61	Type B
R41 BK - g	First	66	63	Type C
R42 BK - h	Ground	64	61	Type B
R42 BK - h	First	66	63	Type C

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R43 BK - j	Ground	64	61	Type B
R43 BK - j	First	66	63	Type C
R44 BK - k	Ground	64	61	Type B
R44 BK - k	First	66	63	Type C
R45 BK - l	Ground	64	61	Type B
R45 BK - l	First	66	63	Type C
R46 BK - m	Ground	64	61	Type B
R46 BK - m	First	66	63	Type C
R47 BG - a	Ground	64	61	Type B
R47 BG - a	First	66	63	Type C
Stage 2				
R48 AR - a	Ground	63	60	Type A
R48 AR - a	First	65	62	Type B
R49 AR - b	Ground	64	61	Type B
R49 AR - b	First	65	62	Type B
R50 AP - p	Ground	64	61	Type B
R50 AP - p	First	65	62	Type B
R50 AP - p	Ground	65	62	Type B
R50 AP - p	First	65	62	Type B
R51 AP - b	Ground	65	62	Type B
R51 AP - b	First	65	62	Type B
R52 AP - c	Ground	64	61	Type B
R52 AP - c	First	66	63	Type C
R53 AP - d	Ground	64	61	Type B
R53 AP - d	First	65	62	Type B
R54 AP - e	Ground	64	61	Type B
R54 AP - e	First	65	62	Type B
R54 AP - f, g	Ground	64	61	Type B
R54 AP - f, g	First	65	62	Type B
R56 AH - d	Ground	63	60	Type A

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R56 AH - d	First	65	62	Type B
R60 AG - a	Ground	64	61	Type B
R60 AG - a	First	65	62	Type B
R61 AG - b	Ground	64	61	Type B
R61 AG - b	First	65	62	Type B
R62 AG - c	Ground	63	60	Type A
R62 AG - c	First	65	62	Type B
R63 AG - d	Ground	64	61	Type B
R63 AG - d	First	65	62	Type B
R64 AG - e	Ground	64	61	Type B
R64 AG - e	First	65	62	Type B
R65 AG - f	Ground	64	61	Type B
R65 AG - f	First	65	62	Type B
R66 AG - g	Ground	64	61	Type B
R66 AG - g	First	65	62	Type B
R67 AG - h	Ground	64	61	Type B
R67 AG - h	First	65	62	Type B
R68 AG - i	Ground	60	57	Type A
R68 AG - i	First	61	58	Type A
R69 AG - j	Ground	60	57	Type A
R69 AG - j	First	61	58	Type A
R70 AG - k	Ground	59	56	Type A
R70 AG - k	First	60	57	Type A
R71 AG - l	Ground	62	59	Type A
R71 AG - l	First	64	61	Type B
R78 AB - a	Ground	60	57	Type A
R78 AB - a	First	61	58	Type A
R79 AB - b	Ground	61	58	Type A
R79 AB - b	First	63	60	Type A
R80 AB - c	Ground	62	59	Type A

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R80 AB - c	First	63	60	Type A
R81 AB - d	Ground	62	59	Type A
R81 AB - d	First	63	60	Type A
R82 AB - e	Ground	62	59	Type A
R82 AB - e	First	63	60	Type A
R83 AB - f	Ground	61	58	Type A
R83 AB - f	First	63	60	Type A
R84 BJ - a	Ground	62	59	Type A
R84 BJ - a	First	64	61	Type B
R85 BJ - c	Ground	63	60	Type A
R85 BJ - c	First	65	62	Type B
R86 BJ – d to k	Ground	63	60	Type A
R86 BJ – d to k	First	65	62	Type B
R87 BJ - l	Ground	63	60	Type A
R87 BJ - l	First	65	62	Type B
R88 BH - a	Ground	63	60	Type A
R88 BH - a	First	65	62	Type B
R89 BH – b to g	Ground	63	60	Type A
R89 BH – b to g	First	65	62	Type B
R90 BH - h	Ground	63	60	Type A
R90 BH - h	First	65	62	Type B
R91 BH - i	Ground	63	60	Type A
R91 BH - i	First	65	62	Type B
R92 BH - j	Ground	63	60	Type A
R92 BH - j	First	65	62	Type B
R93 BH - k	Ground	63	60	Type A
R93 BH - k	First	65	62	Type B
R94 BH - l	Ground	63	60	Type A
R94 BH - l	First	65	62	Type B
R95 BH - m	Ground	63	60	Type A

BLOCK REFERENCE (FROM NORTH TO SOUTH)	BUILDING LEVEL	PREDICTED ROAD TRAFFIC SOUND PRESSURE LEVEL AT RESIDENTIAL FAÇADE		MINIMUM GLAZING SOUND INSULATION PERFORMANCE (dB R_w) AND TYPICAL GLAZING SELECTION NORMALLY CAPABLE OF MEETING THIS PERFORMANCE
		DAY dB $L_{Aeq, 15h}$	NIGHT dB $L_{Aeq, 9h}$	
R95 BH - m	First	65	62	Type B
R96 BH - n	Ground	63	60	Type A
R96 BH - n	First	65	62	Type B
R97 BH - o	Ground	63	60	Type A
R97 BH - o	First	65	62	Type B
R99 BF - a	Ground	63	60	Type A
R99 BF - a	First	65	62	Type B
R102 BF - y	Ground	63	60	Type A
R102 BF - y	First	65	62	Type B
R103 BF - x	Ground	63	60	Type A
R103 BF - x	First	65	62	Type B
R104 BF - w	Ground	63	60	Type A
R104 BF - w	First	65	62	Type B
R105 BF - v	Ground	63	60	Type A
R105 BF - v	First	65	62	Type B
R106 BF - u	Ground	63	60	Type A
R106 BF - u	First	65	62	Type B
R107 BF - t	Ground	63	60	Type A
R107 BF - t	First	65	62	Type B
R108 BF - s	Ground	63	60	Type A
R108 BF - s	First	65	62	Type B
R109 BF - p	Ground	65	62	Type B
R110 BF - o	Ground	64	61	Type B
R110 BF - o	First	65	62	Type B