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CRG Acoustics Pty Ltd ACN 151 847 255
In association with CRG Traffic Pty Ltd

ACOUSTICAL CONSULTANTS

4 September 2013

CRGref: 10330a RFI Letter 4_09_2013

Azzura International Constructions,
Shop 8, Corner Fern Street 7 Gold Coast Highway,
SURFERS PARADISE QLD 4217

RE: RESPONSE TO REQUEST FOR FURTHER INFORMATION PROPOSED DEVELOPMETN APPLICATION, TOURIST ACCOMODATION, KIRKWOOD ROAD, TWEED HEADS

Thank you for your request for CRG to provide comments regarding acoustical issues raised in the Tweed Shire Council Request for Further Information dated 22nd March 2013. We have reviewed the RFI, and offer the following comments:

1.0 Aircraft Noise

Item 1 of Tweed Shire Council's Information Request relates to aircraft noise and is as follows:

> **1. Aircraft Noise**
>
> As per the requirements of the Environmental Noise Impact Report for Lot 1 DP 1168904 prepared by CRG Acoustics Pty Ltd dated 24 July 2012 (crgref: 10330a report.rev.1), to ensure that the indoor noise criterion at noise sensitive habitable rooms of the proposed buildings can be achieved, additional noise measurements carried out by a qualified acoustic consultant are required in accordance with Australian Standard AS2021 (with measurements conducted in 1/3 octave bands) and additional modelling of the proposed building shells completed.
>
> The additional noise modelling will require obtaining NATA certified sound transmission loss data in 1/3 octave bands from building material suppliers so direct assessment with the measured aircraft noise results in 1/3 octave bands can be undertaken to ensure the required sound transmission loss is achieved.
>
> Specific design proposals for the development based on the above shall be provided to Council for review and approval prior to determination of the development application.

Attended octave band measurements of aircraft over flights were conducted with a Larson Davis (Type 1) 1/3 Octave Band Sound Level Meter on Tuesday 30/07/2013, Wednesday 31/07/2013 and Thursday 1/08/2013 at the northern end of the subject site. Refer to Attachment A at the rear of this letter for an aerial image showing the monitoring location.

Outdoor measurements were conducted generally in accordance *with* Australian Standard AS2021 – 2000 *"Acoustic – Aircraft noise intrusion – Building siting and construction"*.

Measurements were conducted in *"A"* weight, *"Slow"* response with the meter in a free-field location approximately 1.5m above ground.

Weather conditions during the survey periods were fine and clear with winds less than 5m/s.

It is noted that due to the prevailing winds on Tuesday 30/07/2013, Wednesday 31/07/2013 and Thursday 1/08/2013 the Gold Coast Airport was using Runway 14, which resulted in aircrafts landing from the north with take-offs towards the south. Aircraft landing from the north did not pass over the subject site.

The measured aircraft take-offs on Runway 14, the arithmetic average of the take-offs and the calculated Aircraft Noise Reduction (ANR) are presented in Table 1 below.

Aircraft Information	Measured Aircraft OverfFlight L_{Amax} "Slow"Response dB(A) 1/3 Octave Band Levels																		
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	AP
1st August 2013																			
Jetstar Take-off, Runway 14, JQ403, 9:19am	49	58	55	60	61	63	62	69	70	67	67	67	67	75	63	60	56	51	78
Jetstar Take-off, Runway 14, JQ433, 9:24am	57	61	60	63	68	65	67	69	70	69	69	69	68	67	66	63	58	53	78
Qantas Take-off, Runway 14, QF861, 9:29am	60	65	67	67	71	69	70	72	72	71	71	70	69	69	66	64	60	54	81
Virgin Take-off, Runway 14, VA512, 9:32am	57	64	60	66	67	69	69	69	68	68	68	68	69	67	64	62	57	49	79
30th July 2013																			
Virgin Take-off, Runway 14, VA726, 7:25am	58	67	68	65	70	70	71	71	69	68	70	69	69	71	66	64	59	52	80
Virgin Take-off Runway 14, VA504, 8:30am	55	62	68	64	69	71	71	73	72	70	70	70	70	69	67	64	61	55	81
Jetstar Take-off, Runway 14, JQ403, 8:56am	51	61	63	61	63	64	65	68	71	68	69	68	69	69	65	62	58	55	78
Virgin Take-off Runway 14, VA512, 9:17am	56	66	69	65	68	70	70	69	69	69	69	69	68	68	65	62	59	51	79
Qantas Take-off, Runway 14, QF861, 9:22am	57	65	69	65	69	72	71	70	70	70	70	70	69	68	66	65	61	54	80
29th July 2013																			
Jetstar Take-off, Runway 14, JQ413, 4:01pm	47	57	59	59	60	63	65	66	71	67	69	67	66	74	63	61	60	53	77
Jetstar Take-off, Runway 14, JQ731, 4:20pm	58	59	61	60	62	62	64	67	72	69	68	68	68	77	65	63	60	56	79
Tiger Take-off, Runway 14, TT975, 4:40pm	45	55	57	60	56	59	62	63	62	64	64	62	63	72	60	55	53	41	75
Jetstar Take-off, Runway 14, JQ451, 4:56pm	49	60	62	60	62	64	64	68	72	68	69	68	69	75	65	63	60	54	78
Virgin Take-off Runway 14, VA536, 5:10pm	57	65	68	65	68	68	70	69	69	68	69	69	68	68	65	63	60	51	79
Jetstar Take-off Runway 14, JQ964, 5:15pm	44	51	54	55	55	59	59	62	63	65	64	64	62	71	59	54	49	40	74
	Averaged Aircraft Over Flight L_{Amax} "Slow"Response dB(A) 1/3 Octave Band Levels																		
Arithmetic Average of Aircraft Take-offs	**53**	**61**	**63**	**62**	**65**	**66**	**67**	**68**	**69**	**68**	**68**	**68**	**68**	**71**	**64**	**62**	**58**	**51**	**78**
Adopted Internal Noise Limits	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**50**
Required Aircraft Noise Reduction (ANR) for Bedrooms and Dedicated Lounges	**16**	**24**	**25**	**25**	**27**	**28**	**29**	**31**	**32**	**31**	**31**	**30**	**30**	**33**	**27**	**24**	**21**	**14**	**28**
Required Aircraft Noise Reduction (ANR) for Other Habitbale Spaces	**11**	**19**	**20**	**20**	**22**	**23**	**24**	**26**	**27**	**26**	**26**	**25**	**25**	**28**	**22**	**19**	**16**	**9**	**23**
Required Aircraft Noise Reduction (ANR) for Bathrooms, Toilets and Laundries	**6**	**14**	**15**	**15**	**17**	**18**	**19**	**21**	**22**	**21**	**21**	**20**	**20**	**23**	**17**	**14**	**11**	**4**	**18**

Table 1: Measured L_{Amax} aircraft levels at the subject site measurement location.

Based upon attended measurements of aircrafts using the Gold Coast Airport (refer to Table 1 above) the arithmetic average of the noise levels from arrivals aircrafts on Runway 14 was 79 dB(A) L_{Amax}.

The presented building materials over the page are based upon the arithmetic average of the measured onsite L_{Amax} levels from aircraft take-offs using Runway 14 of 78 dB(A). This is considered an acceptable site specific assessment noise impact level as AS2021 defines the aircraft noise level as "*the arithmetic average of the maximum sound levels occurring during a series of flyovers by a specific aircraft type and the load conditions measured in A-weighted decibels (dB(A)) using the S time-weighting of a sound level meter"*.

Further, AS2021 defines the aircraft noise reduction (ANR) as "*A calculated or measured value. For design purposes, the arithmetic difference between the aircraft noise level at a site and the indoor design level".*

Below are examples of building construction which will achieve the calculated Aircraft Noise Reduction (ANR) levels presented in Table 1 on the previous page. The building construction examples indicate the types of materials / construction (from Australian suppliers) which would be required for the proposed onsite buildings to achieve the internal noise criterion for sleeping areas and dedicated lounges of 50 dB(A); other habitable spaces of 55 dB(A); and bathrooms, toilets and laundries of 60 dB(A).

GLAZINGS

(Sourced from Winsulation Australia and the Experimental Building Station – Department of Housing and Construction Technical Study 48 "Air born sound transmission through elements of buildings")

Sleeping Areas and Dedicated Lounges

Operable Glazing	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Winsulation 10.5mm hush laminate, 12mm airspace / 6.5mm hush laminate acosutic frames and acoustic seals Rw 39	27	26	25	29	30	34	35	38	37	38	39	39	39	43	45	45	47	49

Operable Glazing	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Glass 6mm and 5mm thick spaced 44mm in acoustic frame and acoustic seals		24	27	29	31	34	35	34	36	37	39	41	42	44	45	48	49	47

Other Habitable Rooms

Operable Glazing	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Glass 6mm and 7.5mm thick spaced 13mm in acoustic frame and acoustic seals		24	20	21	23	25	28	31	33	34	34	35	32	31	34	36	38	39

Bathrooms, Toilets and Laundries

Operable Glazing	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Glass 6mm thick in acoustic frame and acoustic seals	21	19	18	20	21	23	25	26	26	26	25	24	23	24	26	27	30	33

ENTRY DOORS

(Sourced from Raven Australia and Door Seals of Australia - DSA)

Other Habitable Rooms, Bathrooms, Toilets and Laundries

Entry Doors	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Raven RP8 SI and RP10 fully morticed 35mm Solid-core Door Rw 30	21	21	21	27	22	27	24	25	27	28	28	29	31	34	36	35	35	35

Entry Doors	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
DSA Solidcore 40mm thick door Rw 34	19	24	23	27	33	32	34	34	35	35	32	31	33	34	36	38		

ROOF / CEILING SYSTEMS

(Sourced from Ortech Industries, Durra Australia)

Sleeping Areas and Dedicated Lounges and Other Habitable Rooms

Roof / Ceiling Systems	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
S50 Durra Roof / Ceiling System St-06 with 220mm air cavity	24	27	35	38	44	43	51	53	53	56	57	57	60	62	61	63	63	64

Bathrooms, Toilets and Laundries

Roof / Ceiling Systems	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
S50 Durra Roof / Ceiling System St-07 with 100mm air cavity	24	17	20	27	29	35	42	44	45	48	43	50	55	58	59	61	63	64

EXTERNAL WALL SYSTEMS

(Sourced from Ortech Industries, Durra Australia and Proactive Technology Australia)

Sleeping Areas and Dedicated Lounges and Other Habitable Rooms

External Walls	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Proactive Technologies: 75mm Hebel Powerpanel with 13mm Fyrchek plasterboard fixed to 64mm steel studs 20mm apart with 25mm Polastic insulation and 13mm Fyrchek plasterboard internal	32	29	32	38	40	38	44	48	51	58	62	64	65	66	64	61	68	72

External Walls	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Durra Wall System St-12 with S50 panel and 4.5mm cement sheeting both sides of steel stud with 60mm air cavity and 50mm rockwool blanket	29	35	34	33	35	37	37	37	39	42	42	45	46	45	48	49	49	46

External Walls	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Durra Wall System St-33 with 0.62mm metal wall cladding S50 Panel with 175mm air cavity and 65mm fiberglass blanket	25	30	32	34	36	38	43	44	47	49	51	54	57	63	67	67	72	75

Bathrooms, Toilets and Laundries

External Walls	Sound Transmission Loss dB for 1/3 Frequency Bands (Hertz)																	
	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
Durra Wall System St-32 with 0.62mm metal wall cladding S50 Panel with 100mm air cavity and 50mm fiberglass Anticon blanket	24	17	20	27	29	35	42	44	45	48	43	50	55	58	59	61	63	64

It is noted that Ortech Industries website indicates that the they can deliver a range of Durra Building Systems, which combine the use of Durra Panel and Durra Steel sections, that be used for modular building kits such as demountable and permanent buildings.

It is also noted that should the above building systems / materials / suppliers not be preferred for the proposed development the intended building systems suppliers should provide NATA certified Sound Transmission Loss Data; otherwise, the suppliers should provide $R_w + C_{tr}$ which achieve or exceed those provide in Section 6 of the previous acoustic report completed for the development (CRGref: 10330a report rev.1 dated July 2012).

As there is very limited sound transmission loss data available in 1/3 octave bands for building components available in Australia the previous acoustic report had recommended that building components be chosen based upon the $R_w + C_{tr}$ value rather than the R_w value; as the $R_w + C_{tr}$ provides a more reliable indication of the products low frequency noise mitigation performance.

2.0 Road Traffic Noise

Item 2 of Tweed Shire Council's Information Request relates to road noise and is as follows:

> **2. Road Noise**
>
> It appears that the Environmental Noise Impact Report for Lot 1 DP 1168904 prepared by CRG Acoustics Pty Ltd dated 24 July 2012 (crgref: 10330a report.rev.1) includes an assessment of the ground and first floor levels against AS 3674 - Acoustics - Road traffic noise intrusion - Building Siting and Construction to determine the extent of building treatments that would be required to achieve the internal noise criterion for the road noise affected buildings. However, the second storey, where applicable, has not been addressed. Further information is required for review and assessment.

The main issue in regards to road traffic noise was that the third floor level was not assessed. These third floor units were assessed (being Type "E" units), but the results were not presented in the noise impact report, as aircraft noise far exceeded the requirements for noise control. The highest third floor road noise impact level were 1 dB below the highest road noise impact levels reported. This lower impact level at the elevated receptor was due to the fact that the units containing three floors were set back further from the Highway than units containing two floor levels.

All concerns for control of road traffic noise intrusion are well covered by control for aircraft noise intrusion. We submit that the road noise issue will be sufficiently addressed through the building treatment requirements for control of aircraft noise intrusion. This point would have been made clear if a request for further information was provided by Council. It is also noted that the requirements for unit acoustical treatment is an aspect that can be conditioned. A condition could be set requiring a detailed analysis prior to issue of a Construction Certificate, and a Post Construction Noise Impact Compliance Assessment report.

Further to the above we present the top floor level PEN3D road traffic noise modeling results below:

Bullet Point 8 of Item 6 (Engineering) of Tweed Shire Council's Information Request also refers to road noise and is as follows:

- Address any impacts of the proposed development on noise exposure to adjoining residential properties (i.e. from the Pacific Highway);

Based upon the cut topography across the subject site, road traffic noise levels are likely to approximately raise by between 3 to 4 dB at the existing offsite dwellings to the west once earthworks are undertaken at the site (without the inclusion of road traffic noise from Kirkwood Road extension).

With the inclusion of the Kirkwood Road extension within the existing and proposed topography scenarios the variation in road traffic noise is predicted to be approximately 3 dB. For PEN3D calculation results refer to the rear of this letter.

It is noted that the average person cannot typically detect a 3 dB variation in sound pressure level, with a 5 dB variation considered a perceivable difference. Therefore, given that the Kirkwood Road extension is currently being constructed, a 3 dB variation in sound pressure level from road traffic noise from the Pacific Highway is not considered an unacceptable noise increase.

The predicted impacts would also be below the external noise criterion for existing dwellings impacted by the redevelopment of existing roads of 60 dB(A) $L_{Aeq\ 15hr}$ and 55 dB(A) $L_{Aeq\ 9hr}$.

We also note that the Pacific Highway is approximately 380m from the offsite dwellings on the opposite side of the subject site.

Please do not hesitate to contact the undersigned regarding any queries in relation to the above information.

Letter Reviewed By:

JAY CARTER BSc
Director

Letter Compiled by:

Matthew Lopez BEng
Consultant

Attachment A: Aerial Image of the subject site showing attended aircraft noise measurement location (Source: NSW Spatial Information Exchange http://maps.six.nsw.gov.au/).

WITHOUT KIRKWOOD ROAD EXTENSION

POINT CALCULATIONS
Pen3D2000 V 1.9.11
Project Code:10330a
Project Description:Noise assessment of kirkwood rd tourist park
File:Z:\CRG ACOUSTICS\ACOUSTIC JOBS\10330a Tourist Pk Kirkwood Rd Tweed Heads Sth\Noise Modelling\10330a_proposed topography.PEN
File Description:Data file covering proposed topography

Tuesday 02 Jul, 2013 at 16:18:31
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Leq(24hour) (dB(A))	Leq(15hour) (dB(A))	Leq(9hour) (dB(A))
gf dwelling	351486.4	879443.8	1.8	56.2	57.2	52.2
ff dwelling	351486.4	879443.8	4.6	57.9	58.9	53.9

Project Description:Noise assessment of kirkwood rd tourist park
File:Z:\CRG ACOUSTICS\ACOUSTIC JOBS\10330a Tourist Pk Kirkwood Rd Tweed Heads Sth\Noise Modelling\10330a_existing topography.PEN
File Description:Data file covering existing topography

Tuesday 02 Jul, 2013 at 16:20:13
CoRTN Calculations
All road segments included. Segmentation angle: 1degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Leq(24hour) (dB(A))	Leq(15hour) (dB(A))	Leq(9hour) (dB(A))
gf dwelling	351486.4	879443.8	1.8	53	54	49
ff dwelling	351486.4	879443.8	4.6	54	55	50

WITH KIRKWOOD ROAD EXTENSION

POINT CALCULATIONS
Pen3D2000 V 1.9.11
Project Code:10330a
Project Description:Noise assessment of kirkwood rd tourist park
File:Z:\CRG ACOUSTICS\ACOUSTIC JOBS\10330a Tourist Pk Kirkwood Rd Tweed Heads Sth\Noise Modelling\10330a_proposed topography.PEN
File Description:Data file covering proposed topography

Tuesday 02 Jul, 2013 at 16:34:01
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Leq(24hour) (dB(A))	Leq(15hour) (dB(A))	Leq(9hour) (dB(A))
gf dwelling	351486.4	879443.8	1.8	56.8	57.8	52.8
ff dwelling	351486.4	879443.8	4.6	58.4	59.4	54.4

Project Description:Noise assessment of kirkwood rd tourist park
File:Z:\CRG ACOUSTICS\ACOUSTIC JOBS\10330a Tourist Pk Kirkwood Rd Tweed Heads Sth\Noise Modelling\10330a_existing topography.PEN
File Description:Data file covering existing topography

Tuesday 02 Jul, 2013 at 16:32:36
CoRTN Calculations
All road segments included. Segmentation angle: 1degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Leq(24hour) (dB(A))	Leq(15hour) (dB(A))	Leq(9hour) (dB(A))
gf dwelling	351486.4	879443.8	1.8	53.7	54.7	49.7
ff dwelling	51486.4	879443.8	4.6	55.2	56.2	51.2