



Transport for NSW

Western Harbour Tunnel and Warringah Freeway Upgrade

Appendix G –
Little Zak's Academy noise assessment

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Transport for NSW
Western Harbour Tunnel and Warringah Freeway Upgrade project
[via Jacobs Arcadis]

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Western Harbour Tunnel and Warringah Freeway Upgrade Memorandum for inclusion in Submissions Report – Noise and Vibration Assessment for Little Zak's Academy, Rozelle

1 Introduction

This memorandum provides a summary of additional information for inclusion in the Western Harbour Tunnel and Warringah Freeway Upgrade project submissions report.

In particular, this memorandum provides additional information for the Victoria Road construction support site (WHT2) noise assessment that was prepared for the project environmental impact statement, Appendix G (Technical working paper: Noise and vibration). This memorandum updates the noise and vibration impact assessment for the receiver located at number 6-8 Waterloo Street, Rozelle (Little Zak's Academy). This memorandum also updates some of the airborne noise predictions for other sensitives presented in Table 5-30 of Appendix G (Technical working paper: Noise and vibration).

This memorandum is technical in nature and uses acoustic terminology throughout. A summary and explanation of the common acoustic terms that have been used in this memorandum is provided in Appendix A, Section A.1 of Appendix G (Technical working paper: Noise and vibration).

2 Little Zak's Academy (6-8 Waterloo Street, Rozelle)

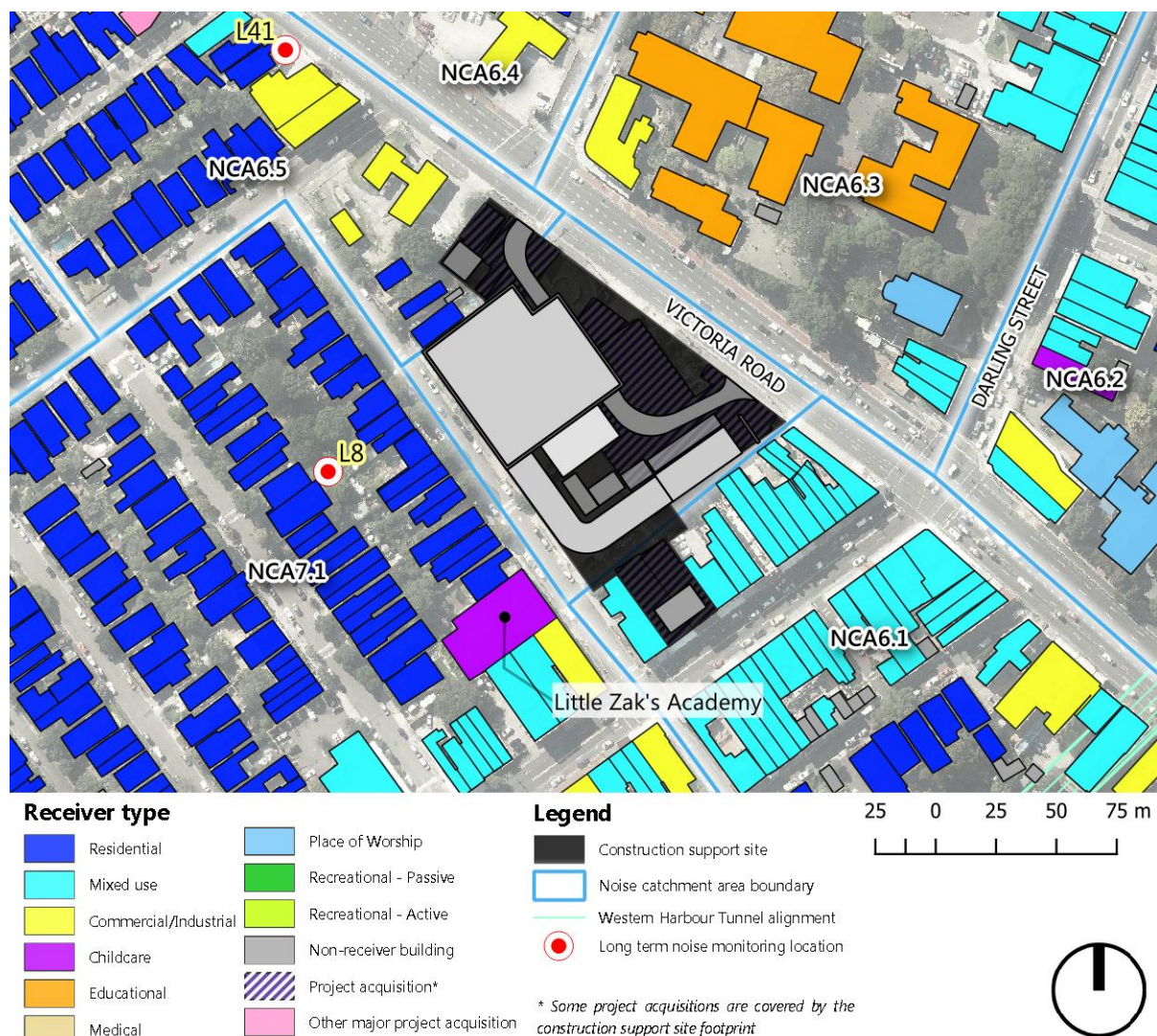
The Victoria Road construction support site (WHT2) would be located within the former Balmain Leagues Club site at Rozelle and would be used to support excavation of the mainline tunnels. Access for plant and equipment required to excavate the tunnels would be via an access decline constructed in the south-east corner of the site within an acoustic shed. Works at this construction support site are scheduled to occur over a period of around four and a half years. Further information on the Victoria Road construction support site (WHT2), including indicative site layout, is included in Section 6.7 of the environmental impact statement.

As discussed in Appendix G (Technical working paper: Noise and vibration) of the environmental impact statement, a land use survey was carried out to identify the receiver types and uses of buildings around the project that could potentially be impacted by noise or vibration from the project. The survey was carried out to assist with defining appropriate management objectives for the sensitive receivers.

Since the completion of the land use survey, it has been identified that 6-8 Waterloo Street, Rozelle, has been redeveloped and is now a childcare centre. The centre is expected to be open and taking enrolments from mid-2020. The distance between 6-8 Waterloo Street, Rozelle and the closest point of the construction support site is around 19 metres. The receiver building is identified as a commercial receiver in Appendix G (Technical working paper: Noise and vibration).

The assessment has been based upon the construction certificate documentation for the Little Zak's Academy childcare centre development (Vic Lilli & Partners, 2019) and follows the methodology described in Appendix G (Technical working paper: Noise and vibration) for assessment of construction noise impacts. The location of this receiver is presented in Figure 2-1. As-built or construction drawings of the development were not available for the preparation of this assessment.

Figure 2-1 – 6-8 Waterloo Street, Rozelle and Victoria Road construction support site (WHT2)



2.1 Ambient noise levels

For the environmental impact statement, noise monitoring was carried out along the project extent to quantify the existing noise environment in areas where receivers may potentially be affected by construction noise. Little Zak's Academy is located in noise catchment area (NCA) 7.1.

The existing daytime ambient noise levels at Waterloo Street are dominated by road traffic noise from Victoria Road. The ambient noise level measurements recorded at a shielded ground floor location in the vicinity of Waterloo Street were 57 dB(A) $L_{Aeq, 15\text{minute}}$ during the daytime (shown as L8 in Figure 2-1 above and Location 8 in Table 2-2 and Appendix C of Appendix G (Technical working paper: Noise and vibration))

2.2 Hours of construction

As described in Chapter 6 (Construction work) of the environmental impact assessment, spoil haulage would typically be carried out during standard construction hours (7.00am to 6.00pm Monday to Friday, 8.00am to 1.00pm Saturday and no construction works on Sundays or public holidays). Tunnel construction and fitout would be carried out up to 24 hours per day, seven days per week either within an acoustic shed or underground. Night time deliveries would be required to support the tunnelling activities.

Little Zak's Academy is anticipated to be open 7.00am to 6.00pm Monday to Friday.

2.3 Noise management levels

The *NSW Interim Construction Noise Guideline* and AS/NZS 2107:2016 do not provide specific construction noise criteria for childcare centres. Typically, sensitive areas within childcare centres are external/internal play areas and sleeping areas.

As detailed in Section 3.4.1.2 of Appendix G (Technical working paper: Noise and vibration), a conservative external screening test of 50 dB(A) $L_{Aeq, 15\text{minute}}$ has been adopted as the noise management level (NML) for childcare centres. This screening test is based upon suitable internal noise levels for sensitive areas such as indoor play or sleeping areas within these facilities and assumes a 10 dB(A) noise reduction from outdoors to indoors through an open window. The assumed 10 dB(A) noise reduction is consistent with guidance in the *NSW Interim Construction Noise Guideline* however can be conservative because the external to internal noise reduction can vary largely for different buildings and façade constructions.

It should be noted that the adopted external screening NML for childcare centres of 50 dB(A) $L_{Aeq, 15\text{minute}}$ in the environmental impact statement is below the measured ambient noise level of 57 dB(A) $L_{Aeq, 15\text{minute}}$ in the vicinity of this receiver location.

As stated in Section 3.4.1.2 of Appendix G (Technical working paper: Noise and vibration), more detailed analysis may be required during detailed design to determine appropriate criteria for childcare centres depending on which spaces are noise affected, and if sleeping areas are close to works activities.

2.4 Airborne noise impacts

2.4.1 Predicted airborne noise level

Airborne noise impacts from activities associated with the construction works were assessed by modelling the noise sources, receiver building location, topographical features, and possible noise mitigation measures using a computer noise model (CadnaA) developed for the project. The model calculates the contribution of each noise source to each identified noise-sensitive receiver building location surrounding the work site, and allows for the prediction of the total noise from a works area or construction support site for the various stages of construction work. Details of the approach to noise modelling and factors taken into account by the noise model are detailed in Section 4.2.1 of Appendix G (Technical working paper: Noise and vibration).

The highest predicted noise levels for each construction stage at 6-8 Waterloo Street, Rozelle, are presented in Table 2-1. The estimated timeframes for each construction stage is provided in Table 5-21 of Appendix G (Technical working paper: Noise and vibration).

Table 2-1 – Predicted construction noise levels, $L_{Aeq\ 15\ minute}$ dB(A) – 6-8 Waterloo Street, Rozelle – Victoria Road construction support site (WHT2)

Receiver building	Noise management level (External)	Predicted noise levels at each construction stage ²								
		Early works	Site establishment	Establishment of construction facilities	Piling for decline and acoustic shed	Surface level decline construction	Acoustic shed construction	Tunnel construction	Tunnel fitout	Tunnel commission and site rehabilitation
		VIC_01	VIC_02	VIC_03	VIC_04	VIC_05	VIC_06	VIC_07	VIC_08	VIC_09
Childcare	50	78	82	70	70	76	65	66	64	69

- Notes:
1. Construction noise level cells are shaded based on the predicted worst case NML exceedance of the controlling time period as follows: Light blue is < 10 dB(A) above NML, Mid blue is 11-20 dB(A) above NML, Dark blue is >20 dB(A) above NML.
 2. Predicted noise levels for each stage are based on the reasonable worst-case 15 minute construction works scenario as described in Section 4.2.2 of the WHT NVA.

The highest predicted noise levels occur during early works, site establishment and surface level decline construction works. Table 2-1 indicates that noise intensive works during each major construction stage of the project are predicted to be above the noise management level at 6-8 Waterloo Street, Rozelle.

It should be noted that the predicted noise levels at this non-residential receiver building are based on a reasonable worst-case where all activities in each stage are occurring concurrently. However, actual noise levels would typically vary and be less than those predicted for most of the time in each stage. The actual expected noise levels would be determined during further design development once a construction contractor is appointed and the construction equipment, methodology and detailed mitigation measures are known.

When boundary fencing is installed around the construction support site, the predicted construction noise levels would vary at the ground level and the 2nd floor. The highest predicted noise levels are for the 2nd floor. The construction certificate documentation indicates a number of building features that would provide substantial noise reduction from outdoor to indoor. The following building specific features are expected to increase the external screening noise management level of 50 dB(A) $L_{Aeq,15minute}$ (assuming opened windows) adopted in the environmental impact statement for childcare centres:

- Mechanical ventilation enables the exchange of fresh air indoor while windows are kept shut (outside-to-inside sound reduction for a masonry façade with closed windows is generally 20 dB(A) or more)
- No windows in the retained brick façade shielding 2nd floor spaces within the childcare centre
- Upgraded façade windows on the ground and first floor of the centre.

The external screening NML adopted in Section 3.4.1.2 of Appendix G (Technical working paper: Noise and vibration) assumed a conservative external to internal noise reduction of 10 dB(A) based on opened windows. Windows at the childcare centre are likely to be closed to manage existing environmental noise. As discussed in Section 2.1, 6-8 Waterloo Street, Rozelle, is already exposed to traffic noise that is above the external screening NML of 50 dB(A) $L_{Aeq,15minute}$ for childcare centres, and as such the external screening NML in the environmental impact statement is conservative. The specific receiver construction noise management level will be refined post-approval during further design development by the appointed contractor.

2.4.2 Cumulative noise impacts

Due to the childcare centre being located a substantial distance away from the construction works at Iron Cove (part of the M4-M5 Link project), and with shielding provided by intervening buildings, it is unlikely to experience high construction noise levels from other construction projects and no cumulative construction noise impacts are expected.

2.4.3 Management measures

Table 2-1 indicates that 6-8 Waterloo Street, Rozelle is predicted to be above the childcare screening noise management level during noise intensive works during each major construction stage of the project.

Management of impacts to sensitive receivers would include, but not limited to:

- A construction noise and vibration management plan will be prepared as part of further design development (refer to environmental management measure CNV1 of Table D2-1 of this submissions report)
- Where construction has the potential to result in noise and vibration levels above the relevant amenity criteria, the contractor will be required to prepare a location and activity specific Construction Noise and Vibration Impact Statement (CNVIS) based on the proposed detailed construction methodology (refer to environmental management measure CNV2 in Table D2-1 of this submissions report). The CNVIS will identify likely noise and vibration levels and propose measures that would be implemented to manage them, with consideration of the guidance and mitigation measures in the Interim

Construction Noise Guideline (DECC, 2009) and the Construction Noise and Vibration Guideline (RMS, 2016). Site specific measures may include:

- Consideration in the site layout to increase shielding to noise sensitive spaces from noise generating equipment, noting that site mitigation measures are typically designed to provide adequate mitigation to nearby residential receivers during the more sensitive night time period
 - Consultation with the childcare centre during project design development and the construction phase to identify specific needs and tailor mitigation measures accordingly where reasonable and feasible.
- Mitigation measures will be implemented where construction activities from surface works are predicted to exceed noise management levels at receivers as detailed in environmental management measure CNV8 (refer to Table D2-1 of this submissions report). Approaches would include, where reasonable and feasible, detailed programming and respite protocols, community consultation, engagement and notification, limiting timing of noise intensive work and use of portable noise barriers around particularly noisy equipment.

As per Section 3.4.1.2 of Appendix G (Technical working paper: Noise and vibration), identification of noise management levels for the different sensitive spaces within the childcare centre based on their use (such as teaching spaces and passive recreation areas) may be required during further design development.

2.5 Ground borne noise and vibration impacts

Vibration generated from construction works would vary depending on the level and type of activity carried out at each site during each activity. Vibration-intensive works would occur during the early stages of the works, such as site establishment, piling and decline excavation and construction. The most vibration-intensive activity proposed for the construction support site is likely to be the use of a large rock hammer.

For vibration, the childcare centre is within the indicative minimum working distance of 73 metres for human response to vibration from a large rock hammer. There is potential for the property to be located within the indicative minimum working distances of 22 metres for cosmetic damage from vibration for a large rock hammer, depending upon the location of excavation works within the site boundary. Details of recommended minimum working distances for vibration-intensive plant and equipment is provided in Table 4-11 of Appendix G (Technical working paper: Noise and vibration).

Ground borne noise could be audible at times if large rock hammers are used as part of the access decline excavation works. This is due to the proximity of the works to the building.

However, the potential levels of ground borne noise and vibration impacts experienced by receivers would be dependent on vibration source levels, separation distance, intervening soil and rock strata, dominant frequencies of vibration and the receiver structure.

A detailed assessment of the childcare building and attended vibration monitoring will be carried out to ensure vibration levels remain below appropriate limits for that structure, as per environmental management measure CNV6 (refer to Table D2-1 of this submissions report).

As required by environmental management measure CNV7 (refer to Table D2-1 of this submissions report), reasonable and feasible measures will be implemented to minimise ground-borne noise where exceedances are predicted.

As per CNV8 (refer to Table D2-1 of this submissions report), mitigation measures will be implemented where construction activities are predicted to exceed noise management levels at receivers as a result of surface road works, local area and utility works., where feasible and reasonable, including detailed programming and respite protocols. As these construction activities would often result in high airborne noise levels, coordination of respite periods would assist with managing both ground-borne and airborne noise impacts.

3 Update of airborne noise predictions for other sensitive receivers

A transcription error was identified in Table 5-30 of Appendix G (Technical working paper: Noise and vibration). The updated predicted noise levels for non-residential receiver buildings, including Little Zak's Academy (6-8 Waterloo Street, Rozelle), are presented in Table 5-30 of Appendix G (Technical working paper: Noise and vibration). The updated Table 5-30 is presented in Table 3-1. Those numbers which have been updated are bold.

Table 3-1 – Predicted construction noise levels – other sensitive receivers, L_{Aeq 15minute} dB(A) – Victoria Road construction support site (WHT2) (Update of Table 5-30 of Appendix G (Technical working paper: Noise and vibration))

Receiver type	Noise catchment area	Noise management level	Predicted noise levels at each construction stage ^{1,2}								
			VIC_01	VIC_02	VIC_03	VIC_04	VIC_05	VIC_06	VIC_07	VIC_08	VIC_09
Commercial ³	4.4	70	≤ 40	≤ 40	< 35	≤ 36	≤ 39	< 35	< 35	< 35	≤ 40
	4.5	70	36 - 45	40 - 42	< 35	35 - 37	36 - 40	< 35	< 35	< 35	37 - 45
	5.2	70	36 - 53	39 - 52	≤ 40	37 - 44	35 - 43	≤ 36	≤ 39	< 35	37 - 50
	6.1	70	42 - 50	43 - 54	≤ 42	38 - 48	42 - 51	≤ 38	≤ 39	≤ 36	42 - 50
	6.2	70	42 - 72	44 - 70	≤ 52	37 - 60	41 - 54	≤ 54	≤ 51	≤ 46	42 - 67
	6.3	70	≤ 82	≤ 79	≤ 64	≤ 69	≤ 63	≤ 63	≤ 61	≤ 54	≤ 77
	6.4	70	45 - 72	47 - 74	37 - 58	43 - 64	43 - 64	≤ 60	≤ 53	≤ 46	45 - 67
	6.5	70	63 - 77	60 - 79	52 - 63	61 - 66	57 - 72	49 - 61	44 - 54	38 - 48	63 - 76
	7.1 ⁴	70	≤ 75	≤ 77	≤ 65	≤ 65	≤ 70	≤ 58	≤ 59	≤ 59	≤ 69
	7.2	75	≤ 44	≤ 48	≤ 36	≤ 42	≤ 40	< 35	< 35	< 35	≤ 41
Childcare	5.2	50	42 - 45	45 - 46	< 35	37 - 37	< 35	< 35	< 35	< 35	39 - 41
	6.2	50	≤ 61	≤ 57	≤ 46	≤ 52	≤ 51	≤ 44	≤ 44	≤ 40	≤ 52
	6.3	50	≤ 48	≤ 57	≤ 37	≤ 53	≤ 44	≤ 45	< 35	< 35	≤ 49
	7.1 ⁴	50	47 - 78	50 - 82	39 - 70	43 - 70	42 - 76	35 - 65	35 - 66	35 - 64	42 - 69
Educational	6.3	55	≤ 83	≤ 80	≤ 65	≤ 69	≤ 71	≤ 63	≤ 63	≤ 60	≤ 81
	6.4	55	≤ 43	≤ 47	≤ 37	≤ 42	≤ 40	< 35	< 35	< 35	≤ 40
Other sensitive receiver ³	7.1	60	43 - 49	47 - 52	36 - 41	42 - 47	45 - 47	≤ 39	≤ 36	≤ 35	43 - 48
	8.1	60	≤ 42	≤ 48	≤ 38	≤ 45	≤ 47	≤ 35	< 35	< 35	≤ 43
Recreational ³	7.1	65	43 - 54	47 - 57	35 - 42	42 - 47	41 - 44	≤ 39	≤ 40	≤ 36	41 - 50
	7.2	65	46 - 48	46 - 51	≤ 38	39 - 43	≤ 38	≤ 35	< 35	< 35	37 - 45
Place of worship	4.4	55	38 - 40	41 - 42	< 35	39 - 41	42 - 44	< 35	< 35	< 35	38 - 40
	6.2	55	54 - 64	52 - 55	40 - 43	47 - 49	46 - 49	39 - 39	39 - 41	36 - 38	50 - 64
	6.3	55	≤ 76	≤ 77	≤ 63	≤ 64	≤ 72	≤ 59	≤ 62	≤ 59	≤ 71

- Notes:
1. Construction noise level cells are shaded based on the predicted worst case NML exceedance of the controlling time period as follows: Light blue is < 10 dB(A) above NML, Mid blue is 11-20 dB(A) above NML, Dark blue is >20 dB(A) above NML.
 2. Predicted noise levels for each stage are based on the reasonable worst-case 15 minute construction works scenario as described in Section 4.2.2 of the of Appendix G (Technical working paper: Noise and vibration).
 3. There is a range of NML for other sensitive receiver buildings, which are defined in Section 3.4.1 of Appendix G (Technical working paper: Noise and vibration). Each nearby other sensitive receiver has been assessed against the applicable NML.
 4. The update of a commercial receiver to be Little Zak's Academy (6-8 Waterloo Street, Rozelle) is included

Document control

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