

## HEARING SUMMARY – SIIRI WILKENING – NOISE AND VIBRATION

1. My role in the Project has been to undertake a construction noise and vibration assessment. I have also assessed the operational noise effects of the Project and recommended appropriate structural mitigation measures which are now incorporated in the Project design. Overall, the noise effects for Protected Premises and Facilities (PPFs) along the SH1 corridor will be much improved compared to the existing situation.

### Changes

2. I prepared two briefs of evidence, one for operational noise and one for construction noise.
3. I wish to correct the labelling of the assessment areas in my Traffic Noise Assessment Report (TR7) (Appendix A), which are reversed along SH1. A corrected figure is included with this summary statement, to replace the figure in the report. (The areas are listed in Table 5.2 on page 20.)
4. Since preparing my assessment, evidence in chief and rebuttal, I understand that a design change will allow the dwelling at 32 Mataroa Road, Mt Wellington (assessment area 2), to be retained. I have not assessed this dwelling in the past as a PPF as it was intended to be removed, but have done so now with the following results:
  - (a) I predict that the existing noise level at the dwelling is 71 dB  $L_{Aeq(24h)}$  (Category C)
  - (b) This would increase to 72 dB  $L_{Aeq(24h)}$  for the Do-nothing scenario in the design year (Category C)
  - (c) With the preferred mitigation option, which in this area is a 2.4 metre high barrier, I predict the noise level to reduce to 65 dB  $L_{Aeq(24h)}$  with the Project in the design year (Category B).
  - (d) The predicted 7 decibel noise level reduction is significant and can be assessed as moderately positive.

### Road operation effects

5. In terms of road operation effects, I understand there are two submitters who have outstanding concerns.

### Auckland Council's noise expert

6. The opening statement for the Council stated that the following matters remain outstanding:
  - (a) Whether the noise assessment should include consideration of receivers categorised as little annoyed and annoyed in addition to the highly annoyed receivers I have already assessed.
  - (b) Whether the conditions provide for too much scope to allow increases in noise levels during detailed design of the Project.
  - (c) If the noise level at Waikaraka Cemetery should be mitigated to 50 dB  $L_{Aeq(24h)}$
7. Mr Styles and I have discussed the use of the “highly annoyed” category, and I understand that this issue is now resolved. The disagreement stemmed from a difference in interpretation of the results. I used the assessment of the number of potentially highly annoyed persons as a method of comparison of mitigation options (through the numbers reported in the Assessment report), while Mr Styles interpreted the outcome as an assessment of actual community response (i.e. relating to actual people’s reactions). For completeness, I undertook an assessment of the number of people

potentially annoyed or little annoyed for one assessment area. The results<sup>1</sup> showed that the outcome would be the same, i.e. the number reduced or increased similarly as for the “highly annoyed” category. Therefore, we agreed that no further assessment would be required as the extended information would not provide additional benefit.

8. In relation to the circumstances of this Project, I disagree that the conditions provide too much scope for PPFs to receive noticeably higher traffic noise levels due to changes to the proposed structural mitigation during detailed design, for the following reasons:
- (a) The structural mitigation recommended as the preferred option must be implemented and included in the detailed design, and the noise criteria categories for each PPF predicted with that mitigation achieved. These requirements are anchored in conditions ON.2 and 3 and are fundamental to the implementation of this Project. The only exception may be where detailed design confirms that any of the structural mitigation measures is not practicable.
  - (b) For this Project, the only structural mitigation measures are the use of low noise road surface (which is used across all of the Auckland motorway system) and noise barriers (which are being installed with every new motorway project across Auckland, and in some instances retrofitted without projects in the vicinity). Based on these factors, it is in my opinion highly improbable that for this Project, the detailed design would omit or reduce mitigation measures to a degree that noise levels would noticeably increase at PPFs.
  - (c) Nevertheless, my experience with large scale roading projects shows that there needs to be some flexibility for the detailed design to adjust the preferred barrier heights, lengths and locations. This would be particularly the case if the road height or edge location changes slightly (e.g. where the ramps join SH1 from the Project road), and noise barriers need to be located appropriately at the edge and at a relevant height. Any such changes need to be reassessed in accordance with ON.4. Council will receive any such assessments, irrespective of changes in noise levels or noise criteria categories, as required by the conditions. Therefore, even if the change is only 1 or 2 decibels (i.e. unnoticeable), Conditions ON.4(a) or (b) would be invoked.
  - (d) In order to provide a simple explanation of noise levels with and without the Project, and the effects of mitigation, I have produced graphs that are attached to this summary. The graphs show the do-nothing noise level for each PPF (blue bar), and the noise level with the Project and preferred mitigation in place (orange bar). Where the blue bar is above the orange bar, the noise level would reduce, and where the orange bar is above the blue bar, the noise level would increase. In addition, the green and red lines show the upper end of the Category A and B.
  - (e) The graphs show that greatest noise level reductions will generally be achieved for those PPFs that receive the highest noise levels. This is because the noise barriers will be most effective for the closest receivers behind. PPFs that receive lower noise levels, are generally further removed from SH1 or SH20, and would therefore have less or no benefit from the barriers, but retain existing mitigation from intervening buildings.
  - (f) Any changes to barrier heights or lengths would have the greatest effect on the noise levels for close PPFs (those that already had high noise levels). As these PPFs have noise levels

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<sup>1</sup> Rebuttal Evidence (Traffic), paragraph 4.15

that already approach the upper end of Category A, or are within Category B, only limited changes to barriers would result in a change in noise criteria category (the change would have to be no more than 1 or 2 decibels for many PPFs), which would then invoke Condition ON.4(b). A change of this scale (i.e. 1-2 dB) is unnoticeable and therefore I do not consider that in the context of this Project the conditions provide too much scope for change.

- (g) In my opinion, the conditions are strongly focussed first on implementing the recommended mitigation options in my assessment report, and second on ensuring that BPO is maintained even if changes to the recommended mitigation are required during detailed design. The conditions do, in my opinion, not give scope to omit mitigation (e.g. for cost reasons) or result in significantly higher noise levels than predicted in my assessment report.

- 9. The issue of noise mitigation at the Waikaraka Cemetery has been discussed at length during conferencing, at which I participated.<sup>2</sup> At that time, the discussion showed the many conflicting interests in regards to noise mitigation in the form of a barrier or bund, e.g. ground water and visual effects. Mr Styles and I agreed that noise mitigation for the cemetery would be desirable. However, no design has been undertaken, and we agreed that a barrier in the order of at least 2 metres adjacent to the road would result in effective mitigation. My noise level predictions show that with a 2 metre barrier adjacent to the road in the vicinity of the cemetery, noise levels would range from 51 to 54 dB  $L_{Aeq(24h)}$ , and for a 3 metres barrier from 50 to 53 dB  $L_{Aeq(24h)}$ . For that reason, I cannot currently provide a practicable noise mitigation design that would achieve 50 dB  $L_{Aeq(24h)}$  within the cemetery site but it appears that we can achieve a level close to that. I note that many cemeteries across Auckland are located adjacent to major roads without the provision of noise mitigation such as barriers.

### **Onehunga Mall Cul-de-sac Residents Opening Statement**

- 10. I am aware of the opening statement made by the Onehunga Mall Cul-de-sac submitter which raised several points relating to construction and operational noise effects from the Project. I would like to clarify some of the issues raised, based on my assessments undertaken.
  - (a) The submitter is concerned about the difference in noise survey results when compared with the noise level prediction in the assessment report.<sup>3</sup> We measured noise levels at 31 Onehunga Mall. The measurement results cannot be compared with the noise levels predicted in my Assessment report, as positions are not the same. The measurement position was in front of a façade (thus including a façade correction of approximately 2 decibels), while the assessment location is at the façade (i.e. an incident level without façade correction), resulting in the discrepancy described by the submitter. Therefore, I confirm that my predictions are correct. The controlling noise source at the Onehunga Mall PPFs will remain SH20. With the proposed barrier in place, noise levels at the Onehunga Mall dwellings will generally reduce by 1 to 4 decibels.
  - (b) The submitter questions the AADT values used in the predictions, based on the values ticked in the calculation sheets included as Appendix B of the Traffic Noise and Vibration assessment report. The AADT I used for the predictions were provided by the Project's traffic engineer, and reflect current and future traffic volumes. The tick box in the calculation sheets

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<sup>2</sup> Joint witness statement Waikaraka Park and Cemetery 26 May 2017, paragraph 5.3

<sup>3</sup> Onehunga Mall Cul-de-sac Opening Statement, paragraphs 8.4 to 8.6

relates to the noise criteria category levels in accordance with NZS6806 and are not the values used. Namely, for altered roads with any traffic volume (2,000 – 75,000 AADT or more than 75,000 AADT) the noise criteria categories are the same, i.e. Category A up to 64 dB  $L_{Aeq(24h)}$ , Category B 64 to 67 dB  $L_{Aeq(24h)}$  and Category C above 67 dB  $L_{Aeq(24h)}$ . Therefore, there would be no change in predicted levels or categories irrespective of which AADT value it ticked.

- (c) Regarding the request for a higher noise barrier on SH20 adjacent to the dwellings at Onehunga Mall,<sup>4</sup> due to the elevation of the road a higher barrier would not result in additional noise reduction benefits. I do not, therefore, consider that a higher barrier of 4 metres would result in additional benefits compared with the 2 metre barrier I recommend.
- (d) In terms of the effects from construction noise and vibration, and how these are addressed,<sup>5</sup> the dwellings at Onehunga Mall will be treated the same as all residential receivers around the Project. The conditions provide a framework for management and mitigation, through the CNVMP and site specific management plans as required, to proactively and in response, deal with any construction noise and vibration issues. At present, the specific management and mitigation for the dwellings at Onehunga Mall cannot be determined. However, mitigation varies from receiver to receiver, and is dependent on the duration, magnitude and timing of works and the receiving environment. It may range from consultation, establishing if a receiver is sensitive in the first place (if people are at work, they are removed from the noise source), working out practical ways of dealing with potential issues (e.g. is there a second bedroom in the house that could be used for the one night when works are undertaken), scheduling works for a time when people are on holiday or, as one possible option, offer temporary relocation for limited periods to undertake high noise works at night-time. I note that night-time works such as resurfacing are undertaken routinely across the Auckland motorway system.

### **Conclusion on operation effects**

- 11. Existing noise levels in the vicinity of the Project roads are high, generally ranging from the mid-60s to above 70 dB  $L_{Aeq(24h)}$ . With the implementation of the recommended mitigation, I consider that the Project will result in an improvement in traffic noise effects for SH1 and some SH20 residents, particularly for those dwellings currently most affected by road noise. Where noise levels cannot be practicably mitigated, this occurs generally where dwellings are located above the road or are multi storey. For those dwellings where external noise levels cannot be sufficiently mitigated, building modification mitigation will need to be investigated and implemented in consultation with those parties.

### **Construction effects**

- 12. During conferencing, we agreed that construction noise and vibration effects could be appropriately managed through a methodology of trigger levels and management plans, which are anchored in the conditions. It was also agreed that the need for a Draft CNVMP is diminished with the more expanded conditions now proposed.

### **Issues outstanding:**

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<sup>4</sup> Onehunga Mall Cul-de-sac Opening Statement, paragraph 8.1

<sup>5</sup> Onehunga Mall Cul-de-sac Opening Statement, Section 4

13. At the outset of the hearing there were a few construction issues outstanding:
  - (a) What the appropriate vibration standard should be in the conditions.
  - (b) The need for a draft Construction Noise Vibration Management Plan.
  - (c) The construction effects on Stratex.
  - (d) If the effects of construction noise and vibration can be understood with the present information.
14. As a result of ongoing discussions I understand that most of these issues have now been largely resolved but for completeness I have provided a summary of my position.

#### **Vibration standard for unoccupied buildings**

15. The proposed conditions contain vibration limits that apply to a variety of buildings, both occupied and unoccupied and at varying magnitude to protect amenity or from superficial building damage. The criteria have been derived from the German DIN 4150-3:1999 standard and the British BS5228-2:2009 (condition CNV.5). The Category A and B criteria are used as trigger levels for further work to be undertaken, either through management or more intensive engagement with affected receivers.
16. The value under contention was the Category B value for “all other buildings” which translates to unoccupied buildings when taking into consideration all other lines within the table in Condition CNV.5.
17. Mr Styles and Mr Millar both disagree with the proposed Category B vibration limits. They both consider that the DIN4150-3 long limits should apply, ranging up to 50 mm/s (frequency dependent).
18. While I am of the view that the BS5228:2009 limits are appropriate to avoid building damage, I acknowledge that these criteria are not “limits” as such but rather criteria which trigger the application of further measures such as consultation and more detailed site specific assessment. Therefore, I consider that the use of the DIN 4150-3 criteria instead of the BS5228-2 criteria as Category B triggers for unoccupied buildings may be appropriate. In my opinion, the likelihood of these criteria being applied is small, as in most business areas work continues throughout night and weekends, thus not resulting in these buildings being “unoccupied buildings” at any time. I understand that this will resolve Mr Millar’s and Mr Styles’ concerns.
19. In his rebuttal evidence Mr Millar compares the vibration limits of the British Standard to the magnitude of an earthquake. While this is not relevant now, because I agree with the application of the DIN4150-3 Standard as discussed above, I want to clarify that I consider such comparison to be unreasonable for numerous reasons.

#### **Need for a draft CNVMP**

20. Mr Styles and I have differing views on the need for a framework CNVMP. In my view, more construction detail is needed for such a document to be of use and in any event the conditions provide the appropriate framework for the management of effects. I understand that with the expanded conditions as recommended in CNV.6A, CNV.7A and CNV.7B, Mr Styles may now be satisfied that the CNVMP will be prepared to an appropriate standard and would not require a draft

document to be provided at this time. However, further refinement of the conditions may be required to fully close this issue out.

### **Stratex**

21. The Stratex building in Sylvia Park Road is in close proximity to the works. Following expert discussion, and to address potential effects, the construction vibration conditions have been expanded to include provision for vibration sensitive businesses, and specifically Stratex (see CNV.7B). In my opinion, even with constraints that may be placed on the construction activities due to the sensitivity of the Stratex equipment, the Project can be constructed along Sylvia Park Road with appropriate management and choice of methodology. The conditions require checks and balances to avoid business activities inside the building being disrupted. This means that construction activities will be designed around the constraints of those business activities, similar to any other construction site.

### **Nature of the construction noise effects assessment**

22. In regards to understanding the effects of construction works, I am of the opinion that:
  - (a) The cause of the potential effects is known (i.e. the high noise and vibration activities),
  - (b) A conservative envelope has been provided (in the Figures in my Assessment report) which identifies those receivers that could be affected and more specifically the area where the relevant noise or vibration criteria can only be met with additional mitigation or where other management is required, and
  - (c) The conditions set out a framework that ensures the process for that management and mitigation is clearly set out (i.e. where noise and vibration criteria are exceeded site specific plans are required which require consultation with landowners and BPO measures to be adopted.)
23. This process is commonly used for large infrastructure projects, and has been successfully implemented on numerous projects in the past.

### **Conclusion on construction effects**

24. Overall, I consider that construction noise and vibration effects can be addressed through a thorough management methodology as set out in the conditions. By setting appropriate trigger levels in conditions CNV.4 and CNV.5, to require further management in conditions CNV.6A, CNV.7A and CNV.7B, effects can be managed on a site by site basis in consultation with affected parties. This is a standardised approach to construction management and similar to the approach adopted for Waterview, City Rail Link and MacKays to Peka Peka Expressway. Responses could range from engagement with affected receivers, to timing and staging of works, use of equipment, choice of construction methodology and mitigation such as temporary barriers or similar. The exact management and mitigation will be determined at a time when the construction details are known, however, the performance criteria and management methodology provide an appropriate framework for that time to allow effects to be addressed.