Dunning Thornton consultants

Site 9 – Structural Effects & Construction Methodology

Structural Effects

Kumutoto Site 9 presents a reasonably significant challenge from a natural hazard perspective with its high shaking hazard, liquefaction/lateral spreading potential and susceptibility to Tsunami/Seiching waves. The site is also relatively low and could be subject to potential, occasional future inundation, particularly as a consequence of prolonged sea-level rise. The structural, geotechnical and architectural design mitigates these issues with a high-performance structure expected to perform well in excess of code minimum requirements. In addition, the development will result in the remediation of existing in-ground contamination.

The liquefaction and lateral spreading potential arises through the relatively un-compacted reclamation fill dating from 1900. As part of the development, subterranean contiguous-piled walls or piled frames will be constructed, perpendicular to the direction of potential lateral spread. The ground floor slab and the superstructure will be supported on the walls/frames. In the event of liquefaction/lateral spreading the contiguous-piled walls/frames will brace the structure through the liquefied material while allowing lateral spread to occur beneath the building with little ill-effect.

Above the ground-floor the building superstructure will be base-isolated to provide a high level of seismic life-safety protection coupled with damage avoidance, improved business continuity and protection of contents. Base isolation will provide seismic, life-safety performance in excess of Importance Level 3 [IL3]. Above the base isolators the structure will be predominantly steel-framed to provide the strength and resilience at the least weight. The upper floor slabs will be reinforced concrete.

Minimal and localised de-watering may occur during construction to enable formation of the lift pit and deeper foundations. The de-watering, if required, will be restricted to small areas. Any effects will be a localised due to the ready re-supply of water from the groundwater and the sea. Accordingly, water-tables beneath neighbouring buildings will not undergo change.

Excavation will typically be shallow, with the exception of the piles. Existing foundations that are encountered will be removed only if they obstruct the new works. Excavated material will be tested for contamination and treated/disposed as appropriate.

The new building ground floor will be set as high as practicable while still providing access from existing waterfront levels. This means that the ground floor and lift pits may become susceptible to occasional inundation as a result of sea-level rise after approximately 100 years. Future mitigation to prevent flooding of the ground

floor will be possible by simply raising the building at the isolator level. Lifting technologies capable of raising the building structure are already in existence.

As with other low-lying properties around the Wellington region, ground floor spaces may be inundated during Tsunami or Seiching waves. The first floor level has been set sufficiently high to avoid damage, based on maximum wave height predictions. While significant damage could be expected to the ground floor non-structural elements, the primary structure will have sufficient resilience to resist the wave actions.

Construction Methodology

The Site 9 foundations will be constructed in reclamation fill, adjacent to the harbour edge but inside the existing Seawall. Construction activities will include excavation, removal of existing foundations (from previous structures on the site), piling, Continuous-Flight-Auger [CFA], minor de-watering and construction of the reinforced concrete slab and beams. The following steps outline, in concept, the construction methodology that will be used.

1. Site establishment, fencing, site sheds etc.
2. Storm-water protection/diversion etc. Temporary filters, kerbs etc. to prevent construction and excavation materials entering the storm-water system.
3. Additional proof-drilling to determine depths for piles
4. Site-wide excavation to approximately 400mm deep. This is to provide a bund against any spills or flooding. The excavated material shall be assessed for contamination, treated if required and disposed to landfill/cleanfill as appropriate.
5. Construction of CFA contiguous-piled walls or piled frames perpendicular to the seafront.
6. General excavation to expose the existing, remaining foundations and lower general ground surface levels. The excavated material shall be assessed for contamination, treated as required and disposed to landfill/cleanfill as appropriate.
7. Demolition of existing foundations. Debris will be removed to landfill.
8. Additional excavation, as required, to the underside of the ground floor foundations. The excavated material shall be assessed for contamination, treated if required and disposed to landfill/cleanfill as appropriate.
9. Construction of a concrete tidy slab across the ground foot footprint.
10. Construction of the structural, reinforced-concrete ground floor slab, foundations and lift pit.
11. Construction of the ground floor columns and installation of the base-isolators.
12. Construction of the steel and concrete superstructure, above the isolation plane.

Note that the sequence described above would be a progressive one starting from one end of the site. I.e. Slabs and columns may be in progress at one end of the site while excavation is still underway at the other end.

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