



24 January 2020

Auckland Council  
35 Graham Street  
Auckland

Attention: Mr. Brendon Leckey

Manager Field Surveying Central

Building Consents - Auckland Council

Dear Brendon,

**Seascope Project - Diaphragm Wall**

**71-77 Customs Street East Auckland Central Auckland 1010 BCO10098016-1:**

**- Formal Response to Auckland Council Independent Reviewer's RFIs:**

We refer to your Auckland Council Independent Reviewer's RFI dated 15 January 2020, our combined replies (including MM, T&T, MARCH and CCNZL) to the RFIs (item by item) are as follows:

We have not been party to the scoping or briefing of this independent party's review, but nonetheless we have responded to the RFI queries raised using reference to the full set of Building Consent documentation, "Seascope Project – D Wall Structure Far Face Verification Report dated 31/3/19 issued to Auckland Council" and with reference to recent and fortnightly meetings with the Auckland Council.

1. Please confirm whether the known defects throughout the full thickness of the wall were completely repaired or if some remain on the far face of the wall. If not, provide further information on how these will meet B1 structural and B2 durability requirements.
  - ⇒ CCNZL and March will complete a far face condition assessment (and in consultation with Mott MacDonald and T&T) on parts of the D Wall to demonstrate upon reasonable grounds that the design and consent requirements have been met.
  - ⇒ The D-wall will meet the consented design requirements taking into account acceptable tolerances of defects to the internal and external face, satisfying B1 & B2 requirements.
    - Note that B2 requirements are achieved by concrete cover, which is the reaction between the alkaline concrete (pH 12.5) and oxygen to protect the steel. If small bentonite (pH design limits of 6.5-12 [on site tested as pH 9] - therefore alkaline in nature) inclusions are present at a micro-scale, these will also provide protection to the steel. The surrounding soil itself is slightly alkaline also, therefore is unlikely to alter this alkaline condition within the wall.
2. The CCNZL report advises that possible defects could exist on the far face of the wall however the likelihood of this occurring is low if there is no defect on the inside face. Please provide how you arrive at this conclusion.



- ⇒ Yes, the report does identify that there is a risk of external face defects to the localised D-wall, but the risk of this is lower than that to the internal face of the D-wall. The technical reports provided support this due to an understanding of the condition of the adjacent materials to the upper part of external face of the D-wall and how these compare to those adjacent to the internal face of the diaphragm wall. The internal face of the D-wall at a high level abuts demolition rubble and material from the former use of the site. This material is not consistent and susceptible to allowing inclusions to contaminate the inner face concrete. The external face of the D-wall abuts either well-compacted sub-soils that form the pavements to the north and south elevation of the site or a set of temporary works used to restrain these material (sheet piles & king-post walls), a storey deep liner wall to the White Rabbit structure on the west of the site, or the basement structure of Ballantyne House on the east of the site. These dense conditions do not create the same inconsistent condition present in the inner face of the D wall, and thus greatly reduces the likelihood of defects in this zone. Note that once below the backfilled and reclaimed top strata, the D Wall is trenched into ideal subgrade conditions to both faces. This leads to the likelihood of defects on either the inner or far face to be unlikely. This is further proven by the condition of the inner face at lower levels, and thus the expectation that the lower level far face is also in an acceptable state.
  - ⇒ Attached Supporting Document – please see attached folder (Item 2 King Post & Sheet Pile).
  - ⇒ Please also refer to Clause 12 in “SEASCAPE PROJECT – D WALL STRUCTURE FAR FACE VERIFICATION REPORT” dated 31 Mar 2019.
3. Is it your intention that known and unknown far face defects will be left as is using risk-based assessment as the means for justifying compliance?
- ⇒ As noted above, the investigations to the localised external face of the D-wall are not yet complete. A set of visual investigations remain to be completed to the localised external face of the diaphragm wall to corroborate the evidence produced to suggest that the far-face condition is better than that of the internal face.
  - ⇒ Yes, a risk-based approach will be applied to determine the acceptable levels of defects that are encountered (including the standard defect management procedure of classification of defect type – minor, major and critical), which will be agreed among Mott MacDonald, March and CCNZL prior to the investigation. This will be used to gain an understanding of this sample set representing the remaining panels of the external face that are not intended to be visually inspected. The panels that have been carefully chosen to be visually inspected represent those with the higher risk of external face defects.
4. Provide a schematic representation of the all existing defects reported in the March forensic report (Section 5) on a wall panel elevation drawing. This should also include information on which defects are rectified and which are not rectified. This information should also cover the remaining entire depth of the D wall and not just the top 5 metres.
- ⇒ Please see schematic mapping in attached folder (Item 4 Defect Mapping). Defects at all depth were all remediated, and all the on-site QA records are available under all QA System which were already in place since the start of the project.
5. Horizontal Core Testing at W06 - It is noted that March's report (Section 5) does not mention defects in panel W06. Please provide information of the defects on this panel, including if the defect was through the full thickness and was repaired full thickness. If these defects were of the "mattressing" type, please seek comment from March on the likelihood of similar defects existing on the far-face.





- ⇒ Panel W06 did not have any "mattressing" nor any defect through the full thickness. The defects were only superficial. The defects observed were mostly related to the age of the concrete, density of steel, consequently its flowability, and some inclusions being formed as a consequence. Please see attached folder (Item 5 W06 defect and repair) and reference to the schematic mapping attached.
- ⇒ Reference to Clause 12 in "SEASCAPE PROJECT – D WALL STRUCTURE FAR FACE VERIFICATION REPORT" dated 31 Mar 2019, the forensic report issued by March in October 2018, categorized some typical types of defects and gave typical examples found on the project but did not list all the defects panel per panel.
- ⇒ Some NDT and coring were performed (by CCNZ) as a correlation. The coring showed some D Wall thickness > 670mm of sound concrete (though the design D-WALL thickness is only 600mm), and even though most of the coring could not go through and stopped at the far-face steel reinforcements. Please refer to Clause 9 in "SEASCAPE PROJECT – D WALL STRUCTURE FAR FACE VERIFICATION REPORT" dated 31 Mar 2019.
- ⇒ All the defects were repaired in accordance with the standard Remedial Strategy which was to be expected.

Ground Water Quality - There is no information in any part of the CCNZL report on ground water/soil quality and chloride content, and also no evidence that the reinforcement is not always embedded on bentonite or concrete. Please provide information on the ground water/soil quality tests and in particular chemical analysis of the ground water including pH levels and chloride content. Was the pH of the inclusions containing bentonite and soil/concrete mix measured? Would SEI's conclusion change if the defects are filled with soil or a bentonite-soil mixture or any unfilled (as can be seen in some photos and therefore completely exposed to ground water?) Has SEI considered the water quality data for this site and how the presence of chloride in the soil would alter the passivation limit on the "Pourbaix" diagram?

- ⇒ Please see attached folder (Item 5 PH of Water, soil and bentonite), which provided information from T&T (Geotechnical Engineer), the materials have a pH of 7.3 - 9.3 – indicating that they are slightly alkaline. Soltest report shows pH >9 for the measurements they made in the wall so locally not aggressive and groundwater beyond wall was ok. This area of the wall will be subjected to variance in groundwater levels, corresponding generally with tides given proximity to the sea. T&T's (Geotechnical Engineer's for the Project) Geotechnical Reports did not provide any specific details of chloride testing nor MM during the design and consenting phases. However, we will carry out a testing for chloride levels now and we will share the results with AC when it's become available. Bentonite [pH design limits of 6.5 - 12 (on site tested as pH 9) - therefore alkaline in nature] inclusions are present at a micro-scale; these will also provide protection to the steel. All of this is directed at the risk of implications of exposed reinforcement and reduced cover.
6. NOT Scans of Grids A & H - We note several discrepancies in the reporting of the NDT scans. Figures 4.2 and 4.3 are identical which should not be possible. The NDT imaging of the three panels indicate significant zones of "inhomogeneous material" and yet the report concludes that that the concrete is "good" without any justification. Furthermore, Motts commented separately that the NDT results were "somewhat inconclusive". Please clarify
- ⇒ The original NDT report was in both Chinese and English. While deleting Chinese language, Figure 4.3 was replaced by Figure 4.2 by mistake. Please refer to attached folder for original NDT report (Item 6 NDT Original Report in CN&EN).
  - ⇒ Impact Imaging NDT method was used worldwide, and it has much better result than any other NDT method. Even though, accuracy at far face is lower than near face. This NDT provided the ratio as some criteria, and it evaluated these area as good concrete, therefore, no justification / verification (by core drill) was required.



⇒ From a MM perspective, these NDT scans do not clearly provide an indication of the condition of the external face (interference by high concentrations of rebar)– in particular defining whether any reinforcement is exposed or as to whether there is reduced cover. Hence why MM have required a risk-based approach whereby some visual inspections of the localised external face of the D-wall have been asked for.

7. Additional Wall Liner on Grids 1 & A - Please provide clarification from Motts on whether the 0 wall is providing structural support to the proposed "57" storey superstructure or only acting as a retaining wall. Furthermore, Motts' letter on remedial measures states that the walls were designed for waterproofing performance. There appears to be some confusion regarding the actual function of the D Wall. Please clarify the temporary and permanent function of the D wall in locations where there are additional wall liners and also in location where there are no wall liners. According to CCNZ report, the *"D Wall acts as a retaining wall until the 5 levels of concrete mid-floors are completed. D-wall is designed to support upper structure only in some places where there are 600mm reinforced wall liner wall to be constructed."* The CCNZ report states that the additional liner can compensate for minor defects in the far face but does not explain how this is accomplished. Please provide detailed clarification from Motts.

CCNZL were incorrect in the earlier report, for which we apologise. MM response to this follows:

- ⇒ "The CCNZL's earlier report states that the additional liner can compensate for minor defects in the far face but does not explain how this is accomplished' is not correct. The liner wall does not necessarily compensate for any defects to the external face of the D-wall. The liner wall has a completely separate function."
- ⇒ CCNZL now understand that the liner wall function is to transfer load of the mega-frame across the various independent D Wall sections. This is amplified in the "Substructure Design Report" which is part of the consent documentation (under Substructure Building Consent) and referred to in the following query, of which the response is direct from MM.

8. Mott's comments on remedial measures and construction sequencing. - Mott's letter does not specifically mention structural demands or capacity of the D wall in the permanent case or comment on the risk or effect of potential long-term corrosion effects on the structural performance of the D wall. Also, there is no comment on the loss of strength from unbonded reinforcing caused by bentonite inclusions in the cover zone. Please provide Motts comments on these issues.

- ⇒ Mott MacDonald response - "The reader should refer to the Substructure Design Report & supporting calculations which were part of the approved Substructure Building Consent Documentation. These describe the function of the D-wall and its critical design actions. MM have checked the upper portions of the D-wall for ULS actions and as the wall has been designed for an SLS condition the permanent case can accommodate a degree of loss of reinforcement section associated with acceptable tolerances in defects (for both B1 & B2)."

9. Provide comments from Motts on whether subsequent remedial works to the D wall will be compromised (due to access restraints, etc.) by the continuing construction of the additional wall liners and other superstructure works.

- ⇒ Mott MacDonald response – "No additional remedial measures are considered necessary to the internal face of the D-wall as a means of mitigating the outcome of the external face condition assessment."





10. Producer Statements: Please provide PS1 from Motts/March on the proposed remedial works. Please also provide PS2 from the Aurecon peer review for the proposed remedial works. A revised PS3 and PS4 for these works will also be required.

⇒ There should be no change to the PS1 and PS2 or additional documentation as the consented design will be implemented. There is no change to the design. The PS3 producer statement from the Contractors will describe how the consented design has been achieved (with appropriate tolerances for defects, including this risk-based approach for condition assessment and remediation). PS4 will rely on the Quality Control processes in place by the Contractors, along with addressing MM's NCR's and CAN's.

11. Provide detailed findings from the excavations on the outer-face of the D-wall undertaken against the Ballantynes boundary.

⇒ Please refer to the attached folder (Item 11 GL 8 Far-Face), some photos and video shows:

- 1) some Fare Face concrete cover looks imperfect.
- 2) However, Core Drill from Far-Face is sound concrete, (refer to attached MARCH report, extracted from Forensic Report):
- 3) Videos will show how difficult to break over poured concrete at Far-Face.

⇒ Excavation on the far-face along Ballantyne House (RL 0.425m):

- Panel E01: no defect noticed to the exception of small bulging.
- Panel E02: no defect noticed to the exception of small bulging.
- Panel E03: no defect noticed to the exception of small bulging.
- Panel E04: some defects observed and remediated: mainly continuity of some defect seen on the near face, and going through the D Wall (contamination of soils/bentonite).
- Panel E05: minor defect; slight inclusions indicating concrete surface and overflow.

12. We understand Concrete Structure Investigations Ltd was onsite carrying out scanning on the D-wall. Please provide these results or reasons why this information was not included in the CCNZL report.

⇒ CSI Ltd was offered an opportunity to trial their NDT technology on D wall (W06 panel). However, it has been realised that their technique won't be suitable for the 600 thick double layer heavily reinforced D-Wall. Upon consultation with our Consultants, it has been concluded to use other techniques and testing methods by Others. Thus, no submissions were made in the CCNZL Report.

We hope the above combined response (with the respective in-puts from MM, T&T, March & CCNZL) answered the RFI's raised by Auckland Council's Independent Reviewer.



As we have offered in our earlier communications, we are more than happy to attend a joint meeting with your Independent Reviewer and Auckland Council officials, together with MM, T&T, March & CCNZL key team members if that helps to further clarify queries if any.

We look forward to receiving your timely acknowledgement and response.

Please feel free to contact me if you have any queries.

Thank You!

Sincerely Yours,

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Sathy Thurai-rajah

***Construction Director/ Project Director***

For & on behalf of:

**China Construction New Zealand Ltd.**

**Attachments:**

Memory stick of all the supporting documentation (due to the excessive capacity of file sizes).

Note: Will be delivered By Hand to AC by our CCNZL Staff.

**Legend/ Contributing parties for the response:**

MM	—	Mott MacDonald (Structural Engineer)
T&T	—	Tonkin & Taylor (Geotechnical Engineer)
MARCH	—	March Construction Limited
CCNZL	—	China Construction New Zealand Limited