

15 October 2021

Aurecon
PO Box 9762
Auckland 1149

Attention: Helen McLean

Dear Helen

P2B NOISE AND VIBRATION ASSESSMENT ADDENDUM - EARLY WORKS NIMT BRIDGES

This letter is an addendum to our Papakura to Drury South Noise and Vibration Assessment (the Assessment), dated 2 June 2021. It references that report and should be read in conjunction with it.

The Assessment of construction noise and vibration effects assumed that all buildings inside the proposed designation would be Crown owned and vacant at the time of construction. However, early works in the rail corridor are required to enable electrification works of the North Island Main Trunkline (NIMT). The early works consist of the following activities, more fully described in sections to follow, and herein referred to as “the Works”:

- Site preparation and vegetation clearance
- Road relocation
- Bridge piling
- Bridge construction

The Works will occur when the dwelling at 168 Flanagan Road is still privately owned and occupied, and therefore the receiving environment will be different to that assumed in the Assessment.

This addendum discusses the proposed Works, their noise and vibration levels and effects on occupants of 168 Flanagan Road and potential management and mitigation measures.

Existing environment

Table 2-1 of the Assessment details a measured ambient noise level at 168 Flanagan Road of 71 dB $L_{Aeq(15min)}$ during daytime. The derived 24-hour¹ noise level is 69 dB $L_{Aeq(24h)}$, which is a high noise level for residential use.

Proposed works

Site preparation and vegetation clearance

The site will need to be cleared in preparation for the Works. That will involve vegetation clearance (with chainsaws and chipper). Two temporary traffic safety barriers are proposed to be installed adjacent to the relocated Flanagan Road (refer the drawing in Annex A).

Road relocation

The proposed Works require realignment of Flanagan Road against the closest road boundary of the site at 168 Flanagan Road. We note that some of the 168 Flanagan Road residential building appear to encroach on

¹ As traffic distribution over the day is known, the short duration survey results can be used to derive a 24-hour traffic noise level, by subtracting 2 decibels from the daytime level to derive the 24-hour level.

the road reserve, so the road will be realigned into road reserve land that is currently occupied by the residential building.

Road realignment will involve the use of earthmoving machinery such as excavators and trucks, vibratory roller and asphalt machine. Relevant equipment and noise levels are shown in the Assessment, Appendix A, Table 3-2.

The road relocation works will take approximately 4 months and are proposed to occur from February to May 2022.

Bridge piling

The Works require piling in close proximity to the dwelling at 168 Flanagan Road (refer Annex A). Piling would be undertaken in the following steps (timing is given for the southern abutment closest to 168 Flanagan Road):

1. Install 1500 diameter sleeves (9 OFF) using a 9T vibro hammer on a Kobelco CK1800 Crawler Crane to approximately 9-10m deep
2. Drill and concrete 600 diameter (37 OFF) CFA Piles using SR45 Piling Rig. These piles are located adjacent to and between the sleeves of (1) above. Three piles per day can be installed, with an estimated total of **13 days** piling.
3. Install inner 1200 diameter permanent steel casing inside the 1500 diameter sleeves to approximately 15 to 18 m deep and excavate to base of 1200 diameter pile (24 to 28m deep)
4. Drive 1200mm cast-in-site concrete plug at base of pile using a 15T mandrel to a set blow count record. The construction of each 1200 diameter pile takes approximately 4 days, with an estimated total construction period of **36 days** for the southern abutment closest to 168 Flanagan Road.

The northern abutment would require a similar process and timing.

In addition, there is the potential for temporary secant piling adjacent to SH1 as follows:

1. Install 900 diameter sleeve using a 9T vibro hammer on a Kobelco CK1800 Crawler Crane to R.L. 0
2. Drill 900 diameter pile to foundation level approximately 20m deep and concrete. The construction of the temporary secant piles will take approximately **20 days** in total.
3. The secant piling may require partial closure of SH1 and may therefore need to be undertaken during night-time.

The total piling duration will be approximately 2.5 months (or, if secant piling is required, 3.5 months).

Bridge construction

Following the pile installation, the bridges will be constructed as follows:

1. Construct pile extensions and construct headstocks
2. Install bearings and beams – will need to be undertaken during Block of Line (BOL) at night-time
3. Install precast panels and erect formwork – will need to be undertaken during Block of Line (BOL) at night-time
4. Pour concrete deck
5. Construct Diaphragms
6. Install bridge barriers precast.

Construction times and duration

The overall construction period (including low noise and vibration generating activities) for the Works will be approximately 17 months.

All works will occur generally Monday to Saturday, 7.30 am to 6pm (i.e. inside the normal daytime construction hours). Where night-time works are required, these are noted in the sections above.

Predicted noise levels

The following Table 1 shows the likely equipment noise levels for the different stages of work set out above, and the predicted noise levels received at 168 Flanagan Road. The predictions take into consideration a 2.5m noise barrier where it would shield the works. Further discussion of barrier options are included below in the section about management and mitigation options.

Table 1: Equipment noise levels and predicted noise levels at 168 Flanagan Rd

Activity	Activity Sound Power Level	Predicted highest noise level at 168 Flanagan Road
	dB L _{WA}	dB L _{Aeq(30min)}
Site clearance and vegetation clearing	111	80 – 90 (prior to barrier installation)
Road relocation	110	70 – 76 (where shielded by barrier) 75 – 80 (where not shielded by barrier)
Piling works (driven/drilled) (Southern abutment)*	118	79 – 83 (where shielded by barrier) 78 – 87 (where not shielded by barrier)
Piling works (secant) (some at night-time)	108	69 – 74 (where shielded by barrier) 69 – 78 (where not shielded by barrier)
Bridge construction (some at night-time)	110	61 – 67 (where shielded by barrier) 68 – 75 (where not shielded by barrier)

* Northern abutment construction will result in approximately 10 to 15 dB lower noise levels

The noise levels above will not occur continuously but will occur intermittently when machinery is operating at power. However, there would be extended periods of several weeks where the noise levels will be at and above the 75 dB L_{Aeq} daytime noise criterion (refer Assessment Section 3.1.1).

Some daytime works are likely to cause disturbance and will require management (refer Assessment Appendix A, Section 3.2.1).

Only limited night-time works are proposed, and only where they are necessary to avoid traffic or rail disruption. While they may cause sleep disturbance (refer Assessment Appendix A, Section 3.2.3), with appropriate management effects can be managed to a reasonable level (refer Management and Mitigation section below).

Predicted vibration levels

There are three main activities that are likely to cause elevated vibration levels: the use of vibratory rollers during the Flanagan Road relocation, vibrated pile casings and impact piling. We have also included the values for bored piling, which generates significantly less vibration.

Figure 1 (overleaf) shows the regression curves for these activities, and Table 2 shows the predicted vibration levels at 168 Flanagan Road. We note that vibration propagation efficiency is site specific, so the regression

curves and predictions are intentionally conservative for this planning envelope assessment (i.e. they include a 100% safety factor on typical levels to represent confidence intervals).

Figure 1: Vibration Regression Curves

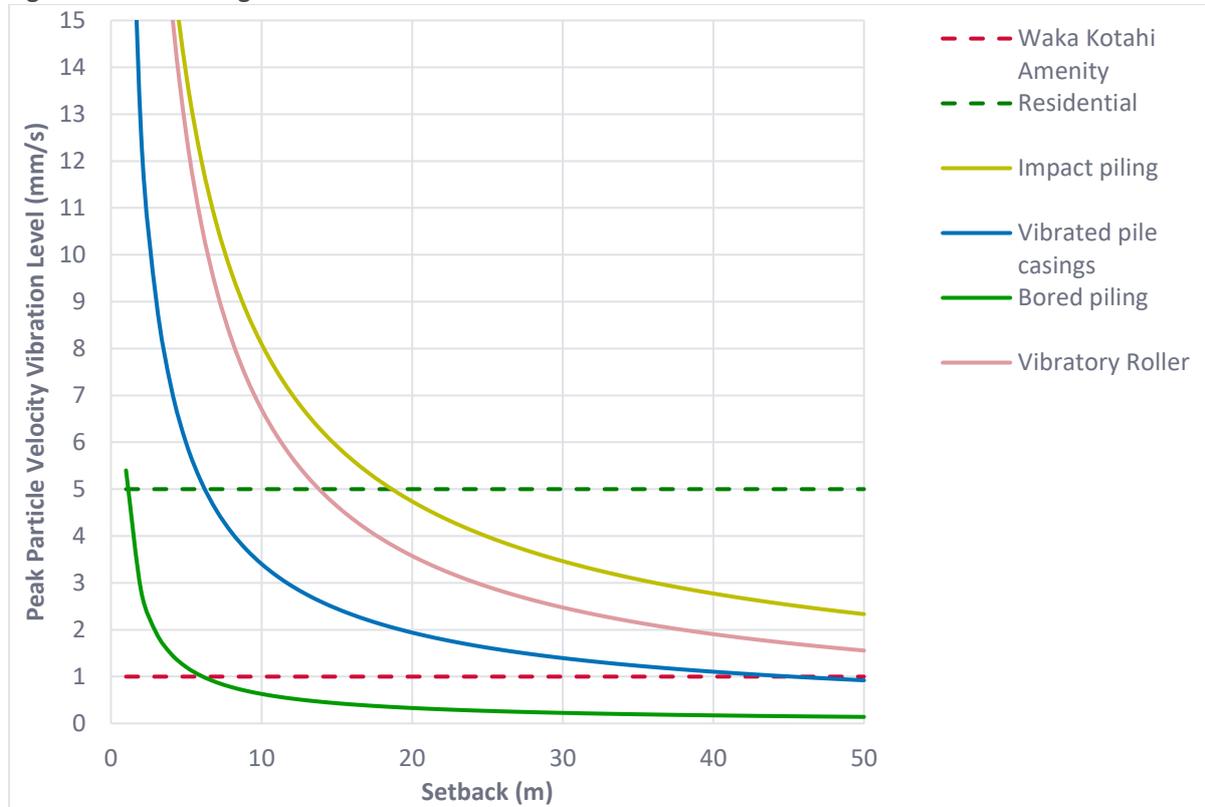


Table 2: Predicted vibration levels at 168 Flanagan Road

Activity	Closest distance (m)	Predicted vibration level (mm/s PPV)
Vibratory roller	5	12.6
Impact piling	11	7.5
Vibrated pile casings	11	3.2
Bored piling	11	0.6

Vibratory rolling and impact piling are predicted to reach vibration levels above the building damage criteria (refer Assessment, Appendix A, Table 2-2), i.e. above 5 mm/s PPV. Vibrated pile casings are predicted to reach vibration levels above the amenity criterion of 1 mm/s PPV.

Levels of such magnitude will need to be managed in order to avoid adverse effects (refer Assessment, Appendix A, Table 3-7).

Management and mitigation

CNVMP

The predicted noise and vibration are relatively high and will need to be carefully managed. This would generally be done through the proposed Construction Noise and Vibration Management Plan (CNVMP) (refer Assessment, Section 3.4).

Noise barriers

Noise barriers are recommended to be installed they would be effective and practicable. Given the space constraints of the works adjacent to the dwelling at 168 Flanagan Road, the most appropriate option is likely a temporary movable construction noise barrier.

Where practicable, the following guidelines should be incorporated in the design and utilisation of temporary noise barriers:

- The panels should be constructed from materials with a minimum surface mass of 6.5 kg/m². Suitable panels include 12 mm plywood or the following proprietary 'noise curtains':
 - Duraflex 'Noise Control Barrier - Performance Series' (www.duraflex.co.nz)
 - Soundex 'Acoustic Curtain - Performance Series' (www.ultimate-solutions.co.nz)
 - Flexshield 'Sonic Curtain with 4 kg/m² mass loaded vinyl backing' (www.flexshield.co.nz)
 - Alternatives should be approved by a suitably qualified acoustic specialist because some proprietary noise curtains have insufficient surface mass for general use
- The panels should be a minimum height of 2.5 m, and higher if practicable to block line-of-sight
- The panels should be abutted or overlapped to provide a continuous screen without gaps at the bottom or sides of the panels
- The panels should be positioned as close as practicable to the noisy construction activity to block line-of-sight between the activity and noise sensitive receivers

Such barriers should be installed either close to the receiver (dwelling) or close to the source (e.g. piling rig) for maximum benefit, and be moved with activities as necessary.

Specific measures for 168 Flanagan Road

We recommend that the following management and mitigation measures are implemented, following the framework identified in the Assessment, Section 3.4:

- Occupiers of 168 Flanagan Road are consulted with to understand their sensitivities (they may not be at home during working hours).
- Noise barriers are installed as soon as practicable, immediately after vegetation clearance and before road relocation works are commenced, and the barriers are moved with the activities as necessary to retain maximum effectiveness and benefit.
- A building condition survey is offered to be undertaken prior to any of the Works commencing. The building condition survey would be repeated following the completion of the works to ascertain if any cosmetic damage has been caused by the works that need to be remedied.
- Temporary relocation is offered for the duration of the night works (refer above), and potentially some of the highest noise daytime works if occupiers would be home at that time. This would ensure that residents are not disturbed by these noise levels as they are removed from the receiving environment.
- Vibratory rollers are not used within 15 m of the dwelling, and only non-vibratory compaction is used.
- Night-time works are limited to only those times when they are required to avoid traffic or rail disruption.
- Vibration measurements are undertaken during piling works within 50m of the dwelling at 168 Flanagan Road.

Other receivers in the vicinity

We have reviewed if any other buildings may be affected by the proposed Works. All other buildings will be at a significant distance from the Works and are predicted to readily comply with the relevant daytime limits.

There is a residual risk that night-time works may just exceed the night-time criteria at 190 Flanagan Road (approximately 150m from the Works), but regardless, will be managed through the CNVMP as recommended in the Assessment.

A childcare centre at 74 Mercer Street is located on the far side of SH1. Daytime works on the NIMT bridges will be partially shielded by the elevation of SH1 and are predicted to comply with the relevant daytime noise limits. The centre is not occupied during night-time.

There are no other receivers close by that would be adversely affected specifically by the Works.

Yours faithfully

MARSHALL DAY ACOUSTICS LTD



Siiri Wilkening

Acoustician

