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TH511-02 01.06.04 F05 BN CNVIS Add5 Concrete pours (r2)

John Holland CPB Ghella JV
Level 9, 50 Bridge Street,
Sydney NSW 2000

Sydney Metro Chatswood to Sydenham – TSE Works - Concrete pours

1 Introduction

1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Barangaroo Construction Site* (*Barangaroo CNVIS*) and has been prepared on behalf of John Holland CPB Ghella Joint Venture (JHCPBG) in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWTSE-JCG-TPW-EM-PLN-002012] for the Design and Construction of the Tunnel and Station Excavation (TSE) Works of the Sydney Metro City & Southwest Project (the Project).

JHCPBG is proposing to extend concrete deliveries and pours for the station structure at Barangaroo worksite to the morning shoulder (i.e. 6am to 7am) and to the evening (i.e. 6pm to 10pm) periods for approximately 12 months. These extended working hours will allow the construction of the Barangaroo Station Box to be completed on time and will avoid any potential delays to the Project (see justification in Section 1.2).

These works have been assessed in combination with other potentially concurrent works, which have previously been assessed in the *Barangaroo CNVIS*, *Spoil haulage CNVIS addendum* (TH511-02 01.06.04 F03 BN CNVIS Add3 Spoil Haulage (r4)) and *TBM removal CNVIS addendum* (TH511-02 01.06.04 F04 BN CNVIS Add4 TBM removal (r7)).

This memorandum has been prepared to address the potential construction noise and vibration impacts from the proposed concrete deliveries and pours during the morning shoulder and evening periods.

1.2 Justification for out of hours construction works

The concrete for the Station Structure is subject to strict quality specifications and can only be poured up to a maximum ambient temperature of 32ºC on a given day. In addition to this, concrete temperature at placement cannot exceed 26ºC. During the summer period, experience has shown that a key component of the concrete mix such as the aggregate heats up quickly during the day when stockpiled prior to concrete batching. This limits the window within which concrete batching can occur on any one day and effectively requires all concrete deliveries to be completed by the early afternoon on hot days.

This technical memorandum assesses an early start of 6am to allow for the required daily volume of concrete to be delivered before aggregate and concrete temperatures exceed the maximum allowable temperature. Extended hours have also been proposed until 10pm to allow for concrete batching and deliveries to recommence in the late afternoon when temperatures cool down.

In addition, throughout the works program there is potential that concrete pours will be required outside standard operating hours to manage the interface between overhead crane operation and the proposed works. Undertaking the concrete pours during a later shift (6pm-10pm) and early morning (6am to 7am) will eliminate potential hazards that arise from cranes and ensure safety standards are maintained.

These extended working hours will allow the construction of the Barangaroo Station Box to be completed on time and will avoid any potential delays to the Project.

JHCPBG will seek to vary the Environment Protection Licence to permit the out of hours works set out in this report.

2 Construction noise assessment

2.1 Construction activities

Key details regarding the location and layout of the noise generating plant that will operate during concrete deliveries and pours were informed by the Design and Construction Teams (Figure 2-1).

Table 2.1 presents the list of plant and associated sound power levels that are proposed to be used for these works.

Table 2.1: Construction activities and applicable sound power levels

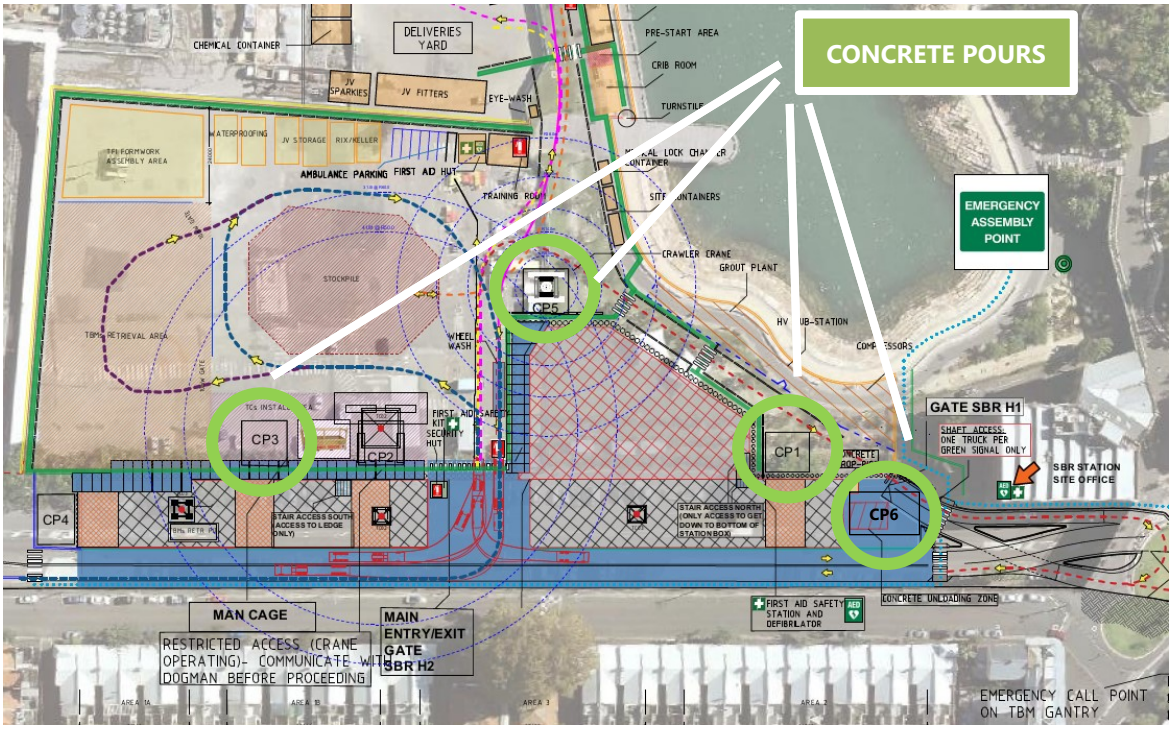
Activity	Key plant and equipment	Morning shoulder	Evening	Sound power level, dB(A)		Comments
		6am -7am	6pm – 10pm	L_{Aeq}	L_{Amax}	
Concrete deliveries and pours	Concrete agitator (unloading)	1	1	108	111[1]	Concrete pours from CP1 or CP5 (Figure 2-1)

Activity	Key plant and equipment	Morning shoulder	Evening	Sound power level, dB(A)		Comments
		6am -7am	6pm – 10pm	L_{Aeq}	L_{Amax}	
	Concrete truck (moving on and off site)	4 p.h.	4 p.h.	106	111[1]	Entering from gate SBR H2 and exiting site from gate SBR H1 (Figure 2-1)

Notes: 1. As per the Barangaroo CNVIS, it is assumed that air brake silencers are to be correctly installed and fully operational for any heavy vehicles.

Concrete works during standard construction hours are already covered in the *Barangaroo CNVIS*.

Figure 2-1: Construction activities and locations



The concrete works would be carried out up to end of March 2020 currently with the following:

- Scenario S5 assessed in the *Barangaroo CNVIS;*
- Spoil loading and haulage assessed in the *Spoil haulage CNVIS addendum;*
- TBM retrieval assessed in the *TBM removal CNVIS addendum*.

From April 2020, only concrete deliveries and pours will be carried out at the Barangaroo worksite outside standard construction hours.

2.2 Predicted construction noise levels

Noise results are summarised in Table 2.2 and Table 2.3. These predicted noise levels included the recommended mitigation measures presented in Section 2.3.1.

Table 2.2: Predicted construction noise levels at the closest noise sensitive receivers during morning should period (6am to 7am)

Address	NCA	Type of receiver	Morning Shoulder (6am to 7am)										External equivalent NMLs	
			S5	Spoil Haulage	TBM retrieval	Concrete pours[3] from					Cumulative[2] (up to March 2020)	ICNG NML	Existing ambient noise levels, LAeq	
						CP1	CP3	CP5	CP6	Maximum[1]				CoA E37	CoA E41
17 EDWARD STREET BALMAIN EAST	BN_06	Residential	45	43	42	33	34	34	35	35	48	50	information not available in the EIS	N/A	55
18-18A HIGH STREET MILLERS POINT	BN_03	Residential	48	52	51	52	48	49	45	52	57	50	~ 58	N/A	55
34-34A HIGH STREET MILLERS POINT	BN_03	Residential	45	51	51	51	49	49	46	51	56	50	~ 58	N/A	55
40-40A HIGH STREET MILLERS POINT	BN_03	Residential	48	54	50	49	54	49	44	54	58	50	~ 58	N/A	55
65-69 KENT STREET MILLERS POINT	BN_03	Residential	47	51	51	49	49	47	44	49	56	50	~ 58	N/A	55
89-105 KENT STREET MILLERS POINT	BN_03	Hotel	46	48	50	44	48	44	43	48	54	60	~ 58	N/A	N/A
35-37 BETTINGTON STREET MILLERS POINT	BN_02	Hotel	48	49	47	46	44	44	46	46	54	60	~ 58	N/A	N/A
24 MUNN STREET BARANGAROO	BN_02	Residential	45	49	46	44	41	45	38	45	53	50	~ 58	N/A	55

Note:

1) This is the worst-case scenario of all potential concrete pour locations
2) Cumulative impacts include S5 scenario, Spoil haulage, TBM retrieval and the worst-case scenario from the concrete pours
3) These predicted noise levels included the recommended mitigation measures presented in Section 2.3.1.

Table 2.3: Predicted construction noise levels at the closest noise sensitive receivers during evening period (6pm to 10pm)

Address	NCA	Type of receiver	Evening (6pm to 10pm)											External equivalent NMLs	
			S5	Spoil Haulage	TBM retrieval	Concrete pours[3] from					Cumulative[2] (up to March 2020)	ICNG NML	Existing ambient noise levels, LAeq	CoA E37	CoA E41
						CP1	CP3	CP5	CP6	Maximum[1]					
17 EDWARD STREET BALMAIN EAST	BN_06	Residential	45	43	42	33	34	34	35	35	48	54	55	70	55
18-18A HIGH STREET MILLERS POINT	BN_03	Residential	48	52	51	52	48	49	45	52	57	50	64	70	55
34-34A HIGH STREET MILLERS POINT	BN_03	Residential	45	51	51	51	49	49	46	51	56	50	64	70	55
40-40A HIGH STREET MILLERS POINT	BN_03	Residential	48	54	50	49	54	49	44	54	58	50	64	70	55
65-69 KENT STREET MILLERS POINT	BN_03	Residential	47	51	51	49	49	47	44	49	56	50	64	70	55
89-105 KENT STREET MILLERS POINT	BN_03	Hotel	46	48	50	44	48	44	43	48	54	60	64	80	N/A
35-37 BETTINGTON STREET MILLERS POINT	BN_02	Hotel	48	49	47	46	44	44	46	46	54	60	64	80	N/A
24 MUNN STREET BARANGAROO	BN_02	Residential	45	49	46	44	41	45	38	45	53	50	64	70	55

Note:

1) This is the worst-case scenario of all potential concrete pour locations
2) Cumulative impacts include S5 scenario, Spoil haulage, TBM retrieval and the worst-case scenario from the concrete pours
3) These predicted noise levels included the recommended mitigation measures presented in Section 2.3.1.

As can be noted from Table 2.2 and Table 2.3, noise levels from concrete pours are predicted to be below the internal NMLs in PPA Conditions E37 and E41 at all locations. However, cumulative noise impacts are expected to be above the internal NMLs in Condition E41 by up to 3dB.

In accordance with PPA Condition E32 and APPENDIX A2 of the *Sydney Metro City and Southwest Construction noise and Vibration Strategy,* additional mitigation measures are to be considered (e.g. at-property treatment, temporary relocation, other forms of mitigation where impacts are predicted to be long term and significant).

At-property treatments and temporary relocation for the noise affected receivers were considered, however, they were deemed unreasonable for the following reasons:

- Only cumulative noise impacts are expected to be above internal NML for a relative short period of time as other potentially concurrent activities are likely to be completed by March 2020.
- Cumulative noise impacts are expected to marginally exceed the internal NML in Condition E41 (i.e. 1-3 dB). This is not considered significant.
- Concrete pours will not be carried out throughout the entire night. Pours will stop by 10pm and will only recommence from 6am.
- Predicted noise levels at the closest noise sensitive receiver are similar or lower than the existing ambient noise levels L_{Aeq} (see Table 2.2 and Table 2.3).
- Implementation of at-property treatment is a relatively long process (i.e. at least one year). Considering the duration of the proposed works, noise affected receivers would receive acoustic treatments after the proposed works are completed.
- Temporary relocation is not a feasible option due to the duration of the proposed works.

Recommended mitigation measures are presented in Section 2.3.1.

Predicted noise levels are expected to be above relevant ICNG NMLs by up to 8dB(A) when considering potentially concurrent activities and by up to 4dB(A) when considering concrete works in isolation during the morning shoulder and evening periods.

The following points are noted:

- The noise predictions in this CNVIS represent a realistic worst-case scenario when concrete pour operations occur at worst-case intensity throughout the assessment periods.
- Actual noise levels can often be less than the predicted levels presented in this CNVIS when measured over the assessment period due to:
    - variation in the operating state of the concrete agitator during the delivery;
    - the final delivery orientation of the concrete agitator within the delivery area compared with each receiver;

- variation in the noise levels from different concrete agitators.

- Predicted noise levels at the closest noise sensitive receiver are similar or lower than the existing ambient noise levels L_{Aeq} (see Table 2.2 and Table 2.3).

2.3 Noise mitigation and management

2.3.1 Specific mitigation measures

During the assessment of the works Renzo Tonin & Associates played a key role in assisting JHCPBG to determine the feasible and reasonable physical noise mitigation measures required to reduce noise impacts from the operation of the site. In accordance with the *Barangaroo CNVIS*, the following noise mitigation and management measures are recommended to reduce potential noise impacts from the concrete delivery works:

- Set up relevant traffic management measures to minimise the use of air brakes when leaving the site;
- Air brake silencers are to be correctly installed and fully operational for any heavy vehicles;
- Minimise unnecessary acceleration on site;
- Alternative reverse alarms, such as 'quackers' will be installed on all plant, where practicable.

Additionally, a temporary partial enclosure with 12mm plywood and noise blankets on scaffolding will be installed to minimise the noise impact to the closest noise sensitive receivers. This has been included in the noise model. This partial enclosure has been designed to provide a minimum of 10dB reduction. Noise monitoring and site inspection will be undertaken to confirm this level of noise attenuation is achieved.

2.3.2 Noise monitoring

Attended noise monitoring will be undertaken to verify that the construction activities are consistent with the assessed noise modelling scenarios and that noise levels resulting from construction works are not higher than the levels predicted in this CNVIS. Attended monitoring on private property is subject to obtaining the property owner/occupier's consent (where required).

Attended noise monitoring will be undertaken in the NCAs most impacted by the works. The nominated monitoring locations are identified in Table 2.4, and have been selected as they present the best opportunity to validate the predicted noise levels.

Table 2.4: Nominated verification monitoring locations

NCA	Nominated receiver address	Monitoring location at 1 m from
BN_02	24 MUNN STREET BARANGAROO	Southern facade
BN_03	40-40A HIGH STREET MILLERS POINT	Western facade

NCA	Nominated receiver address	Monitoring location at 1 m from
BN_06	17 EDWARD STREET BALMAIN EAST	Eastern facade
OSR	89-105 KENT STREET MILLERS POINT	Western facade

Note: Monitoring on private property is subject to owner consent and where relevant, occupier consent. If property access is denied, monitoring will still be carried out outside property boundaries.

If verification monitoring shows that the external noise levels are consistently above the predicted levels, investigation will be undertaken to understand the cause of the exceedance and additional mitigation and management measures will be implemented in accordance with Sydney Metro City and South West Noise and Vibration Strategy.

2.3.3 Consultation with affected receivers (PPA Condition E33)

As outlined in Section 5.4.1 of the *Barangaroo CNVIS*, consistent with requirements in PPA Conditions E33, JHCPBG will continue to consult with potentially affected stakeholders including business and residential receivers regarding specific mitigation measures applicable to the construction works at the Barangaroo site.

2.4 Construction related road traffic assessment

Construction traffic has been previously assessed in the *Spoil haulage CNVIS addendum* and considered to have minor impact on public roads used to access and exit the site. Concurrent work activities (including concrete pours) at Barangaroo worksite have been coordinated and planned so that the maximum number of truck movements on site during all assessment periods does not exceed what has already been assessed in the *Spoil haulage CNVIS addendum* (i.e. 8 trucks per hour).

Therefore, consistent with the conclusions of the *Spoil haulage CNVIS addendum*, construction traffic due to the proposed works is expected to have minor impact on surrounding public roads.

2.5 Other assessments

The proposed works are not vibration intensive and so construction vibration or ground-borne noise impacts have not been considered further in this addendum assessment.

3 Conclusion

This technical memorandum is an addendum to the report *Barangaroo CNVIS* to review the potential noise and vibration impacts for the proposed concrete deliveries and pours at the Barangaroo worksite during morning shoulder (6am to 7am) and evening (6pm to 10pm) periods.

These works have been assessed in combination with other potentially concurrent works occurring at the site, which have previously been assessed in the *Barangaroo CNVIS*, *Spoil haulage CNVIS* and *TBM removal CNVIS addendum*.

The predicted noise levels are expected to be above relevant ICNG NMLs by up to 9dB(A) when considering potentially concurrent activities and by up to 7dB(A) when considering concrete deliveries and pours in isolation. It should be noted that the noise predictions in this CNVIS represent a realistic worst-case scenario when concrete operations occur at worst-case intensity throughout the assessment periods. Actual noise levels can often be less than the predicted levels presented in this CNVIS when measured over the assessment period.

Construction traffic due to the proposed works is expected to have minor impact on surrounding public roads. The proposed works are not vibration intensive and so construction vibration or ground-borne noise impacts have not been considered further in this addendum assessment.

Noise monitoring will be undertaken on a regular basis to verify compliance with the predicted noise levels.

The consultation and notification process in accordance with PPA Condition E33 will continue and from now on will also include these additional out-of-hour works.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
17.01.2020	Issued	-	0	M. Tabacchi	M. Tabacchi	B. Carlyle
21.01.2020	Addition of CP3 and CP6	-	1	M. Tabacchi	M. Tabacchi	B. Carlyle
03.02.2020	Update following AA's comments	-	2	M. Tabacchi	M. Tabacchi	T. Gowen

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.