ACOUSTIC ASSESSMENT

ROAD TRAFFIC NOISE IMPACT
MECHANICAL PLANT & VEHICULAR NOISE IMPACT
AGED-CARE CENTRE OPERATIONAL NOISE IMPACT
RETAIL/RESTAURANT OPERATIONAL NOISE IMPACT
ACOUSTIC PRIVACY BETWEEN UNITS

NO. 54-56 KILDARE ROAD & 1A CARINYA STREET, BLACKTOWN

(PRELIMINARY REPORT FOR CONCEPT DA DESIGN)
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ACOUSTIC ASSESSMENT

NO. 54-56 KILDARE ROAD & 1A CARINYA STREET, BLACKTOWN
(PRELIMINARY REPORT CONCEPT DA DESIGN)

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ACOUSTIC ASSESSMENT
NO. 54-56 KILDARE ROAD & 1A CARINYA STREET, BLACKTOWN
(PRELIMINARY REPORT CONCEPT DA DESIGN)

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was requested by St Maurice Aged Care to undertake an acoustic assessment of the proposed mixed-use development at No. 54-56 Kildare Road & 1A Carinya Street, Blacktown.

The acoustic assessment addresses a number of noise related matters regarding the design and operation of proposed development, including the retail/restaurant premises on the ground floor level. Contained herein is an assessment of:

Part 1 (Road Traffic Noise Assessment):
As the proposed mixed use development is in the vicinity of the main road, Kildare, the basis for design is to comply with the current traffic noise criteria stated in the NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008.

Part 2 (Mechanical Plant & Vehicular Noise Assessment)
An assessment considering the noise impact of the mechanical plant units proposed for use on the subject development to surrounding residential premises. The assessment procedures of the Environmental Protection Authority’s (EPA) Industrial Noise Policy (INP) were used to derive the external noise criteria from the noise survey.

Part 3 (Aged-Care Centre Operational Noise Assessment)
An assessment considering the noise impact from the use and operation of the communal spaces of the proposed aged-care facility. The assessment procedures of the Environmental Protection Authority’s (EPA) Industrial Noise Policy (INP) were used to derive the external noise criteria from the noise survey.

Part 4 (Retail/Restaurant Operational Noise Assessment)
An assessment considering the noise impact from the use and operation of the retail and restaurant tenancies. Similarly, the assessment procedures of the Environmental Protection Authority’s (EPA) Industrial Noise Policy (INP) were used to derive the external noise criteria from the noise survey.
Part 5 (Acoustic Privacy Between Units)

Airborne and impact sound isolation between units through common partition elements such as walls, floors and services/waste pipes have also been considered in this assessment as required by Section F5 of the current Building Code of Australia (BCA).

To address the above acoustic matters it was necessary to reference specific criteria from current and relevant documentation. The basis for design and the acoustic recommendations provided herein are to satisfy the requirements of the following publications:

- NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008;
- Australian Standard AS2107-2016 Recommended design sound levels and reverberation times for building interiors;
- Environmental Protection Authority’s (EPA) Industrial Noise Policy (INP), and
- Part F5 of current Building Code of Australia (BCA).

The aim of acoustic assessment is to determine the type and extent of noise mitigation measures required to achieve the nominated noise criteria of each of the above sub-noise assessments.
2.0 SITE DESCRIPTION

2.1 SITE ADDRESS

The site is located at No. 54-56 Kildare Road & 1A Carinya Street, Blacktown. Attached as Appendix A is an aerial photograph identifying the assessment site location, surrounding premises and noise monitoring location.

2.2 DESCRIPTION OF THE ASSESSMENT SITE

The proposed mixed use development consists of the following:

- Lower Basement: car park level.
- Upper Basement: car park level.
- Ground floor level: sixteen (16) aged-care centre residential tenancies, three (3) retail/restaurant tenancies with one (1) indoor dining/lounge area, one nurse station room/administration room, one sitting room and one staff room with storage and bathroom facilities.
- 1st floor level: eighteen (18) aged-care centre residential tenancies, one (1) outdoor communal space for aged-care centre (fronting Kildare Road) and one (1) indoor dining/lounge area.
- 2nd floor level: eighteen (18) aged-care centre residential tenancies, one nurse station room and one (1) indoor dining/lounge area.
- 3rd floor level: Ten (10) residential apartments.
- 4th floor level: Nine (9) residential apartments.
- 5th floor level: Nine (9) residential apartments.

There are total of 52 aged-care centre residential tenancies, 1 outdoor communal space for aged-care centre, 3 indoor dining/lounge areas, 3 retail/restaurant tenancies and 28 residential apartments.

2.3 SURROUNDING PREMISES

The assessment site is surrounded by:

- Residential premises in all directions;
- Blacktown Senior Citizen Centre and place of worship to the north;
- Residential premises to the west and north-west, and
- Kildare Road to the north.

2.4 SITE LOCATION OF SOUND SOURCES

2.4.1 Part 1 (Road Traffic Noise Assessment)

The assessment site is located adjacent to the main road, Kildare Road. The ambient noise profile of the
area is dominated by local traffic.

2.4.2 Part 2 (Mechanical Plant & Vehicular Noise Assessment)

As the mechanical plant design layout and selection are not available during DA stage, Koikas Acoustics prepared a ‘generic’ mechanical plant noise assessment. The mechanical plant considered in this assessment was based on plant utilised on other similar projects.

The proposed development may include the following mechanical plant units, which have the potential to produce noise impacts to surrounding premises:

- 1 x car park exhaust fan;
- 1 x car park supply fan, and
- 1 x outdoor AC condenser for each aged-care residential tenancies and residential apartments (i.e. total of 86 AC condenser units).

1. It is assumed that the car park exhaust fan is to be located within basement level B1 and connecting to the ductwork which terminates on the rooftop level.
2. It is assumed that the car park supply fan is to be located within basement level B1 and connecting to the ductwork which has an air-intake grille on the ground floor level above the drive-way area.
3. It is assumed that the AC unit is to be located on the balcony of each residential tenancy and in the concrete footpath area (could be mounted at an elevated height) next to the retail tenancy.

It is noted that as the vehicle enters or within the underground car park area, vehicular noise impact would be negligible as most acoustic energy is shielded by masonry underground car park building structures. The noise impact from vehicles at the opening driveway area of the car park entrance is normally not an issue considering the duration of for a vehicle driving from the entrance to the underground car park area or vice versa.

Based on previous projects and experience, to achieve compliance with the nominated noise criteria to adjacent residential premises, noise mitigation measures may be required to attenuate noise generated by mechanical plant and vehicles. Refer to Section 10 of this report for details.

2.4.3 Part 3 & 4 (Aged-Care Centre and Retail/Restaurant Operational Noise Assessment)

Similarly, as the design details are limited at early planning stage, the operational noise impact assessment for the aged-care centre and retail/restaurant premise considered in this assessment was based on similar projects and assumptions.
The noise sources considered includes noise from outdoor communal space, noise break-out from indoor dining/lounge areas over three floor levels and noise-generating from retail/restaurant tenancies.

2.4.4 Part 5 (Acoustic Privacy Between Units)

Noise impact from domestic activities within the residential tenancies were also considered. The aim is to achieve the minimum airborne and impact sound isolation requirements described in Section F5 of the BCA between units through common partition walls, floors and services/waste pipes.
3.0 NOISE CRITERIA

3.1 ROAD TRAFFIC NOISE IMPACT ASSESSMENT - PART 1

The aim of the road traffic noise impact assessment is to ascertain the type and extent of noise mitigation measures required to achieve the indoor road traffic noise criteria stated in the NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008. The noise criteria nominated in this document is summarised below.

If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following $L_{Aeq}$ levels are not exceeded:

- in any bedroom in the building: $35\text{dB}(A)$ at any time 10pm-7am
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway): $40\text{dB}(A)$ at any time.

It is also stated that if the internal noise levels with windows and doors open exceed the criteria by more than $10\text{dB}(A)$, the design of the ventilation for that space must be such that the windows and doors can remain closed.

The note to Table 3.1 in Section 3.6.1 Airborne Noise in the NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008 states that the airborne noise is calculated as:

- $L_{eq\,(9hr)}$ for night time - 10pm to 7am
- $L_{eq\,(15hr)}$ for daytime - 7am to 10pm.

The assessment procedures outlined in Australian Standard 3671-1989 Traffic noise intrusion building siting and construction have been used to determine the traffic noise levels that will affect the proposed development. These traffic noise levels will determine the type and extent of building materials required to adequately reduce road traffic noise intrusion to residents.

The Australian Standard AS2107-2016 Recommended design sound levels and reverberation times for building interiors has been referenced on a comparative basis to determine appropriate indoor traffic noise levels for the ground floor retail/restaurant spaces. This standard is applicable for steady-state or quasi-steady-state noise sources and not intended for transient type noise sources like traffic, however, in the absence of any other policy/guidelines providing recommended indoor noise criteria for retail/restaurant premises, Koikas Acoustics has adopted the recommended indoor design sound levels for commercial premises in AS2107-2016.
3.2 MECHANICAL PLANT & VEHICULAR NOISE IMPACT - PART 2, 3 & 4

3.2.1 Background Noise

The mechanical plant noise, vehicular noise (Part 2), aged-care centre noise (Part 3) and retail/restaurant noise (Part 4) impact are normally based on undertaking an unattended ambient and ambient background noise survey at a representative site over consecutive 15 minute intervals for a period of one week.

In this case, unattended noise survey results taken at another ‘near-by’ premise was used for this preliminary acoustic assessment for concept DA stage design only. Attended measurements were also taken.

A more rigorous assessment can be conducted at a later stage including a full seven-day unattended noise survey pertaining to the subject assessment site which will provide more reliable results for determining the assessment noise criteria.

The background noise level $L_{A90}$, 15 minutes is normally determined in the absence of extraneous noise such as traffic, wind, rain, conversation, birds chirping, insect noise and unnatural increases in noise from distant sources due to local air movement. The EPA defines such sources as incidental noise which can cause the masking of offensive noise from a specific source. Where traffic or other incidental noise cannot be excluded, then it is considered that these noise sources are part of the background noise.

3.2.2 Offensive Noise (POEO Act 1997 No.156)

Offensive noise is applied in both the POEO Act and Noise Control Regulations as being:

- Noise that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
  - Is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or
  - Interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
  - That is a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

3.2.3 NSW EPA’s Noise Guide for Local Government (May 2013)

Section 2 of the NGLG provides guidance on how to examine the nature and characteristics of a noise.

- the location of the noise source
- its audibility at certain locations
- the time the noise is made and its duration
• its characteristics
• the reported effect it has on people.

In Section 2.1.4 Offensive noise test, the EPA considers a range of factors to determine whether the noise is offensive.

The above check list was proposed for use for Council officers and authorised persons making a systematic judgement about whether a particular noise is offensive. The DECCW goes on to say that “Not all questions need to be answered ‘yes’ before a noise is deemed to be offensive”.

Offensive noise test: Checklist of considerations

Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?
This establishes that the noise is likely to be heard by neighbours. Its volume alone may be annoying. An example would be music being played at a very high volume in a residence so it can be heard over very noisy activity outside, such as construction work. The noise may also be loud relative to the background noise. An example would be loud fireworks set off late at night. Noise measurements using a sound level meter would help to determine how loud the noise is relative to the background noise level in the area.

Q2: Does the noise include characteristics that make it particularly irritating?
The presence of tones, impulses or fluctuations in volume can make people more likely to react to the noise. These can be judged subjectively but noise measurements will help to quantify the extent of these characteristics. Examples might be screeching sounds from poorly maintained equipment or a ‘beeper’ alarm that uses a pulsed sound made up of one or two alternating frequency tones, usually higher pitched, that are louder than the background noise in the area.

Q3: Does the noise occur at times when people expect to enjoy peace and quiet?
People usually expect their surroundings to be quieter during the evening and at night. Talk to the complainants about how the noise affects them to see if it is interfering unreasonably with their comfort at home. Is it regularly disturbing their sleep, making it difficult to have a conversation, study, read or hear the TV? Noise that regularly disturbs sleep is likely to be considered offensive by complainants and this should be taken into account in your assessment.

Q4: Is the noise atypical for the area?
Where noise from an activity that is causing nuisance is new or unusual for an area, people are more likely to react. Look at the typical uses of the area and determine whether the activity is consistent with the local environmental plan. An example might be a community event with amplified music affecting a residential area that has not traditionally been affected by such events.

Q5: Does the noise occur often?
Noise can be more annoying when it occurs frequently. Examples might be a leaf blower used every morning or a band that practises frequently without regard to the impact on neighbours.

Q6: Are a number of people affected by the noise?
In many situations $L_{Aeq}$ will be the most suitable descriptor for describing the noise under investigation. This should be measured at the most affected point on or within the residential property boundary or, if this is more than 30 metres from the residence, at the most affected point
within 30 metres of the residence. Note, however, that other descriptors may be more appropriate: see subsection 2.3.4 for alternatives.

The background level is the $L_{A90}$ measurement of all noise in the area of the complaint without the subject noise operating or affecting the measurement results.

### 3.2.4 EPA’s Industrial Noise Policy (INP)

In January 2000, the EPA produced a document entitled *Industrial Noise Policy* (INP), which is primarily used to assess noise from industrial extractive, commercial and warehousing industries, individual industrial sources such as rotating machinery, heating, ventilation and air conditioning.

The EPA specific objective is to assess noise from industrial noise sources scheduled under the new Protection of the Environment Act 1997. As a consequence, the INP’s objectives are to protect the community from excessive intrusive noise, and preserve amenity from specific land uses. In summary, the following steps are undertaken to assess in accordance with the assessment procedures of the INP:

- determine the magnitude and nature of all relevant noise sources;
- measure the existing background and ambient noise levels;
- determine project/specific noise levels from intrusive and amenity noise criteria;
- compare the measured noise levels with the project specific noise levels, and
- consider cost effective and practical noise mitigation measures where noise levels exceed the nominated criteria.

#### EPA’s Intrusive Noise Criterion

The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (A-weighted) noise level ($L_{Aeq, 15}$ minutes) does not exceed the background noise level by more than 5 dB(A).

When the noise source contains annoying characteristics such as prominent tonal, impulsive, intermittent, irregular and dominant low frequency components, adjustments are made.

| The intrusive noise criterion is: | $L_{Aeq, 15}$ minutes $\leq$ rating background noise level + 5 |

#### Noise Amenity Criteria (EPA’s INP)

In order to limit the continuing increase in noise, the EPA has nominated recommended acceptable and maximum ambient noise levels for various receiver sites from industrial noise.

Table 2.1 of the *EPA’s INP* (below) specifies the following acceptable and maximum recommended
LAeq, 15 minutes noise levels for this project specific type of area. In this case, the area is described as being urban.

The EPA refers to ‘urban’ as an area with an acoustical environment that:

- is dominated by “urban hum” or industrial noise sources;
- has through traffic with characteristically heavy and continuous traffic flows during peak periods;
- is near commercial or industrial districts;
- has any combination of the above.

Where “urban hum” means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

<table>
<thead>
<tr>
<th>Type of Receiver</th>
<th>Indicative Noise Amenity</th>
<th>Time of Day</th>
<th>Acceptable</th>
<th>Recommended Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Urban</td>
<td>Day</td>
<td>60</td>
<td>65</td>
</tr>
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<td></td>
<td></td>
<td>Evening</td>
<td>50</td>
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<td></td>
<td></td>
<td>Night</td>
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<td>65</td>
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<td></td>
<td></td>
<td>Evening</td>
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<td>Night</td>
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<tr>
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<td>All Areas</td>
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<td>70</td>
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<td>Evening</td>
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<td></td>
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<td>Night</td>
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</tbody>
</table>

Table 1.2 of the EPA’s INP (below) specifies the modification to the acceptable noise level to account for existing level of industrial noise:
The above table is normally used when an existing industrial noise source exists. In this case, no correction is warranted.

The amendments to the *EPA’s INP* (2006) state that both the predicted amenity noise level criteria and the intrusive noise level criteria need to be satisfied, i.e. the more stringent of the two criteria applies. Generally, when the *EPA’s INP* is complied with, offensive noise is unlikely to occur. In some cases, when the amenity criterion is lower, this does not mean that it is a more stringent criterion compared to the intrusive noise criterion.

### 3.3 ACOUSTIC PRIVACY BETWEEN UNITS – PART 5

#### 3.3.1 BCA Sound Insulation

*Volume 1* of the BCA refers to three relevant classes of residential buildings:

- **Class 2**: Flat or apartments with two or more dwellings (units);
- **Class 3**: Boarding house, hotel or residential part of other buildings;
- **Class 9c**: Aged Care Buildings.

For this class of buildings, services must not be compromised by:

- The incorporation or penetration of a pipe or other surface element for Class 2, 3 and 9c
- A door assembly for Class 2 and 3

Partitions for this class are to comply with Part F5 Sound Insulation of the Building Code of Australia.
Volume 2 of the BCA refers to one relevant class of residential buildings:

Class 1(a): Detached house, terrace, villa
Class 1(b): boarding house, guest house, hostel.

For this class of buildings, services must not be chased into concrete or masonry separating walls.

Partitions for this class are to comply with Part 3.8.6 Sound Insulation of the Building Code of Australia. As this subject site is separated by common partition walls, there is the potential for noise emanating from one premise to adversely impact the acoustic amenity of residents within the adjoining premises.

To comply with the BCA the following are also required:

- Junction between walls and roof must be sealed in accordance with Figure 3.8.6.2 of Part 3.8.6.3 of BCA.
- Masonry partition systems must be laid with all joints filled solid, except for adequately sound insulated articulation joints, including those between the masonry and any adjoining construction.
- Solid filled to joints between concrete panels and any adjoining construction.
- Where one layer of plasterboard is required on both sides of a wall system, joints must be staggered on opposite sides (Refer to Figure 3.8.6.3 of Part 3.8.6.3 of BCA).
- Where one layers of plasterboard is required, the first layer must be installed in accordance to the above and the second layer joints must not coincide with those of the first layer.
- Outer layer joints between sheets must be taped and filled solid.
- Joints between sheets and any adjoining construction must be taped and filled solid.
- Steel framing and perimeter members must not be less than 0.6 mm in thickness.
- Steel studs must be not less than 63 mm in depth unless another depth is specified in Table 3.8.6.2 of BCA.
- Steel/timbers studs must be fixed to steel top and bottom plates with sufficient depth to permit secure fixing of the plasterboard.
- All steel/timber members at the perimeter of the wall are required to be securely fixed to the adjoining structure and bedded in resilient compound or the joints must be caulked so that there are no voids between the steel members and the wall.
- Structure members such as noggings or the likes must not bridge between timber studs supporting different wall leaves.
- Services must not be chased into concrete or masonry separating walls.
  - If a duct, soil, waste, water supply or storm water piper serves or passes through a separating wall or is located in a separating wall
• A door or panel providing access to a duct or pipe required to be separated must –
  — Not open into any habitable room, other than a kitchen; and
  — In any other part must be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10 mm and be construction of
    • Wood, plasterboard or blockboard not less than 33 mm thick; or
    • Compressed fibre reinforced cement sheeting not less than 9 mm thick; or
    • Other suitable material with a mass per unit area not less than 24.4 kg/m², and

• In the case of water supply pipe, it must –
  — Only be installed in discontinuous construction; and
  — In the case of a water supply pipe that serves one dwelling, not be fixed to the wall leaf on the side of any other dwelling and have a clearance not less than 10 mm to the other wall leaf.

• Electrical outlets must be offset from each other –
  — In masonry walling, not less than 100 mm, and
  — In timber or steel framed walling, not less than 300 mm.

**Sound Insulation of Walls**

• Where a habitable room in one sole occupancy unit adjoins a wet area in an adjoining sole occupancy unit, the separating wall is to achieve a weighted sound reduction index with spectrum adaptation terms (Rw + Ctr) of no less than 50 and be of a discontinuous construction. **Discontinuous** construction consists of a wall with two leaves separated by a minimum air gap of 20mm, and, for masonry type construction where brick ties are required they are of the resilient type, or for any other type construction no mechanical linkage between the two leaves exists except at the periphery. **Periphery** refers to the end of the walls, the sub-base below and above.

• Where a habitable room in one sole occupancy unit adjoins a habitable room in another sole occupancy unit, the separating wall is to achieve a weighted sound reduction index with spectrum adaptation terms (Rw + Ctr) of no less than 50.

• Where a habitable room in one sole occupancy unit adjoins a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification an acoustic rating of Rw not less 50 is required.

Further, the installation of the separating wall is to be in accordance with the requirements of Part 3.8.6.3 and 3.8.6.4 of the BCA for Class 1 buildings.
IMPORTANT:

- Where a wall is required to have a sound insulation rating and has a floor above, the wall must continue to either underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall.

- Where a wall is required to have a sound insulation rating and has a roof above, the wall must continue to either underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall.

**Sound Insulation Ratings of Floors**

A floor in a Class 2 or 3 and 9(c) building must have an Rw+Ctr (airborne) not less than 50 and an Ln,w (impact) not more than 62 if it separates-

(i) sole-occupancy units; or

(ii) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or part of a different classification.

**Sound Insulation Ratings of Services**

If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an Rw+Ctr (airborne) not less than-

(i) 40 if the adjacent room is a habitable room (other than a kitchen); or

(ii) 25 if the adjacent room is a kitchen or non-habitable room.

If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (i) and (ii) above.
4.0 ATTENDED NOISE SURVEYS

All noise methodologies and equipment used comply with the following Australian Standards:

- AS1259.2-1990 “Acoustics - Sound Level Meters - Integrating - Averaging”, and


4.1 SURVEY DATES AND DURATION

An attended noise monitoring survey was conducted by Koikas Acoustics at representative location to determine the ambient noise conditions pertaining to the area and to calibrate the noise model. The noise survey was conducted between 1700 and 17:15 hours on Thursday 15th June 2017.

4.2 LOCATION OF NOISE SURVEY AND MICROPHONE POSITION

The attended noise surveys were conducted at corner of Kildare Road and Carinya Street, Blacktown. The microphone was placed at 1.5 meter above the footpath level (Location A) in a free-field condition. This site was considered appropriate for measuring ambient road traffic noise levels.

An aerial photograph showing the assessment site, surrounding premises and monitoring location is attached as Appendix A.

4.3 METEOROLOGICAL CONDITIONS

The meteorological conditions over the noise monitoring period did not influence the survey results.

4.4 SURVEY INSTRUMENTATION AND CALIBRATION

The attended noise survey was conducted with one NTi XL2 Type 1 precision spectrum analyser S/N A2A-06312-E0.

The equipment used for taking noise level measurements was field calibrated before and after the survey with a Type 1 pistonphone calibrator. There were no system drifts observed with these measurements.
### 5.0 ATTENDED NOISE SURVEY RESULTS

The measured noise levels obtained from the unattended noise surveys within the subject site are as follow:

<table>
<thead>
<tr>
<th>Noise Metric &amp; Period</th>
<th>1/1 Octave Band Centre Frequency $L_{Aeq, Period}$ [Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_{Aeq, 15min(Day)}$</td>
<td>1700-1715</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>31.5</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>45</td>
<td>55</td>
<td>55</td>
<td>61</td>
<td>63</td>
<td>62</td>
<td>58</td>
<td>42</td>
<td>68</td>
</tr>
</tbody>
</table>
6.0 NOMINATED NOISE CRITERIA

6.1 ROAD TRAFFIC NOISE CRITERIA – PART 1

A summary of the project specific road traffic noise criteria used in this assessment is given below. The noise levels below refer to internal noise levels.

Indoor Noise Criteria

<table>
<thead>
<tr>
<th>Space</th>
<th>Night Time</th>
<th>Daytime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedrooms</td>
<td>35dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 9hrs</td>
<td>40dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 15hrs</td>
</tr>
<tr>
<td>Living Areas &amp; Lounge/Dining</td>
<td>40dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 9hrs</td>
<td>40dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 15hrs</td>
</tr>
<tr>
<td>Retail/Restaurant</td>
<td>50 dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 9hrs</td>
<td>50 dB L&lt;sub&gt;Aeq&lt;/sub&gt;, 9hrs</td>
</tr>
</tbody>
</table>

6.2 MECHANICAL PLANT, VEHICULAR, AGED-CARE CENTER AND RETAIL/RESTAURANT OPERATIONAL NOISE CRITERIA – PART 2, 3 & 4

The determination of the noise criteria is summarised in Table 2. This includes the calculated Intrusive, and Amenity noise criteria, that is to be achieved to surrounding residential receivers from the new development.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>Existing Background Noise Levels</th>
<th>Intrusive Noise Criteria</th>
<th>Amenity Criteria</th>
<th>Limiting Criteria Maximum Allowable Noise Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L&lt;sub&gt;A90&lt;/sub&gt;, Period</td>
<td>L&lt;sub&gt;A90&lt;/sub&gt; + 5 dB</td>
<td>L&lt;sub&gt;Aeq&lt;/sub&gt;, Period</td>
<td>[dB(A)]</td>
</tr>
<tr>
<td><strong>Daytime</strong></td>
<td>(1800 to 2200 hours)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45&lt;sup&gt;1&lt;/sup&gt;</td>
<td>50</td>
<td>60</td>
<td>50 Intrusive</td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td>(1800 to 2200 hours)</td>
<td>40&lt;sup&gt;1&lt;/sup&gt;</td>
<td>45</td>
<td>45 Intrusive</td>
</tr>
<tr>
<td><strong>Night time</strong></td>
<td>(2200 to 0700 hours)</td>
<td>37&lt;sup&gt;1&lt;/sup&gt;</td>
<td>42</td>
<td>42 Intrusive</td>
</tr>
</tbody>
</table>

1. The existing background noise levels were based on another noise survey conducted near-by. These noise levels were used for this preliminary noise assessment only. A more rigorous assessment can be conducted at a later stage including a full seven-day unattended noise survey at the subject site to provide a more statistical reliable and most updated survey results to determine the assessment noise criteria.

Therefore, the nominated mechanical plant noise criteria adopted for this assessment are:

- **L<sub>Aeq,15 min</sub> ≤ 42 dB<sup>1</sup>**, for mechanical plant and vehicular noise assessment during night-time<sup>1</sup> period
- **L<sub>Aeq,15 min</sub> ≤ 45 dB<sup>2</sup>**, for aged-care centre and retail/restaurant operational noise assessment during evening<sup>2</sup> period
1. As mechanical plant may operate during any time of the day and vehicles may also enter the car park at any time, therefore the night-time background noise levels have been referenced in setting the appropriate noise criteria.

2. It is assumed that all aged-care facilities (communal areas and indoor dining/lounge areas) and retail/restaurant will cease to operate after 10:00pm therefore the evening background noise levels have been referenced in setting the appropriate noise criteria.

6.3 ACOUSTIC PRIVACY BETWEEN UNITS – PART 5

A summary of acoustic requirements for partition systems is presented in Table 3 below:

<table>
<thead>
<tr>
<th>RECEIVER Space (Sole Occupancy Unit)</th>
<th>SOURCE Space (Sole Occupancy Unit)</th>
<th>Rw FSTC</th>
<th>Rw + Ctr FSTC</th>
<th>Wall Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole occupancy unit (excluding wet areas¹)</td>
<td>Sole occupancy unit (excluding wet areas¹)</td>
<td>50</td>
<td>55</td>
<td>-</td>
</tr>
<tr>
<td>Sole occupancy unit (wet areas¹ only)</td>
<td>Sole occupancy unit (wet areas¹ only)</td>
<td>50</td>
<td>55</td>
<td>-</td>
</tr>
<tr>
<td>Sole occupancy unit (excluding wet areas¹)</td>
<td>Sole occupancy unit (wet areas¹)</td>
<td>50</td>
<td>55</td>
<td>discontinuous</td>
</tr>
</tbody>
</table>

| Sole occupancy unit | Lift shaft | 50 | 50 | discontinuous |
|                     | plant room | 50 | 50 | discontinuous |
|                     | Stairway | 50 | 50 | - |
|                     | Public corridor | 50 | 50 | - |
|                     | Public lobby | 50 | 50 | - |
| Sole occupancy unit | Sole occupancy unit | 62 (L_n,w) | 50 | 50 | ceiling/floor |
| Door of a sole occupancy unit | Stairway, public corridor, public lobby or the like | 30 | - | - |
| Soil and waste services in sole occupancy unit (other than kitchen) | 40 | - | - |
| Soil and waste in kitchen or non-habitable space | 25 | - | - |
| Storm water pipes in sole occupancy unit (other than kitchen) | 40 | - | - |
| Storm water pipe in kitchen or non-habitable space | 25 | - | - |

¹ Wet areas including kitchen, bathroom, toilet, laundry, sanitary compartment or the like.

IMPORTANT:

- Where a wall is required to have a sound insulation rating and has a floor above, the wall must continue to either underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall.
- Where a wall is required to have a sound insulation rating and has a roof above, the wall must continue to either underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall.

Refer to Section 3.3 of this report for details.
7.0 SOURCE SOUND POWER LEVELS

7.1 ROAD TRAFFIC – PART 1

The sound power levels for the traffic noise along each lane of Kildare Road (total two traffic flowing lanes) were derived based on the measured maximum $L_{A_{eq}, 15\text{hours}}$ and $L_{A_{eq}, 9\text{hours}}$ noise levels, and are presented in Table 4 below for both daytime and night-time period.

Table 4. Derived Sound Power Levels of Traffic for Kildare Road [dB/m]

<table>
<thead>
<tr>
<th>Noise Metric &amp; Period</th>
<th>$L_{A_{eq}, 15\text{hours (Day)}}$ 0700-2200</th>
<th>$L_{A_{eq}, 9\text{hours (Night)}}$ 2200-0700 2200-0800 [Sunday/Public Holiday]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1 Octave Band Centre Frequency $L_{A_{eq}, \text{Period}}$ [Hz]</td>
<td>31.5 63 125 250 500 1k 2k 4k 8k Total</td>
<td></td>
</tr>
<tr>
<td>31.5</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>63</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>125</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>250</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>500</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>1k</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>2k</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>4k</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>8k</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>53</td>
</tr>
</tbody>
</table>

Note: The sound power levels shown in Table 4 are dBA/metre.

An additional 1 dB increase in noise level has been included to account for future traffic volume increase in year 2027. The 1 dB increase in road traffic noise level was calculated based on compounded annual traffic volume increase of 2% over 10 years period from 2017 to 2027.

7.2 MECHANICAL PLANT – PART 2

As discussed previously, Koikas Acoustics was unable to conduct an accurate mechanical plant noise assessment as the mechanical plant details are not currently available.

The sound power levels of relevant mechanical plant that could be used for the subject development site are listed below:

Table 5. Sound Power Levels of Mechanical Plant $L_{A_{eq}}$ [dB]

<table>
<thead>
<tr>
<th>Plant</th>
<th>1/1 octave band centre frequency $L_{A_{eq}}$ [Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31.5 63 125 250 500 1k 2k 4k 8k Total</td>
</tr>
<tr>
<td>Car Park Supply/Exhaust Fan Fantech AP0804GP6/17</td>
<td>- 62 72 82 90 89 84 78 70 94</td>
</tr>
<tr>
<td>Outdoor AC Condensing Unit Daikin RXYMQSASV4A</td>
<td>- 42 49 56 56 59 57 52 42 64</td>
</tr>
</tbody>
</table>

The recommended noise mitigation measures for mechanical plant were based on the above sound power levels. A more rigorous mechanical plant noise impact assessment may be required at a later stage when the design details are available and if the location of the plant are in different locations.
Further, if any of the assumptions made in this assessment are incorrect, there will likely be a need for further calculation to determine the noise effect of the mechanical plant to surrounding residential premises.

### 7.3 NOISE FROM AGED-CARE CENTRE & RETAIL/RESTAURANT PREMISES – PART 3 & 4

The sound power levels of human speech at various vocal effort are shown in Table 9 below which were used in computer noise model representing the noise levels from outdoor dinners.

<table>
<thead>
<tr>
<th>Frequency [Hertz]</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech levels - raised vocal effort (male)</td>
<td>46</td>
<td>58</td>
<td>66</td>
<td>64</td>
<td>60</td>
<td>56</td>
<td>48</td>
<td>69</td>
</tr>
<tr>
<td>Speech levels - normal vocal effort (male)</td>
<td>42</td>
<td>53</td>
<td>61</td>
<td>58</td>
<td>54</td>
<td>51</td>
<td>43</td>
<td>64</td>
</tr>
<tr>
<td>Speech levels - casual vocal effort (male)</td>
<td>39</td>
<td>48</td>
<td>56</td>
<td>49</td>
<td>50</td>
<td>47</td>
<td>43</td>
<td>58</td>
</tr>
</tbody>
</table>

The above sound power levels were either calculated from the attended noise level measurements undertaken by Koikas Acoustics or are published data.

In this case, the sound power levels for “normal vocal effort” were considered in this acoustic assessment as this is typical of the vocal effort patrons speak in both indoor and outdoor areas.
8.0 NOISE MODELLING – PART 1

8.1 CADNA (A) NOISE MODEL

The road traffic noise sources were modelled in a computer program called CadnaA. CadnaA incorporates a computer aided drafting (CAD) program that utilises the height of the ground, the position of buildings and other structures to run through a set of algorithms calculating at user defined grid points and user input receiver locations the overall sound pressure level and frequency dependant noise level spectrum. These levels are then interpolated to calculated noise level contours.

The noise level calculations take into account the propagation of sound from a sound source as a function of its distance, the shielding effects of barriers and buildings, the attenuation and reflection off the ground and buildings.

Receiver locations were assigned in the computer model at representative positions to determine the resultant noise levels at each facade and floor level for the proposed development and surrounding premises. The predicted noise levels at these locations were used to provide recommendations on appropriate building facade construction materials and/or noise mitigation measures that would achieve the required noise reductions so as to comply with the nominated noise criterion.

Refer to Appendix B for calculated road traffic noise levels around the peripheral of the subject building on each floor level.

8.2 ARCHITECTURAL DRAWINGS

This acoustic assessment and noise model were based on the following architectural drawings prepared by McNally Architects:

<table>
<thead>
<tr>
<th>Drawing Title</th>
<th>Drawing No.</th>
<th>Rev</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Basement</td>
<td>A100</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Upper Basement</td>
<td>A101</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Ground Floor Plan</td>
<td>A102</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Level 1 Floor Plan</td>
<td>A103</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Level 2 Floor Plan</td>
<td>A104</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Level 3 Floor Plan</td>
<td>A105</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Level 4 Floor Plan</td>
<td>A106</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Level 5 Floor Plan</td>
<td>A107</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
<tr>
<td>Roof Plan</td>
<td>A108</td>
<td>-</td>
<td>21/07/2017</td>
</tr>
</tbody>
</table>
8.3 CALCULATED ROAD TRAFFIC NOISE LEVEL CONTOUR RESULTS

Part 1 (Road Traffic Noise Assessment)

Indoor Noise Criterion = $L_{A_{eq}, \text{Period}}$ 35~40 dB, Residential
Indoor Noise Criterion (Daytime/Evening) = $L_{A_{eq}, \text{Period}}$ 50 dB, Retail/Restaurant

Receiver points were located around the facades of the building in the computer model in order to predict road traffic noise levels around the periphery of the proposed building envelope. The calculated maximum $L_{A_{eq}, 15 \text{ hours}}$ and $L_{A_{eq}, 9 \text{ hours}}$ noise levels outside the most noise affected facade (northern facade) on different floor level are provided below:

<table>
<thead>
<tr>
<th>Floor Level</th>
<th>$L_{A_{eq}, 15 \text{ hours}}$</th>
<th>$L_{A_{eq}, 9 \text{ hours}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground floor level</td>
<td>68</td>
<td>63</td>
</tr>
<tr>
<td>1st floor level (Aged-care centre)</td>
<td>66</td>
<td>61</td>
</tr>
<tr>
<td>2nd floor level (Aged-care centre)</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>3rd floor Level (Residential)</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>4th floor Level (Residential)</td>
<td>64</td>
<td>59</td>
</tr>
<tr>
<td>5th floor Level (Residential)</td>
<td>63</td>
<td>58</td>
</tr>
</tbody>
</table>

The calculated maximum noise level outside the most noise-affected aged-care centre facade was found to be $L_{A_{eq}, 15 \text{ hours}}$ 68 dB for daytime and $L_{A_{eq}, 15 \text{ hours}}$ 54 dB (eastern façade) for night-time period. Therefore, a maximum noise reduction of 28 dB during the daytime and 19 dB during the night-time is required for aged-care tenancy.

The calculated maximum noise level outside the most noise-affected residential apartment facade was found to be $L_{A_{eq}, 15 \text{ hours}}$ 65 dB for daytime and $L_{A_{eq}, 15 \text{ hours}}$ 60 dB for night-time period. Therefore, a maximum noise reduction of 25 dB during the daytime and 25 dB during the night-time is required for residential apartments.

Refer to Appendix B for illustration of road traffic noise levels for each floor level.
9.0 RECOMMENDATIONS FOR ROAD TRAFFIC NOISE IMPACT ASSESSMENT – PART 1

The recommended building materials provided in the section are required in order to achieve the nominated indoor traffic noise criterion levels.

9.1 CEILING/ROOF SYSTEM

The proposed masonry ceiling/roof system including following building materials will be satisfactory:

- Ceiling/roof with minimum 200 mm thick concrete and one layer of 13 mm thick plasterboard ceiling.

Alternatively, a metal deck ceiling/roof system with:

- 0.42 mm metal deck roof followed by
- a layer of 100 mm thick 14 kg/m$^3$ insulation batts fitted tightly between the ceiling joists and
- one layers of 13 mm thick plasterboard screw fixed beneath the ceiling joists.

9.2 EXTERNAL WALLS

The following external wall systems will be satisfactory:

- minimum 110 mm thick brick or formwork with concrete infill;
- Insulation batts (14kg/m3) fitted between 51 mm or 64 mm steel studs, and
- One layer of 13 mm plasterboard.

Alternatively,

- Two leaves of 110 mm thick brick;
- Minimum 20 mm air-gap separation, and
- One layer of 13 mm plasterboard on the inside.
9.3 WINDOWS/SLIDING DOORS

The required minimum glazing thickness of the windows and sliding doors to the habitable spaces of the proposed development are presented in Appendix C of this report.

**Disclaimer**
Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing that is predicted to achieve satisfactory acoustic performance. No consideration has been given to other factors such as safety, thermal or energy efficiency that may render the recommended glazing as non-compliant with other standards or guidelines. It is therefore the responsibility of the client to ensure all glazed windows and sliding doors installed on-site meet all building design requirements.

**Notes**

1. All glazing systems should be built into a solid frame.
2. Window frames should be tightly fitted to the external wall minimising any air gaps. Where large air gaps (typically >20mm) are present, timber packing material and an appropriate acrylic sealant such as Knauf Bindex (or approved equivalent) should be used. For smaller air gaps <10mm an appropriate acrylic type sealant such as Knauf Bindex (or approved equivalent) should be used.
3. All open-able windows and glazed door systems should be air tight when closed.
4. Q-lon type seals or the equivalent must be fitted along the perimeter of all glazing systems to minimise air gaps. If the windows/doors are not designed to be air-tight when closed, the total noise attenuation performance of the walls and ceiling-roof system will be reduced.
5. Recommended glass systems above have been calculated based on current architectural drawings as established within this report.
6. Typical Rw / STC values have been included for reference only. Under no circumstances should windows or glass doors be ordered off the included Rw / STC value. Our calculations and recommendations for glass systems are based on a more detailed 1/1 octave band analysis of noise transmission.

Where alternate glass types/thicknesses are proposed to those recommended by Koikas Acoustics, these may be used in the building provided that the glass manufacturer can demonstrate the installed system can achieve or exceed the following Sound Transmission Loss (STL) values shown in Table 7 below.

<table>
<thead>
<tr>
<th>System description</th>
<th>Frequency [Hz]</th>
<th>1/1 octave STL [dB]</th>
<th>Rw</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>63</td>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>12.5mm V-Lam Hush</td>
<td>25</td>
<td>29</td>
<td>33</td>
</tr>
<tr>
<td>12.38mm Laminated</td>
<td>23</td>
<td>27</td>
<td>31</td>
</tr>
<tr>
<td>10.38mm Laminated</td>
<td>21</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>6.38mm laminated</td>
<td>18</td>
<td>22</td>
<td>27</td>
</tr>
<tr>
<td>4mm float</td>
<td>15</td>
<td>19</td>
<td>23</td>
</tr>
</tbody>
</table>

**Important:** Typical Rw / STC values have been included for reference only. Under no circumstances should windows or glass doors be ordered off the included Rw / STC value. Our calculations and recommendations for glass systems are based on a more detailed 1/1 octave band analysis of noise transmission with sound transmission loss values shown in Table 7.
9.4 MECHANICAL VENTILATION

People occupying habitable spaces that are affected by road noise intrusion may require that they keep windows/doors closed in order to achieve the indoor design sound levels recommended. Therefore, in order to meet the Codes and recommendations of relevant Australian Standards it will be necessary to provide additional ventilation to these particular spaces. Additional ventilation is to be compliant with relevant provisions of the BCA.

It is generally accepted that with windows or doors opened to provide sufficient natural ventilation to a room, the indoor noise level is generally 10 dB below the outside noise level. Therefore, where outdoor noise levels are greater than 10 dB above the indoor design sound level criteria, then windows and doors will need to be closed in order to satisfy the criteria.

It is noted, indoor road noise contributions via the mechanical ventilation plant should be at least 10 dB lower than the recommended indoor sound level of traffic noise intrusion. This will ensure that the combined road noise intrusion and mechanical plant noise does not exceed the indoor noise criterion.

There are two (2) options that are acoustically viable to satisfy the additional ventilation requirement:

**OPTION 1: Mechanical ventilation**
A small air supply fan unit with a minimum 4 metres length of acoustically lined to the inner side of the duct with 50 mm thick insulation. See details attached in Appendix E.

**OPTION 2: Fresh air supply to air conditioning**
Connecting a fresh air supply to the air handling unit of the nominated air conditioning system. May not be applicable for all types of air conditioning systems. Please contact AC supplier to verify.

Consultation with a mechanical services consultant is recommended to ensure that any adopted air supply approach is compliant with BCA and applicable Australian design standards. Alternative designs could be considered provided that noise intrusion is minimised and the internal noise levels do not exceed the nominated sound criteria levels.

Based on calculated external road noise levels noise levels shown in Appendix B, most habitable spaces will require mechanical ventilation. Habitable spaces in which the installation of the mechanical ventilation system is required are nominated in Appendix C (marked with a "✓" sign). Mechanical ventilation details are provided in Section 9.4 and Appendix E of this report.
10.0 **RECOMMENDATIONS FOR MECHANICAL PLANT & VEHICULAR NOISE IMPACT ASSESSMENTS – PART 2**

10.1 **MECHANICAL PLANT NOISE ASSESSMENT**

In order to achieve compliance with the nominated night-time mechanical plant noise criteria at the adjoining/surrounding residential premises, noise mitigation measures are required to attenuate the noise levels generated by the mechanical plant. The following noise mitigation measures are required:

<table>
<thead>
<tr>
<th>MECHANICAL PLANT</th>
<th>NOISE MITIGATION MEASURES</th>
</tr>
</thead>
</table>
| Car Park Exhaust Fan                 | • Minimum 12 metres of ductwork from the exhaust fan to terminating grille on rooftop level.  
• Line 5 metres along the inside of the metal duct work with a minimum of 50mm rigid grade fibreglass batts between the outlet end of the duct work and the extraction fan.  
• Terminating grille outlet on the rooftop level must be at least 3 metres away from the building edge.  
• Assuming the cross-sectional area of the metal duct work is not more than 1 m².  
Car Park Supply Fan                   | • Minimum 6 metres of ductwork from the exhaust fan to terminating grille on rooftop level.  
• Line 6 metres along the inside of the metal duct work with a minimum of 50mm rigid grade fibreglass batts between the outlet end of the duct work and the extraction fan.  
• Terminating grille outlet on the rooftop level must be at least 3 metres away from at residential window.  
• Assuming the cross-sectional area of the metal duct work is not more than 1 m².  
Outdoor Residential AC Unit           | • The outdoor condensing unit is to be mounted with rubber mounts or similar resilient mounts at balcony level of each aged-care tenancy and residential apartment.  
• The outdoor condensing unit is to be located at least 5 metres from any adjoining residential boundary. Unless a masonry noise barrier of minimum 1.8 m is separating the outdoor condensing unit and adjoining residential boundary.  
• The outdoor condensing unit may require to operate under “night mode” such that an additional noise reduction of 4—6 dB can be achieve during night-time period between 0700 and 2200 hours.  

It is recommended that the lining material begin one duct length away from the actual fan.

Duct work in risers adjacent to habitable spaces (if any) and mechanical plant sitting on the rooftop deck (if any) must be vibration isolated to minimise structure borne vibrations that may transmit into walls and floors which would otherwise manifest as airborne noise in those spaces.
Furthermore, incorporate a spring mounted system or isolation pad between the motor and the concrete ceiling or walls for the automated garage roller door (if any) to minimise any structure-borne noise impact.

Rubber mounts for air-conditioning units, plant on the rooftop deck and motorised roller door systems that could be used include Embelton Rubber Mounts Type NR/NRD.

Contact salesperson at Embleton for details
Contact name: Nishi K Grover
Contact No.: 02 9748 31888 / 0429 308 107

**IMPORTANT:**

- This acoustic report do not include the assessment of retail/restaurant mechanical plant on ground floor level as the plant selection and locations were unknown at the time of preparing this acoustic report. It is the responsibility of each individual retail/restaurant tenancy (especially for kitchen exhaust fans) to ensure that the mechanical plant noise criteria discussed in this report are achieved.

- If any of the assumptions made in this assessment (in relation to the mechanical plant noise assessment) or information provided by other consultants are incorrect, there will likely be a need for further calculation to determine the noise effect of the mechanical plant to surrounding residential premises.

**10.2 VEHICULAR NOISE IMPACT ASSESSMENT**

As discussed previously, the vehicular noise impact would be negligible as most acoustic energy is shielded by masonry underground car park building structures. The noise impact from vehicles whilst at the opening driveway area of the car park entrance is normally not an issue when considering the duration of a vehicle driving from the entrance to the underground car park area or vice versa.

However, to further minimum the vehicular noise impact from the driveway entrance area to the adjoining residential dwelling at No. 1 Carinya Street, a noise barrier of 1.8 m can be erected along the common boundary (The necessity of the noise barrier will be confirmed at a later stage when the traffic volume is known).
The following construction materials will be adequate for the recommended noise barrier:

- Double lapped 15mm thick timber fence palings offset so that there are no air gaps. This equates to a total barrier thickness of 30 mm;  
  OR
- 15mm compressed fibre cement panels with no air gaps at the joins;  
  OR
- 6mm compressed fibre cement panels either side of a 51mm steel frame;  
  OR
- 15mm plexiglass panels with no air gaps at the joints.

It is to be noted that gaps between the panels and the posts or the ground will significantly reduce the effectiveness of the noise barrier and may lead to non-compliant noise levels at the adjoining premises. Therefore, all gaps should be sealed with soil or other materials.

This noise barrier is required to be a minimum of 1.8 metres in height and the extent is shown in Appendix D.

The requirement of this noise barrier can be further clarified once the traffic volume in/out of the car park area is known at a later stage.
11.0 RECOMMENDATIONS FOR AGE-CARE CENTRE AND RETAIL/RESTAURANT OPERATIONAL NOISE IMPACT ASSESSMENT – PART 3 & 4

The noise impact from people occupying the indoor dining/lounge areas and outdoor communal space is less significant compared to the ambient road traffic noise level from Kildare Road. Therefore, the noise impact from aged-care centre and retail/restaurant tenancies is expected to comply with the nominated noise criteria provided that:

- No live-band music is playing within any retail/restaurant and dining/lounge area;
- Only light background music can be played (i.e. music level which is lower than normal conversational noise level of say 60~65 dB(A));
- Shouting and yelling are not common occurrences;
- Glazing windows/doors of the indoor dining/lounge areas may require to be closed for noisy function or event (if any), and
- All aged-care facilities and retail/restaurant may be limited to 10:00 pm.

The noise impact of the aged-care centre and retail/restaurant operations were based on limited information provided at time of preparing this report and therefore, there will likely be a need for further calculation to determine the noise effect of the aged-care facilities and retail/restaurant to surrounding residential premises.
12.0 ACOUSTIC PRIVACY BETWEEN UNITS – PART 5

12.1 INTERNAL WALL SYSTEMS

There are generally three types of walls that need to be considered:

- Discontinuous (impact rating) and achieve Rw + Ctr 50
- Continuous and achieve Rw + Ctr 50
- Continuous and achieve Rw 50

The following wall systems are described in the same order.

MASONRY WALLS

A masonry wall system that is expected to achieve:

Rw + Ctr 50 and is

discontinuous providing impact rating:

- two leaves of solid 110mm thick clay masonry bricks with
- cavity not less than 50mm between leaves
- 13mm thick render on each outside face
- the two leaves separated with acoustic wall ties (eg Matrix Industries ph 6553 2577) type MB-01,
- or polymer Ni-Ties polymer plastic acoustic brick ties from Vespol Pty Ltd or Novaplas Pty Ltd
- or, not physically connected with any brick ties

Insul Version 8.0.9 Predicted acoustic rating: 51 Rw+Ctr (Error ±3Rw)
Alternatively,

- one leave of 110mm thick solid masonry bricks with
- 64mm minimum width steel studs at 600mm centres,
- 20mm gap to achieve discontinuity
- cavity filled with 50 – 60 mm thick glass wool or polyester batts or the equivalent with minimum density 20 kg/m³
- adjacent to a dry area, 13 mm thick plasterboard screw fixed to the steel stud or adjacent to a wet area, 6 mm thick fibre cement panels
- 13 mm thick plasterboard glue fixed to other side of the masonry wall. Air gaps between the two surfaces should be kept to a minimum. Alternatively, 13 mm render to the masonry side will provide better acoustic performance.

**Insul Version 8.0.9 Predicted acoustic rating: 56 Rw+Ctr (Error ±3Rw)**
A masonry wall system recommended for use to achieve:

\[ \text{Rw} + \text{Ctr} 50 \]

but not required that it is a discontinuous wall type is as follows:

- single leaf of 220 mm brick masonry with
- 13 mm thick render on each face.

**Insul Version 8.0.9 Predicted acoustic rating:** 50 Rw+Ctr (Error ±3Rw)
A masonry wall system recommended for use to achieve:

\[ R_w \] 50 is as follows:

- single leaf of 150 mm brick masonry with
- 13 mm thick render on each face

*Insul Version 8.0.9 Predicted acoustic rating: 50 \( R_w \) (Error ±3\( R_w \). Error expected to be much less)*
**CONCRETE WALLS:**

Concrete wall systems recommended for use to achieve:

\[ Rw + Ctr \geq 50 \] and

be of a **discontinuous** wall type providing impact is as follows:

- 13 mm thick plasterboard daub fixed to
- 100 mm thick concrete panel
- 20mm cavity
- 64mm wide steel studs at 600mm centres
- cavity filled with 70mm thick glass wool or polyester batts or the equivalent
- 13 mm thick plasterboard screw fixed to the steel stud

*Insul Version 8.0.9 Predicted acoustic rating: 63 Rw + Ctr (Error ±3Rw)*
A wall system recommended for use to achieve:

\[ Rw + Ctr \geq 50 \]

but not require that it is of a discontinuous wall type is as follows:

- 150 mm thick concrete panel with
- 13 mm thick render on each face. If plasterboard is used, gaps must be less than 2 mm.

*Insul Version 8.0.9 Predicted acoustic rating: 50 Rw + Ctr (Error ±3Rw. Error expected to be less)*
A concrete wall system recommended for use to achieve:

\( Rw 50 \) is as follows:

- 100mm thick concrete panel with
- 13 mm thick render on each face. If plasterboard is used, gaps must be less than 2 mm.

*Insul Version 8.0.9 Predicted acoustic rating: 52 Rw (Error ±3Rw Error expected to be less)*
12.2 SOIL AND WASTE PIPES

For services and/or waste pipes from one unit that pass through another unit the following noise control measures are recommended:

To achieve an Rw + Ctr not less than 25:
- Minimum of two (2) layers of 13 mm plasterboard are required to partition the services/waste pipes from any non-habitable room (including the kitchen),

To achieve an Rw + Ctr not less than 40:
- Minimum of two (2) layers of 13 mm plasterboard are required as a partition for the services/waste pipes from a habitable room, and in addition the pipes are to be lagged with an acoustic lagging material such as Pyrotech’s Soundlag 4525C or similar.

Further, an access door or panel must be firmly fixed so as to overlap the frame or rebate the frame by not less than 10 mm, and be fitted with a proper sealing gasket along all edges and constructed of:

- wood, particle board or block board not less than 38 mm thick; or
- compressed fibre reinforced cement sheeting not less than 9 mm thick; or
- other suitable material with a mass per unit area not less than 24 kg/m².

For the services shaft wall, the following will be satisfactory:
- 75 mm Hebel Powerpanel (HEB1204);
- 28 mm furring channel, (minimum 43 mm cavity) 50 mm glasswool insulation, AND
- 13 mm Fyrchek.
12.3 TIMBER ENTRY DOORS

For timber doors incorporated into a partition separating a sole-occupancy unit from a common area, hallway or lobby area, that door is required to provide an $R_w$ of not less than 30. A suitable door system for this purpose would be a 40mm solid core timber door with Raven type acoustic perimeter and drop seals.

The Schlegel type equivalent are also recommended as an alternative door seal.
12.4 FLOOR CONSTRUCTION

Deemed to satisfy ceiling/floor systems are described in the BCA. The acoustic impact noise ratings as required by the BCA is significantly less stringent compared to the Strata Management By Law 14. Both Acts must be complied with. The most stringent criterion to achieve impact isolation of floors between sole-occupancy units is the Strata Management By-Law Act 14. This however is a qualitative criterion and therefore is subjective. It would be necessary for the Body Corporate or Executive Committee Members to decide whether the standard By-Law remains or is modified and a quantifiable acoustic impact rating is enforced for the ceiling/floor system of the subject development building. Where solid floor coverings such as timber or ceramic tiles are proposed, additional sound insulation materials will be required to address impact noise transmission.

If the minimum impact isolation requirements are to be achieved, the BCA’s acoustic rating of $L_{n,w} \leq 62$ can be achieved with the following ceiling/floor systems:

<table>
<thead>
<tr>
<th>Description</th>
<th>$R_w + C_v$ (not less than)</th>
<th>$L_{n,w}$ (not more than)</th>
<th>$R_w$ (not less than)</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floor construction type: Concrete</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>150 mm thick concrete slab with—</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 28 mm metal furring channels and isolation mounts fixed to underside of slab, at 600 mm centres; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) 65 mm thick polyester insulation with a density of 8 kg/m², positioned between furring channels; and</td>
<td>50</td>
<td>62</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>(c) one layer of 13 mm plasterboard fixed to furring channels.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 mm thick concrete slab with carpet on underlay.</td>
<td>50</td>
<td>62</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>100 mm thick concrete slab.</td>
<td>45</td>
<td>-</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td><strong>Floor construction type: Autoclaved aerated concrete</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75 mm thick autoclaved aerated concrete floor panel with—</td>
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</tr>
<tr>
<td>(a) 8 mm ceramic tiles with flexible adhesive and waterproof membrane, located above the slab; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) timber joists at 600 mm centres; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) R1.5 glass wool insulation positioned between timber joists; and</td>
<td>50</td>
<td>62</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>(d) 26 mm metal furring channels and resilient mounts fixed to underside of joists; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e) two layers of 13 mm plasterboard fixed to furring channels.</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Where alternative floor/ceiling systems are proposed, rubber, cork or foam underlays could be used to reduce impact noise.

Prior to installing any timber or tiled floor coverings, it is recommended that testing be undertaken of a small sample of the selected timber/tile floor system and underlays to verify what combination of materials will achieve compliance with the criterion.

The following are also noted:

- The lower the rating number the better the acoustic performance for $L_{n,Tw}$ or $L_{n,w}$ ratings.

- The information provided in this report relates to acoustic matters only. Supplementary advice should be sought for other matters relating to flooring installation, construction, design, structural, fire-rating, water proofing, and the likes.

- Product installation details and methodologies must be sought from product supplier, installer or other experts. Koikas Acoustics is not liable for any product defects.
13.0 SUMMARY AND CONCLUSION

Koikas Acoustics Pty Ltd was requested to undertake an acoustic assessment of the proposed mixed use development to be located at No. 54-56 Kildare Road & 1A Carinya Street, Blacktown, which includes the following:

Part 1 (Road Traffic Noise Assessment)

- Two unattended traffic noise surveys were conducted by Koikas Acoustics to determine the existing ambient noise levels and the existing traffic noise emanating from Kildare Road.

- The noise survey results were used to calculate the traffic noise impact to the internal spaces of the proposed Aged Care Centre and residential premises. The predicted resultant traffic noise levels were then used to determine what type of building materials (recommended in Section 9.0 of this report) would be required to provide satisfactory noise attenuation through the external building envelope.

- Additional BCA compliant mechanical ventilation system will be required for some habitable spaces. Habitable spaces in which the installation of the mechanical ventilation system is required are nominated in Appendix C (marked with a “*” sign). Mechanical ventilation details are provided in Section 9.4 and Appendix E of this report.

Part 2 (Mechanical Plant & Vehicular Noise Impact Assessment)

- The unattended noise survey results obtained for another assessment nearby were also used to determine the mechanical plant and vehicular noise criteria apply to the surrounding residential premises during night-time period. The nominated mechanical plant & vehicular noise criterion adopted for this assessment is:

  \[ L_{Aeq,15 \text{ min}} \leq 42 \text{ dB} \]  

- Noise impact from the proposed mechanical plant will meet the nominated noise criteria provided that the recommended noise mitigation measures stated in Section 10.0 of this report are implemented.
Part 3 & 4 (Aged-Care Facilities and Retail/Restaurant Operational Noise Impact Assessment)

- Similarly, the unattended noise survey results were used to determine the aged-care centre and retail/restaurant operational noise criteria apply to the surrounding residential premises (evening period only). The nominated aged-care centre and retail/restaurant operational noise criterion adopted for this assessment is:

  - \( L_{\text{Aeq,15 min}} \leq 45 \text{ dB} \), for residential premises during evening period.

- Noise impact from the operation of the proposed aged-care facilities and retail/restaurant tenancies will meet the nominated noise criteria provided that the recommended noise mitigation measures stated in Section 11.0 of this report are implemented.

Part 5 (Acoustic Privacy Between Units)

- Airborne and impact sound isolation between units through common partition elements such as walls, floors and services/waste pipes have also been assessed to Building Code of Australia (BCA) and NSW Standard By-Law 14. The detailed recommendations are provided in Section 12 of this report.

This acoustic report was prepared based on limited information provided at time of preparing this report and therefore for concept DA design, there will likely be a need for further calculation to determine the noise effect for all parts at a later stage when more details become available.

Based preliminary acoustic assessments provided in this report, Koikas Acoustics certifies that the proposed mixed use development at No. 54-56 Kildare Road & 1A Carinya Street, Blacktown is capable of satisfying the nominated criteria described in this report being traffic noise intrusion, complying with the intent of the EPA’s Industrial Noise Policy which is to prevent “offensive noise” as described in the POEO Act 1997 with practical noise mitigation measures and will also achieve satisfactory noise attenuation between one sole occupancy unit and another adjoining sole occupancy unit and public corridors and stairwells.
ROAD TRAFFIC NOISE MODEL (GROUND FLOOR LEVEL)

NOISE SOURCES

- Road traffic noise along Kildare Rd.

Note:

- $LA_{eq}$, 15hrs noise level shown are at 1.5 m above the ground floor level of the subject development building.

- The maximum reading at the proposed building is $LA_{eq}$,15hrs 68 dB.

- Night-time $LA_{eq}$,9hrs noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
ROAD TRAFFIC NOISE MODEL (1st FLOOR LEVEL)

NOISE SOURCES

~ Road traffic noise along Kildare Rd.

Note:

- $L_{Aeq,15hrs}$ noise level shown are at 1.5 m above the 1st floor level of the subject development building.

- The maximum reading at the proposed building is $L_{Aeq,15hrs}$ 66 dB.

- Night-time $L_{Aeq,9hrs}$ noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
ROAD TRAFFIC NOISE MODEL (2nd FLOOR LEVEL)

NOISE SOURCES

~ Road traffic noise along Kildare Rd.

Note:

- LAeq, 15hrs noise level shown are at 1.5 m above the 2nd floor level of the subject development building.

- The maximum reading at the proposed building is LAeq,15hrs 65 dB.

- Night-time LAeq,9hrs noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
ROAD TRAFFIC NOISE MODEL
(3rd FLOOR LEVEL)

NOISE SOURCES

~ Road traffic noise along Kildare Rd.

Note:

- \( L_{Aeq} \), 15hrs noise level shown are at 1.5 m above the 3rd floor level of the subject development building.

- The maximum reading at the proposed building is \( L_{Aeq}, 15hrs \) 65 dB.

- Night-time \( L_{Aeq}, 9hrs \) noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
ROAD TRAFFIC NOISE MODEL (4th FLOOR LEVEL)

NOISE SOURCES

- Road traffic noise along Kildare Rd.

Note:

- $L_{Aeq}$, 15hrs noise level shown are at 1.5 m above the 4th floor level of the subject development building.

- The maximum reading at the proposed building is $L_{Aeq,15hrs}$ 64 dB.

- Night-time $L_{Aeq,9hrs}$ noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
ROAD TRAFFIC NOISE MODEL (5th FLOOR LEVEL)

NOISE SOURCES

- Road traffic noise along Kildare Rd.

Note:

- $L_{Aeq,15h}$ noise level shown are at 1.5 m above the 5th floor level of the subject development building.

- The maximum reading at the proposed building is $L_{Aeq,15h}$ 63 dB.

- Night-time $L_{Aeq,9h}$ noise levels are approximately 5 dB lower.

PRINT DATE: 19/06/17
10.38 mm laminated glazing

12.38 mm laminated glazing

6.38 mm laminated glazing

4 mm

Mechanical Ventilation System is Required
1st FLOOR LEVEL

- 10.38 mm laminated glazing
- 12.38 mm laminated glazing
- 6.38 mm laminated glazing
- 4 mm

Mechanical Ventilation System is Required
12.38 mm laminated glazing
10.38 mm laminated glazing
6.38 mm laminated glazing
4 mm

Mechanical Ventilation System is Required
Mechanical Ventilation System is Required
12.38 mm laminated glazing
10.38 mm laminated glazing
6.38 mm laminated glazing
4 mm

Mechanical Ventilation System is Required
Extent of the Recommended Noise Barrier
(Refer to Section 10.2 of the report for details)
Fan
Concrete / Timber / Steel Roof
Cowling over
Minimum 4m of lined ductwork
Fan
Ceiling material fixed to hangers or the likes
Diffuser
Wall facade
Concrete / Timber / Steel Roof

Minimum 4m of lined ductwork

Ceiling material fixed to hangers or the likes

Diffuser

Fan

Wall facade