

Appendix A

Acoustic Assessment (Herring Storer Acoustics)



BUNBURY FORUM SHOPPING CENTRE EXTENSION

ENVIRONMENTAL ACOUSTIC ASSESSMENT FOR DA SUBMISSION

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1. INTRODUCTION

Herring Storer Acoustics were commissioned by NS Projects on behalf of Challenger Management Services Ltd to undertake an acoustic assessment for the extension of the Bunbury Forum Shopping Centre.

The objective of this study was to review noise emissions from the proposed development, to the surrounding premises to determine whether compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997* could be achieved. From information received, we believe that the extension will include cafés and restaurants, with alfresco areas. Therefore, this report not only considers noise emission from mechanical services and trucks with loading docks, but also patron noise associated with the cafés / restaurants.

The assessment has been based on the drawings provided and used for the Development Application submission.

2. SUMMARY

Noise emissions associated with the extension of the Bunbury Forum Shopping Centre will be able to achieve compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

The preliminary assessment of the mechanical services shows that noise emissions would comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*, provided screening towards the residences is included in the design. During the design stage of the project, once the design of the mechanical services has been undertaken and equipment selected a noise assessment of the mechanical services will be undertaken.

Noise emissions from delivery vehicles within loading docks will also be assessed during the design stage. From preliminary modelling, noise emissions from this source would be able to comply with the Regulatory requirements, provided the large refrigerated delivery trucks are limited to the day and evening periods.

Finally, noise emissions from the cafés and restaurants would comply with the Regulatory requirements, provided the first floor alfresco areas are screened from the neighbouring residences. The requirements of the barrier will be included in the design to ensure compliance is achieved.

3. CRITERIA

3.1 ENVIRONMENTAL PROTECTION (NOISE) REGULATIONS 1997

The *Environmental Protection (Noise) Regulations 1997* stipulate the allowable noise levels at any noise sensitive premises from other premises. For noise sensitive premises, the allowable noise level is determined by the calculation of an influencing factor, which is added to the baseline criteria set out in Table 1 of the Regulations. The baseline assigned noise levels are listed in Table 3.1. For commercial premises, the assigned noise levels are fixed, as listed in Table 3.1.

TABLE 3.1 – ASSIGNED NOISE LEVELS

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _{A 10}	L _{A 1}	L _{A max}
Noise sensitive premises within 15 metres of a dwelling (Highly Sensitive Areas)	0700 - 1900 hours Monday to Saturday	45 + IF	55 + IF	65 + IF
	0900 - 1900 hours Sunday and Public Holidays	40 + IF	50 + IF	65 + IF
	1900 - 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35 + IF	45 + IF	55 + IF
Commercial Premises	Any Time	60	75	80

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
 The L_{A1} noise level is the noise that is exceeded for 1% of the time.
 The L_{Amax} noise level is the maximum noise level recorded.

It is a requirement that noise from the site be free of annoying characteristics (tonality, modulation and impulsiveness) at other premises, defined below as per Regulation 9.

“impulsiveness” means a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax Slow} is more than 15dB when determined for a single representative event;

“modulation” means a variation in the emission of noise that –

- (a) is more than 3dB L_{A Fast} or is more than 3dB L_{A Fast} in any one-third octave band;
- (b) is present for more at least 10% of the representative assessment period; and
- (c) is regular, cyclic and audible;

“tonality” means the presence in the noise emission of tonal characteristics where the difference between –

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as L_{Aeq,T} levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as L_{A Slow} levels.

Where the above characteristics are present and cannot be practicably removed, the following adjustments are made to the measured or predicted level at other premises.

TABLE 3.2 – ADJUSTMENTS FOR ANNOYING CHARACTERISTICS

Where tonality is present	Where modulation is present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB

The influencing factor at the existing neighbouring residential premises located across Pennant and Strickland Street has been determined to be between +2 and +4. Thus, the assigned noise levels would be as listed in Table 3.3. For information, the neighbouring residence of concern are indicated on Figure F1 below.

TABLE 3.3 - ASSIGNED OUTDOOR NOISE LEVEL - NEIGHBOURING RESIDENCE

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _A 10	L _A 1	L _A max
Noise sensitive premises	0700 - 1900 hours Monday to Saturday	47 - 49	57 - 59	67 - 69
	0900 - 1900 hours Sunday and Public Holidays	42 - 44	52 - 54	67 - 69
	1900 - 2200 hours all days	42 - 44	52 - 54	57 - 59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	37 - 39	47 - 49	57 - 59

Note: L_A10 is the noise level exceeded for 10% of the time.
 L_A1 is the noise level exceeded for 1% of the time.
 L_Amax is the maximum noise level.



FIGURE F1 – NEIGHBOURING PREMISES OF CONCERN

Note: Receiver location 10 is opposite the outdoor alfresco area.

4. MODELLING

To assess the noise that would be received at the neighbouring residences from the noise emissions associated with the extension of the Bunbury Forum Shopping Centre, noise modelling was undertaken using the noise modelling program SoundPlan.

It is noted that the extension to the shopping centre is the development of a new section located in the western portion of the existing shopping centre.

To determine the noise received at the neighbouring premises, noise modelling was undertaken for the following scenarios :

- Mechanical services;
- Delivery Vehicles; and
- Patrons associated with cafes and restaurants.

Additionally, modelling was undertaken generally in accordance with the *EPA Draft Guidance for Assessment of Environmental Factors No. 8 – Environmental Noise*, including worst case down wind conditions as shown in Table 4.1.

TABLE 4.1 – EPA METEOROLOGICAL CONDITIONS

Type	Day Time
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	4
Wind Direction	Downwind
Temperature Inversion	Pasquil Stability Factor E

Calculations were based on the noise levels for the mechanical services, as summarised in Table 4.2. The sound power levels for the delivery trucks are listed in Table 4.3.

TABLE 4.2 – MECHANICAL SERVICES SOUND POWER LEVELS

Item	Noise Level, dB(A)
Compressors	4 @ 89
Air Handling Units	4 @ 81
Air Conditioning Unit	8 @ 72
Exhaust Systems	8 @ 83
Refrigeration	4 @ 82

TABLE 4.3 – DELIVERY TRUCKS SOUND POWER LEVELS

Item of Equipment	Sound Power Level, (dB(A))
Fixed axle truck	89
Small Refrigerated Truck	84

For the patronage of the café and restaurant, the noise emissions have been based on the voice level of 60 dB(A), with one person per square metre. This is a conservative assessment as not all persons speak at the same time.

The use of the delivery dock is understood to accommodate 19m articulated delivery trucks, and have been assumed to be refrigerated trucks (i.e worst case scenario). In addition to the larger deliveries a bakery delivery occurring between 5am and 7am each morning has been assumed to be a 13m rigid truck.

It is noted that the area leading to the delivery dock is a road, hence noise emissions only need to be considered when the delivery trucks are actually contained within the loading dock itself. Outside of this space the trucks are in a public area and therefore compliance with the Regulations are not applicable and hence have not been considered.

Notes :

- 1 For the noise to be less than 10% of the time and be assessed under the L_{A1} assigned noise levels, the truck engines and refrigeration units would need to be turned off while unloading is occurring.
- 2 Although it is unlikely that deliveries using large refrigerated trucks would occur at the specialty shop loading docks, however, to be conservative, the noise modelling and assessment includes the noise received at the neighbouring residences from these large delivery trucks.
- 3 From the information provided, it is understood that the Woolworths and the northern specialty loading docks is underneath part of the car park / plant and also have a barrier wall along the western or northern boundaries. Thus, the Woolworths loading dock is basically shielded from the residence to the west, with the northern speciality loading dock barriered to the residences to the north.
- 4 Results of preliminary modelling indicated that without a barrier to the western side of the loading dock to the Mini Major, noise received at the neighbouring residences from the refrigerated trucks could exceed the assigned noise levels at all times. Thus, the noise modelling and assessment, include a barrier to this loading dock.
- 5 The mechanical services will be screened from the neighbouring residences and the noise modelling and assessment include such screening.
- 6 With regards to the outdoor alfresco areas, we note that a barrier will be required to the first floor outdoor alfresco areas associated with the entertainment premises.

We note that during the night period, some items of plant would not be operating or not operating at full capacity, while others have night period, low noise modes. Thus, during the night period, noise emissions from the proposed extensions have been determined to be 4 dB(A) lower than for the day period.

5. RESULTS

Calculations were undertaken to residences likely to be affected by the extension of the shopping centre, as outlined in the Section – Criteria. However, to simplify the assessment, only the calculated noise level at worst case locations for the groups of residences (ie worst case for the different assigned noise levels) have been used in the assessment.

The resultant noise levels at the worst case locations are listed in Table 5.1.

TABLE 5.1 – CALCULATED NOISE LEVELS

Location	Calculated Noise Level (dB(A))				
	Mechanical Services		Refrigerated Truck	Small Delivery	Patrons
	Day / Evening	Night			
R1	33 (38)	29 (34)	37 (42)	28 (33)	10
R2	35 (40)	31 (36)	40 (45)	34 (39)	11
R3	36 (41)	32 (37)	45 (50)	38 (43)	11
R4	37 (42)	33 (38)	41 (46)	34 (39)	12
R5	37 (42)	33 (38)	37 (42)	26 (31)	21
R6	37 (42)	33 (38)	40 (45)	22 (27)	24
R7	36 (41)	32 (37)	42 (47)	22 (27)	29
R8	36 (41)	32 (37)	43 (48)	27 (32)	30
R9	35 (40)	31 (36)	45 (50)	33 (38)	34
R10	34 (39)	30 (35)	42 (47)	29 (34)	39

() Includes +5 dB(A) penalty for tonal component.

Note: Noise received at the existing neighbouring noise sensitive premises from mechanical services and trucks could be tonal, thus, a +5 dB(A) penalty has been applied to the calculated noise levels. Noise emissions from voices is broadband and does not contain any annoying characteristics.

Noise emissions from the mechanical services and patron noise would occur for more than 10% of the time. Thus, noise emissions associated with these sources needs to comply with the assigned L_{A10} noise level. However, noise emissions associated with truck deliveries would be present for less than 10% of the time. Therefore, noise from deliveries needs to comply with the Assigned L_{A1} noise levels.

Tables 5.2 to 5.4 compares the calculated noise levels for the L_{A10} noise sources, being the mechanical services and patron noise, with the assigned noise levels.

Note : The following assessment include the appropriate adjustments for penalties.

TABLE 5.2 – ASSESSMENT OF MECHANICAL SERVICES NOISE LEVEL EMISSIONS

Location	Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L _{A10} Noise Level (dB)	Level of compliance (dB)
R1	38	Day	47	Complies
	38	Evening Sunday / Public Holiday	42	Complies
	34	Night	37	Complies
R2	40	Day	47	Complies
	40	Evening Sunday / Public Holiday	42	Complies
	36	Night	37	Complies
R3	41	Day	48	Complies
	41	Evening Sunday / Public Holiday	43	Complies
	37	Night	38	Complies
R4	42	Day	48	Complies
	42	Evening Sunday / Public Holiday	43	Complies
	38	Night	38	Complies
R5	42	Day	48	Complies
	42	Evening Sunday / Public Holiday	43	Complies
	38	Night	38	Complies
R6	42	Day	49	Complies
	42	Evening Sunday / Public Holiday	44	Complies
	38	Night	39	Complies
R7	41	Day	49	Complies
	41	Evening Sunday / Public Holiday	44	Complies
	37	Night	39	Complies
R8	41	Day	49	Complies
	41	Evening Sunday / Public Holiday	44	Complies
	37	Night	39	Complies
R9	40	Day	49	Complies
	40	Evening Sunday / Public Holiday	44	Complies
	36	Night	39	Complies
R10	39	Day	49	Complies
	39	Evening Sunday / Public Holiday	44	Complies
	35	Night	39	Complies

TABLE 5.3 – ASSESSMENT OF PATRON NOISE LEVEL EMISSIONS

Location	Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L _{A10} Noise Level (dB)	Level of compliance (dB)
R1	10	Day	47	Complies
		Evening Sunday / Public Holiday	42	Complies
		Night	37	Complies
R2	11	Day	47	Complies
		Evening Sunday / Public Holiday	42	Complies
		Night	37	Complies
R3	11	Day	48	Complies
		Evening Sunday / Public Holiday	43	Complies
		Night	38	Complies
R4	12	Day	48	Complies
		Evening Sunday / Public Holiday	43	Complies
		Night	38	Complies
R5	21	Day	48	Complies
		Evening Sunday / Public Holiday	43	Complies
		Night	38	Complies
R6	24	Day	49	Complies
		Evening Sunday / Public Holiday	44	Complies
		Night	39	Complies
R7	29	Day	49	Complies
		Evening Sunday / Public Holiday	44	Complies
		Night	39	Complies
R8	30	Day	49	Complies
		Evening Sunday / Public Holiday	44	Complies
		Night	39	Complies
R9	34	Day	49	Complies
		Evening Sunday / Public Holiday	44	Complies
		Night	39	Complies
R10	39	Day	49	Complies
		Evening Sunday / Public Holiday	44	Complies
		Night	39	Complies

Tables 5.4 and 5.5 compares the calculated noise levels for the L_{A1} noise sources , being the delivery trucks with the critical assigned noise levels.

TABLE 5.4 – ASSESSMENT OF REFRIGERATED TRUCKS NOISE LEVEL EMISSIONS

Location	Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L _{A1} Noise Level (dB)	Level of compliance (dB)
R1	42	Day	57	Complies
		Evening Sunday / Public Holiday	52	Complies
		Night	47	Complies
R2	45	Day	57	Complies
		Evening Sunday / Public Holiday	52	Complies
		Night	47	Complies
R3	50	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	+2
R4	46	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	Complies
R5	42	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	Complies
R6	45	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R7	47	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R8	48	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R9	50	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	+2
R10	47	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies

TABLE 5.5 – ASSESSMENT OF SMALL TRUCKS NOISE LEVEL EMISSIONS

Location	Noise Level, dB(A)	Applicable Times of Day	Applicable Assigned L _{A1} Noise Level (dB)	Level of compliance (dB)
R1	33	Day	57	Complies
		Evening Sunday / Public Holiday	52	Complies
		Night	47	Complies
R2	39	Day	57	Complies
		Evening Sunday / Public Holiday	52	Complies
		Night	47	Complies
R3	43	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	Complies
R4	39	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	Complies
R5	31	Day	58	Complies
		Evening Sunday / Public Holiday	53	Complies
		Night	48	Complies
R6	27	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R7	27	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R8	32	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R9	38	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies
R10	34	Day	59	Complies
		Evening Sunday / Public Holiday	54	Complies
		Night	49	Complies

From the above assessment, noise emissions from the mechanical services and small fixed axle delivery trucks would comply with the Regulatory requirements at all times. However, it is noted that noise emissions from the mechanical services will need to be mitigated and an assessment will need to be undertaken of the final design to ensure that that compliance is achieved.

Noise emissions from small fixed axle delivery vehicles will comply with the Regulatory requirements at all times. However, even with the construction of the barrier wall to the north of the new loading dock, deliveries using large delivery vehicles would need to be limited to the day (including Sundays and Public Holidays) and evening periods.

Finally, noise emissions from the cafés and restaurants would comply with the Regulatory requirements, provided the first floor alfresco areas are screened from the neighbouring residences. The requirements of the barrier will be included in the design to ensure compliance is achieved.

Based on the above assessment, noise received at the neighbouring residences from the shopping centre extension would be deemed to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*.