

Deep foundations

Piling - Barrettes - Dynamic compaction - Compaction grouting
Prefabricated vertical drains

GENERAL LÁZARO CÁRDENAS REFINERY

MINATITLAN - MEXICO



Soil improvement and deep foundations works for the construction of an oil refinery



View of the refinery during construction

In 2003, the national oil company of Mexico PEMEX started a new refinery project at Minatitlan in Veracruz state. CIMESA, the Mexican subsidiary of Solétanche Bachy, was awarded the contract for soil improvement works and deep foundation works.

Geotechnical conditions

This part of the Gulf of Mexico is a very marshy coastal plain underlain by very thick strata of compressible soils. The land

CLIENT:	PETROLEOS MEXICANOS (PEMEX)
MAIN CONTRACTOR SECTION 3:	DRAGADOS PROYECTOS INDUSTRIALES
MAIN CONTRACTOR SECTION 4:	TECNICAS REUNIDAS / ODEBRECHT / RIO SAN JUAN CONSTRUCCIONES
MAIN CONTRACTOR SECTION 5:	TECNICAS REUNIDAS / ODEBRECHT / RIO SAN JUAN CONSTRUCCIONES
DURATION OF THE WORKS:	2005 - 2007

MAIN QUANTITIES:

- Prefabricated vertical drains: 400,000m
- Dynamic compaction: 100,000m²
- Compaction grouting: 170,000ml of boreholes
- Slurry bored piles diam. 600 to 1200mm: 1,630 units for 51,500ml of boreholes
- Starsol piles diam. 500 to 800mm: 2,490 piles reinforced along their entire height i.e. 75,000m
- 800mm thick barrettes: 8.200m²



Vibro-compaction



Site overview with its forest of cranes

on which the refinery was constructed consisted of alternating strata of soft to very soft clay and loose to fairly loose sand of varying fineness. In particular, at depths of between 0 and 20m, there are two layers of liquefiable sand that required major soil improvement works. The strata with adequate bearing capacity to take the foundation loads were found at depths of between 25m and 45m.

Techniques

A trial site was used to validate the technical proposals, i.e. dynamic com-

paction to improve the surface soil stratum and compaction grouting to improve the deeper levels, together with Starsol piling (drilling the soil using a hollow auger and then injecting concrete as the auger is withdrawn) for the foundations.

Site

The first stage in the works consisted of surface soil improvement. This was then followed by deep soil treatment and, finally, the construction of the foundations. The immense size of the site required major mobilization of resources:

- dynamic compaction: up to 5 cranes,
- starsol piling: 2 x 12,000 Starsol,
- piles drilled under drilling fluid: 9 rigs,
- barrettes: 1 rig to construct the 76 barrettes measuring 2.70 x 0.80m and a depth ranging from 35 to 45m,
- compaction grouting: 4 high-depth rigs.

More than 500 people were employed for the successful completion of the project.



One of the Starsol 12000 and vibro-compaction machines



Pile concreting