

## **Section 92 Response Attachments**

### **Attachment 8 - Vibration**

Watercare Services Limited  
c/- Central Interceptor Project Team  
Aecom  
PO Box 4241  
Shortland Street

Attention: Alia Cederman

Dear Ms Cederman

## **Central Interceptor - Main Project Works s92 Response Vibration**

We have reviewed the s92 issues raised by Auckland Council's advisors Styles Group in respect to vibrations and have prepared the following additional information.

### **Issues Raised**

The principal issue identified by Styles Group in the s92 request (letter from Styles Group dated 24 September 2012) is the unqualified use of the DIN4150 provisions for limiting the effects of vibrations on dwellings in the proximity of the construction works. Styles Group considers the DIN4150 recommendations are likely to be too restrictive on the works as most New Zealand dwellings have much greater tolerance to withstand higher levels of vibration without damage.

Styles Group references work currently in progress at the Waterview Connection project where blasting methods and rock breakers are being used to excavate basalt rock in close proximity to dwellings. Dilapidation (condition assessment) surveys of the dwellings have been undertaken and the structures have been assessed to be adequate to sustain significantly higher levels of vibration.

Styles Group recommends that one or both of the following be considered as a modification to the proposed conditions

- "i) That in the event of non-compliance, the vibration limit regime and flow chart be amended to allow for situations where a structure – specific structural evaluation has found that a particular structure is capable of withstanding greater levels of vibration than the DIN4150 limits or twice thereof.

And/or

- ii) The Vibration Assessment is expanded to include a section that demonstrates that the proposed works can be carried out within the currently proposed constraints with a high level of confidence. Particular examples should include blasting and piling activities within 10-15 m of a dwelling whilst achieving an acceptable level of progress."



## Discussion

The DIN4150 standard has been widely applied both in New Zealand and Internationally. It is acknowledged to be conservatively based and provides a high level of confidence that dwellings should not be damaged by the effects of vibrations. This applies to a wide range of structures such that it includes dwellings that include sensitive elements. Hence we agree that the great majority of dwellings should have capacity to sustain significantly higher levels of vibration without damage and, if a condition survey has been undertaken to confirm this, it should be possible to safely increase limits.

The limits recommended in the DIN4150 standard are determined at levels that are designed to ensure there is no reduction in the utility value of a building. This includes crack formation in wall plaster, enlargement of existing cracks and separation of positions. While the level of vibrations to cause structural damage is likely to be many times higher, any diminution of utility value will likely result in complaint. Further, the standard recognises that occupier's perception of vibrations will also impact greatly on their concern for the potential damaging effects of vibration. This may also be alleviated if a condition evaluation has been undertaken to demonstrate the resilience of the structure.

It should be noted, however, that the predominant frequency of ground transmitted vibrations induced by blasting and construction activities are in the 15-30Hz range and the corresponding tolerance levels of people for physiological effects will often be lower than the structural limits, particularly if they are set higher than the DIN 4150 levels for a specific dwelling. (Noise will also be a significant if not dominant factor.) Therefore, it may be necessary to develop alternative solutions in consultation with any affected neighbours for any increase in vibration levels based on condition of the dwelling and tolerance of occupiers. Periodic vacation of the property while specific works are carried out may be an option.

Experience at Waterview has demonstrated that this is manageable but practically needs to be addressed closer to the time of undertaking the works. This is possible when site specific condition evaluations are carried out and current owners / occupiers can be consulted.

In the event that an alternative solution cannot be developed with the owner/occupier, we agree that the cost of works will increase and a risk provision will need to be provided. We do, however, expect the work can, if necessary, be practicably completed using the DIN 4150 Standard criteria. We have experience of successfully using these criteria carrying out blasting and excavating of basalt to within 5m of dwellings on a large site at the Brightside Hospital.

## Summary

It is agreed that the proposal suggested by Styles Group could improve the efficiency of the works provided alternative solutions can be developed in consultation with affected neighbours. This requires the structural condition evaluation of the potentially affected dwellings be completed to confirm the increased integrity and to accurately assess risk to utility. Provided this is undertaken and submitted for approval of the Consents Manager, and any potential for disturbance and complaint (of both vibration and noise) by the occupier can be adequately addressed, we would support the first recommendation of Styles Group.

We would note that, if this is not acceptable or alternative solutions with neighbours are not available, it is still expected to be possible to complete the works under the proposed conditions. This standard has been applied successfully internationally and in New Zealand for many construction projects. It is accepted that significant constraints may result in increased costs and

reduced rate of progress for some areas in close proximity to dwellings but it is also noted that noise limits are also likely to impact on such activities.

During the development and refinement of designation conditions, consideration could be given to whether the proposed wording of Condition 14g could be modified to ensure it provides sufficient flexibility during construction.

## **Applicability**

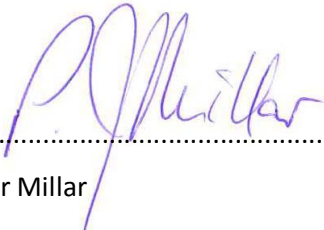
This report has been prepared for the benefit of Watercare Services Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

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