www.aeservices.co.nz
office@aeservices.co.nz
Auckland +64 9 917 0369
Wellington +64 4 890 0122
Christchurch +64 3 377 8952

Report Number: AC24004 – 02 – R1

Papakura District Courthouse - New Auckland

Assessment of Operational and Construction Noise Effects

Prepared for:
Ministry of Justice
C/O –The Building Intelligence Group
PO BOX 830
WELLINGTON

Issued:
12 April 2024

Revision History

Reference	Status	Date
AC24004 – 02 – R1	Revision 1	12 April 2024

Document Acceptance

Author	Signature
Mr Robin Chen *BE Hons (Mech)* Acoustic Engineer	
Reviewer	**Signature**
Mr William Reeve *BE Hons (Mech) MASNZ* Senior Associate Acoustic Engineer	
Approver	**Signature**
Tracy Hilliker *BE Hons (Mech) MASNZ* Associate Acoustic Engineer	

Table of Contents

This page has been left intentionally blank.

1.0 BACKGROUND

Acoustic Engineering Services Ltd (AES) has been engaged to provide acoustic engineering advice relating to a Resource Consent application for a proposed courthouse to be located at 40 Elliot Street, Papakura, Auckland. The Applicant requires an Assessment of Environmental Noise Effects (AENE) for the activity with regard to section 104 (1) of the Resource Management Act (RMA), which requires the actual and potential effects of the activity to be considered.

We have based our analysis on our correspondence to date, along with the following documentation:

- Site plan titled *Papakura District Courthouse – New,* Draft Issue, as prepared by Architectus and dated the 13th of March 2024.
- Civil drawing set titled *Papakura Interim Courthouse,* For Info Issue, as prepared by BCD Group and dated the 22nd of March 2024.
- Spreadsheet titled *Papakura Courthouse – Usage Information,* received via email from Olivia Heaslip (The Building Intelligence Group) on the 7th of March 2024.

1.1 Site and proposal

The proposal is to construct a new Papakura District Courthouse at 40 Elliot Street, Papakura, in Auckland. The facility will use a modular building construction, and has a total gross floor area of 1,825m^2, which includes the courtrooms, registry, judges chambers and facilities, public areas (i.e. waiting rooms, customer service), circulation routes and custodian areas (i.e. holding areas). The facility will operate to the public from 9 am – 5 pm Monday to Friday during the daytime period, with no activity over the weekends or on Public Holidays. The building will not be occupied during any night-time period.

The site is zoned Residential – Mixed Housing Urban under the Auckland Unitary Plan, as well as nearby residential sites to the east and south. Multi-storey residential units at 11 Ray Small Drive are located to the north-east and south-east and overlook the rear of the site. The site to the south containing the Hawkins Performing Arts Theatre is zoned Open Space – Community. The sites to the west include the Papakura Skatepark and Ray Small Park and associated carpark which are zoned Open Space – Recreational. Across to road to the north are a variety of established commercial facilities zoned Business – Light Industry with a badminton facility further to the northwest along Elliot Road. The site and surrounding areas are shown in figure 1.1 below.

Figure 1.1 – Subject site and surrounding area

Public entry to the building will be from the north, and staff entry on the western side of the building. The site will be serviced by carparks to the west and south of the building for public and staff use respectively, all accessed via a driveway from Elliot Street. An external plant area will be located to the south of the building.

There is an existing 1.8 metre high timber paling fencing along the north-east and south-east boundary of the site. This timber fence is in poor condition, with some overlapping palings damaged and warped, which results in gaps along the fence line. The Applicant intends to remediate the boundary fencing condition, which provides the opportunity to upgrade the existing fencing to provide additional acoustic attenuation. To ensure the fencing is acoustically effective, fencing should be continuous, with no gaps or cracks, and well maintained. Sections of existing palings which are warped or damaged are to be removed and replaced with minimum surface mass of 10 kg/m^2, 25 mm thick timber palings, with gaps sealed. Timber palings should have a minimum 25 mm overlap, and can be board-and batten style, or angled overlapping. A sleeper rail (horizontal paling) embedded at ground level will also be required such that there is no gap under the fence line. Alternatively, the existing fence may be completely replaced, conforming to the same standards described above. Figure 1.2 below shows the site plan, and extent of acoustic fencing to be established. The multistorey residential dwellings at 11 Ray Small Drive are located to the east and overlook the site.

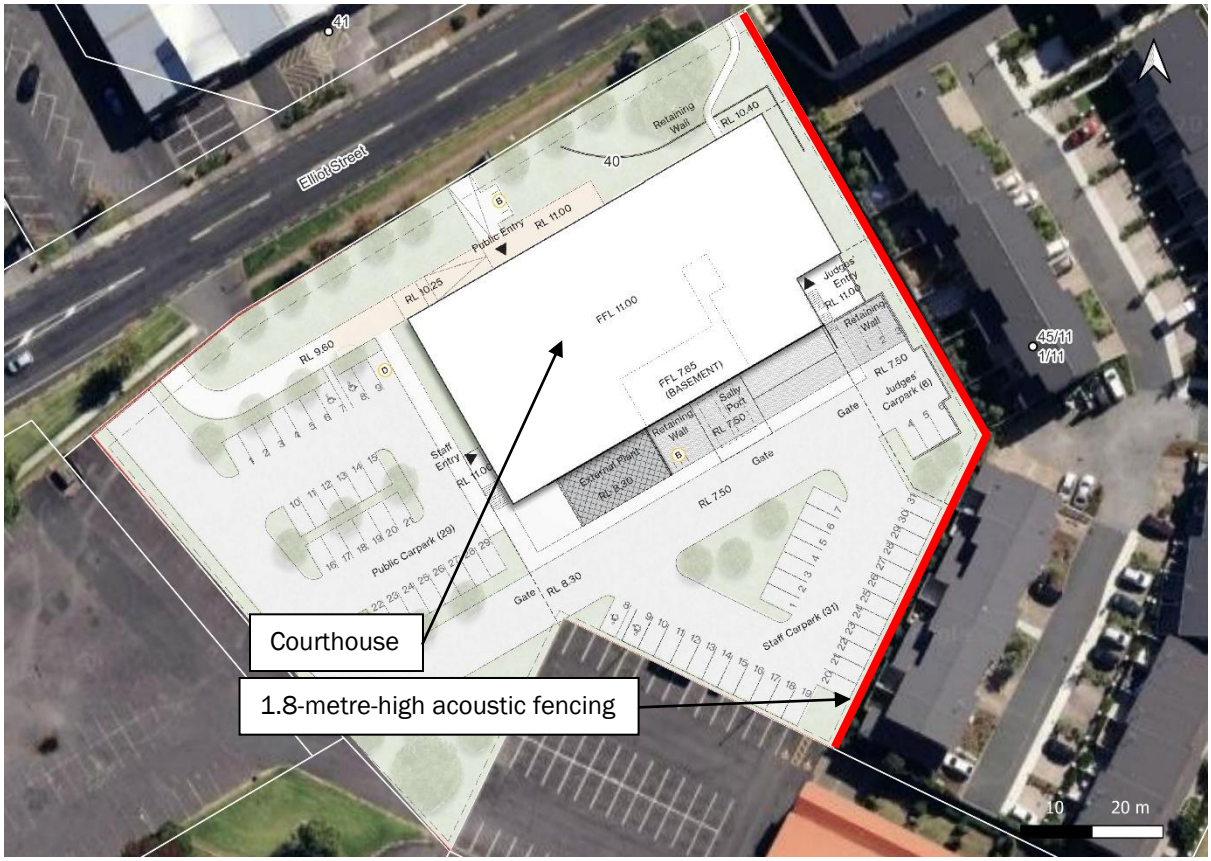

Figure 1.2 – Site layout

2.0 ACOUSTIC CRITERIA FOR OPERATIONAL NOISE

The Resource Management Act 1991 requires consideration of the significance of any adverse effects associated with the proposal. Guidance as to the significance of any adverse noise effects may be obtained from several sources.

2.1 Auckland Unitary Plan

Based on the zoning of the site and nearby sites the following Auckland Unitary Plan (AUP) noise provisions apply to this activity.

> *E25.6.2. Maximum noise levels in residential zones*
>
> *(1) The noise (rating) levels and maximum noise level arising from any activity in the Residential – Large Lot Zone, Residential – Rural and Coastal Settlement Zone, Residential – Single House Zone, Residential – Mixed Housing Suburban Zone, Residential – Mixed Housing Urban Zone and the Residential – Terrace Housing and Apartment Buildings Zone measured within the boundary of an adjacent site in these residential zones must not exceed the levels in Table E25.6.2.1 Noise levels in residential zones below:*

Table 2.1 – AUP Table E25.6.2.1 Noise levels in residential zones

Time	Noise level
Monday to Saturday 7am-10pm	50 dB L_{Aeq}
Sunday 9am-6pm	
All other times	40 dB L_{Aeq} 75 dB L_{AFmax}

E.25.6.22 of the AUP states the following:

> *Except as provided for in Standards E25.6.14 to E25.6.21 above, where noise generated by any activity on a site in one zone is received by any activity on a site in a different zone, the activity generating the noise must comply with the noise limits and standards of the zone at the receiving site.*

Based on this the following noise limit also applies which is relevant to this assessment:

Table 2.2 – Noise limit for Business – Light Industry Zone reproduced from AUP E25

Zone	Noise limit
Business – Light Industry Zone	All times – 65 dB L_{Aeq}

There are no receiving noise limits applicable for the nearby sites classified under the Open Space – Informal Recreation, Open Space – Sport and Active Recreation, and Open Space - Community zones.

The AUP also describes the following general assessment standards:

- Noise levels arising from activities must be measured and assessed in accordance with the New Zealand Standard NZS 6801:2008 Measurement of environmental sound and the New Zealand Standard NZS 6802:2008 Acoustics - Environmental noise except where more specific requirements apply.

- The noise limits of the Plan do not apply to emergency service sirens and callout sirens during emergency situations.

2.2 New Zealand Standard NZS 6802:2008

NZS 6802:2008 *Acoustics – Environmental noise* outlines a guideline daytime limit of 55 dB $L_{Aeq\ (15\ min)}$ and night-time noise limits of 45 dB $L_{Aeq\ (15\ min)}$ / 75 dB L_{AFmax} for "the reasonable protection of health and amenity associated with the use of land for residential purposes".

For town centres and mixed-use areas NZS 6802:2008 offers a guideline daytime and night-time limit of 60 dB L_{Aeq} for non-residential receivers.

The Standard also describes how a -3 dB adjustment may be applied to sound received for less than 50% of the daytime period, and a -5 dB adjustment may be applied to sound received for less than 30% of the daytime period.

Where the level of sound reduces significantly for large periods of time but does not stop completely, an energy average can be calculated across the whole daytime period to determine an overall noise rating level, with a reduction of up to 5 dB permitted. No such adjustment is permitted for the night-time period.

The Standard also describes how a +5 dB penalty should be applied to sound with a special character (SAC). This would not typically be applied to people and vehicle noise sources.

2.3 World Health Organisation

Guidelines for Community Noise[1], a document produced by the World Health Organisation (WHO) based on extensive international research recommends a guideline limit of 55 dB L_{Aeq} to ensure few people are seriously annoyed in residential situations. A guideline limit of 50 dB L_{Aeq} is recommended to prevent moderate annoyance.

Guideline night-time limits of 45 dB L_{Aeq} / 60 dB L_{AFmax} are recommended to allow occupants to sleep with windows open and meet internal limits of 30 dB L_{Aeq} / 45 dB L_{AFmax} within bedrooms to avoid sleep disturbance.

The WHO also recommends a 24 hour noise limit of 70 dB L_{Aeq} for industrial, commercial, shopping and traffic areas.

These guideline noise levels are measured at the façade of dwellings and other noise sensitive locations and the L_{Aeq} limits apply for 16 hours in the daytime, and 8 hours for the night-time.

2.4 Existing noise environment

Robin Chen of AES visited the site on the 4th of March 2024 (a Monday) to observe the ambient environment between 1130 and 1230 hours which is at a time relevant to the operation of the courthouse. Noise measurements were taken in general accordance with NZS 6801:2008 *Acoustics – Measurement of Environmental Sound.*

Noise measurements were taken in the locations shown in figure 2.1 below.

[1] Edited by Berglund, B et al. *Guidelines for community noise.* World Health Organization 1999.

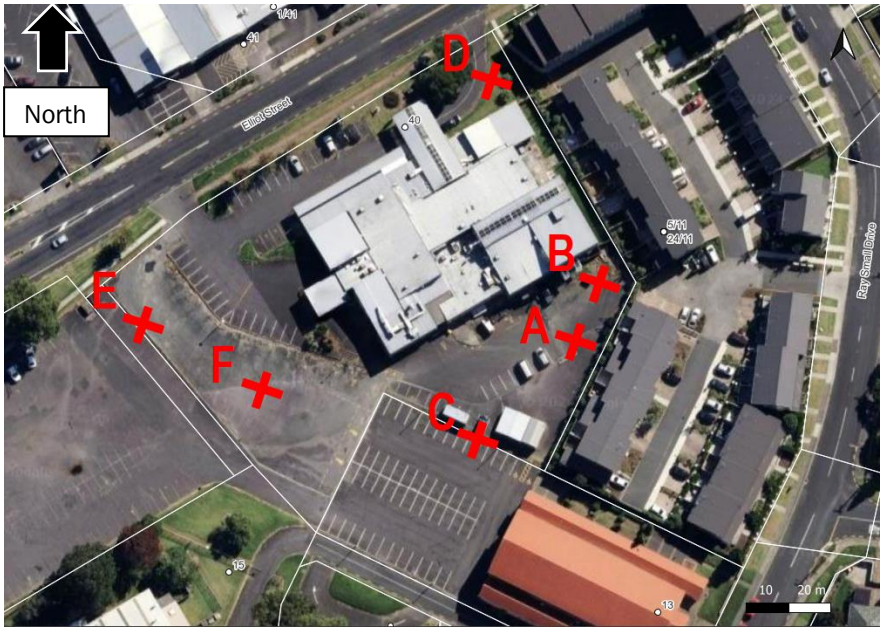

Figure 2.1 – Noise measurement locations

The noise level measured at locations A – C, close to the boundary and the residential units at 11 Ray Small Drive was in the order of 45 – 49 dB L_{Aeq} / 43 – 47 dB L_{AF90} / 54 – 57 dB L_{AFmax}. The dominant noise source in the ambient environment was transient traffic movements on Elliot Street. Insect and bird noise in the nearby foliage was also evident. There was less shielding from traffic noise at measurement locations D – F, and noise levels of 56 – 61 dB L_{Aeq} / 51 – 55 dB L_{AF90} / 64 – 73 dB L_{AFmax} were measured at these locations. During the time of the measurements there was a negligible level of audible commercial activity occurring across the road in the Business – Light Industry Zone.

Measured ambient noise levels are consistent with a suburban area close to a moderately busy road, with locations screened from the road receiving lower noise levels.

2.5 Discussion regarding appropriate noise levels

For nearby residentially zoned sites, we note that the applicable AUP noise limits are 5 dB more stringent than the upper guideline limits outlined in national and international guidance for the protection of residential amenity. The daytime AUP noise limit for residential zones is consistent with the lower guideline limit outlined in the WHO guidance.

We consider that where noise from the activity complies with the AUP residential daytime limit of 50 dB L_{Aeq} and night-time limit of 40 dB L_{Aeq} at the site boundary of any residentially zoned site, noise effects will be minimal.

Likewise, we consider that where noise from the activity complies with the AUP noise limit of 65 dB L_{Aeq} at the site boundary of any site zoned Business – Light Industry, noise effects will be minimal. While the AUP has no noise limits for noise received in Open Space zones, we consider that a limit of 65 dB L_{Aeq} would also be appropriate for noise received at the boundary of adjoining sites with this zoning, given they are primarily carparking areas.

3.0 OPERATIONAL NOISE GENERATED BY THE ACTIVITY

We have assessed noise from the types of activities that are likely to be associated with the operation of the courthouse. Key noise sources are expected to be as follows:

- Noise associated with the use of carparks on site (engine noise, exhaust noise, road/tyre noise and the like).
- Noise associated with prison trucks / vans on site.
- Mechanical plant noise associated with HVAC systems for the building including outdoor condensers and extract systems.
- Breakout noise from the building, in particular voice amplification systems that may be used within the courthouse.
- Noise from use of outdoor areas around the building such as people conversing.

Based on the above noise sources, we have now considered the noise emissions associated with the operational activity on site.

3.1 Noise sources

SoundPlan computational noise modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the site, accounting for screening from buildings and site fencing, worst-case downwind conditions, and sound power levels for each of the noise sources (including acoustic fencing as shown in figure 1.2).

3.1.1 Carpark

The public carpark will be located on the eastern side of the site fronting and accessed from Elliot Street. The staff and judges carparks will be located to the rear of the building on the southern side of the site behind a gated entry, also accessed from Elliot Street via a driveway. The site plans indicate 29 public parks, 31 staff parks and 6 judges parks.

The predominant noise associated with the carpark will be from vehicle movements. Calculations of vehicle movements in the carpark have been based on the method described in *Parking Area Noise, 6th Edition* produced by the Bavarian State Agency for Environment (2007), implemented into SoundPlan. We have used separated driving lanes, assuming each vehicle movement generates a sound power of 87 dB L_{WA} when travelling at 20 km/hr.

Based on correspondence with the Traffic Engineer we understand that the public carpark may generate up to 487 vehicle movements per day, of which 92 vehicle movements in a peak hour. This equates to about 56 vehicle movements in a typical hour. Where a single vehicle movement is a vehicle either entering or exiting the carpark.

The staff and judge's carpark may generate up to 111 total vehicle movements per day, and 37 vehicle movements in each of the peak hours (during the morning arrival or evening departure period). This traffic estimate assumes that half of the staff and judges will arrive and depart once during the day, resulting in a negligible level of activity for the majority of the day (around 5 – 6 movements per hour).

3.1.2 Building breakout

Judges offices and the registry will be located on the southern side of the building. Police, witness, probation facilities and the like will be located on the eastern side of the building, and bathrooms / waiting areas on

the northern side. The courtrooms (custodial and non-custodial) will be located centrally within the building, along with hearing rooms and interview room.

Based on the anticipated activities we expect that breakout noise from the building will be minimal. In this case we have conservatively modelled an internal reverberant noise level of 80 dB L_{Aeq} within the three courtrooms and hearing room, representative of a high level of occupancy, voice amplification system usage and raised conversation. We have assumed that this noise level will be constant throughout the day which we expect to be conservative.

Given the court-rooms and hearing rooms are mostly centralized within the overall building, we have assumed breakout through the roof, with the roof a minimum reduction of 20 dB on the internal reverberant level based on our experience with the Interlink Modular construction build-up.

3.1.3 Loading zone

A loading zone associated with the sally port is provided to the south of the building with larger parks to cater for police vans and larger delivery trucks. We have modelled a vehicle with a sound power of 97 dB L_{wA} travelling at 20 km/hr, and have assumed that it will enter the site via Elliot Street, drive down the driveway, and then back out of the site in a 15 minute period. We expect this to be the loudest activity associated with the loading space. We have conservatively assumed that there might be 4 truck movements per hour and that this activity may occur continuously throughout the daytime operational hours of the facility.

3.1.4 Mechanical Plant

As indicated in figure 1.2 an external plant area will be located on the southern side of the site adjacent to the rear of the building. External plant is likely to include outdoor condenser units associated with heating and cooling of the facility. These may also need to operate during the night-time period (early morning) for building preheat before occupation. We understand that there will be no emergency generator on the site.

The placement of the external mechanical plant is removed from the boundary and is generally a suitable location to reduce noise exposure to neighbouring sites. It is reasonable to expect that these systems can be designed, installed and operated using standard good practice to emit acceptable levels of noise at all times.

We recommend that a Condition of Consent is proffered requiring all mechanical plant systems to be designed to comply with 40 dB L_{Aeq} when received at the site boundary of nearby sites containing residential activity at all times. This will ensure that the mechanical plant noise emissions do not meaningfully contribute to the cumulative daytime noise levels, and that compliance with the night-time noise limits can be realistically achieved.

A combination of the following acoustic mitigation measures may need to be considered in order to achieve acceptable noise levels:

- Use of solid screens, enclosures, and / or acoustic louvres to interrupt line of sight of noise emitting equipment to nearby noise sensitive receivers
- Selection of low noise generating units
- Oversizing units and running on lower operating modes
- Inclusion of vibration isolating mounts
- Attenuators on extract fan discharges
- Controls/BMS design with night set-back mode, run-on timers and the like.

3.1.5 Outdoor areas

We expect there may be noise in outdoor areas around the courthouse associated with court attendees or general public congregating and conversing before and after visiting the facility.

It is difficult to quantify the scale or frequency this could occur throughout any one day. We have conservatively assumed that up to 20 people will be in the outdoor area in front of the building, with half of these conversing in a raised voice effort, and that this will occur continuously throughout the day.

Expected noise levels due to people conversing in outdoor areas have been based on the American National Standards Institute Standard ANSI S3.5 – 1997 *Methods for calculation of the Speech Intelligibility Index*, which contains information on the typical speech levels for both male and female speakers. Based on average values, for a raised voice effort, the sound power of a speaker may be deduced to be 75 dB L_{wA} for a raised voice level effort.

3.2 Expected noise levels

3.2.1 Daytime period

We note that although activity on the subject site will be constant throughout the day, the level of activity will vary. For example, while we have conservatively assumed that building breakout, truck movements, and noise in outdoor areas will occur constantly throughout the day, the staff carpark will only experience a peak number of vehicle movements during the morning and evening periods. The public carpark has a significantly higher number of movements during any peak hour. During the rest of the daytime period there is expected to be minimal activity on the site apart from mechanical plant.

Based on the anticipated activity, a calculated energy average in accordance with Section 6.4.6 of NZS 6802:2008 is appropriate and will provide some reduction in noise level for some receiver positions (such as those that predominantly receive noise from the carparks). The calculated worse-case noise rating levels at ground level during the daytime period are provided in table 3.1 below, with the loudest noise rating level at any point within the receiving site shown.

Table 3.1 – Daytime noise rating levels at ground level

Site	Zoning	Noise rating level with duration adjustment applied (dB L_{Aeq})	Duration adjustment (dB L_{Aeq})
39 Elliot Street	Business – Light Industry	43	-2
41 Elliot Street		45	-2
41A Elliot Street		43	-2
11 Ray Small Drive	Residential – Mixed Housing Urban	43	-3
15 Ray Small Drive		47	-3
19 Ray Small Drive		42	-1
13 Ray Small Drive	Open Space – Community	52	-2
17 Ray Small Drive		44	-2

We have the following comments:

- Noise levels are compliant with the AUP noise provisions during the daytime period at all nearby residential and business zoned sites. Noise generated by the activity will predominantly be due to carpark and truck activity (vehicle movements), which is consistent with the character of noise already observed in the area. Noise contribution from general public conversation in outdoor areas

around the building, and breakout from the building, are predicted to be much lower than vehicle noise.

- A noise level of up to 52 dB L_{Aeq} may be received at the boundary of the carpark of 13 Ray Small Drive, which is zoned Open Space – Community, mainly due to vehicle movements on the site. As noted above there are no applicable receiving noise limits in the AUP for sites zoned Open Space – Community. The nature of the noise generated by the proposed activity when received at this site will be predominantly vehicular, which will be of similar character to the carpark activity on the receiving site. For further context, the noise level received at the building façade on 13 Ray Small Drive (Papakura Theatre) will be in the order of 40 dB L_{Aeq} which is lower than the current background noise levels in the area and therefore expected to provide more-than-adequate protection for the theatre use.

- We expect a worse-case noise rating level of 48 dB L_{Aeq} (including a duration adjustment of -3 dB) at the boundary of the site to Ray Small Park to the west, in the carpark. This is lower than the existing ambient noise level and expected to result in minimal adverse noise effects.

Based on the above we expect general operation of the proposed activity to result in minimal adverse noise effects.

Expected noise level at upper façades of residential properties

Multi-storey residential units at 11 Ray Small Drive will overlook the subject site and proposed activity. The 1.8-metre-high acoustic fencing on the norht-east and south-east boundary will be mostly ineffectual above ground level. We have therefore considered the noise emissions that may be received at the upper façades of the units overlooking the site.

The predominant source of noise received at the adjacent site is expected to be from vehicle movements on site associated with the staff & judges carparks, as well as prison truck movements to the loading zone / sally port at the rear of the site.

Our modelling indicates that a worse-case noise rating level of 46 dB L_{Aeq} will be received at the upper façades of units at 11 Ray Small Drive. This includes an energy adjustment of –5 dB. This level is compliant with the AUP noise provisions and the nature of the noise is expected to be consistent with that already experienced in this area due to the proximity of the road. We therefore expect adverse noise effects to be minimal.

We also expect noise from door slams and engine starts to comply with the AUP night-time limit of 70 dB L_{AFmax} at all nearby properties and we would expect minimal adverse effect at any property from door slams and engine starts.

3.2.2 Night-time period

During the night-time period (2200 – 0700 hours) the building is unoccupied, and therefore the only noise sources expected from the proposed activity will be mechanical plant associated with building preheat. Provided the recommendations outlined in section 3.1.4 above are adopted we expect noise from mechanical plant to be appropriately mitigated and result in minimal noise effects if operating during the night-time period.

4.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Noise and vibration associated with the demolition of existing structures on site, and construction of the new courthouse facilities has the potential to adversely affect adjoining properties, especially if carried out during the early morning or evening hours.

4.1 Construction noise criteria

The site is located within a Residential – Mixed Housing Urban zone as defined within the AUP. Therefore, the construction noise provisions outlined in Chapter E25.6.7 *Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone,* apply.

The relevant noise limits are reproduced in table 4.1 below, including a 5 dB reduction to the limits in line with AUP Rule E25.6.27.4 as the total duration of the construction activity is expected to exceed 20 weeks.

E25.6.27.4 of the AUP is provided below:

- *For a project involving a total duration of construction work that is more than 20 weeks the noise limits in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above shall be decreased by 5 dB in all cases.*

E25.6.7 *Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone* is provided below:

- *Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone when measured 1m from the façade of any building that contains an activity sensitive to noise that is occupied during the works.*

Table 4.1 – Noise limits from the AUP Rule E25.6.27.1 adjusted according to Rule E25.6.27.4

Day of the week	Time period (hours)	Maximum noise level (dB)	
		L_{Aeq}	L_{AFmax}
Weekdays	0630 – 0730	55	70
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	40	70
Saturdays	0630 – 0730	40	70
	0730 – 1800	70	85
	1800 – 2000	40	70
	2000 – 0630	40	70
Sundays and Public Holidays	0630 – 0730	40	70
	0730 – 1800	50	80
	1800 – 2000	40	70
	2000 – 0630	40	70

E25.6 of the AUP also states the following:

- *The noise from any construction work activity must be measured and assessed in accordance with the requirements of New Zealand Standard NZS6803:1999 Acoustics – Construction noise. Construction work is defined in New Zealand Standard NZS6803:1999 Acoustics – Construction noise.*

We note that NZS 6803:1999 states that best practicable options for noise avoidance or mitigation should be applied to construction activities on the site; however, if the best practicable options are applied and the noise limits are still not met, discretion is able to be applied. Nevertheless, we consider that compliance with the long-term construction noise limit as far as practicable would be in line with good practice and would result in reasonable and acceptable noise effects.

Noise from construction activity can consist of a combination of steady state and transient type noise events. A 15-minute averaging time-period for the L_{Aeq} noise descriptor is generally appropriate for the application of the construction noise limits as directed by NZS 6803.

For noise sources that may include transient periods of elevated noise level, or percussive noise sources, the relevant performance standard is the L_{Amax} noise descriptor. While most noise from construction equipment will be reasonably steady-state, we expect there could be instantaneous maximum noise events that cause levels in the order of 10 – 15 dB higher than predicted L_{Aeq} noise levels. Since the L_{Amax} noise limits are 15 dB higher than the L_{Aeq} noise limits during the daytime, the L_{Aeq} levels will generally be the limiting factor for construction noise compliance, and we have focussed on this in our subsequent assessment.

Unless stated otherwise we have assumed that demolition and construction activity will be limited to between 0730 and 1800 hours Monday to Saturday.

4.2 Noise generating activities

There are existing buildings on the site that will need to be demolished, along with sections of driveway that will be removed. We expect that it is likely that this can be carried out by an excavator with a standard bucket attachment and will not require specialist breaking attachments for removing the existing foundations or driveway. If a breaker will be required to remove existing sections of concrete foundation, further localized screening will be required if this is required to occur within 20 meters of the site boundary to keep noise levels consistent with what we've assessed.

Based on the Geotechnical Engineering Report we do not anticipate that traditional rock breaking, or blasting is going to be required anywhere on site. Excavation for the building platform of the site (up to minus 3 meters from current ground level in the centre of the site where the building will sit) where required will be performed by an excavator with a standard bucket attachment. If rock breaking ends is required due to eventual site conditions, further acoustic assessment will be required.

Shallow foundations are the recommended option in the preliminary geotechnical assessment. We have therefore assumed that this will be the foundation methodology adopted. Should piling or alternate foundation methodologies be required due to site conditions, specific acoustic assessment will be required. We note that the preliminary geotechnical assessment recommends that piled foundations are avoided.

We understand that the modular components of the building will be prefabricated off-site and then transported to site with heavy vehicles, where they will be then erected through cranage.

The main sources of noise associated with the demolition and construction of the proposed facility are therefore expected to be:

- Noise from excavator operation
- Noise from compactor and vibratory roller operation

- Noise associated with concrete pumping, pouring and floating for foundations
- Noise from heavy vehicle movements
- Cranage

There will be several additional noise sources that will be present on site, such as noise from tradespeople talking on site, small utility and trade vehicles, and small handheld tools such as concrete needle vibrator, and small handheld tools such as nail guns and drills. However, we would expect the noise levels from these sources to be lower than those identified above and that this noise will be able to be adequately controlled through good practice and the adoption of a Construction Noise and Vibration Management Plan.

SoundPlan computational noise modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* was used to determine the noise levels when received 1.0 metre away from the façade of the closest neighbouring dwellings accounting for façade reflections in line with NZS 6803:1999, taking into account the topography and ground absorption of the nearby environment.

Where nearby dwellings have multiple floors, we have reviewed the noise level at each floor and presented the worst-case noise levels incident on the building.

4.2.1 Site mitigation measures

Site mitigation measures have not yet been confirmed. However, we have assumed that at minimum, 1.8-metre-high solid site hoardings will be installed along the perimeter of the site (legal boundaries) for the duration of the construction activities, completely enclosing the site, except where existing acoustically-effective fencing exists (see section 1.1). Any gate used to access the site would be required to be of solid construction and would need to be kept closed when high noise activities are being undertaken within the site.

The site hoardings and gate must be continuous and maintained with no gaps or cracks and should also comply with the following minimum specifications.

- Height – 1.8 metres
- Surface mass – at least 8.0 kg/m^2 (such as 18 mm plywood). Proprietary flexible noise barriers such as Duraflex Hushtec barriers may be suitable, however these would need further review to confirm acceptability of use.

4.2.2 Receivers

With regard to 11 Ray Small Drive, the analysis below relates to the units immediately adjacent to the site, shown in red in figure 4.1 below, at ground floor level (GFL) and first and second floor level ('upper floor levels'). Noise levels received at other units in the residential development would be significantly lower due to the noise shielding provided by the units on the western side of the site in addition to increased distance from the demolition and construction activity. Key items of construction machinery will be required in some capacity over most of the site (i.e., excavation and compaction). Therefore, we have not assessed each individual residential unit at 11 Ray Small Drive as the worse-case received noise level is expected to be approximately equivalent and representative for each of the units highlighted in red. Where the construction activity is expected to be localized on a certain part of the site (for example, concreting activities on the foundation slab, or crane usage around the building footprint) we have provided some additional commentary.

Figure 4.1 – Closest residential receivers at 11 Ray Small Drive

4.2.3 Noise from excavation

Excavator use is expected for the demolition of the existing building on the site and cuts to accommodate building platforms. We have assumed that an excavator will also be used to rip up any existing sections of the asphalt carpark where required. If a rock hammer or similar machinery will be used to cut the carpark, additional mitigation such as localized hoardings will be required.

As the exact plant to be used for excavation and demolition is yet to be confirmed, we have conservatively assumed the use of a 25 tonne tracked excavator in the first instance. Based on the range of values presented in British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise,* this has a worst-case sound power of 105 dB L_{wA}.

From the cut and fill plan we infer that some level of cut or fill will be required over the majority of the site. Based on this we have modelled the excavator operating at existing ground level at several worst-case positions when considering the locations of the neighbouring dwellings.

The resulting expected worst-case noise levels from excavator use received at 1.0 metre from the façade of neighbouring dwellings are given in table 4.2 below.

Table 4.2 – Expected noise levels from excavator activity received at neighbouring properties

Neighbouring property	Noise level from excavation (dB L_{Aeq})
11 Ray Small Drive – ground level	74
11 Ray Small Drive – upper levels	80
13 Ray Small Drive (Hawkins Theatre)	73
15 Ray Small Drive (IDEA Services – Counties)	62
17 Ray Small Drive (Papakura Girl Guides)	63
19 Ray Small Drive (Papakura Ambulance Station)	62
37 Elliot Steet	57
39 Elliot Street	67
41 Elliot Street	66
41A Elliot Street	62

Based on the above analysis we have the following comments:

- Compliance with the construction noise limits is realistically expected at all nearby sites except for those immediately adjacent to the subject site to the north-east and south-east.
- Our analysis indicates that during a worst case scenario where a 25-tonne excavator is operating in close proximity to neighbouring dwellings, exceedances of up to 10 dB may be expected at upper floor levels for the terraced units at 11 Ray Small Drive, and 4 dB at GFL.
- When the excavator is operating on the southern extremity of the site a 3 dB exceedance may be expected at 13 Ray Small Drive (Hawkins Theatre).
- The larger exceedance at the 11 Ray Small Drive units at upper floor levels is expected and mostly unavoidable due to the proximity, and the units being multi-storey, meaning the 1.8-metre-high site hoardings are mostly ineffective at blocking any noise.

Based on the above we would expect the following mitigation measures below to be required in order to reduce noise levels and result in acceptable noise effects at noise sensitive dwellings:

- Selection of a smaller excavator where practical (i.e., a 14-tonne excavator, which may have a sound power of 98 dB L_{wA} or lower)
- Restricting the timeframe of excavator activity for example not before 0830 hours, or after 1700 hours Monday to Friday.

We note the following:

- With the selection of a smaller excavator, the highest noise levels at the closest neighbouring building façades (i.e., 11 Ray Small Drive terraced units at upper floor levels) are expected to be in the order of 71 – 75 dB L_{Aeq} or less. The internal noise level within a typical dwelling would be 51 – 55 dB L_{Aeq} with windows closed. Although the nature of construction noise will be audible and

identifiable as part of the background noise, for a typical dwelling with windows closed, conversations are likely to still be able to be undertaken at a normal voice effort and day to day activities are still expected to be undertaken with minimal modification or disruption. For most occupants, construction noise levels at 11 Ray Small Drive GFL and 13 Ray Small Drive would be expected to marginally comply with the daytime construction noise limits with a smaller excavator.

- The predicted noise levels received at adjacent dwellings are only expected when the excavator operates at the eastern or southern extremity of the site. In reality the excavator would only be in either location for a short period of time relative to the overall activity. Noise levels would therefore be lower than those predicted for the majority of the works.

- We note that the noise limit for short term construction works defined as up to 15 days is 80 dB L_{Aeq}. While this limit doesn't apply in this situation as the overall duration of the works is expected to be much longer, it does indicate that higher noise levels of this order are typically tolerable where limited in duration.

If the above mitigation measures are adopted and the operating hours of the excavator are restricted, we would consider that the best practicable option has been applied and that the noise effects will be acceptable. A Construction Noise and Vibration Management Plan (CNVMP) should be prepared to ensure that mitigation measures are implemented in due course.

4.2.4 Noise from compactor and vibratory roller

Compactors will be used as part of the earthworks process to compress fill and establish the building footprint. We have considered a worse-case scenario with a vibratory roller on the site, which based on NZS 6803:1999 could have a sound power of 108 dB L_{wA}. This is also expected to be the loudest noise source associated with the compacting activity, with a plate compactor expected to have a sound power level of 100 dB L_{wA} or less.

Compaction works are expected to be required over most of the site in some capacity. Therefore, noise levels received from the compaction activity are expected to be similar, or slightly higher (up to 3 dB), to those predicted for the excavation works.

Exceedances therefore are also predicted at the same neighbouring properties – 11 Ray Small Drive and 13 Ray Small Drive.

We expect the following mitigation measures to be required to reduce noise levels and result in acceptable noise effects:

- Limit the use of a vibratory roller as far as practical and/or prohibit use of a vibratory roller 10 meters from the eastern site boundary, and instead require compacting activities to be performed by a smaller plate compactor only, or by track rolling with a smaller excavator.

- Restricting the timeframe of compacting activity to between 0830 and 1700 hours Monday to Friday.

Similar to that described for excavation, if a smaller plate compactor is used close to the boundaries we expect minimal modification and disruption to day to day activities. Noise effects would be expected to be acceptable. Similar to excavation activities these mitigation measures should be outlined and adopted in a Construction Noise and Vibration Management Plan (CNVMP).

4.2.5 Noise from mobile crane usage

At times a small mobile crane may be required to unload large deliveries, or to erect prefabricated modular elements. We have therefore considered a scenario where the crane is parked at several points around the building footprint.

Based on the range of values presented in British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*, we have assumed a worst-case sound power of 105 dB L_{wA} for the anticipated activity.

Based on this, we expect the following worse-case noise levels shown in table 4.3 below to be received at 1.0 metre from the façade of neighbouring properties from the usage of the mobile crane:

Table 4.3 – Expected noise levels from mobile crane usage received at neighbouring properties

Neighbouring property	Noise level from mobile crane (dB L_{Aeq})
11 Ray Small Drive – ground level	72
11 Ray Small Drive – upper levels	74
13 Ray Small Drive (Hawkins Theatre)	61
15 Ray Small Drive (IDEA Services – Counties)	57
17 Ray Small Drive (Papakura Girl Guides)	57
19 Ray Small Drive (Papakura Ambulance Station)	57
37 Elliot Steet	56
39 Elliot Street	62
41 Elliot Street	62
41A Elliot Street	55

Based on this analysis we expect a 2 dB exceedance at GFL and 4 dB exceedance at FFL for the terraced units at 11 Ray Small Drive due to crane usage.

When in operation, noise from a crane will be an obvious new component of the background noise. However, similar to the above we expect minimal modification and disruption to day to day activities.

We note the following:

- The highest noise levels will only be recorded when the crane operates on the eastern side of the site, which is expected to be for a short period of time relative to the overall activity.
- A 2 dB change in noise level is typically imperceptible, and 4 dB is only a just subjectively noticeable difference, when compared to the 70 dB L_{Aeq} noise limit.

We therefore expect that adverse noise effects associated with cranage will be acceptable.

4.2.6 Noise from concrete activities

We expect that the main noise generating concrete activities on site will be the pumping and pouring of concrete associated with the establishment of the foundation, and the use of power floats.

We understand from correspondence that existing asphalt will be used as far as practical for fill in the carpark area, although some additional fill may be required. Concreting works in the carpark areas will be limited to localised sections of pipe and curbing.

Concrete pumping and pouring

Access to the site will be from the north. Based on the location of the building footprint we anticipate that the pump will be set up somewhere along the northern / north-western to central part of the site.

An assumed sound power level of 105 dB L_{wA} has been sourced from BS 5228-1:2009.

The noise levels emitted by the equipment will vary throughout the process as different tasks are undertaken. For example, we expect the concrete pump will steadily idle most of the time, with higher noise emissions when the engine increases in speed to move the nozzle over the site. Similarly, the concrete trucks will be idling most of the time but will generate higher noise emissions when their engine speed is increased before transferring the concrete to the pump.

The resulting expected noise levels received at neighbouring properties from concrete pump activity are given in table 4.4 below.

Table 4.4 – Expected noise levels from concrete pump activity received at neighbouring properties

Neighbouring property	Noise level from concrete pump (dB L_{Aeq})
11 Ray Small Drive – ground level	53
11 Ray Small Drive – upper levels	59
13 Ray Small Drive (Hawkins Theatre)	57
15 Ray Small Drive (IDEA Services – Counties)	57
17 Ray Small Drive (Papakura Girl Guides)	57
19 Ray Small Drive (Papakura Ambulance Station)	56
37 Elliot Steet	49
39 Elliot Street	59
41 Elliot Street	62
41A Elliot Street	55

Our analysis shows that provided the concrete pump is located within the northern / north-western to central portion of the site, it is realistic for the concrete pump activity to comply with the construction noise provisions at all nearby sites, and we would generally expect this activity to result in minimal effects. We note that units at 11 Ray Small Drive on the southern side of the site would receive significantly lower noise levels (up to 10 dB) due to these units being located further away from the concreting works.

If an early morning pour was required between 0630 and 0730 hours, a more stringent noise limit of 55 dB L_{Aeq} would apply as per the construction noise provisions. Based on the above, exceedances of up to 7 dB would be expected at a number of nearby properties. If earlier than 0630 hours, the 40 dB L_{Aeq} noise limit would be significantly exceeded. If an early morning pour is required, we recommend that all residents at 11 Ray Small Drive shown in figure 4.1 are notified beforehand via letter drop and/or face-to-face meeting, and this procedure is outlined in the CNVMP.

Concrete float

A concrete float might be used on site. While the overall noise levels of the specific equipment on site will vary (due to the noise of the concrete floats available), we have based our analysis on a handheld power float, with a sound power of 100 dB L_{wA}.

We have considered float operation at ground floor level only, at the worst case (closest) locations with regards to neighbouring residential dwellings.

The resulting expected noise levels received at 1.0 metre from the façade of residential dwellings on neighbouring sites from concrete float activity are given in table 4.5 below.

Table 4.5 – Expected noise levels from concrete float activity received at neighbouring properties

Neighbouring property	Noise level from concrete float (dB L_{Aeq})
11 Ray Small Drive – GFL	58
11 Ray Small Drive – FFL	67
13 Ray Small Drive (Hawkins Theatre)	55
15 Ray Small Drive (IDEA Services – Counties)	52
17 Ray Small Drive (Papakura Girl Guides)	51
19 Ray Small Drive (Papakura Ambulance Station)	52
37 Elliot Steet	49
39 Elliot Street	57
41 Elliot Street	56
41A Elliot Street	49

Based on the above we expect concrete floating activities to comply with the construction noise limits at all nearby properties and noise effects to therefore be acceptable.

4.2.7 Noise from heavy vehicle movements

Heavy vehicles associated with the construction activity will generate noise on site when arriving and departing, and when idling on site. Heavy vehicles may also be required to bring in prefabricated modular elements. Vans, utes, and trucks may be used.

It is difficult to quantify the expected noise levels arising from construction vehicles on site due to the intermittent nature of the activity, and the large variance in the vehicle noise characteristics. In this situation, we consider that the best approach to reducing the noise levels from construction vehicles both on and off site would be through operational measures outlined within the Construction Noise and Vibration Management Plan, such as the following measures:

- Limitations on the arrival and departure times of heavy vehicles to between 0730 – 1800 hours Monday to Saturday whenever practical.
- Prohibit the use of engine braking within the vicinity of the site.

- Limit the sound level and frequency of use of vehicle reversing beepers as far as practicable.
- Limit the amount of time vehicles spend idling on site.
- Prohibit the use of vehicle horns on site except for safety purposes.

4.3 Construction vibration criteria

The machinery used throughout the construction works is expected to produce varying levels of vibration. Key vibration sources include the use of an excavator, compactor or vibratory roller, and trucks entering and leaving the site. Vibration effects are typically considered in two ways – with regard to possible structural or cosmetic damage to buildings, and human response. We note that individuals can detect levels of building vibration that are well below those required to cause any risk of damage to the building or its contents.

We expect the above construction works will generate continuous vibration for short periods of time. This vibration may potentially result in two main effects for occupants within the neighbouring buildings – perceptible (structure-borne) vibration, i.e., vibration of walls, floors etc. which is perceived by occupants through tactile sensation or audible motion such as rattling of windows; and low frequency noise, where sound waves radiated by the vibrating surfaces inside buildings are perceived by the human ear as noise – often referred to as ground-borne noise.

Chapter E25.6.30 of the AUP states that construction and demolition activities must be controlled to ensure any resulting vibration does not exceed:

a) The limits set out in German Industrial Standard DIN 4150-3 (1999): *Structural vibration – Part 3 Effects of vibration on structures* when measured in accordance with that Standard on any structure not on the same site; and

b) The limits in Table E25.6.30.1 Vibration limits in buildings in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500 mm of ground level at the foundation of a single storey building.

Vibration levels in the referenced DIN 4150-3 Structural Vibration – Part 3: *Effects of vibration on structures* can be found in table 1 of that standard and are reproduced in table 4.6 below. Compliance with these criteria will ensure that there will not be an adverse effect on the serviceability of a structure. In this case, lines 1 and 2 are most relevant.

Table E25.6.30.1 of the Auckland Unitary Plan as referenced above is provided in table 4.7 below.

Table 4.6 – Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on structures (reproduced from DIN 4150-3:1999)

Line	Type of Structure	Guideline values for velocity, v_i, *in mm/s*			
		Vibration at the foundation at the frequency of			Vibration at horizontal plan of highest floor at all frequencies
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8
*At frequencies above 100 Hz, the values given in this column may be used as minimum values.					

Table 4.7 – Vibration limits in buildings (Table E25.6.30.1 of the Auckland Unitary Plan)

Receiver	Period	Peak Particle Velocity Limit (millimetres/second)
Occupied activity sensitive to noise	Night-time 10 pm to 7 am	0.3
	Daytime 7 am to 10 pm	2
Other occupied buildings	At all times	2

4.4 Vibration generating activities

There are many factors, including soil condition and structural design, which will influence the vibration level experienced in the foundation of any adjacent buildings. However, we would expect that the following vibration levels may be generated by the construction activities:

- Vibration generated by a plate compactor will depend on the specific size and model. A small handheld compactor (typically less than 500 kg) may generate around 0.2 mm/s at a distance of 8 metres. Manufacturer data suggests that this will be predominantly within a frequency range of 60 – 100 Hz.
- A vibratory roller may generate in the order of 1 – 12 mm/s at a distance of 10 metres.
- Excavators and trucks travelling over irregular surfaces could generate 1 – 2 mm/s at distances of 5 metres, reducing to less than 0.1 mm/s at 20 metres.
- A wheeled mobile crane or tracked mobile crane might be expected to generate 2 mm/s at a distance of 8 meters.

4.4.1 Expected vibration levels

The closest dwellings to the site are those at 11 Ray Small Drive. From aerial imagery the units on the north-eastern side of the site are 10 meters or more removed from the site boundary. The foundations of some parts of the units on the south-eastern side of the receiving site (the 'closest building platforms') may be within 5 metres of construction activity proposed in this Application.

Based on the above the closest building platforms of 11 Ray Small Drive may receive 1 – 2 mm/s from excavator and truck movements and 3 – 4 mm/s from use of a small plate compactor when these operate right up against the eastern boundary in a worse-case scenario. Crane usage is expected to be limited to around the building platform and therefore vibration levels are expected to be 2 mm/s or less at all nearby dwellings (since units on the northern side of 11 Ray Small Drive are further removed from the site boundary).

We therefore expect that it is realistic for construction activity on site to comply with the requirements outlined in the DIN Standard – provided the use of a vibratory roller is not permitted close to the boundary. With regard to the vibration limits for occupied buildings outlined in the Auckland Unitary Plan, the 2 mm/s PPV limit may be exceeded at times when a hand-held plate compactor is used in close proximity to the site boundaries.

In terms of adverse effects from construction vibration we have the following comments:

- At 1 mm/s it is possible that items sitting on hard surfaces may begin to rattle (NZTA guidance). At this level BS 5228 guidance states that vibration effects are likely tolerable provided prior warning and explanation is given to nearby residents.

- At levels of 1 – 2 mm/s (when an excavator or truck is right up against the eastern boundary), some people may notice the building vibrating, and a smaller number of people may notice furniture and fixtures rattling. People may also experience some disturbance of radio / TV use and conversation.

- At vibration levels of 3 – 4 mm/s (possible when a small hand-held compactor is used right up at the site boundary), an increased number of occupants may feel like there is disruption to normal activities like the use of radio of TV or may have conversations disturbed.

We therefore recommend the following mitigation measures are adopted for compaction activities:

- Vibratory rollers and hand-held plate compactors can have a large variability in vibration generation depending on a range of factors including the number of vibrating drums, vibration amplitude, drum length, and machine weight. The following should be observed:

    - If a vibratory roller is to be used on the site, we recommend that it is setback at least 10 meters from the eastern site boundary and selected to have a single drum with low amplitude as far as practical.

    - The hand-held plate compactor selected should be as small as practical (i.e., less than 500 kg), such that the more lenient DIN standard frequency band 50 – 100 Hz (outlined in table 4.6) would apply with a 15 mm/sec vibration limit, and we would expect this to be achieved at all nearby dwellings.

- As far as practical these activities should be scheduled to occur at times when the adjacent dwellings are unoccupied or least vibration sensitive, determined through liaison with neighbours or letter drop.

We recommend the above mitigation measures are outlined and adopted in the Construction Noise and Vibration Management Plan.

We also note the following:

- Our predictions are generally conservative as they do not allow for ground to building foundation coupling loss.

- As mentioned above the predicted vibration levels will only be expected when equipment is located right up against the eastern site boundary, which is only expected for short periods of time. For most of the time vibration levels will be lower and expected to be only just perceptible.

Therefore, provided the above mitigation measures are adopted we expect adverse vibration effects from the construction activity to be acceptable.

4.5 Construction noise and vibration management plan

As demonstrated above, managerial and operational strategies need to be adopted by the Applicant to control and reduce noise emissions and vibration from the construction activity. We therefore recommend that the Applicant establishes a Construction Noise and Vibration Management Plan (CNVMP) outlining the measures which will be employed to ensure that noise and vibration impacts on neighbouring properties are minimised as far as practical.

The CNVMP would typically include:

- Relevant noise and vibration limits as outlined in the AUP.

- Restrictions on the operational hours of construction works on site (i.e., 0800 – 1700 hours Monday to Friday for excavation and compaction activities).

- Machinery and equipment to be used and the selection of quieter equipment / methodologies wherever practical.

- Duration of work.

- The physical mitigation required to result in acceptable noise levels (i.e., acoustic fencing as discussed in section 4.2.1 and additional localized screening where required).

- Limitations on the arrival and departure times of heavy vehicles, and operating recommendations.

- Identification of neighbouring properties which may be affected.

- Procedures for liaising with the neighbouring properties prior to high noise/vibration activities being undertaken (i.e., excavation and compaction activities), to determine least noise-sensitive times for these activities. Outlining the process for letter drop if early morning concrete pours are anticipated.

- Details of complaints procedures and the need for and responsibilities of a Noise Liaison Officer for the community.

5.0 CONCLUSION

Noise from all sources expected to be associated with the proposed new District Courthouse at 40 Elliot Street, Papakura, has been assessed.

5.1 Operational noise

Based on our review of the relevant AUP noise limits, NZ Standards, WHO guidelines, and ambient noise measurements in the area, we consider that compliance with the AUP daytime noise limits of 50 dB L_{Aeq} when received at nearby residentially zoned sites and 65 dB L_{Aeq} at any nearby business zoned site would ensure adverse noise effects are minimal. Similarly, during the night-time period, compliance with the residential Auckland Unitary Plan noise limit of 40 dB L_{Aeq} will also ensure noise effects are minimal.

Based on our analysis, noise during the daytime period from vehicle movements, building noise break-out, and outdoor area occupation is expected to result in a maximum noise rating level of 47 dB L_{Aeq} at the closest residential site and 45 dB L_{Aeq} at the closest business zoned site. Predicted levels are consistent with the acoustic criteria we have defined in section 2.5, and we therefore expect adverse noise effects to be minimal. We also expect a noise level of 52 dB L_{Aeq} in the carpark of 13 Ray Small Drive (zoned Open Space – Community) and a noise level of 50 dB L_{Aeq} at the boundary to the carpark of Ray Small Park (zoned Open Space – Sport and Active Rec) to result in minimal adverse noise effects.

During the night-time period the only noise source expected to be associated with the proposed courthouse will be mechanical plant noise associated with building preheat. Given the location of the plant, we consider it practical for these sources to comply with the AUP night-time noise limits, and therefore result in minimal adverse noise effects. We have recommended an appropriate Condition of Consent below.

Overall, we expect that adverse noise effects associated with the day to day operation of the proposed courthouse will be minimal.

To ensure noise emissions from the development are appropriately managed, we recommend that the following conditions of consent or advice notes are adopted:

- *All external mechanical plant shall be designed to not exceed 40 dB L_{Aeq} noise limit at the site boundary of any site containing residential activity at all times.*

- *Acoustic Fencing will extend as per figure 1.2, confirming to the following specification. This can be achieved by remediation of the existing fence or installation of new fencing meeting the following minimum specifications:*

    - *Height – at least 1.8 meters*

    - *Surface mass – at least 10 kg/m²*

    - *The fence must be continuous and maintained with no gaps or cracks.*

5.2 Construction noise and vibration

Noise and vibration from demolition and construction activity associated with the establishment of the proposed courthouse has been considered.

Our analysis indicates that some activities such as excavation and compactor use close to the site boundaries may exceed the construction noise provisions of the AUP. This is mostly unavoidable due to the setback between the site and neighbouring properties, in particular the residential multi-storey units at 11 Ray Small Drive overlooking the subject site.

While the vibration limits for protection against structural damage can be met, the construction vibration provisions of the AUP relating to amenity may be exceeded when compaction works occur close to the eastern site boundary.

We expect that construction noise and vibration effects will be accepted provided the following mitigation measures are adopted:

- All construction activities on the site shall comply with the long term noise limits in Table 2 of NZS 6803:1999, or as far as is practicable provided all reasonable mitigation measures are adopted.
- A Construction Noise and Vibration Management Plan (CNVMP) shall be prepared and adopted for the development prior to the commencement of works, including at minimum the matters outlined in section 4.5 above.
- Site hoarding and acoustic boundary fencing is installed as discussed in section 4.2.1 above.
- For the excavation and compaction activities:
    - Operating hours are limited to between 0830 and 1700 hours Monday to Friday.
    - Minimizing the size of the plant as far as practical.
    - Where practical a hand-held plate compactor is used for any compaction works instead of a vibratory roller. If a vibratory roller is required, it is to be selected with a single drum and low vibration amplitude as far as practical, and setback at least 10 meters from the eastern site boundary.
    - As far as practical vibratory roller or hand-held compactor use would be scheduled to occur when adjacent dwellings are unoccupied or at times identified as being of lower sensitivity to residents.