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Wagga Wagga Car Park Project

Noise Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged by Health Infrastructure to undertake an assessment of noise and vibration likely to be associated with a proposed Carpark Project (WWHCP) development located 260-280 Edward Street, Wagga Wagga, NSW

In this report, we will:

- Identify nearby noise sensitive receivers and anticipated operational noise sources with the potential to adversely impact nearby development.
- Identify relevant Council and EPA acoustic criteria applicable to the development.
- Predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to ensure ongoing compliance with noise emission goals.

In addition, the report will include an in-principle review of construction noise and vibration.

2 SITE DESCRIPTION AND PROPOSED WORKS

The proposal includes the construction of the following three new car parks as part of the WWBH development project:

- Multi Storey Car Park (MSCP) at the northern end of the site
- Docker car park at the western end of the site
- Yathong car park at the southern end of the site.

A six level multi storey carpark (MSCP) is proposed at the existing CP2/CP3 location to the south of the proposed UNSW Medical School. The entry and exit to the MSCP would be separated and directly from Lewis Drive. The entry is aligned adjacent to the exit from CP4 and the drop off area to provide direct access for those users to proceed into the MSCP easily should parking not be available in CP4. The MSCP is proposed to include 358 parking spaces .The Yathong Street car park is proposed to include 74 spaces and the Docker Street car park is proposed to have 159 spaces. The acoustic design of the carparks covered in this report is based on the Architectural concept and feasibility design drawings prepared by Jacobs Architects, GTA Consultants (NSW) Pty Ltd report. Noise sensitive development in the vicinity of the site consists of:

- Residential development at:
    - Residential properties and the Motor Inn Hotel to the east of the multi-storey car park along Yabtree Street
    - Residential properties on Docker Street to the west and Rawson Lane to the south of the two on-grade car parks.

The multi-storey car park is proposed to be naturally ventilated and as such the external walls to the car park are perforated / open (and not solid/imperforate sheeting). The figure below details the layout of the car parks

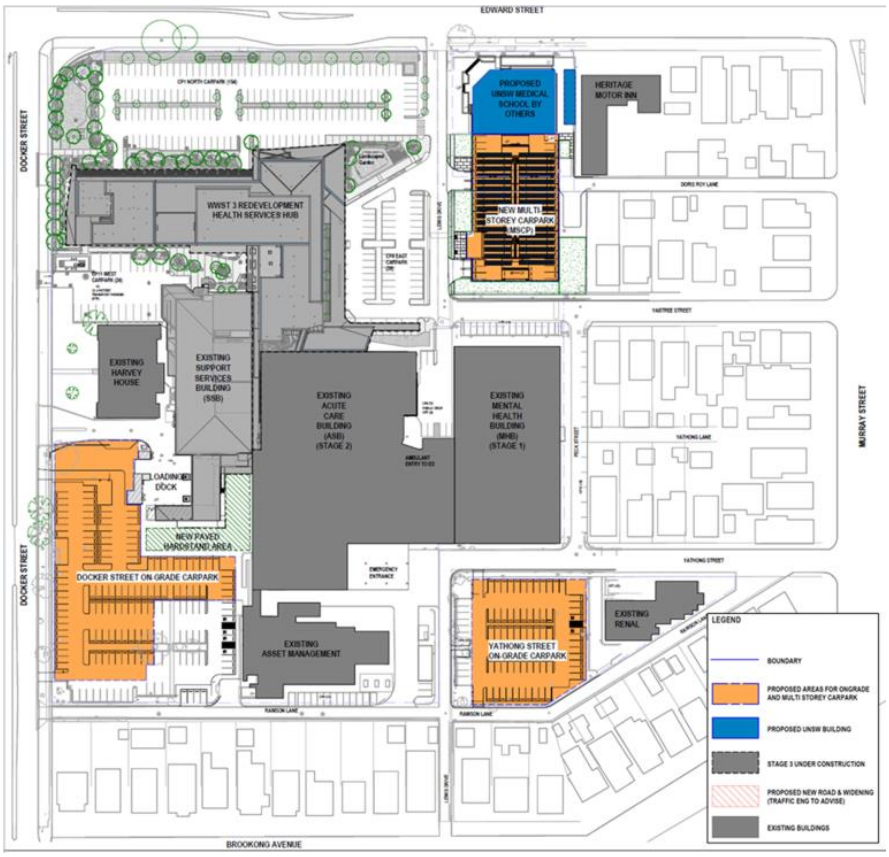

Figure 1 – MSCP and On-Grade Car Parks

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 SURVEY OF AMBIENT NOISE

The existing acoustic environment around the prosed development was conducted by this office between the 6th – 12th October 2015 at the residential property located at 1 Yathong Street, and between the 15th – 22nd May 2018 at 32 Docker Street.

These levels have been presented within the approved SSDA report Wagga Wagga Base Hospital – Stage 3 Redevelopment Acoustic Logic report, number 20180392.1/2103A/R2/YK, dated 21 March 2018. This data has ben utilised as it has been approved as part of the SSDA for the project as a whole, and supplementary attended measurements have confirmed these background noise levels to be accurate.

Table 1 – Long Term Noise Logging Data

Location	Time of Day		
	Daytime (7am-6pm)	**Evening (6pm-10pm)**	**Night (10pm-7am)**
1 Yathong Street	50dB($AL_{eq(15min)}$) 45dB(A)L_{90}	48dB($AL_{eq(15min)}$) 41dB(A)L_{90}	45dB($AL_{eq(15min)}$) 36dB(A)L_{90}
32 Docker Street	67dB($AL_{eq(15min)}$) 53dB(A)L_{90}	65dB($AL_{eq(15min)}$) 47dB(A)L_{90}	59dB($AL_{eq(15min)}$) 41dB(A)L_{90}

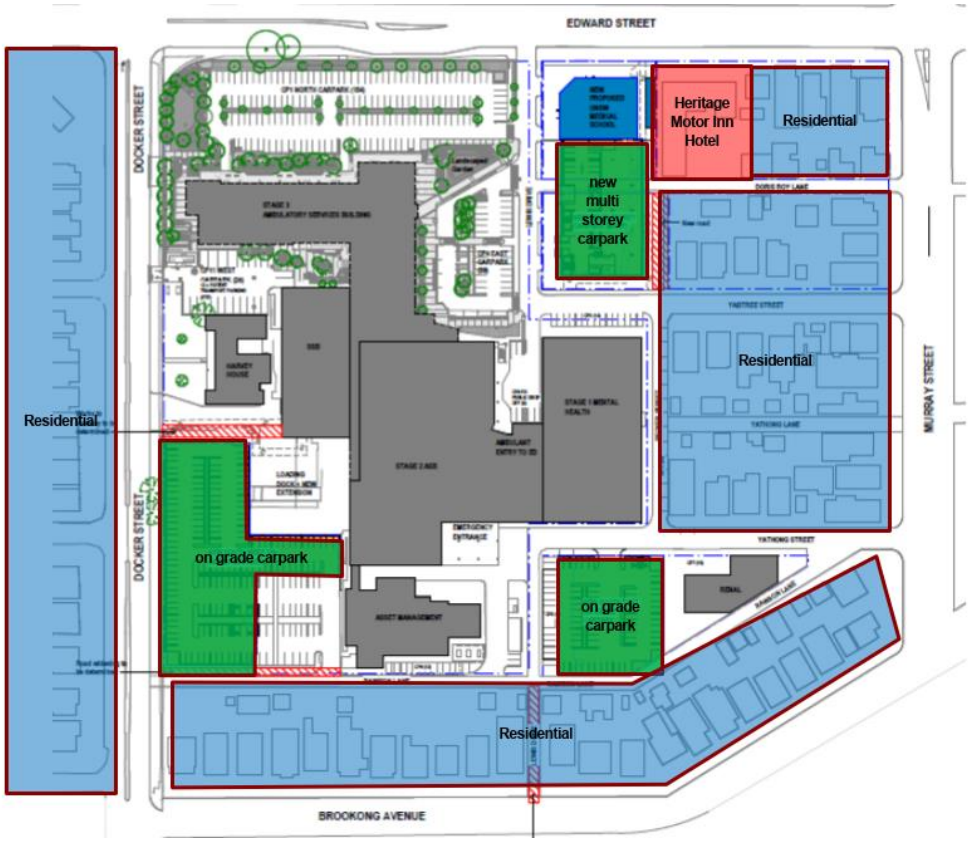

Figure 2 – Locations of adjacent properties and car parks

5 NOISE EMISSION CRITERIA

The following noise controls and guidelines are applicable to the site:

- Environmental Protection Authority (EPA) Noise Policy for Industry
- EPA Road Noise Policy.
- Construction noise and vibration will be reviewed with reference to:
    - EPA Interim Construction Noise Guidelines.
    - Assessing Vibration – A technical guideline.

5.1 EPA NOISE POLICY FOR INDUSTRY

The EPA Noise Policy for Industry is used in the assessment of operational noise, but not construction noise. The Industrial Noise Policy has two sets of criteria that must be reviewed - the Intrusiveness and the Amenity criteria.

5.2 NPFI - INTRUSIVENESS ASSESSMENT

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels and is used in the assessment of noise impacts on residential noise receivers.

The criteria are as follow:

Table 2 - EPA Intrusiveness Criteria

Location	Time of Day	Background noise Level - dB(A)L_{90}	Project intrusiveness noise level dB(A)$L_{eq(15min)}$ (Background + 5dB)
Yathong Street Properties and Motor Inn	Day Time (7am - 6pm)	45	50
	Evening (6pm - 10pm)	41	46
	Night (10pm - 7am)	36	41
Docker Street	Day Time (7am - 6pm)	53	58
	Evening (6pm - 10pm)	47	52
	Night (10pm - 7am)	41	46

5.2.1 NPFI - Amenity Assessment

The Amenity criteria set additional criteria based on the land use of the noise sensitive receivers.

Amenity criteria are as follows:

Table 3-EPA Amenity Criteria

Receiver Location	Time of Day	Project amenity noise level dB(A)$L_{eq(15\ min)}$
All Potentially Affected Residential Properties	Day Time (7am – 6pm)	53
	Evening (6pm – 10pm)	48
	Night (10pm-7am)	43

5.2.2 NPFI – Project Triger Noise Levels

Table 4 EPA Project Trigger Noise Levels

Location	Time of Day	Project intrusiveness noise level	Project amenity noise level	Project Trigger Noise Level dB(A)$L_{eq(15\ min)}$
Yathong Street Properties and Motor Inn	Day Time (7am - 6pm)	**50**	53	**50**
	Evening (6pm - 10pm)	**46**	48	**46**
	Night (10pm - 7am)	**41**	43	**41**
Docker Street	Day Time (7am - 6pm)	58	**53**	**53**
	Evening (6pm - 10pm)	52	**48**	**48**
	Night (10pm - 7am)	46	**43**	**43**

5.3 SLEEP AROUSAL ASSESSMENT

An assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy:

For the research on sleep disturbance to date it can be concluded that:

- *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.*
- *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

55dB(A) L_{max} has been adopted for the purposes of this assessment as per the EPA Road Noise Policy guidelines

5.4 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA Road Noise Policy.

Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 5- Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Local Roads	Day (7am to 10pm)	55dB(A)$L_{eq(1hr)}$
	Night (10pm to 7am)	50dB(A)$L_{eq(1hr)}$

However, if existing noise levels exceed those in the table above, section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible.

5.5 CONSTRUCTION NOISE AND VIBRATION IMPACTS

5.5.1 EPA Interim Construction Noise Guidelines

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than:
    - 10dB(A)$L_{eq(15min)}$for work during standard construction hours (7am-6pm Monday to Friday and 8am to 1pm on Saturdays) and

- 5dB(A)$L_{eq(15min)}$for work outside of standard construction hours.

- "*Highly noise affected level*". Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of noise emission goals for both standard hours of construction and outside standard hours are presented.

Table 6– Construction Noise Emission Goals

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residences	55 (Standard Construction Hours)	75
Hospital Wards	45 (internal noise level)	N/A

5.5.2 Construction Vibration

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels are presented below:

Table 7– Construction Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Hospital – Ward Areas	When in Use	0.28	0.56
Hospital – Operating Theatre/Precision Laboratories	When in Use	0.14	0.28
Commercial	When in Use	0.56	1.1
Impulsive Vibration			
Residences	Daytime	8.6	17
Hospital – Ward Areas	When in Use	2.8	5.6
Hospital – Operating Theatre/Precision Laboratories	When in Use	0.14	0.28
Commercial	When in Use	18	36

6 NOISE EMISSION ASSESSMENT

An assessment of operational noise emissions is presented. The following noise sources are assessed:

- Noise from cars circulating within the car park building (average noise emissions).
- Noise from cars starting/doors closing (peak noise events/sleep disturbance analysis).
- Noise created on public roads and on local roads as a result of traffic generated by the site.
- A preliminary assessment of noise from mechanical plant. We note the plant will be minor as the MSCP is proposed to be naturally ventilated.
- A discussion of construction noise will be presented.

6.1 NOISE FROM THE MSCP AND ON -GRADE CAR PARKS

Noise generated within the car park building is assessed with reference to the EPA Industrial Noise Policy.

Noise emission predictions are based on the following data/assumptions:

- The primary noise created by the car park is from cars circulating. The primary means of noise egress is via the building façade, which is open to enable natural ventilation of the car park.
- Vehicle numbers for both the MSCP and on grade car parks are based on the traffic report from GTA Consultants.
- Typical sound power of a car circulating within the car park (5-10km/h) is assumed to be 84dB(A)L_{eq}.
- No noise reduction has been assumed for the perforated / open cladding proposed to the exterior of the building.
- All predicted noise emissions are based on the implementation of treatments within Section 7

Table 8 - MSCP - Night
(Peak Hour Assessment)

Receiver Location	Noise Source	Predicted Noise Level – dB(A)$L_{eq(15min)}$	Acoustic Criteria Night dB(A)$L_{eq(15\ min)}$	Complies?
Yathong Street / Doris Roy Lane Properties and Motor Inn	Cars entering and manoeuvring within the car park/parking	41dB(A)L_{eq}	41dB(A) $L_{eq(15\ min}$	Yes

Note: The night period noise level criterion has been used as this is the most stringent

Table 9 – On-Grade Car Parks - Night (Peak Hour Assessment)

Receiver Location	Noise Source	Predicted Noise Level – dB(A)$L_{eq(15min)}$	Acoustic Criteria Night dB(A)$L_{eq(15\ min)}$	Complies?
Docker Street	Cars entering manoeuvring within the car park/parking	38dB(A)L_{eq}	43dB(A) $L_{eq(15\ min}$	Yes
Rawson Lane	Cars entering manoeuvring within the car park/parking	39dB(A)L_{eq}	43dB(A) $L_{eq(15\ min}$	Yes

Note: The night period noise level criterion has been used as this is the most stringent

6.2 NOISE GENERATED BY ADDITIONAL TRAFFIC ON PUBLIC ROADS

Noise created as a result an increase in traffic on public roads is assessed with reference to the EPA Road Noise Policy.

Access to the MSCP will be provided via Lewis Drive, allowing for all movements in and out of the car park. The Docker Street car park will be accessed via two new separate entry and exit driveways on Docker Street, with entry via the northern access and exit via the southern access. Access to the Docker Street car park will be restricted to left-in/ left-out. Yathong Street will provide entry to the Yathong car park while Rawson Lane will accommodate the exit under a left-out only arrangement, with both located in the same location as the existing accesses to the car park. The MSCP is primarily used for patients and visitors and the Yathong and Docker Street car parks are generally used by staff. Vehicle numbers for both the MSCP and on grade car parks are based on the traffic report from GTA Consultants.

Predicted noise levels are as follows:

Table 10– Noise Generated by Additional Road Traffic

Time of Day	Permissible Noise Level dB(A)	Predicted Noise Level – dB(A)L_{eq}	Complies
Night (10pm to 7am)	50dB(A)$L_{eq(1hr)}$	<50dB(A)$L_{eq(1hr)}$	Complies

6.3 TRANSIENT NOISE EVENTS (SLEEP AROUSAL)

Noise events occurring between 10pm and 7am should be assessed for potential sleep disturbance impacts on nearby residents.

The primary potential noise source will therefore be from predominantly staff passenger vehicles (cars starting/doors closing). The MSCP is primarily used by patients and visitors. Noise from tyre squeal, cars driving over speed bumps, using boom gates and similar is capable of being eliminated through appropriate design and equipment selection, and is discussed in section 7.

The transient noise assessment will be assessed is based on the following assumptions:

- The loudest typical peak noise event from the use of the car park will be from a car door closing or a car starting, both with an approximate sound power level of approximately 95dB(A)L_{max}
- When predicting noise impacts from the car start/door close, predictions are made of the noise from the parking space closest to each of the respective noise receivers.

Noise emissions are assessed against Road Noise Policy Sleep Disturbance guidelines, as presented below.

Table 11 Sleep Arousal Assessment

Noise Source	Noise Receiver Location	Predicted Noise Level	Sleep disturbance criterion (internal)	Compliance
Car start/door close	Yathong Street	50dB(A) L_{max}	55dB(A) L_{max}	Complies
	Docker Street	48dB(A) L_{max}	55dB(A) L_{max}	Complies
	Rawson Lane	49dB(A) L_{max}	55dB(A) L_{max}	Complies

6.5 NOISE FROM MECHANICAL PLANT

No mechanical equipment is proposed for the on-grade car parks. Given that the MSCP is proposed to be natural ventilated, there would be very little by way of mechanical plant that would be anticipated:

- Ventilation equipment would be limited to small toilet exhaust fans which could be acoustically treated, if necessary.

- Appropriate equipment selection with respect to boom gates should be utilised to minimise any motor noise or metal on metal impact noise.

Through appropriate equipment selection and, if necessary acoustic treatment, compliance with EPA Industrial Noise Policy noise emission guidelines can be achieved.

6.6 CONSTRUCTION IMPACTS

6.6.1 Construction Noise

With respect to general construction noise, the impacts on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. Excavation and piling works tend to be the loudest typical construction activity.

Detailed acoustic assessment of individual activities cannot be undertaken prior to knowing the activities/construction methods proposed, their duration and location.

However, based on Initial analysis:

- Excavation/soil retention phase - Primary noise emissions occur during excavation and piling, with some equipment items having sound power levels of approximately 115dB(A)$L_{eq(15min)}$. Noise levels exceeding EPA "Noise Affected" target levels are likely to occur

- Given the proximity of the residential land uses to the site, exceedances of the Highly Noise Affected level are likely to intermittently occur, particularly during excavation and vibrated piling (however auger piling is unlikely to exceed the 75dB(A) "Highly Noise Affected" level.

- During erection of structure, it is the use of hand tools (saws, angle grinders etc for formwork), concrete pumps and slab finishing equipment which are the loudest typical activity (sound power levels of approximately 105dB(A)$L_{eq(15min)}$). Noise levels exceeding EPA "Noise Affected" levels are likely to occur. Exceedances of the "Highly Noise Affected" level are unlikely for extended periods except in close proximity to concrete trucks.

Construction noise impacts can be minimised using the following:

- Use of augured rather than driven or vibratory piling should be considered if feasible.

- Location of static plant (concrete pumps, cranes) as far as practicable away from the boundaries to maximise the distance to the residences.

- Use of electric as oppose to diesel cranes should be adopted if practicable. In the event that diesel cranes are proposed, it is likely that acoustic treatment of the crane engine will be required.

- Letter box drops or similar to advise residents on activities with the potential to result in noise levels reaching the "Highly Noise Affected" noise level (rock excavation within 20m of property boundary). Leaflet should advise of the likely duration of the activity.

In light of the above, we recommend:

- On completion of the construction program, acoustic review of proposed construction activities and plant/methods should be undertaken to identify the extent and duration of potential exceedances of EPA construction noise management levels. While there is certainly risk of exceedances of EPA construction noise guidelines, given the limited extent of demolition and excavation, the degree of noise impact during construction would be less than typical development of similar size that also has a basement.

- Identify feasible acoustic controls or management techniques (for example, selection of plant, use of screens around static plant, notification of adjoining land users, respite periods) when exceedance of management noise levels may occur.

- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

- Implementation of a noise monitoring program during construction to provide feedback back to the Builder to ascertain whether construction noise goals are being exceeded and determine additional management strategies.

Through adoption of the above, noise impacts on nearby development can be managed to prevent unreasonable impact.

7 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls to minimise noise generation:

- Polished concrete surface or similar must be avoided in the car park to prevent tyre squeal. Broom or float finish or other similar finishes should be adopted.

- Speed limit in the car park itself to be limited to 10km/h to minimise noise generation. Below 10km/h, the primary noise source will be from the car engine, as opposed to tyre on road noise, and so provided that vehicle speeds are controlled, there will be little additional benefit in selecting road finishes to further reduce noise.

- The car park pavement shall be smooth and level to ensure minimal vertical displacement and potential for noise generated by wheel to concrete impacts.

- Speed humps, if used, should either be concrete or plastic type, and should be fixed/installed to avoid any impact noise generated when cars drive over them.

- Noise absorptive lining should be installed to the underside of the slab soffit over the eastern natural ventilation openings within the façade. This treatment should extend 2100mm back from the façade slab edge. The absorptive material is to be 50mm thick Echosoft or similar material with NRC no less than 0.8. The impact barrier on the eastern façade is to be at least 900mm above the slab edge and is required to be imperforate (solid, no openings).

- Where proposed, acoustic review of any boom-gate or inter-com system at the car park entry should be conducted at detailed design stage.

- Grates and any cover plates are to be fixed flush and tight.

- A detailed construction noise and vibration management plan should be undertaken following preparation of the construction program. Review of the mitigation techniques outlined in section 6.8 of this report should be done, and implemented where feasible.

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8 CONCLUSION

Noise emissions associated with the proposed Carpark Project (WWHCP) development located 260-280 Edward Street, Wagga Wagga, NSW have been assessed with reference to relevant EPA and Council acoustic guidelines.

Provided that the recommendations presented in Section 7 of this report are adopted, noise emissions from the operation of the site will comply with acoustic criteria.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Thomas Aubusson