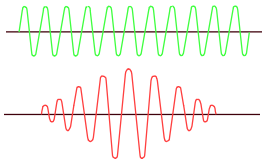
Murlan Consulting Pty Ltd

35 Water St, Wahroonga (Waterbrook Health)

Acoustic Assessment for DA Submission



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Vipac Engineers & Scientists Ltd

Sydney, NSW

2nd March 2008

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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by Murlan Consulting Pty Ltd to assess the acoustic interaction of the proposed private hospital development at 35 Water Street, Wahroonga with the surrounding environment.

An acoustic assessment of the proposed development has been carried out in accordance with Ku-Ring-Gai Council requirements and the appropriate standards and guidelines set out in Australian Standard AS/NZS 2107:2000, BCA (2008) and Department of Environment and Climate Change (DECC) Industrial Noise Policy (INP) and Environmental Criteria for Road Traffic Noise (ECRTN).

The road traffic and background noise surveys have been conducted to establish the existing traffic and background noise levels in the area. This report is based on noise levels measured at the boundary of the proposed development on Water Street. The ingress of noise through glass windows/doors of the various spaces are to be controlled using well-sealed glazing as specified in Table 6 of this report.

The traffic noise generation due to this development has been assessed using CORTN model. The increased noise level would be within the DECC ECRTN criteria.

Limiting criteria for mechanical plant/equipment noise emission have been determined based on general guidelines from the DECC Industrial Noise Policy (Section 3.3). Once the plant and equipment selection has been finalised, a separate acoustic assessment should be conducted such as at Construction Certificate Stage. At this later juncture the design and specification of the necessary treatments can be carried out to control the noise emission to ensure compliance with the criteria specified.

Provided the recommendations in this report are carried out, the proposed private hospital development is predicted to comply with the noise requirements of Ku-Ring-Gai Council and relevant Australian standards or guidelines.

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1. INTRODUCTION

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by Murlan Consulting Pty Ltd to assess the acoustic interaction of the proposed private hospital development at 35 Water Street, Wahroonga with the surrounding environment.

The proposed development will comprise:

- An existing building (Rippon Grange) to be refurbished.
- Three (3) other buildings – an east, west and main wing comprising of private suites.
- Two (2) levels basement carparks.

This report takes into account the recommendations and guidelines set out in Ku-Ring-Gai Council DCPs, BCA 2008, Australian Standard AS/NZS 2107:2000 and DECC's Industrial Noise Policy and DECC's Environmental Criteria for Road Traffic Noise.

2. NOISE SURVEY

From a site inspection, review of the architectural drawings and based on our experience with similar developments, we consider the following noise issues associated with the proposed development need to be addressed:

- Vehicular traffic affecting the northern and eastern façades.
- Noise emission from operation of mechanical plant/air conditioning to the surrounding area.
- Noise transmission between separate units.
- Potential impact from generated traffic onto the surrounding environment.

2.1. SURVEY DETAILS

The site is located on a block bounded by Water Street, Young Street and Billyard Ave, as illustrated below in Figure 1. The site in general is surrounded by private residential properties with residential traffic on the local roads.

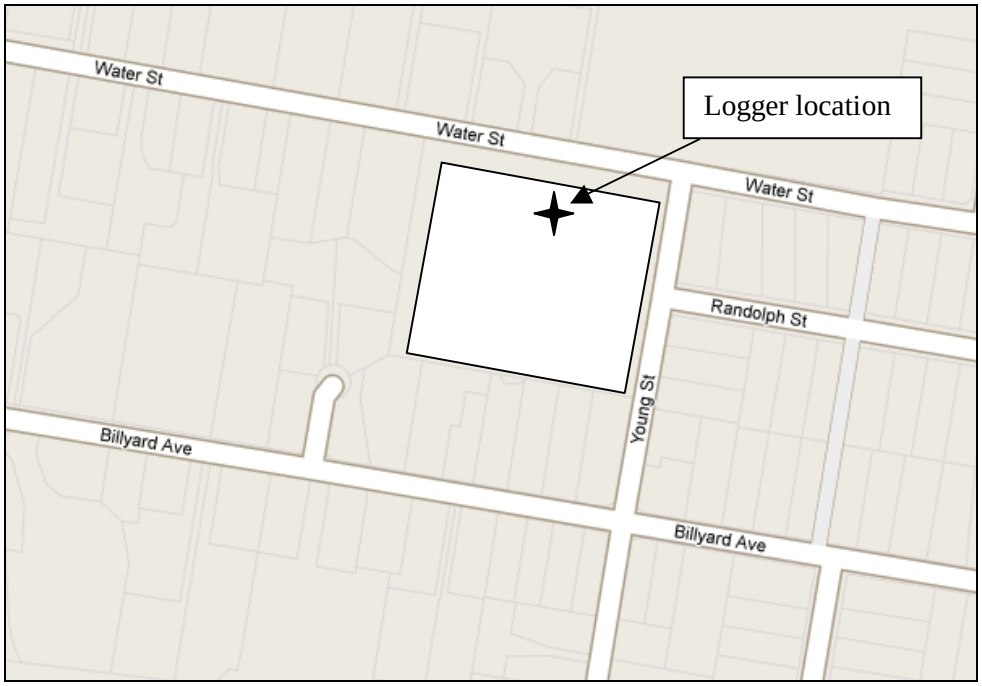

Figure 1: Site and Logger Location

2.1.1. Noise Survey

A noise survey was conducted between Tuesday 11th and Thursday 13th of April 2006 using an unattended noise logging monitor which was positioned just inside the boundary facing Water Street. The noise monitoring is usually conducted outside school holidays for a period of one week. In this case as the time for DA submission was limited and the school holidays were due to start, the survey was conducted for a limited period of 2 days. The noise levels have been obtained using 2 days of data logging, however if required, the monitoring activity can be conducted for a longer period. It is our opinion that the background noise survey is still representative of the present noise environment.

Internal software calculated and stored the L_n percentile noise levels for each sampling period. Measurements were made of L_{Amin}, L_{Amax}, L_{A90}, L_{A10}, and L_{Aeq}, the results were stored in an internal memory and were later retrieved for detailed analysis.

2.2. INSTRUMENTATION

Measurements were conducted using the following equipment:

- LD 870 Environmental Noise Monitor
  Serial Number A0181

- Larson Davis Sound Level Calibrator
  Model CA250, Serial Number 1247

The equipment was checked for calibration immediately before and after the measurement periods and there was no adverse deviation between the two.

2.3. MEASUREMENT RESULTS

2.3.1. Road Traffic Noise Level

Table 1 below presents a summary of the road traffic noise measurements at the site. Values have been rounded to the nearest 0.5 dB.

Table 1: Summary of Existing Traffic Noise Level L_{Aeq}

All Values in dBA

Period	L_{Aeq}	Noisiest $L_{Aeq\ (1hr)}$
Day (7am – 10pm)	$L_{Aeq,15hr}$ 55	59
Night (10pm – 7am)	$L_{Aeq,9hr}$ 49	54

2.3.2. Background Noise Level

Table 2 below presents a summary of our background noise measurements of the site. For the background noise assessment purposes, the survey results were analysed in accordance with the DECC Industrial Noise Policy where the time periods are defined as:

- Day: 7am – 6pm
- Evening: 6pm – 10pm
- Night: 10pm – 7am

Table 2: Summary of Existing Ambient and Background Noise Levels

All Values in dBA

Period	L_{Aeq}	L_{A90}	RBL[1]
Day	56	39	37
Evening	51	39	38
Night	49	39	36

[1] Note: RBL is the median of the overall assessment background noise level calculated using EPA Industrial Noise Policy methodology, as defined in the glossary of acoustic terms.

3. NOISE CRITERIA

As part of the Development Application submission for this project, the Council requires evidence that the proposed development will not be adversely affected by the existing noise climate and that it will not generate unexpected or unreasonable noise that may affect the amenity of the adjoining neighbours and the surrounding area.

3.1. TRAFFIC NOISE GENERATION CRITERIA

To assess the impact of traffic noise generated by the development, we consider the NSW DECC Environmental Criteria for Road Traffic Noise (DECC ECRTN) to be the appropriate industry standard to apply to this development. According to the NSW DECC Environmental Criteria for Road Traffic Noise, traffic noise resulting from the proposed development should not raise the existing noise levels higher than those as shown in Table 3.

Table 3: Criteria for Road Traffic Noise Generated by New Development

Type of Development	Period	$L_{Aeq,T}$ dB(A)
13. Land use developments with potential to create additional traffic on local roads	Day (7am – 10pm)	$L_{Aeq(1hr)}$ 55
	Night (10pm – 7am)	$L_{Aeq(1hr)}$ 50

Where the above criteria are already exceeded, DECC recommends that:

> "*Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments.*

In all cases, traffic arising from the development should not lead to an increase in existing noise levels by more than 2 dB".

3.2. ROAD TRAFFIC NOISE INTRUSION CRITERIA

To ensure that the appropriate noise standards can be achieved, it will be necessary to utilise a facade glazing system, which will attenuate the measured road traffic noise levels for all spaces.

In terms of internal noise levels for health care buildings subjected to external noise, the recommended indoor design levels specified in Australian Standard 2107:2000 have been used. Table 4 below summarises the relevant internal levels from AS/NZS 2107:2000 for various spaces.

Table 4: AS/NZS 2107:2000 Recommended Design Sound Levels for Different Areas of Occupancy in Buildings

Type of occupancy/activity	Recommended design sound level, L_{Aeq} in dB(A)	
	Satisfactory	Maximum
Private Wards	35	40
Waiting rooms, sitting rooms, reception areas, corridors and lobbies	40	50
Nurse Stations	40	45
Office areas	40	45
Consulting rooms	40	45
Kitchens	50	55
Dining room, Cafe	45	55
Chapel, quiet rooms	30	35
Gymnasium	45	55
Therapy rooms	40	45
Meeting rooms, training rooms	30	40
Basement carpark	55	65

3.3. EXTERIOR MECHANICAL PLANT AND EQUIPMENT NOISE EMISSION CRITERIA

To control noise likely to emanate from the air conditioning/ventilation systems, plant and equipment of the development to the surrounding environment the DECC Industrial Noise Policy is used.

The procedures detailed in DECC INP have been followed to determine the limit of allowable noise emission from the proposed site. The assessment procedure has two requirements that must be met, namely:

- that the noise source not be 'intrusive'; and also
- that the 'amenity' of the nearby land be preserved.

This policy sets out two separate noise criteria designed to ensure developments meet environmental noise objectives. The first criterion accounts for intrusive noise and the second criterion applies to protection of amenity of particular land uses. The new development is assessed by applying both the amenity and intrusiveness criteria to the situation and adopting the more stringent of the two. This becomes the project specific noise levels. Applying the most stringent requirement as the project specific noise levels ensures that both intrusive noise is limited and the amenity is protected.

Table 5: Amenity Criteria, Intrusiveness Criteria and Project Specific Noise Levels at Noise Sensitive Receiver

All Values in dBA

Period	Existing L_{Aeq}	Existing RBL	Recommended Acceptable L_{Aeq}[2]	Amenity Criteria Level	Intrusiveness Criteria Level	Project Specific Level
Day	56	37	55	47	42	**42**
Evening	51	38	45	41	43	**41**
Night	49	36	40	39	41	**39**

Hence, noise from mechanical plant and equipment associated with the proposed development should comply with the lowest figure of the Project Specific Levels which is 39dB(A), the night time level.

4. ACOUSTIC ASSESSMENT AND RECOMMENDATIONS

4.1. TRAFFIC NOISE GENERATION

Calculations were made based on the data obtained from Section 6.3 of the traffic report (Report by TRAFFIX ref: 08199v1-october 2008). The CORTN model (Calculation of Road Traffic Noise) was used to make predictions of noise levels with the additional traffic volume due to this development. Based on an increase of 12% on Water Street and 21% on Young Street over current volume, would result in an increase of 0.5dB and 0.8dB respectively. The increase is marginal and the levels are within the DECC ECRTN.

4.2. GLAZING REQUIREMENTS

Acoustic treatment of new developments by such means as acoustic glazing is sometimes required to reduce noise impacts on occupants and should result in noise levels within such units being in accordance with Ku-ring-gai Council requirements or relevant Australian Standards.

4.2.1. Glazing for Hospital Facility

Calculations were performed for all glazing on the potentially worst affected façades for road traffic noise levels. It was assumed that the performance of the wall would be STC/R_w 50 or better. The measured noise levels were adjusted to account for different receiver heights and distance attenuation.

[2] Recommended Acceptable L_{Aeq} noise level for residence in suburban areas from Table 2.1 in EPA Industrial Noise Policy

Table 6 show the minimum glazing requirements for this project to achieve the recommended internal sound level as specified in AS/NZS 2107:2000, assuming windows/doors are closed and mechanical ventilation/air-conditioning is running.

Table 6: Schedule of Window and Glazing

Building	Space	**Recommendations**		
		Glass Type	**Minimum Rw Rating for Glass Alone**	**Minimum Rw Rating for Glass+Frame**
Rippon Grange	Chapel	6 mm monolithic	31	28
	All others	4 mm monolithic	28	25
Main wing, west wing and east wing	All	4 mm monolithic	28	25

Note: Glazing thicknesses indicated above are the minimum thicknesses required to achieve the noise criteria. Glazing thicknesses may need to be increased for reasons of safety, fire, etc.

4.2.2. General Remarks

Glazing is generally the weakest component of any building façade where it would serve as a major noise transmission path, especially in cases where it has not been installed properly. Table 6 above provides the performance requirements for the fitted glass and aluminium frame to attenuate road traffic and general background noise.

All Windows/doors of this development should be well sealed (air tight) when closed with good seals such as **Q-LON**® acoustic seals (or equivalent) around the top and bottom sliders and also with other sliding door and fixed section. Any air gap will significantly reduce the performance of the glazing in terms of the ability to attenuate noise. All of the above assumed that the glass is properly sealed airtight. In the case of service rooms such as toilets, laundries, kitchens, gallery etc, a 4mm thick windows/glazing with minimum R_w of 28 is considered sufficient (without seals).

4.3. MECHANICAL SERVICES EQUIPMENT NOISE EMISSION

Noise emission from the proposed development such as roof top plant equipment, exhaust fans and the swimming pool would have to be controlled in accordance with EPA Industrial Noise Policy so that adjacent properties or developments will not be adversely affected.

At this stage, the design and selection of the mechanical equipment such as bathroom exhaust systems, air-conditioners, required to service the proposed development has not been finalised. A detailed analysis of noise emission to the surrounding properties from the plant equipment can be conducted at a later stage once this has been finalised.

Following the approval of the proposed DA, at Construction Certificate stage, detailed assessment of mechanical plant and equipment noise and their ameliorative measures can be conducted to ensure compliance with the project specific noise criteria.

In general, based on previous experience with similar size developments, a number of amelioration measures can be implemented to control the noise emission.

Typical amelioration measures are outlined below (not necessarily limited to):

- Construction of acoustic enclosures for plant equipment and acoustic louvres at ventilation openings;
- Location of plant equipment away from noise sensitive receivers;
- The extraction systems to be constructed such that the outlet is either shielded from the noise sensitive premises and/or is pointing in a direction at least 90 degrees away from the nearest residence.
- Achieving no direct 'line of sight' path between the nearest residence and all the major plant equipment and air conditioning and extraction systems.

4.4. SOUND TRANSMISSION BETWEEN PREMISES (BCA 2008)

It is necessary to safeguard future occupants from loss of amenity as a result of undue sound being transmitted between adjoining sole-occupancy premises and also from common spaces into sole-occupancy premises. Under the BCA 2008 Deemed to Satisfy sound insulation requirements for a class 9a health-care building, there is no minimum standard. Therefore, as a minimum, we would recommend the requirements of a 9c Aged Care Facilities. This is summarised in Table 7 and Table 8.

Table 7: Required R_w + Ctr to Achieve BCA 2008 Requirements for Separating Partitions

SEPARATING PARTITIONS	Minimum BCA 2008 Requirement
Walls between sole occupancy	Rw 45
Walls between sole occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room	Rw 45
Walls separating a sole occupancy units from a kitchen or laundry	Rw 45 & of discontinuous construction
Floors between sole occupancy units.	Rw 45

A waste pipe or other penetration that is embedded in or passes through a floor, serves or passes through more than one occupied space must be separated by construction of a partition with the Rw+ Ctr ratings specified in and Table 8.

Table 8: Required Measured Laboratory R_w to Achieve BCA 2008 R_w requirements for Services

SEPARATING PARTITIONS	Minimum BCA 2008 Requirement
(a) 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	
(i) if the adjacent room is a habitable room (other than a kitchen); or	$R_w + C_{tr}$ 40
(ii) if the room is a non-habitable room	$R_w + C_{tr}$ 25
(b) a storm water pipe passes through a sole occupancy unit	
(i) if the adjacent room is a habitable room (other than a kitchen); or	$R_w + C_{tr}$ 40
(ii) if the room is a non-habitable room	$R_w + C_{tr}$ 25

Note, according to the BCA 2008 requirements:

1. For the purpose of complying with the BCA 2008 sound insulation requirements, the Rw must be determined in accordance with AS/NZS 1276.1 or ISO 717.1, using results from laboratory measurements.

2. Discontinuous construction means a wall system having a minimum 20mm cavity between two separate leaves with:

- for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and
- for other than masonry, there is no mechanical linkage between leaves except at the periphery.

A staggered stud wall, which has a common top and bottom plate, is not considered to be discontinuous. Refer to glossary of acoustic terminology in Appendix B for definitions of the sound insulation ratings.

4.4.1. Sound Isolation of Pumps

A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating pump or other pump.

5. ACOUSTIC DETAIL DESIGN

At the design/construction certificate stage, we would recommend that acoustic consultants be engaged to review architectural and mechanical services drawings with the developer, architect and mechanical consultant.

Acoustic consultants provide details of noise mitigating construction and services to meet project acoustic requirements (Council requirements, Australian Standard AS 2107 etc.) for partitions, impact, riser ducts, waste pipes, hydraulics, lift noise and plant vibration isolation, including provision of relevant construction details. At the design stage, the construction detailing of junctions (e.g. wall/floor/roof/window/service penetrations) can be conducted to ensure acoustic integrity is upheld.

6. GUIDELINES FOR CONSTRUCTION NOISE

According to Section 171 of Environmental Noise Control Manual (ENCM), noise level restrictions depend upon the construction period. If the project is to be completed within 4 to 26 weeks, therefore;

"Construction noise should not exceed 10dB above the existing daytime background level assuming that the demolition/construction periods will occur up to 26 weeks."

The above noise criteria are applicable within the following construction hours:

- Monday to Friday: 7 am to 6 pm.
- Saturday:

  7 am to 1pm, if inaudible from the adjacent residences.

  8 am to 1pm, if audible from the adjacent residences.
- No construction work to take place on Sundays or Public Holidays.

Noise nuisance caused by construction noise is normally of short duration. If a noisy activity has to take place, which could affect the neighbouring properties, the neighbours should be warned particularly in regard to the duration of the activity.

7. ACOUSTIC COMPLIANCE TESTING

Upon the project completion, we recommend that compliance testing be conducted during representative periods; daytime and nighttime. Noise measurements shall be conducted inside the sensitive spaces in order to confirm satisfactory noise levels or identify the cause of any excessive noise inside these areas.

8. CONCLUSION

An acoustic assessment of the proposed development has been carried out in accordance with Ku-Ring-Gai Council requirements and the appropriate standards and guidelines set out in Australian Standard AS/NZS 2107:2000, BCA (2008) and Department of Environment and Climate Change (DECC) Industrial Noise Policy (INP) and Environmental Criteria for Road Traffic Noise (ECRTN).

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The traffic noise generation due to this development has been assessed using CORTN model. The increased noise level would be within the DECC ECRTN criteria.

Limiting criteria for mechanical plant/equipment noise emission have been determined based on general guidelines from the DECC Industrial Noise Policy (Section 3.3). Once the plant and equipment selection has been finalised, a separate acoustic assessment should be conducted such as at Construction Certificate Stage. At this later juncture the design and specification of the necessary treatments can be carried out to control the noise emission to ensure compliance with the criteria specified.

Provided the recommendations in this report are carried out, the proposed private hospital development is predicted to comply with the noise requirements of Ku-Ring-Gai Council and relevant Australian standards or guidelines.

APPENDIX A: ARCHITECTURAL DRAWINGS

The environmental assessment carried out in this Report was based on the following architectural drawings prepared by Tanner Architects, provided by Murlan Consulting Pty Ltd.

Drwg No.	Revision	Description
AR.DA.002	P10	Site & Roof Plan
AR.DA.004	P10	Rippon Grange & pool plans & elevations and sections
AR.DA.005	P10	Basement Floor Plan – B3
AR.DA.006	P10	Basement Floor Plan – B2
AR.DA.007	P10	Floor Plan – B1
AR.DA.008	P10	Floor Plan (Ground Level)
AR.DA.009	P10	Floor Plans
AR.DA.010	P10	Elevations & Section 1
AR.DA.011	P10	Elevations & Section 2
AR.DA.012	P10	Elevations & Sections – East Wing

APPENDIX B: GLOSSARY OF ACOUSTIC TERMS

Decibel, dB:

Unit of acoustic measurement. Measurements of power, pressure and intensity. Expressed in dB relative to standard reference levels.

dBA:

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Sound Pressure Level, L_p (dB), of a sound:

20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Sound Power Level, L_W (dB), of a source:

10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone. Sound power level does not change with distance. The sound power level of a machine may vary depending on the actual operating load.

Ambient Sound:

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.

Percentile Level - L_{90}, L_{10}, etc:

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. $\mathbf{L_{90}}$ is the level which is exceeded for 90% of a measurement period. $\mathbf{L_{90}}$ is commonly referred to as the **"background"** sound level.

$L_{AEQ,T}$:

Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

R_w – Weighted Sound Reduction Index:

A new single number quantity for airborne sound insulation rating which replaces STC. STC has been traditionally used for the classification of partitions and to define acoustical requirements in the Building Code of Australia.

For majority of partitions, the value for R_w will be similar to the value for STC. Partitions with particularly poor performance at 100Hz may have lower values for R_w than for STC. Conversely, partitions with poor performance at 4kHz may have higher values for R_w than for STC.

C_{tr} – Adaptation factor:

C_{tr} is a spectrum adaptation factor which has been chosen in the proposed new BCA to take into account lower frequency level sounds. For an airborne sound insulation, the C_{tr} factor and the R_w of building element will need to be considered. C_{tr} is a negative number which means that $R_w + C_{tr}$ of a building element will be less than the R_w of the building element. For example a wall system may have an R_w of 55 but would have an $R_w + C_{tr}$ of 50 if the C_{tr} value was –5.

Weighted Standardised Level Difference, $D_{nT,w}$:

A term used in combination with C_{tr} to describe the airborne sound insulation rating of a building element when tested on site. A higher $D_{nT,w}$ means a higher difference between the sound levels in the originating (source) room and the receiving room and thus a higher standard of insulation. The higher the $D_{ntw} + C_{tr}$ of a building element, the better the performance of the building element in terms of airborne sound insulation.

Weighted Normalised Impact Sound Level, $L'_{n,w}$:

A term used to describe the impact sound insulation of the floor. In the proposed new BCA, the use of parameter $L'_{n,w}$ plus spectrum adaptation term C_I will be used to quantify the floor impact sound insulation ratings. The lower the $L'_{n,w} + C_I$ of a floor, the better the performance of the floor in terms of impact sound insulation.

Weighted Standardised Impact Sound Level, $L'_{nT,w}$:

A term used in combination with a spectrum adaptation C_I to describe the impact sound insulation rating of a floor when tested on site. Similar to the $L'_{n,w}$, it measures adequateness of a floor in controlling impact sound.