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Dear Sherilyn,

As discussed, I have given consideration to those technical noise matters remaining unresolved following the hearing of submitters and noise experts at the above hearing held at Council on May 3rd 2016. I have undertaken a further evaluation of the matters where submitter's noise experts have disagreed to the recommendations set out in the Officers Report. I make these further comments and recommendations under the headings set out below. Where scope issues allow, I have made certain recommendations to enhance the operation and enforcement of the relevant noise rules.

State Highway Reverse Sensitivity Measures (Submitter 457 – NZTA)

As notified the Proposed District Plan (PDP) currently provides for noise sensitive activities within 80m of the state highway as permitted activities, subject to meeting certain acoustic standards to protect sensitive indoor environments. The 80 metre corridor of noise effects adjacent to each side of the state highway is based on the approach of the Operative District Plan which has since the 1990's required high levels of traffic noise to be reduced via screening or fencing, or if that is not provided, via insulation of habitable rooms within buildings housing activities sensitive to noise.

Rule 12D.1.12 requires action to mitigate noise from the state highway where the outdoor free-field noise level at the most affected exterior wall of the building containing the habitable room will be likely to exceed 57 dB LAeq(24hr). There is no dispute requiring road traffic noise effects to be addressed where the received level exceeds this limit, and thus generally, there are no differences of view that this level of traffic noise should trigger mitigation in the form of a noise barrier (to reduce the received noise level to 57 dB LAeq(24hr) or less, or in the form of acoustic insulation of habitable rooms in the building housing noise sensitive activities.

Different Mitigation Rule For Traffic Noise?

The first of the differences in the experts in this area are that NZTA claim traffic noise needs to be dealt with differently to District Plan measures designed to mitigate noise of aircraft, city noise or industrial noise. NZTA are claiming a separate noise rule is required for the mitigation traffic noise from state highways because of variations in noise levels with distance from the highway and due to orientation of dwellings to the road.

The sole justification for an alternative rule for traffic noise is provided at paragraph 34 of Mr Smith's evidence where he states "*...there is considerable difference in noise levels based on the building orientation, and also distance from the road*". On its own I do not consider these factors sufficient differentiate traffic noise from other situations where noise mitigation is required under Rule 12D.1.12.1. This rule stipulates mitigation of noise received within "habitable rooms"¹ is required to be addressed where noise effects arise outdoors from land use activities within the Civic and Community Zone, Centres Zone, Industrial / Service Zone, within 40 metres of the boundary of a rail designation, or within 80 metres of the nearest edge of a state highway carriageway. In all cases I consider the degree of noise effects will differ with varying distance to source and building orientation and that the methods proposed within consolidated approach of Rule 12D.1.12 are adequate to deal with these variables.

I consider there is no technical justification for removing traffic noise from the range of noise sources specified in Rule 12D.1.12.1 and consequently drafting a separate alternative rule to address noise from the state highway affecting habitable rooms within any building housing noise sensitive activities. Removing traffic noise mitigation requirements from Rule 12D.1.12 and stipulating them in a separate rule would have the unfortunate effect of undermining the integrated and consolidated nature of Rule 12D.1.12 which aims to deal holistically with the issue of noise mitigation and acoustic protection for noise sensitive activities within one relatively straight forward rule.

Insulation Rule

Mr Smith, noise expert presenting evidence for NZTA states he is supportive of proposed Rule 12D.1.12 generally but prefers an acoustic insulation rule based on maximum noise limits to be achieved indoors, as opposed to specifying the minimum acoustic performance of façade elements. He considers the Council rules will provide adequate protection for occupants, but in his opinion, it is not the most efficient form of control.

There is agreement between the experts with the concept that where the need to implement mitigation of traffic noise is triggered in Rule 12D.1.12, it is appropriate and efficient in many cases to use of acoustic insulation techniques to protect indoor amenity within habitable rooms. There is few, if any, differences in the actual acoustic outcome within the rooms once acoustically treated, however there are fundamental differences in how acoustic insulation requirements should be stipulated in the rule which is based on the differences in methods recommended to be used to calculate, design, and if necessary, test or verify the acoustic insulation of any habitable room actually complies (this is usually done via acoustic testing in the field).

¹ I note Mr Smith's summary at paragraph 3 refers to Council's approach as requiring acoustic insulation for "all occupied rooms" however Rule 12D.1.12 clearly only applies to "habitable rooms".

In developing the PDP method for specifying acoustic insulation against outdoor noise I foresaw a need to define a method that was easy to understand, reliable and simple for Council to implement, building designers and users to understand and use.

Acoustic standards for habitable buildings are controlled by the NZ Building Code, however insulation against outdoor sounds is not included. However in my discussion with Council's officers I saw a need for any District Plan rule specifying acoustic insulation against outdoor noise to dovetail in with existing methods Council Officers use to check building compliance which follow the NZ Building Code general approach. By conducting my own research and looking at what other Council's use, the "D2m,nT,w +Ctr" method was preferred as this could integrate with existing building design checks and if used in conjunction with a "generic construction schedule" of commonly adopted building methods and materials, would form an efficient and practical method that would suit Council and plan users. As this method can be field checked using ISO Standard 140 this method is simply referred to below as the "ISO method".

I have termed the alternative approach promoted by NZTA (and KiwiRail) the "**Indoor decibel method**". This method for stipulating acoustic insulation is a performance standard based on the decibel levels received (measured) within habitable rooms. It is agreed the indoor decibel levels being requested are generally consistent with international guidelines to protect health and amenity, however in my experience implementing and designing acoustic insulation to achieving an indoor target involves unnecessary complexity in terms of design assumptions, and uncertainty associated with making noise forecasts without adequate knowledge. For example there no guidance is available setting out reliable estimates for future traffic volumes on the state highway and a rule user therefore one must make their own assumptions.

In drafting District Plan insulation standards there is an obvious attraction of simply adopting the indoor design decibel sound level as the performance standard, however this apparent simplicity belies the mistakes and errors that can be made in attempting to follow that approach. I consider the raft of assumptions needed and lack of technical input data makes these types of calculations difficult and uncertain in outcome. Therefore, I do not support the indoor decibel method for the following reasons;

- 1) An analogous situation is the approach of the NZ Building Code which specifies minimum acoustic performance standards to be achieved for protecting habitable rooms against indoor noise from adjoining tenancies. These requirements are based on acoustic performance of building elements of the common walls, and are stipulated (and if necessary tested) based on the "sound reduction index" unit referred to as STC (sound transmission class). The design of walls to achieve the required standard are based on the sound transmission qualities for different types of wall claddings, etc.. The NZ Building Code does not ask building designers to meet a specified indoor level of sounds from adjacent occupancies, instead the Building Code sensibly requires walls, floors, etc to meet a minimum transmission loss standard. The ISO method I have recommended to Council adopts this same approach (but of course deals with traffic noise outside the room, not noise from an adjoining tenancy). In this way noise levels within the adjoining "source" room do not have to be estimated by each and every user of the rule which would in my view lead to uncertainty and inconsistencies in the final designs provided to the builders, and when built, uncertainty in the acoustic outcome for the "receiving room". For the recommended ISO method, field testing (if required) can be simply

- undertaken using international standards specifically designed to guide field testing of transmission loss of building facades².
- 2) I believe in deciding upon the form of District Plan rules Council's have a particular duty to consider the "workability" and enforcement matters associated with these rules. This factor does not seem to feature in the NZTA arguments supporting then use of an indoor decibel limit for stipulating acoustic insulation. The recommended method for Council's to follow are those based on ISO 717:2013 Acoustics - Rating of sound insulation in buildings and of building elements. The units are either $D_{tr,2m,nTw} + C_{tr}$. The performance standard is usually 30 or 35 dB – signaling an approximate 30 dB (or 35 dB) reduction in noise from outside the room to inside the room.
 - 3) The NZTA proposal for stipulating acoustic insulation requires an acoustic design that firstly requires the outdoor sound level to be quantified, followed by the design of building exterior envelope which needs to reduce noise to not exceed the specified sound level "indoors" from outdoor sources, for example, not more than 40 dB LAeq(24 hour) in habitable rooms. While the "target" indoor decibel levels requested by NZTA is indeed a commendable design aim, such rules are not recommended for District Plans as they require traffic forecasting, require extra work and assumptions by designers and are likely to be applied inconsistently, with uncertain outcomes. The method makes compliance difficult to be certain of, especially as there are no specific NZ or international standards governing how to test conformance with an indoor performance standard based on sound levels measured indoors. Thus, these types of rules do not work well for Council's which need District Plan acoustic performance standards that are clear with straight forward field testing using applicable international Standards. This is how the sound transmission requirements of the NZ Building Code are administered, a process Council's are fully familiar with.

Experience has shown the disadvantages of the "indoor decibel" method are ;

- External sound level against which the building must act has to be predicted each time a new dwelling is designed. As there is no standardized guidance provided, in my view this will lead inevitably to differences in approach and inconsistency in outcomes.
- These predictions need to be undertaken by an expert. There is little if any design guidance available (such as forecast traffic volumes on state highways or forecasts of what road surfaces will be used in the future). Little, if any, assistance is provided to the user of such a rule in undertaking this noise predictions. This means the user of the rule may conduct noise predictions using uncertain inputs and make assumptions (e.g. regarding road surface) that may not hold true in the future.
- Imposes unnecessary costs and risks for the building designer and owner. Any risks associated with conducting an erroneous noise prediction or under-estimating future traffic flows are borne by the owner or developer whereas the Agency responsible for roading corridor (and its effects) bears no risks in this regard.
- This "indoor decibel" method has particular disadvantages for council's regarding field testing, if this required once the building is constructed. There are no NZ standards or international standards specifically designed to assist with such testing. For example, traffic noise testing would require 24 hr testing – on which day should the test be conducted, and how to exclude non-traffic sounds found in the local environment? I have attempted to measure compliance with indoor traffic noise levels in rooms adjacent to state highways and found this to be very difficult. For example noise from aircraft

² Under the relevant ISO Standards the "sound reduction index" is instead referred to as the "standardized level difference" but in essence it is the same approach

passing overhead can ruin the readings, which need to be taken over a period of 24 hours (resulting in a lengthy test period).

- The indoor decibel approach in my view leads to an inconsistent design approach to deal with outdoor noise with the result new insulated buildings:
 - (a) may achieve different required indoor sound levels in areas with the same outdoor noise environment, and
 - (b) due to inadequate design, buildings housing noise sensitive activities may perform poorly in the long run.

The advantages of the ISO method are;

- The designer is fully informed of the acoustic performance requirements the building must achieve (in a similar way to dealing with inter-tenancy noise within NZ Building Code procedures).
- The design is easy to check from plans. No traffic noise or rail noise calculations are required.
- Field testing (if necessary) is straight forward using existing international Standards designed for this purpose.
- There is an element of risk sharing as the design target for acoustic performance of the building facade has already been calculated and included in the insulation rule. There are consequently lower risks for the rule user and a greater expectation that the required insulation standard will be achieved compared to the above “indoor decibel” method.

From what I can detect NZTA’s support for an “indoor decibel” type of acoustic insulation standard in Rule 12D.1.12 of the Kapiti District Plan is inconsistent with the guidance and recommendations for specifying acoustic insulation of habitable rooms from outdoor noise found within:

1. NZ Standard NZS6806:2010 Acoustics – Traffic Noise – Noise From New & Altered Roads.

Clause 5.2.3.2 of that Standard states;

- 5.2.3.2 *For assessment of internal noise this Standard requires the acoustic insulation performance of buildings to be specified and, where necessary, rated using the ‘standardised level difference’*

The accompanying comment box states;

- C5.2.3.2 *Noise received inside buildings should be quantified by using the ‘standardised level difference’ which is a single figure value representing the characteristics of the building structure, the location of any openings and the rating of any acoustically weak elements such as windows.*

The ‘Standardised Level Difference’ is defined as follows on page 24 as;

Standardised level difference

A single value used to describe the acoustic performance of the external building envelope (including windows, walls, ceilings, and floors where appropriate) Standardised level difference shall be described using $DnTw + Ctr$ as defined in ISO 717-1 using spectrum number 2 (A-weighted traffic noise spectrum). The Ctr correction term shall be included within the rating method to ensure these methods adequately consider low frequency sounds associated with road-traffic.

2. NZS6802:2008 Acoustics – Environmental Noise

Clause 8.6.9 refers to acoustic insulation of buildings. The example of a recommended insulation rule is quoted in C8.6.9 as;

‘Where the provisions of this plan require that any building used for a noise-sensitive activity be adequately isolated from external sound sources, the building should be orientated, screened, sited, and acoustically insulated, to minimise internal noise levels. The building envelope shall be designed and constructed to achieve the following sound insulation in accordance with ISO 140-5:1998 and ISO 717-1:1996.....

Acoustic Insulation Issues Raised By Mr Smith

It is relevant to discuss the issues raised by Mr Smith in his support for the indoor decibel approach. Mr Smith’s evidence states his view that the Council’s ISO Method (which he terms the ‘façade performance’ approach) does not consider the varying noise levels at different distances from the State highway, nor the orientation of the receiving building. He terms the Council’s approach a ‘one size fits all’ approach.

Clearly this is not the case as Rule 12D.1.12.2 stipulates a minimum insulation standard for dwellings within 40 metres of the edge of the carriageway to achieve a performance standard of not less than $D2m,nT,w + Ctr > 35$ dB. Taking the NZTA indoor target indoor decibel limit of 40 dB LAeq(24 hour), this higher performance standard is suitable for protecting against an outdoor traffic noise levels of up to LAeq(24 hour) of 75 dB which is a very high level not likely to be experienced at any current or future dwelling in the district (unless traffic grows at sustained high levels for many years). Rule 12D.12.1 stipulates from 41 metres to 80 metres a performance standard of not less than $D2m,nT,w + Ctr > 30$ dB. Under this same indoor noise standard, Rule 12D.2.1 is adequate to protect dwellings up to 70 dB which is unlikely to occur in practice beyond 40 metres from the highway. A 30 dB standard was imposed as a new dwelling will already achieve reduction so 25 to 27 dB, so any extra costs of achieving a 30 dB standard are not great³. Thus, for new habitable rooms between 41 m and 80 metres from the highway the main advantage is from the ventilation requirement which will allow comfortable indoor conditions whilst keeping windows closed to reduce the ingress of outdoor noise from road traffic.

The above two tiered insulation limits do appropriately, in my view, respond to the variable traffic noise levels that occur in areas near state highways in the Kapiti district.

Distance From Highway

Mr Smith advises the insulation requirements should extend out to 100metres from the edge of the state highway carriageway. Rule 12D.1.12 refers to controls applying out to 80 metres from the highway. The argument raised by Mr Smith is that traffic noise levels could exceed the ‘trigger’ value of 57 dB LAeq(24 hour) in outdoor traffic noise, and thus some distant dwellings will not be adequately mitigated.

As a describe below in some cases this may occur in limited areas, however the “extra” noise above 57 dB would not be great. At our pre-hearing meeting Mr Smith agreed to present pictorial evidence showing forecast traffic noise contours for future state highway noise at year 2025 which were presented at the McKays to Pekapeka expressway project Board of Inquiry. He agreed to show the 57 dB contour overlain with a

³ Cost studies on these types of insulation studies undertaken by quantity surveyors engaged by WCC o assess district plan insulation requirements indicated (in 2004 dollars) costs for a typical to achieve $D2m,nT,w + Ctr > 30$ dB as around 1.8% to 3.5%, rising to 8% to 11% of the build cost for a typical 3 bedroom dwelling having to meet the $D2m,nT,w + Ctr > 35$ standard.

computer drawn line indicating an 80 metre setback distance. This would be the most accurate means to determining the “excess” areas where levels exceeding 57 dB would occur in the future at distances greater than 80 metres from the highway.

I have done this exercise manually myself for selected areas and I am satisfied that due to the mitigation measures required to be implemented as part of the consenting process for this expressway, there are very few (mainly rural) areas where the forecast future 57 dB LAeq(24 hour) contour would lie at distances more than 80 metres from the edge of the carriageway. Not surprisingly the 57 dB contour would be likely to be exceeded at 80 metres from the highway in rural areas as this is where the noisier road surface is to be applied, and no other mitigation measures (such as noise walls) are proposed as there are few if any dwellings likely to be affected. I understand that in order for dwellings to establish in these areas in the future area generally require some form of subdivision or resource consent will be required.

The approach of NZTA requires a calculation of traffic noise for any proposed dwelling located out to 100 metres from the highway. This District Plan requirement would make it necessary to hire an expert to undertake a calculation and produce a report to Council even where the forecast 57 dB LAeq(24hour) contour did not extend beyond 80 metres from the highway. The BoI evidence shows this is the situation throughout much of the urban areas due to mitigation to be incorporated into the project. I consider this approach will result unnecessary expense for the owner or developer of the new dwelling.

Overall, I consider the “100 metre approach” to be wasteful and inefficient. I do not accept that there is sufficient evidence on potential noise effects beyond the 80 metre distance to demonstrate that the traffic noise mitigation methods of Rule 12D.1.12 need to extend to 100 metres from the highway.

KiwiRail Holdings Ltd (Submitter 447)

The expert appearing for KiwiRail, Dr Stephen Chiles raises several technical issues, including requesting acoustic mitigation be required to be addressed within any new, altered or relocated buildings housing noise sensitive activities located within 80 metres from any existing railway. From my understanding Council are not accepting that KiwiRail has no scope to argue for any mitigation measures applying beyond 40 metres. I reproduce the relevant extract from the original KiwiRail submission s follows;

KiwiRail supports the intention of this rule, requiring acoustic treatment for new, relocated or altered buildings used for noise sensitive activities and located within 40m of the rail line. KiwiRail also supports all standards listed for this rule.

I note Rule 12D.1.12.1 requires noise mitigation where buildings housing sensitive activities lie within 40m from the boundary of a designation for rail corridor purposes which in many cases will exceed the distance to the closest actual rail line by 8 to 10 metres.

In addition to the above, I note the original KiwiRail submission registered support for “all standards listed for this rule” which is at odds with the request of Dr Chiles where he seeks;

- 1) Noise insulation based on internal decibel noise limit (else increase the insulation requirement to D2m,nT,w+Ctr > 35 dB within the 40 metre buffer stipulated with Rule 12D.1.12.1).

- 2) Combined road and railway requirements of rule 12D.1.12 were shown on an overlay on district plan maps.
- 3) Rule 12D.1.12.6 ventilation requirements need to be invoked by part (a) of rule 12D.1.12.4 as well as part (b) where they are currently referenced.

I appreciate the North Island Main Trunk Line extends through the Kapiti District and is a key freight and passenger link. From Waikanae south the line forms a part of the Greater Wellington Commuter Train Network. As such, the rail corridor through Kapiti is a key part of the KiwiRail network and I can understand the need to protect its ability to operate, maintain and enhance its network into the future.

Apart from the scope issue whereby Council was entitled to believe KiwiRail was satisfied with the notified PDP noise provisions (only to learn several major alterations are now requested), in the interests of advancing the rail noise mitigation via Chapter 12 of District Plan, I recommend the following;

- a) Should values of received current or future rail noise in the Kapiti district warrant it, Council could consider increasing the insulation standard to $D2m,nT,w+Ctr > 35 \text{ dB}$ however we do not consider this could be simply based on the worst 1 hour LAeq value. The effects of noise sufficient to justify an increase needs to be described using a 24 hour noise exposure measure such as LAeq(24 hour) as this is consistent with international best practice for assessing transportation noise (rather than a 1 hour LAeq which has been developed locally by an acoustic consultancy firm working for KiwiRail). It is a high overall daily noise exposure which would lead me to recommend increasing the insulation standard as requested, not the highest single one hour rail noise level.
- b) Adding the appropriate ventilation requirements of 12D.1.12.6 to the acoustic certification of Rule 12D.1.4(a) so that the in addition to the current certification for acoustic performance, a clause is added to ensure the ventilation necessary ventilation requirements of Rule 12D.1.12.6 are also certified. This is sensible amendment that although out of scope, would enhance the working of the certification path to achieve compliance. The suggested wording for Rule 12D.1.4(a) is set out as follows;

4. Compliance with standard 1 above shall be achieved by either:

- a. a statement by Licensed Building Practitioner that the construction of the external building elements of the new or altered habitable room conform with Schedule 12.1 and that ventilation of these rooms conforms with the requirements of rule 12D.1.6.;*

or....

I have considered Dr Chiles suggestion for a definition of “altered room” as an alternative to the current definition set out in the “Note” located after Rule 12D.1.12.6(d) which states “...for the purposes of this rule, the term ‘altered habitable room’ means any habitable room that is (or is proposed to be) expanded in floor area by 10% or more, or involves the fitting of new or replacement windows in external walls with an area more than 5% of the floor area of the room”.

I do not consider lowering the threshold to 5% of the floor area will significantly improve the application of the rule or materially benefit the occupants of rooms in an acoustic sense where such small changes in floor area are concerned.

Typographical Error In Rule 12D.1.4 (B)

In reviewing these rules it has become apparent a typographical error has been found in Rule 12D.1.4 (b) where it states

"...compliance with the specified performance standard for sound insulation with a ventilation system installed as required under (f) below"

There is no (f), instead the rule is referring to the ventilation requirements set within Rule 12D.1.12.6. The recommended amendment for this rule is set out as follows;

"...compliance with the specified performance standard for sound insulation with a ventilation system installed as required under ~~(f)~~ Rule 12D.12.1.6 below"

Please advise if there are any matters arising.

Yours sincerely,



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