MARSHALL DAY Acoustics

DOMINION ROAD MIXED USE DEVELOPMENT ENVIRONMENTAL PROTECTION AGENCY – PEER REVIEW

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Project: **DOMINION ROAD MIXED USE DEVELOPMENT**
ENVIRONMENTAL PROTECTION AGENCY – PEER REVIEW

Prepared for: **Environmental Protection Agency**

Attention: **Christina Smits**

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1.0 INTRODUCTION

The Environmental Protection Agency is hearing the Dominion Road Mixed-Use Development resource consent application under the COVID-19 Recovery (Fast-track Consenting) Act 2020. The Panel has requested an opinion on the noise and vibration effects during both construction and operation of the proposal and how such effects can be managed by conditions of consent in the event the Panel decides to grant the application.

In this report I consider the likely noise and vibration emissions from various activities associated with the proposal, the concerns of the submitters relating to acoustic effects, and how the effects were assessed by the applicant and their expert and addressed by the Council within the recommended Conditions.

2.0 ACTIVITIES THAT MAY GIVE RISE TO NOISE AND VIBRATION EFFECTS

I have read the proposal and submissions which raise the potential noise and vibration effects from following activities:

- Construction noise: demolition, rock breaking, concrete cutting, piling
- Construction vibration: rock breaking, piling
- Operational noise: truck movements, customer and occupant vehicle movements, mechanical services noise
- Operational vibration: truck movements
- Operational amenity: façade design of apartments

I will address each of these in the following sections.

3.0 CONSTRUCTION NOISE

3.1 Issue

Construction noise from some activities will be high at adjacent buildings which will disturb the amenity of occupants of those buildings.

3.2 Submissions

Submissions regarding construction noise were received from:

- Ms Roux de Buisson
- The Tsais
- The Perretts

Ms Roux de Buisson is concerned over the high levels of construction noise and comments that "*There are days/weeks forecast for near intolerable noise/vibration during the construction. There will be no refuge.*"

The Tsais and Perrets are concerned over the degree of construction noise.

3.3 Applicant / Expert Evaluation

3.3.1 Planning Report

The application notes that Hegley Acoustic Consultants (HAC) predicts AUP construction noise limit exceedances at 12 properties; 2 of those have noise predictions up to 80 dB L_{Aeq} for some construction activities and one up to 85 dB L_{Aeq}.

Methods for addressing adverse effects are the avoidance of the construction of a basement and the erection of temporary acoustic screens during the construction period. In addition, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared.

Given the short duration of exceedances of the noise limits, it was concluded that the adverse effects can be controlled to reasonable and acceptable levels.

3.3.2 Acoustic Report

THE HAC report relies on the importance of the CNVMP to control the effects of the construction activities. The document would tie together the policies, mitigation measures, training, monitoring and reporting of construction noise and vibration.

The report identifies the following construction phases and the likely noise and vibration sources

- Demolition: excavator, saw cuts, craning, trucks, hydraulic breaker
- Groundworks: no basement, excavation and rock breaking
- Foundation: auger piling
- Erection: standard construction techniques

Piling noise has been assessed on the corners of the site to establish a compliance contour (shown in Figure 2 of the HAC report). The 70 dBA contour appears to be at ~35 m, this is equivalent to a rig L_w of 106 dB L_{WA}. I note that this is quite low for a piling rig and that the sound power level could be up to 5 decibels greater. The adjacent buildings will act as a good acoustic screen for the buildings/dwellings behind so the effect would be that the nearest dwellings would receive noise levels up to 5 decibels greater than that given in the report.

No other sound power data is given in the report for the other major noise sources or activities.

The mitigation noted in the report is:

- An absence of a basement car park
- A 2.4 m high solid plywood hoarding
- Temporary screening around some activities such as concrete saw cutting.

It could be argued that the absence of a basement was due to the practicability of construction rather than as a mitigation measure. There can be no doubt, however, that the absence of the basement will avoid a significant period of rock breaking and associated high noise and vibration. Basements have been a regular feature of buildings in recent times and I, therefore, consider it reasonable to acknowledge the change in philosophy in this design as an attempt to avoid a potential significant effect.

Little mention is made of treatment to equipment such as the use of shrouds for the rock breakers.

The construction noise Standard NZS 6803: 1999 *"Acoustics - Construction Noise"* requires that the highest noise levels be reported for the different activities. Whilst it is good to define the highest levels received at adjacent buildings, it can give the impression that the noise received at the adjacent properties will be very high for long periods of time.

Activities predicted to exceed the 70 dB L_{Aeq} noise limit are:

- Breaker up to 85 dB L_{Aeq} at 378-388 Dominion Road
- Piling up to 80dB L_{Aeq} at 111 Grange Road, and 378-388 Dominion Road
- Concrete cutting up to 80 dB L_{Aeq} at 111 and 128 Grange Road

The HAC report estimates that the durations of exceedance to be quite short: no more than 1 to 2 days for piling and up to 5 days for concrete cutting at 128 Grange Road.

I would say that these estimates are quite optimistic, and the periods of exceedance are likely to be longer. The identified activities, however, are associated with the demolition of the existing building and providing a foundation for the new building. These activities would be required for any development of the site, and I do not believe that they have been exacerbated due to the size of this particular building.

The HAC report notes that whilst noise levels of up to 80 dB L_{Aeq} are high, they do fall within the range permitted by AUP for construction activities of no more than 15 days. Noise levels above 80 dB L_{Aeq} *"could not be tolerated for significant periods of time".*

Construction noise is intrusive and particularly so in Auckland around the volcanic cones where there is an abundance of basalt. The basalt can prove useful for construction though, as it can act as good foundation base. This proposal design minimises the necessity of breaking into the basalt through the avoidance of a basement.

The scale of some aspects of the building may be considered significant but the construction on the boundary of 111 Grange Road and 86/86A Prospect Terrace is relatively simple with a 10 m high concrete wall stepped off the boundary by approximately 7 m. If it is possible to erect this wall at an early stage of construction, then it will act as a very effective acoustic barrier for the remaining construction period.

Other aspects of the design that will reduce the impact of noise from the construction activities are that the apartment building itself is stepped off the eastern boundary by approximately 20 m which provides a reasonable buffer for construction noise. Furthermore, the novel construction technique of pre-fabricating the apartments off site in three sections and then craning them into position will have quite a beneficial effect in reducing the noisy construction activities of erecting an apartment block.

3.4 Council Response / Advice

The Auckland Council noise and vibration expert, Mr Andrew Gordon, noted in his assessment that the construction noise is likely to exceed the permitted noise standards but that the sensitive receivers have been properly identified and that the CNVMP is appropriate for managing the temporary effects during construction.

Whilst the highest generated noise levels during construction may be higher than that predicted in the report, I agree with the applicant and Council's noise experts that the effects are reasonable for the temporary activity and that the CNVMP is the most effective tool for managing those effects.

There is no doubt that construction noise can be high and disruptive. I have reviewed the architectural plans and brief construction methodology and I cannot find anything special or different that would give rise to an extraordinary effect from the construction activities. The design, in fact, has features that would improve the noise emission from construction activities such as the fabrication of the apartments off site.

An aspect of CNVMPs that isn't often touched on is that they set procedures for monitoring and reporting of noise and vibration. It is possible that noise loggers could be located at the nearest dwelling with triggers set to warn the construction team if noise levels get too high. With a positive feedback, the construction team will be able to modify and manage their construction techniques to reduce the effect of the activity.

3.5 Recommended Conditions

Conditions 14 to 16 require the submission and use of a Construction Noise and Vibration Management Plan (CNVMP). The Conditions are thorough and provide a detailed, specific set for a minimum standard for the CNVMP.

Conditions 23 to 24 provide further detailed requirements for communication and engagement with the community during construction and a procedure for handling noise and vibration complaints to be implemented in conjunction with the CNVMP.

Conditions 56 to 59 specify the noise limits permitted for construction activities and Conditions 60 to 62 outline minimum requirements for mitigation and management of noise including a requirement that a noise reduction shroud be fitted on all rock breaking equipment used at site.

3.6 Conclusion

This is an extensive and comprehensive set of Conditions to cover the generation and management of construction noise. There will be periods when the construction noise will be high but if these Conditions are correctly implemented and applied then I consider the noise effects to be reasonable.

4.0 CONSTRUCTION VIBRATION

4.1 Issue

Construction vibration from some activities will be clearly felt at adjacent buildings which will disturb the amenity of occupants of those buildings and may cause cosmetic damage to the building itself.

4.2 Submissions

No specific submission was received concerning construction vibration although I consider that the general concern expressed by the submitters regarding construction would also cover vibration.

4.3 Applicant / Expert Evaluation

4.3.1 Planning Report

The planning report identifies that vibration levels are predicted to generally comply with the AUP limits, but some levels are predicted up to 6 mm/s PPV (exceeding the cosmetic building damage limits of 5 mm/s).

4.3.2 Acoustic Report and Evidence

The HAC report identifies that construction vibration activities shall comply with Rule E25.6.30 in the AUP which sets standards for structural vibration and occupant amenity.

The report notes that the German Standard DIN 4150-3 (1999) sets limits for the protection against cosmetic damage such as cracks forming in plaster board walls (rather than actual building structural damage). I note that the Standard goes further to say that "*Experience shows that **no** damage due to vibration adversely affecting serviceability will occur if these guidelines are complied with. If damage occurs, it is to be assumed that other causes are responsible. Exceeding the guideline values does not necessarily lead to damage".*

The report predicts vibration levels an exceedance of the Residential cosmetic building damage vibration limit of 5 mm/s PPV at 111 Grange Road (5.5mm/s) due to rock breaking and an exceedance of the amenity limit (2 mm/s PPV) at the additional properties of 378 to 388 and 342 to 346 Dominion Road, 82A, 84, 84A, 86 Prospect Terrace and 109 Grange Road.

The predictions appear to be based on measurements from another site. There is little information to evaluate the methodology but is acknowledged that ground-borne vibration is much more difficult to predict than airborne sound because the structural path between source and receiver is not homologous.

The most effective method for evaluating the risk of exceedance of the vibration standards is to monitor the critical activities and this is recommended by both Hegley and the Council.

In addition, it is recommended that some of the closest buildings be inspected by a quantity surveyor to establish a baseline for these dwellings before construction commences (i.e. that a pre-construction building condition survey is undertaken). The We Love Eden submission proposes that additional properties besides those identified by the Applicant be surveyed before construction commences and this is not supported by the acoustic consultant.

I would note that the survey report is of benefit to both the owner and developer/construction company for peace of mind. Superficial damage in a dwelling can be easily missed until some vibration is felt and one looks for cracks. A surveyor report will provide a detailed description of each building and there would be no doubt whether damage had occurred before or during the construction period.

It would be my recommendation that all buildings where vibration levels have predicted to exceed 2 mm/s PPV be offered a building inspection report.

The Applicant has also offered a Condition to relocate the residents along the eastern boundary during the period of piling close to the dwellings. This is a generous and effective measure to improve the occupant's amenity as they will be removed from the period with highest levels of vibration and noise. Vibration monitoring equipment would ensure that the levels did not exceed the cosmetic building damage limits to provide assurance to the owners that damage would not occur to their houses during their absence.

I support the proposed Condition.

Finally, I re-iterate that the DIN Standard states that exceedance of the limit does not necessarily lead to damage and, therefore, I consider that the twin requirement of undertaking building surveys and monitoring vibration levels will provide reasonable assurance that no lasting damage would occur to the buildings from construction activities.

4.4 Council Response / Advice

Mr Gordon notes that the vibration exceedances of the 5 mm/s PPV limit at 111 Grange Road is not specifically addressed, however the pre and post building surveys and vibration monitoring would ensure that effects are minimised, and the avoidance of cosmetic damage objective is met.

I agree with his conclusion.

4.5 Recommended Conditions

Conditions 63 to 66 set the cosmetic damage and vibration amenity limits and I agree with these.

Conditions 67 to 72 cover the requirements for pre and post building condition surveys and they are comprehensive. I would recommend that they apply to some additional buildings where vibration levels have been predicted to exceed 2 mm/s PPV.

As well as 86 and 86A Prospect Terrace, 111 Grange Road and Lot 1 DP170042 Body Corporate Retail Shops on Dominion Road, the following buildings should be included within Condition 67:

e) 82A Prospect Terrace

f) 84 Prospect Terrace

g) 84A Prospect Terrace

h) 109 Grange Road

i) 378 to 388 Dominion Road

j) 342 to 346 Dominion Road.

Conditions 23 to 24 provide further detailed requirements for communication and engagement with the community during construction and a procedure for handling noise and vibration complaints to be implemented in conjunction with the CNVMP.

Conditions 73 to 76 cover vibration monitoring and these are also comprehensive.

I note in Mr Hegley's evidence that two further Conditions are proposed to cover the possibility of re-location for the occupants of the dwellings at 111 Grange Road, 86 Prospect Terrace and 86A Prospect Terrace for periods where vibration levels exceed 2 mm/s PPV and I support these too.

4.6 Conclusion

I note that the vibration levels are much more difficult than noise to accurately predict at the design stage of a building. I do consider that the comprehensive set of Conditions that cover vibration limits, pre and post building surveys, monitoring and even the offer of re-location during significant events would ensure that the overall effect of construction vibration would be reasonable for both building integrity and amenity.

5.0 OPERATIONAL NOISE & VIBRATION

5.1 Issue

Noise and vibration from operational activities, principally from the supermarket, will give rise to nuisance to the adjacent dwellings.

5.2 Submissions

Submissions regarding operational noise and vibration were received from:

- The Tsais
- The Perretts
- Mr Buckland
- Mr Goldfinch

The Perretts are concerned about ongoing noise and vibration, particularly from truck movements and waste collection giving rise to noise and vibration to the dwelling. They have requested that truck movements be restricted to day light hours.

Mr Buckland is also concerned regarding truck movements along the eastern boundary giving rise to vibration in the adjacent dwellings and has requested an independent assessment of the vibration effects to the residential dwellings. Furthermore, he has raised the issue of noise generated by the mechanical ventilation plant.

Mr Goldfinch is concerned that the possible continuous operation of the site will mean that there will be no rest from the activities.

The Tsais are concerned about mechanical ventilation plant, noise from people using the development and vehicle movements including trucks and customer car parking.

5.3 Applicant / Expert Evaluation

5.3.1 Planning Report

The planning report concludes that with the inclusion of the proposed mitigation measures, the noise generated from the proposed supermarket and other commercial activities *"are considered to have less than minor adverse effects on its surrounding environment".*

5.3.2 Acoustic Report and Evidence

The acoustic report and evidence highlight a number of mitigation measures to reduce the acoustic impact to the adjacent dwellings including:

- Complete enclosure of the unloading bay
- A 2.5 m high wall to screen vehicle movements before they enter the enclosure
- Deliveries limited to between 7 am and 10 pm Monday to Saturday and 9 am to 6 pm on Sundays

I would consider this to be best practice for the design of an unloading bay as it restricts the activity to the period with the more permissive daytime noise limit of the AUP and fully encloses the activity. I would recommend that the waste collection activity be also restricted to daytime hours.

The carpark for the supermarket and residential units is located within an internal car park area. The design of the building, surrounding and enclosing the car park, will naturally attenuate any external noise emission and this is considered acceptable.

Little information is provided regarding the noise emission from mechanical plant or the intended mitigation. Although more certainty would be helpful, the level of detail for mechanical services design undertaken at this stage of the development does not allow for the mitigation to be quantified. I note that it is not unusual for supermarkets to be located adjacent to dwellings and the mechanical services equipment can be designed to achieve the necessary noise limit at night.

Mr Hegley addresses the concern of vibration from truck movements and concludes that the likelihood of noticeable levels of vibration at the dwelling to be negligible and I concur.

5.4 Council Response / Advice

Mr Gordon states that in his view the site and building can be designed and laid out to ensure compliance with the permitted noise standards provided truck movements do not occur at night.

I agree with his conclusion.

5.5 Recommended Conditions

Conditions 100 to 103 set the operational noise limits and require an acoustic report to demonstrate that noise from external plant and commercial activities can comply with those limits.

Condition 117 limits the deliveries from large vehicles to between 7 am and 6 pm, which is more stringent than the discussion to limit the movements to daytime hours only. I consider this Condition to provide further benefit for noise emission to the neighbouring sites.

5.6 Conclusion

I consider that the proposal has included best practice design for the unloading bay enclosure which is the major noise source for supermarket activities. I consider that the design is such that the operational noise limits can be met at the adjacent sites.

6.0 ACOUSTIC AMENITY

6.1 Issue

That the development can be designed to ensure that all occupants receive a reasonable acoustic amenity.

6.2 Submissions

This issue is more inward looking but the following submitters have raised acoustic amenity and how it could affect them.

- Ms Roux de Buisson
- The Tsais

The Tsais have raised concern regarding receiving noise from site workers, customers and apartment residents.

6.3 Applicant / Expert Evaluation

6.3.1 Planning Report

The planning report concludes that *"Any potential noise effects from any uses in the neighbouring Mixed Use and Local Centre zone sites to the proposed dwellings will be mitigated through design and construction of the external façades".*

6.3.2 Acoustic Report and Evidence

Mr Hegley has addressed the façade design noting that the AUP noise rules (E25.6.10) require a fixed noise reduction across a façade to noise sensitive occupancies, such as living areas and bedrooms. The required noise reduction for dwellings in Business areas is fixed at 25 dBA for living spaces and 20 dBA and 20 dB at 63 and 125 Hz for bedrooms at night.

This is based on an incident noise level of 60 dB L_{Aeq} during the day and 55 dB L_{Aeq} during the night. Mr Hegley argues that the eastern façade, for example, is adjacent to a Residential Zone boundary where the AUP noise limits restrict noise emission to 45 dB L_{Aeq} at night, 10 decibels more stringent than the Business - Mixed Use Zone noise limit. Mr Hegley concludes *"Simply put, designing in accordance with E25.6.10 would result in the building envelope being over engineered."*

He goes on to say; *"A more reasoned approach is proposed whereby the building envelope of the proposed dwellings is designed to achieve the required internal levels based on the noise levels that can realistically be expected from the neighbours."*

The consequence of this is that apartments may be designed with little to no ventilation. Occupants of the apartments, particularly those facing the residential sites on the eastern boundary, would be required to open their windows to obtain fresh air. This would increase the risk of noise from activities within the apartments being emitted into the environment. Furthermore, if the façade design was to be undertaken based on *"what can be reasonably expected"* then it should include all noise sources, such as traffic movements on Dominion Road and not just what is permitted by the AUP noise rules.

If this approach was approved by the Panel, then I would recommend that the AUP Rules regarding ventilation and cooling be made mandatory for all the apartments to ensure that the occupants do not rely on the opening of windows for adequate ventilation.

6.4 Council Response / Advice

Mr Gordon agrees that the proximity of the residential zone would result in the building envelope being over engineered despite there being no environmental noise measurements undertaken on the site to quantify what the levels are. It is possible that the apartments will be exposed to higher noise levels than that envisaged by the Unitary Plan.

Mr Gordon states that all noise sensitive spaces in apartments exposed to "high" and "intermediate" noise levels will require mechanical ventilation and/or air conditioning. Based on Mr Hegley's calculations, almost a half of the building would not require ventilation of any kind and would rely on opening windows for the occupants to receive fresh air.

I do not agree with his conclusion and have recommended amendments as set out below.

6.5 Recommended Conditions

Condition 106 requires that noise sensitive spaces be designed to 35 dB L_{Aeq} in bedrooms and sleeping areas between 10:00 pm and 7:00 am and 40 dB L_{Aeq} (including all other noise sensitive spaces) for all other times. This is based on an unspecified external incident noise level.

Conditions 106a requires mechanical ventilation and/or cooling system to generate a noise level no more than 35 dB L_{Aeq} at 1 m from a diffuser. Condition 106b requires that "sufficient" ventilation via alternate means be designed to meet the noise limit requirements.

This is a significant relaxation from the ventilation rules given in AUP E25.6.10.3, which I have reproduced below for comparison.

> (3) Where a new room is constructed that is subject to Standard E25.6.10(1) (internal acoustic insulation requirement) and the noise levels in Table E25.6.10.1 Noise levels for noise sensitive spaces in the Business – City Centre Zone, Business – Metropolitan Centre Zone, Business – Town Centre Zone, Business – Local Centre Zone, Business – Neighbourhood Centre
>
> Zone or the Business – Mixed Use Zone, Business – Heavy Industry Zone or the Business – Light Industry Zone (internal design noise level) can only be complied with when doors or windows to those rooms are closed, those rooms must, as a minimum:
>
> (a) be constructed to ensure compliance with the noise limits in Table E25.6.10.1 Noise levels for noise sensitive spaces in the Business – City Centre Zone, Business – Metropolitan Centre Zone, Business – Town Centre Zone, Business – Local Centre Zone, Business – Neighbourhood Centre Zone, Business – Mixed Use Zone, Business – Heavy Industry Zone or the Business – Light Industry Zone; and
>
> (b) for residential dwellings be mechanically ventilated and/or cooled to achieve either:
>
> (i) an internal temperature no greater than 25 degrees celsius based on external design conditions of dry bulb 25.1 degrees celsius and wet bulb 20.1 degrees celsius; or

Note 1

Mechanical cooling must be provided for all habitable rooms (excluding bedrooms) provided that at least one mechanical cooling system must service every level of a dwelling that contains a habitable room (including bedrooms).

(ii) a high volume of outdoor air supply to all habitable rooms with an outdoor air supply rate of no less than:

- six air changes per hour (ACH) for rooms with less than 30 per cent of the façade area glazed; or
- 15 air changes per hour (ACH) for rooms with greater than 30 per cent of the façade area glazed; or
- three air changes per hour for rooms with facades only facing south (between 120 degrees and 240 degrees) or where the glazing in the façade is not subject to any direct sunlight.

(c) for all other noise sensitive spaces provide mechanical cooling to achieve an internal temperature no greater than 25 degrees celsius based on external design conditions of dry bulb 25.1 degrees celsius and wet bulb 20.1 degrees celsius; and

(d) provide relief for equivalent volumes of spill air; and

(e) be individually controllable across the range of airflows and temperatures by the building occupants in the case of each system; and

(f) have a mechanical ventilation and/or a cooling system that generates a noise level no greater than L_{Aeq} 35 dB when measured 1m from the

diffuser at the minimum air flows required to achieve the design temperatures and air flows in Standard E25.6.10(3)(b)(i) and (ii) above.

It is my recommendation that the AUP Rule E25.6.10.3 be used as a model for the Condition. That is, to set a fixed noise reduction across the façade and a mechanical ventilation rule that ensures good internal comfort.

If the Panel accepts Condition 106 then I recommend that it be amended to:

106. Noise sensitive spaces must be designed and/or insulated so that the internal noise levels do not exceed the levels below based on the maximum level of noise permitted by the zone or precinct standards or any adjacent zone or precinct standards combined with the measured total noise at the site from other sources such as Dominion Road traffic."

Finally AUP Rule E25.6.10.b to f shall be reproduced in the Conditions to ensure good acoustic and thermal comfort.

6.6 Conclusion

I disagree with the Applicant's and Council's acoustic expert in the matter of internal acoustic amenity.

I believe that the proposed Condition would give rise to poor acoustic amenity and thermal comfort in some apartments.

I have provided recommendations to modify the Conditions.