Reclamation for Al Raha Beach Development, Abu Dhabi, UAE

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INTRODUCTION

- 10 km long and 0.8km wide, 650 hectares reclamation over 1m to 6m deep contaminated very soft silts, clays and very loose sands (Fig 1).
- Depth of water body was about 10m to 12m.
- The objective was to form a stable reclamation over soft mud with minimal on-going settlement

Fig. 1 Simulated lateral Displacement

RECLAMATION APPROACH

- Form 2.5m thick capping layer by sprinkling sand in 1.2m and 1.3m lifts. Leading edges were at 1V:15H.
- Above the capping layer sand was hydraulically discharged from floating pipelines pumped from cutter suction dredgers.
- On the Eastern precincts the seawalls were formed by installing diaphragm wall seawalls after reclamation. The temporary reclamation slopes were 1V:H or 1V:4H (Fig 2).
- On Western Precincts the seawalls were L-shaped precast retaining wall units founded on stone column foundation (Fig 3).
- On Western precincts the seawalls were formed 1st and then filled within.

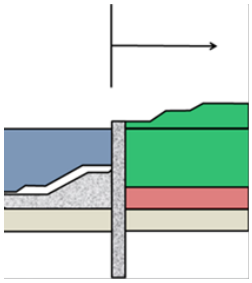

Fig. 2 Diaphragm wall as Seawall

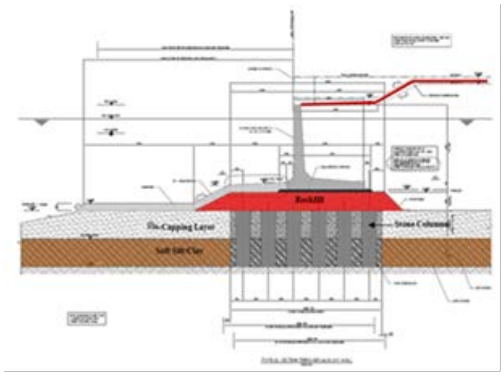

Fig. 3 Precast L-Shaped Seawall on Stone Columns

GROUND IMPROVEMENT

- Densification of the ground using the deep vibro-compaction technique (Fig 5)
- Form sand compaction piles in the underlying capped very soft silt/clay layer to minimise on-going settlements (Fig 8).
- Carry out impact compaction of the surface at 2.1 m NADD using a Landpac to achieve the bearing capacity of 150 kPa (Fig 6).
- For liquefaction, to achieve a relative density of at least of 60%, and bearing capacity at surface, the CPT qc versus depth profile shown in Fig 4 needed to be achieved, with the qc values corrected to account for the crushability/compressibility of the calcareous sands encountered at the site.
- Fig 7 shows the actual CPT qc data from a typical location where the criterion has been met.
- Zone load test results are shown in Fig 9 and 10.

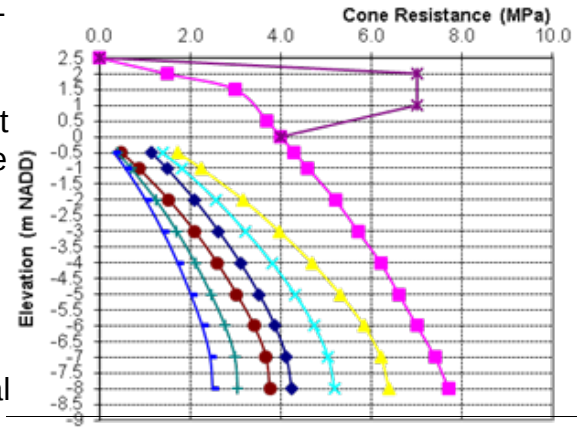

Fig. 4: qc versus Depth Profile to be Achieved by Densification

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Fig. 5: Deep Vibrocompaction at 3.85m Triangular Grid Centres

Fig. 6: Landpac Compacting Near Surface layers

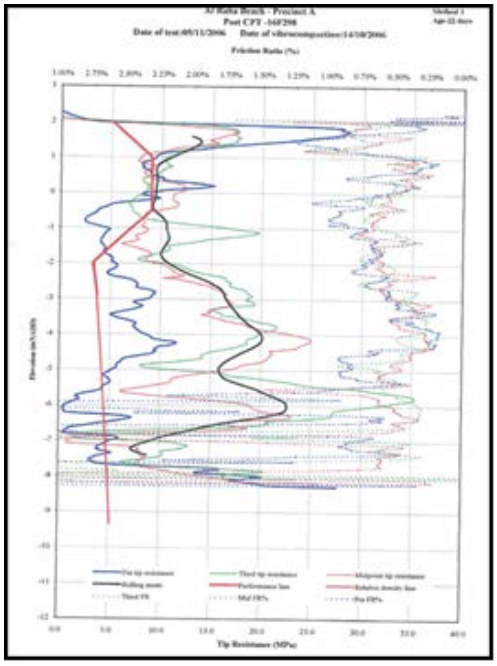

Fig 7: Typical CPT qc Profiles after Treatment to compared with the qc criterion

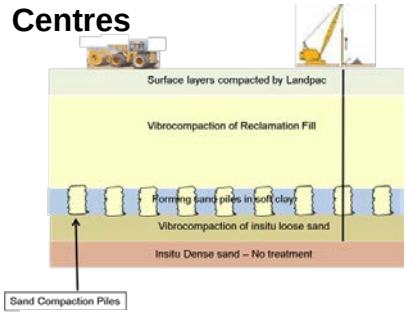

Fig 8: Formation of Sand Columns within Very Soft Clay/Silt Layer with the Vibroflot

Fig 9: Set-up for Zone Load Test

INSTRUMENTATION

- Spider magnet deep settlement gauges, surface settlement markers, piezometers, and inclinometers near seawalls were installed.
- The settlement monitoring results are shown in Fig 11. They indicate that the settlements have stabilized in a short time of less than 3 months.

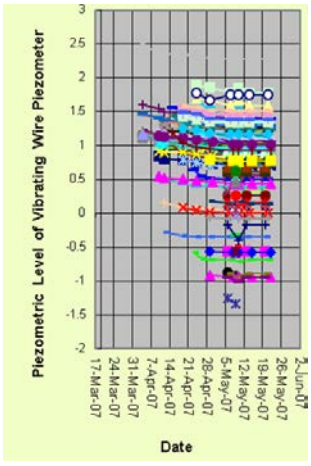

Fig 11: Reclamation Settlement

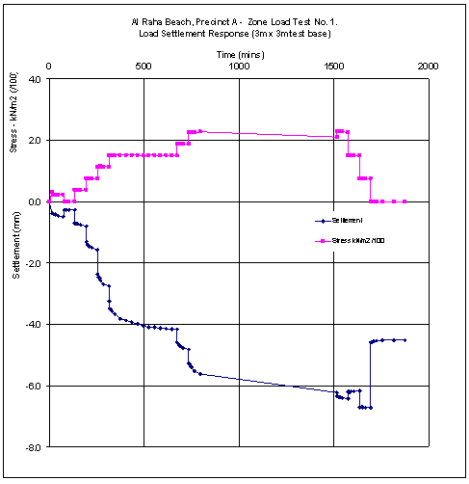

Fig 10: Settlement Plots from a Typical Zone Load Test

CONCLUSIONS

- The reclamation approach of initially capping the very soft layers with a 2.5m capping layer and then placing reclamation fill by pipeline was successful without experiencing any failures.
- Stone column foundations for the L-shaped seawall was very effective, with minimal settlements and lateral movements.
- Vibrocompaction easily achieved the qc values, and the relative density required.
- Surface compaction with Landpac achieved bearing values in excess of 150 kPa
- The reclamation settlements stabilised within 3 months with negligible on-going settlements.

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