

Report



DA ACOUSTIC ASSESSMENT

Hornsby Ku-Ring-Gai Chase Hospital - Stage 1 Redevelopment Health Infrastructure

CONFIDENTIAL

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1. EXECUTIVE SUMMARY

This report has been prepared to address the acoustic assessment for the Stage 1 redevelopment of the Hornsby Ku-Ring-Gai Chase Hospital.

The report discusses the findings of the unattended noise survey conducted to derive the external acoustic criteria in accordance with relevant statutory guidelines. This report also recommends criteria for:

- Traffic noise impact on noise sensitive location outside the site.
- Non-residential locations such as child care centres and churches.
- Noise impact from car park and loading dock activities.

Based on the assessment conducted in accordance with the criteria listed above, the following is addressed and / or recommended:

- In-principle acoustic recommendations are for mechanical services works related to the redevelopment (see Section 6).
- Aggregate limiting sound power and sound pressure levels for the stand-by generator. Also operational procedures for maintenance operations are also given.
- Aggregate limiting sound pressure levels for the substation.
- Assessment of traffic noise impact on external noise sensitive locations. It is found that noise levels generated by post-development traffic volumes will not exceed the recommended criteria.
- Assessment of car park noise levels at Burdett Street. Since the redeveloped car park will have a reduced number of spaces, it is found that the noise levels generated after the redevelopment will have a negligible impact.
- Assessment of car park noise levels at Gate 7. Based on the capacity and assumptions discussed in Section 6.5, it is found the generated noise levels will comply with the criteria.
- Operational procedures for loading dock activities.

Finally, it is our opinion that the acoustic treatment for the facilities which are addressed as part this DA assessment, can be implemented with conventional architectural components, operational methodologies and mitigation measures for mechanical services. Consequently compliance can be achieved with the criteria listed in Section 5 of this report.



2. BACKGROUND

2.1. Authorization

Authorization to conduct this project and prepare this report was provided by Matthew von Bertouch of Thinc on behalf of Health Infrastructure.

2.2. Background Information

The following project documentation has been used to conduct the DA acoustic assessment:

- Architectural drawing WH-AR-1002 (Revision A)
- Architectural drawing WH-AR-1221 to WH-AR-1227 (Revision A)
- Architectural drawing WH-AR-4001 and WH-AR-4002 (Revision A)
- Architectural drawing WH-AR-4101, WH-AR-4102 and WH-AR-4103 (Revision A)

2.3. Revision History

Rev.	Date Issued	Comment
1.0	17 th August 2012	DRAFT
2.0	5 th October 2012	For Comment
3.0	12 th November 2012	For Issue



3. INTRODUCTION

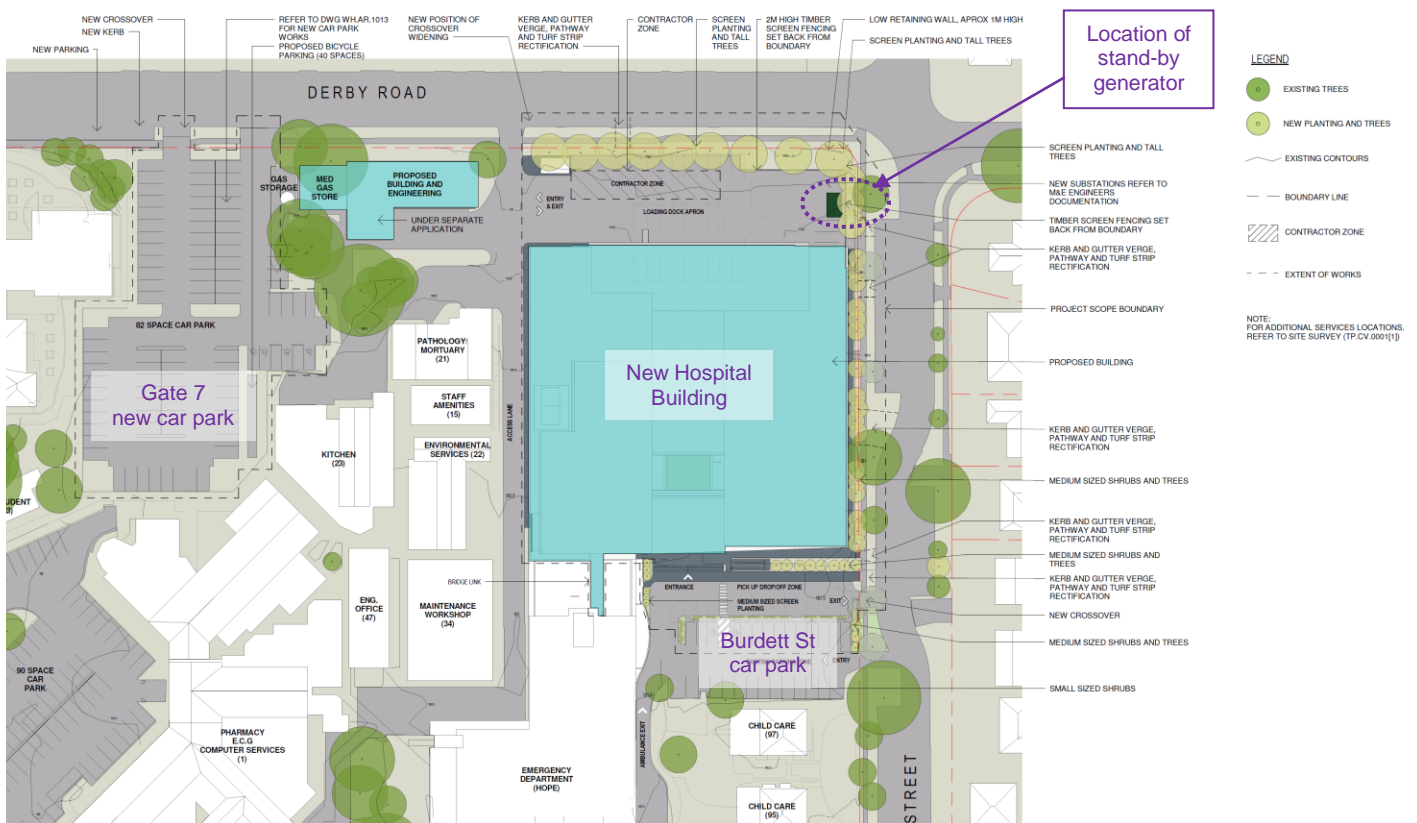
NDY has been engaged by Thinc on behalf of Health Infrastructure to conduct a DA acoustic assessment for the Stage 1 redevelopment of the Hornsby Ku-ring-gai Hospital.

The redevelopment works will be undertaken within the premises of the Hornsby Ku-ring-gai Hospital, along Derby Road and Burdett Street. The redevelopment will comprise the following:

- 82 new car park spaces at Gate 7
- 28 car park spaces between the new hospital building and the child care centre along Burdett Street. This represents a net loss of 15 car park spaces when compared to the existing car park capacity at this location.
- A new hospital building housing theatres, clinical services and clinical support. The building will comprise 5 levels.

Figure 3-1 shows the components of the Stage 1 redevelopment.

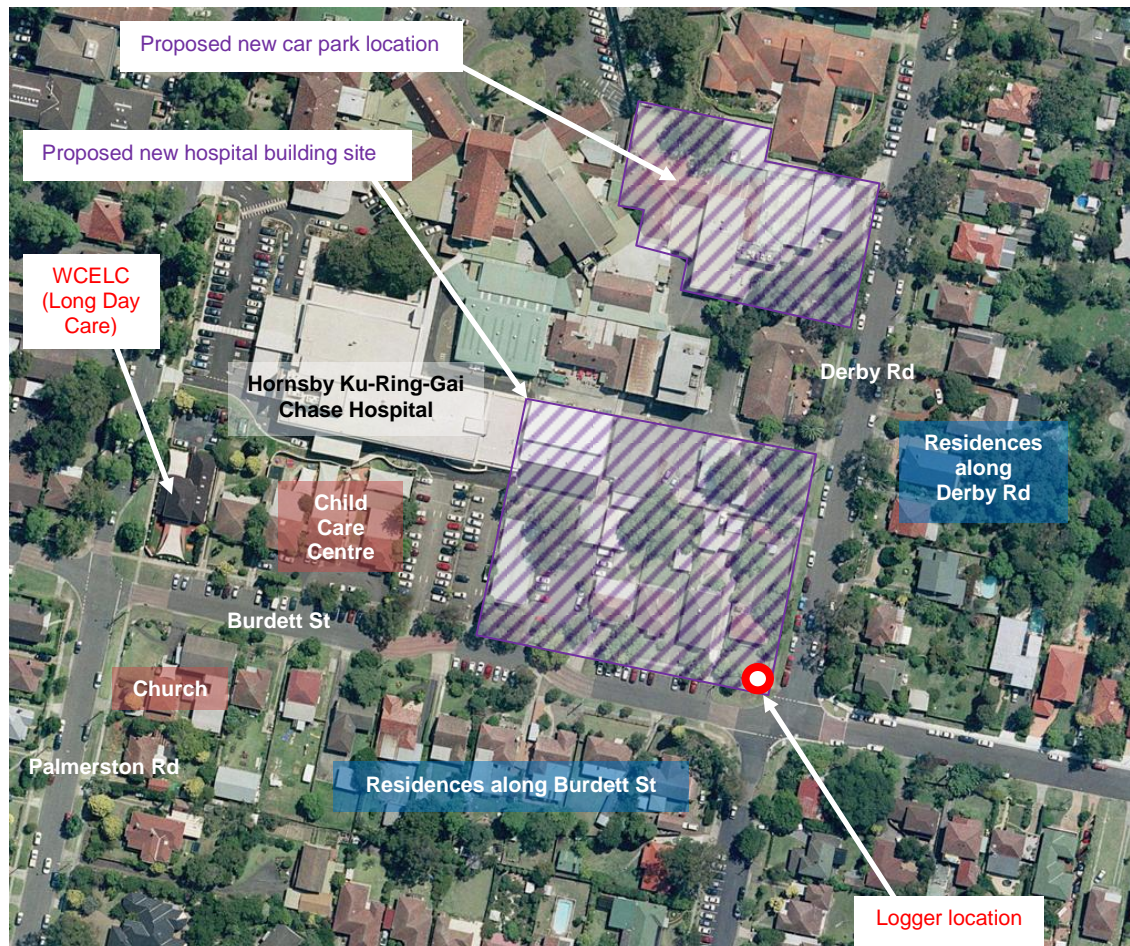
Figure 3-1: Stage 1 redevelopment (extract from architectural drawing WH-AR-1002, Revision A)





Residences are located opposite the proposed development on Derby Road and Burdett Street. These represent the most noise sensitive receivers, on which our acoustic assessment will be conducted. These are shown in Figure 3-2.

Figure 3-2: Location of noise sensitive receivers



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In addition to the residences, the following non-residential premises have been identified in the vicinity of the site (see Figure 3-2):

- A church located in the corner of Burdett Street and Palmerston Road.
- The Wairoongah Children's Early Learning Centre (WCELC) also situated on the corner of Burdett Street and Palmerston Road.
- A child care centre managed by the Hornsby Ku-Ring-Gai Hospital, which is located along Burdett Street.

The acoustic assessment discussed in this report also considers these non-residential locations.



4. ACOUSTIC SURVEY

4.1. Methodology

Unattended noise measurements were conducted to determine the existing ambient noise levels for the area. Noise measurements were taken for a period of 1 week from the 1st August 2012 until the 8th August 2012. The location of the noise logger is shown as *Logger location* in Figure 3-2.

The equipment used to conduct these unattended measurements was an Acoustic Research Laboratories NL-42EX Rion logger (serial number 00521658). The equipment calibration was checked prior to, and after the noise survey. The noise monitor was configured to record all relevant noise indices including background noise (LA90) and equivalent continuous noise levels LAeq. Samples were recorded at 15 minute intervals. The noise monitor responses were set to *fast*.

4.2. Weather Data

In order to verify that noise data was obtained during suitable meteorological conditions, weather data was obtained from the Bureau of Meteorology (BOM). Rain and wind speed data was used from the Terry Hills meteorological site (ID 60900) as representative of the site.

Noise data has been excluded from the results if:

- Rain was observed during the fifteen minute noise measurement period and/or
- Wind speed exceeded 5 m/s at the measurement height of 1.5m above ground. Wind data obtained from the BOM is presented as the value at 10m above ground, and the measured values are halved for the purpose of assessing wind speed at 1.5 m above ground.

4.3. Measured Noise Levels

For the purpose of assessment, the measured data was processed into time the NSW INP periods as follows¹:

- Daytime: 0700 to 1800 hrs
- Evening: 1800 to 2200 hrs
- Night-time: 2200 to 0700 hrs

The measured background (LA90) and equivalent continuous (LAeq) noise levels during these defined time periods are presented in Table 4-1.

The LA90 noise levels presented are *Rating Background Levels* (RBLs), being the median of the lowest 10th percentile of the background LA90 samples in each daytime, evening and night-time measurement period, for each 24 hour period during the noise survey.

The LAeq noise levels presented are the logarithmic average of all the LAeq samples taken in each of the daytime, evening and night-time periods.

¹ Sundays and bank holidays are adjusted by extending the night-time period to 0800 hrs as per the NSW INP.



Table 4-1 Unattended measured noise levels – Logger Location

Noise Index	Noise Level dB re 20 μ Pa		
	Daytime 0700 to 1800	Evening 1800 to 2200	Night-time 2200 to 0700
LA90 (RBL)	43	43 ¹	38
LAeq	57	54	50

Note: 1. Evening background noise levels were marginally higher than day time levels. The evening levels have been adjusted to that of the daytime as per procedures discussed in the NSW INP

A summary of the noise logging data is provided in Appendix A.



5. ACOUSTIC CRITERIA

5.1. External Noise Level Criteria

Based on the unattended noise survey discussed in Section 4 of this report, the external noise level criteria for nearest residences have been derived in accordance with the NSW Industrial Noise Policy (NSW INP). This was issued by NSW Environmental Protection Authority which is now part of the NSW Office of Environment and Heritage.

The NSW INP provides assessment methodologies, criteria and detailed information on the assessment of stationary mechanical plant items in NSW.

The NSW INP criteria for industrial noise sources consider two (2) components:

- Controlling **intrusive** noise impacts for residential receivers. Assessing intrusiveness generally requires noise measurements to quantify background (L_{A90}) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source(s) under consideration should be controlled to within 5 dB of the background noise level.
- Maintaining noise **amenity** for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use to industrial-type noise. The cumulative effect of noise from industrial sources needs to be considered. The existing noise level from industrial sources is measured. If it approaches the amenity value for the land use, noise levels from new industrial-type noise sources need to be controlled so that the cumulative effect does not result in aggregate noise levels that would significantly exceed the criterion.

Nearby noise sensitive receivers are considered to be *suburban* according to the definitions in the NSW INP for the purposes of assessing the amenity criteria. Refer to Appendix B for the weekly graph distribution of measured noise levels.

Therefore, the project external noise level criteria for residences have been derived from the unattended measured noise levels discussed in Section 4. The criteria are shown in Table 5-1.

Table 5-1: External noise level criteria - Residential properties

Type of Receiver	Noise Level dB re 20 μ Pa		
	Daytime 0700 to 1800	Evening 1800 to 2200	Night-time 2200 to 0700
Intrusiveness Assessment $L_{Aeq,15min}$			
Residential Premises	48	48	43
Amenity Assessment $L_{Aeq,period}$			
Residential Premises	47	44	40

For receivers other than residences, we recommend the amenity criteria discussed in the NSW INP as per the Application Notes for this policy. These criteria are listed in the table below.



Table 5-2: External noise level criteria – Non-Residential receivers

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level dB	
			Acceptable	Recommended Maximum
Commercial premises	All	When in use	65	70
Hospital ward – Internal	All	Noisiest 1 hour period	35	40
Hospital ward – External	All	Noisiest 1 hour period	50	55
Places of worship - Internal	All	Noisiest 1 hour period when in use	35	40

For the purpose of this assessment:

- The criteria corresponding to the receiver types listed in the table above, should apply at those identified in Section 3 of this report.

On the assumption that the existing building facades offer an external to internal noise reduction of 15 dB (with the weakest facade component assumed to be commercial quality glazing, no operable panes, with 6 mm glass), the corresponding external noise level at the facade of buildings is the internal noise level listed in Table 5-2, plus 15 dB. Should compliance testing be undertaken, measurements should be undertaken within the affected building(s) and measured results assessed against the recommended internal noise level.

5.1.1. Emergency Equipment Maintenance and Testing

For noise events which occur for a period of less than two and a half hours in any 24 hour period, (such as maintenance operations for the stand-by generators), the predicted noise levels related to these short term events can be decreased by the modifying factors listed in Table 5-3.

Table 5-3: Modifying factors for duration

Duration of Noise Event	Modifying Factors	
	Day time and evening (0700 to 2200)	Night-time (2200 to 0700)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
Less than 1.5 minutes	20	10

These factors should apply to the predicted noise level from these short term events before comparison with the NSW INP criteria in Table 5-1 and Table 5-2.



5.2. Guideline for Child Care Centres – Acoustic Assessment

An external noise level criteria suitable for the child care centre and WCELC, are provided in the Guideline for Child Care Centre - Acoustic Assessment by the Association of Australian Acoustical Consultants (AAAC).

In Section 7 of this guideline, the following is recommended for the noise level $L_{eq}(1 \text{ hour})$ generated by road traffic, rail traffic or industry:

- It should not exceed 55 dBA at the outdoor play or activity area,
- It should not exceed 40 dBA at the indoor play or sleeping areas.

These criteria apply during the hours the centre is operating.

5.3. The State Environmental Planning Policy (Infrastructure) 2007 (SEPP 2007)

5.3.1. Noise and Vibration from Rail Corridors

Clause 87 of the SEPP 2007 requires that the potential impact of rail noise and vibration should be considered for several development types which includes hospitals.

Hence, in order to provide guidelines for this type of assessment the Department of Planning of the NSW Government has prepared a document called Developments Near Rail Corridors and Busy Roads – Interim Guideline (DNRCBR-IG).

Section 3.5.1. of the DNRCBR-IG discusses the level of assessment that is required based on distance from the rail corridor. These are summarised in Figure 5-1 and Figure 5-2.

For developments located within Zone A, a full impact assessment is required. For single dwelling residences located within Zone B, standard mitigation measures apply.

The nearest rail corridor to the development is the North Shore and Western Line. This is at approximately 965 m from the site. Consequently, based on this distance, it is concluded that no rail noise and vibration assessment is required.

Figure 5-1: Summary on the application of rail noise assessment (extract from DNRCBR-IG, Section 3.5.1)

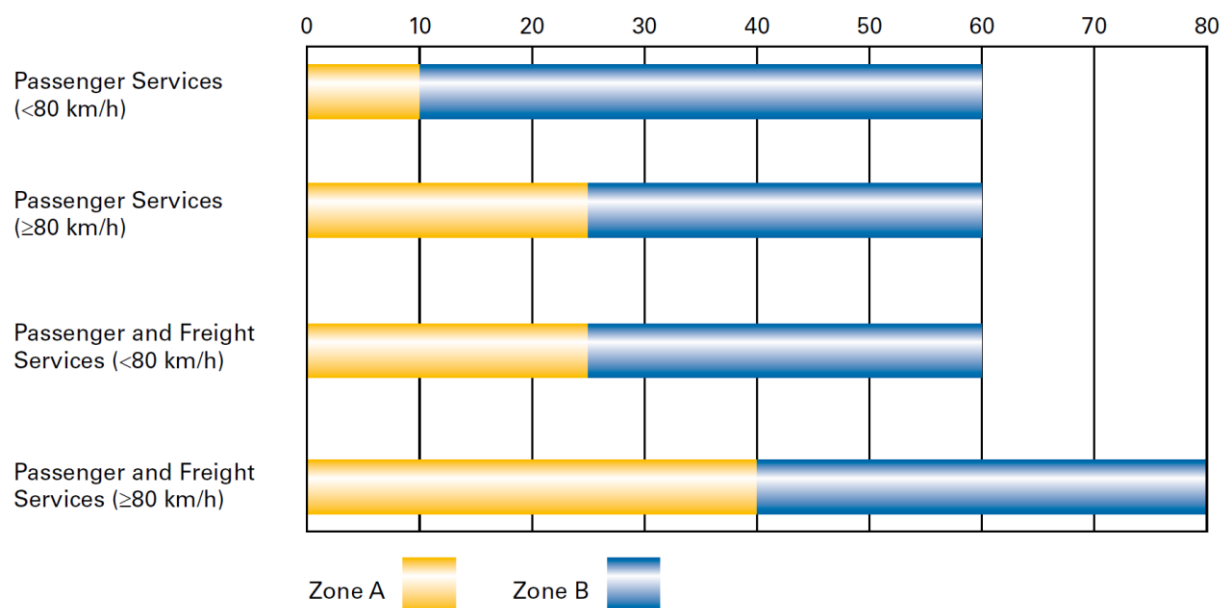


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)



Figure 5-2: Summary on the application of rail vibration assessment (extract from DNRCBR-IG, Section 3.5.1)

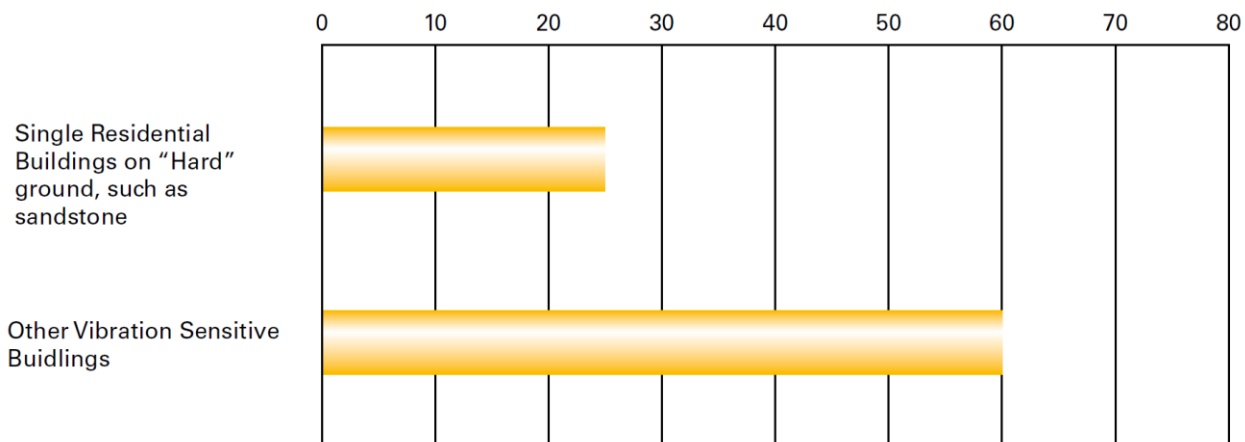


Figure 3.2: Distance from the nearest operational track (m)

5.3.2. Noise and Vibration from Road Corridor

Clause 102 of the SEPP 2007 requires that the potential impact of road noise and vibration should be considered for several development types which includes hospitals. A development should be assessed if the nearby road is a freeway, tollway or a transit way or has an annual average daily traffic volume (AADT) of more than 40,000 vehicles (based on the traffic volume data available on the website of the RTA).

The latest traffic volume information available (which corresponds to 2005), for the Sydney-Newcastle F3 Freeway (which is nearest major road corridor), indicates that the AADT is 76,649.

Hence, a "screen test" should be conducted in accordance with the DNRCBR-IG to determine whether a full acoustic assessment is required. Figure 5-3 summarises such "screen test" procedure. This corresponds to residential flat building and other sensitive developments (i.e. hospitals).



Figure 5-3: Screen test for other sensitive developments – 100/110 km/hr (extract from DNRCBR-IG, Section 3.5.2)

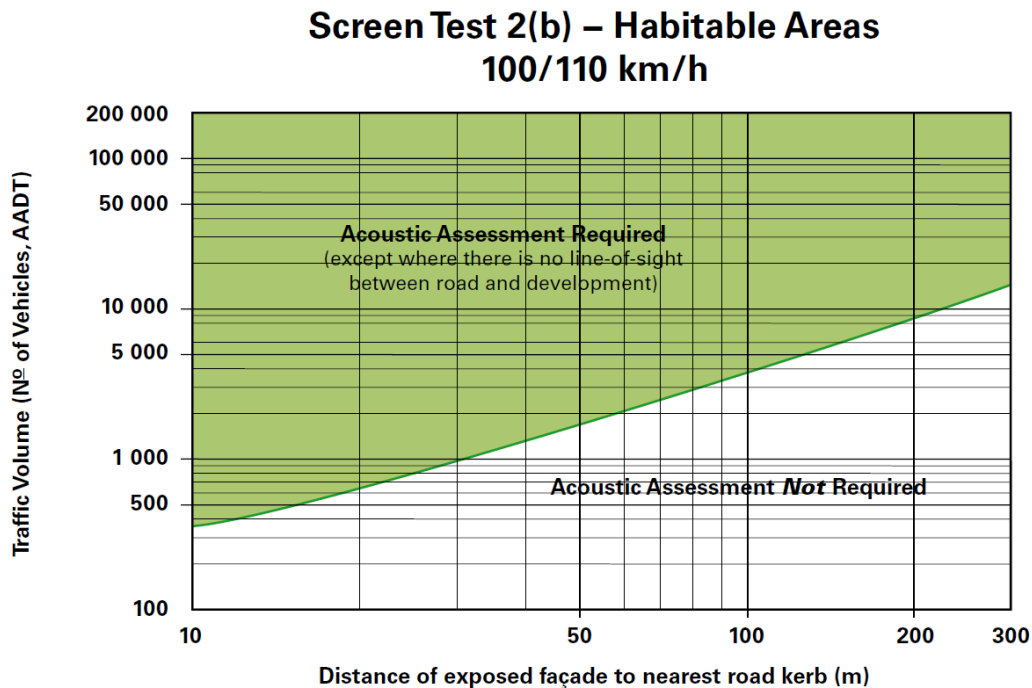


Figure 3.4(b): Screen tests for habitable areas of multiple dwellings (noting that any exposed façade is direct line-of-sight)

The Sydney-Newcastle F3 Freeway is located at approximately 420 m from the development. Therefore, by extrapolating the information shown in Figure 5-3 to account for the AADT indicated above, it is determined that an acoustic assessment is required for noise and vibration from the freeway provided that there is line-of-sight between the freeway and the development. From site inspections and noise measurements obtained on site, it is found that there is no such line-of-sight, and consequently it is concluded that no detailed acoustic assessment is required.

5.4. Traffic Noise Criteria

Traffic noise impacts on the nearby residential dwellings should satisfy the conditions discussed in the *NSW Road Noise Policy* (NSW RNP) issued by the NSW Office of Environment and Heritage.

Section 3.4 of the NSW RNP states the following:

*“For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use developments**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.*

Consequently, for this development, an increase in traffic noise levels related to the new development should be limited to a maximum of 2 dB.

5.5. Noise Impact from Car Park and Loading Dock Activities

Traffic movements in the proposed new car park and loading dock will be assessed against the NSW INP. As such, the noise level criteria as discussed in Section 5.1 will be used in the assessment. These criteria are applied in this way because the parking conditions will change and a holistic view of the entire site in this manner is appropriate and provides a conservative assessment.



6. ACOUSTIC ASSESSMENT

6.1. Mechanical Services

Detailed noise information for mechanical services in the new hospital building is not available at this stage. Hence, NDY Sound has used typical noise data of common plant items to predict the environmental noise emission from the site to the nearest noise sensitive receivers. These comprise:

- Existing hospital buildings to the north and west of the site.
- Residences as identified in Section 3 of this report.

Assessing the worst case scenario the shortest offset distance between the mechanical plant and the receivers is approximately:

- 17 m to existing hospital buildings located north from the site.
- 27 m to residences across Burdett Street.
- 42 m to residences across Derby Road.

The existing emergency department (Hope building) is immediately adjacent to the new building, approximately 12 m from the proposed mechanical plant in Level 5.

In order to achieve the environmental noise emission criteria (see Table 5-1 and Table 5-2) the development should achieve the following limiting aggregate sound power levels:

- 80 dB L_{WA} from cooling tower(s) on Level 5.
- 70 dB L_{WA} from all the plant rooms.

The limiting aggregate sound power levels for the plant, is the summation of the emitting sound power level contributions from all mechanical plant items in each plant room or plant area. These plant items include chillers, cooling towers, pumps, fans, AHUs, boilers, condensers and outdoor split units.

In order to achieve the recommended limiting sound power levels, the following in principle measures will need to be considered during the detailed design stage:

- The mechanical plant items should be fully contained in plant rooms whose walls achieve a minimum weighted sound reduction index of 45 dB R_w. Plant rooms should not be accessible from outside the building. Consequently, ornamental louvres are not recommended in these plant rooms; instead the following measures should be considered:
 - All external air intakes and exhausts should be fully ducted to the relevant plant item (i.e. AHU, FCU or fan). These ducted components should include internally lined ductwork (typically with minimum 50 mm insulation), whose extent should be recommended at a detailed design stage. Wherever possible these intakes and exhausts should aim away from nearest affected receivers.
 - Only relief air paths should have openings through the external plant room walls provided that these include acoustic louvres. It is also recommended that these air openings be installed in the plant room roof.
- All plant room walls and roofs should be internally lined with insulation which achieves a minimum NRC rating of 0.8. Insulation should have a perforated metal facing with more than 20 % perforated area, or woven cloth facing.
- All plant room construction should be fully sealed (air tight), fully closed and free of gaps.



- Install internally lined return air / outside air mixed boxes behind AHUs.
- Install silencers on external air inlets or outlets (especially for fans).
- Implement variable speed drive units whenever possible.
- In the open roof compartment where cooling towers will be located, the walls should be constructed from acoustic louvres (i.e. ornamental louvres are not acceptable). Wall heights should extend as a minimum to the top of the cooling towers (height to be confirmed at a detailed design stage).
- The use of “quiet” or low noise cooling towers.
- Limit the number of operating mechanical plant items (including cooling towers), or reduce operational loads between 6 pm and 7 am.

6.2. Stand-by Generator

The acoustic design of the stand-by generator room should comply with the following conditions, to satisfy with NSW INP criteria detailed in Section 5.1:

- The maximum permissible aggregate sound power level for the generator enclosure should not exceed 75 dBA, AND
- The overall sound pressure level contribution at 10 m from the generator enclosure (under free field conditions) should not exceed 47 dBA.

The aggregate sound power level should include (but not be limited to) the sound power level contributions of the exhaust system, air inlet, air outlets, and noise break-out from the plant enclosure walls, doors and roof.

Likewise, the overall sound pressure level from the plant enclosure at 10 m should include (but not be limited to) the noise contributions generated by the exhaust system, air inlet, air outlets; as well as the noise break-out from the plant enclosure walls, doors and roof.

Any maintenance operation for the stand-by generators should comply with the following conditions:

- Maintenance operations should only be conducted between 7 am and 6 pm.
- Each maintenance operation should only be undertaken for a maximum period of 1 hour.
- Only one maintenance operation can be conducted in any 24 hour period.

6.3. Substations

The aggregate sound pressure levels for the substations should not exceed 55 dBA at 1 m from the equipment.

6.4. Traffic Noise Impact

Peak hourly traffic volumes for AM and PM periods, are listed in the traffic report prepared by Taylor Thomson Whitting titled *“Transport Assessment Report Hornsby Ku-Ring-Gai Hospital Redevelopment – Stage 1 Traffic / Transport Engineering Schematic Design Report”*, issue V5, dated 21st September 2012. These traffic volumes are included for pre-development and post-development scenarios for the major “collector” roads (i.e. Palmerston Road, Burdett Street, Edgeworth David Avenue, Burdett Street, Northcote Road).

In order to prevent an increment in traffic noise on local roads by 2 dB, it is recommended that the traffic volume generated due to operational activities related to the development should be limited to a 60% growth on the “collector” roads.



From the traffic report we found that the predicted additional peak hourly traffic volume is less than the recommended 60% growth. As a result it is predicted that the post development traffic noise levels will not increase by 2 dB. Consequently compliance will be achieved with the recommended criteria.

6.5. Car Park Noise

The redeveloped car park coming off Burdett Street will have a reduced number of car parking spaces available compared to the existing premises. Therefore it is expected the noise levels related to the new car park will be lower than those corresponding to the existing scenario. As a result the noise impact from the new car park will be negligible.

Section 3.4 of the traffic report states the new car park on Gate 7 will have a capacity of 82 car park spaces. Considering this new car park will be used by staff, outpatients and visitors; and based on the parking demand for Stage 1 redevelopment (as discussed in Section 3.3 of the traffic report), the following is assumed:

- 61 spaces will be allocated to staff. Staff will typically arrive or depart from the car park during morning and afternoon peak hours (i.e. 7 am to 9 am in the morning, 4 pm to 6 pm in the afternoon).
- 11 spaces will be used by outpatients. As stated in the traffic report, it is assumed that outpatients will stay for 2 hours. These occurrences will take place during a period of 8 hours which is assumed to be typical opening hours between 7 am and 6 pm.
- 10 spaces will be assigned to visitors. These spaces will be typically occupied for an average period of 1 hour, between 7 am and 6 pm.

Based on these assumptions, it is predicted that the noise generated by the new car park will comply with the criteria recommended in Section 5.5 of this report.

6.6. Loading Dock

In Section 4.7.1 of the traffic report, the following is mentioned in regards to the services vehicles:

“A total of some 25 truck movements could occur within a day (about 15 during the morning period and 10 in the afternoon). Approximately 10 to 15 other deliveries also occur throughout the day using vans, smaller trucks for couriers and other services”.

Based on this traffic volume and in order to achieve the criteria discussed in Section 5.5, the following operational procedures are recommended for trucks and trucks with trailers:

- The loading dock should only operate between 7 am and 6 pm
- Only one arrival or departure event is recommended every 15 minutes.

For any vehicle using the loading dock (including smaller trucks and vans) the following procedures are also advised:

- Engines should be switched off when vehicles are parked in the loading dock.
- No air conditioning or ancillary systems should operate when vehicles are parked in the loading dock.



7. CONCLUSIONS

It is our opinion that the acoustic treatment discussed in Section 6 of this report are feasible and can be implemented with conventional architectural components, construction methods, operational methodologies, and noise control measures.

Provided that at a detailed design stage the acoustic recommendations discussed in this report are considered and developed further, it is our opinion that compliance will be achieved with the acoustic criteria addressed in Section 5 of this report.



8. APPENDIX A: MEASURED NOISE LEVELS

