



# NGHI SON REFINERY PLANT THANH HOA – VIETNAM CONTROLLED MODULUS COLUMNS

Category: Tanks/ Oil Refinery Plant  
 Developer: Consortium between Petro Vietnam- Idemitsu Kosan- Kuwait Petroleum International and Mitsui Chemicals  
 Consultant: Foster Wheeler (Consultant for FEED)  
 Contractor: JGCS  
 Area / Quantity: 225,000 lm of CMC (for Tanks Area : 49, 500 m2)  
 Year: 2014

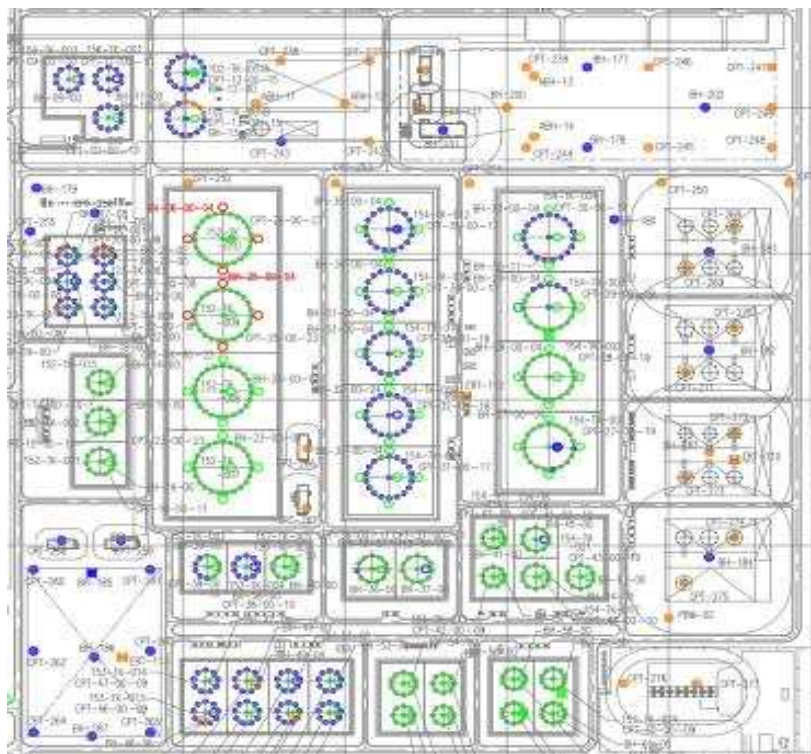


## PROJECT DESCRIPTION

The Nghi Son refinery is located in the Nghi Son economic zone, Tinh Gia district, Thanh Hoa province, Vietnam

The Nghi Son Refinery Plant contains structures for the oil refinery, chemical, auxiliary and common building to produce crude oil, create fuel and chemicals.

For the storage of the liquids, several kinds of tanks will be constructed. These tanks are designed with specific settlement criteria and soil improvement works is recommended to meet the required settlement criteria.



**Figure 1: Figure 1- Tank Farm**

## SOIL CONDITION / GEOTECHNICAL PROBLEM

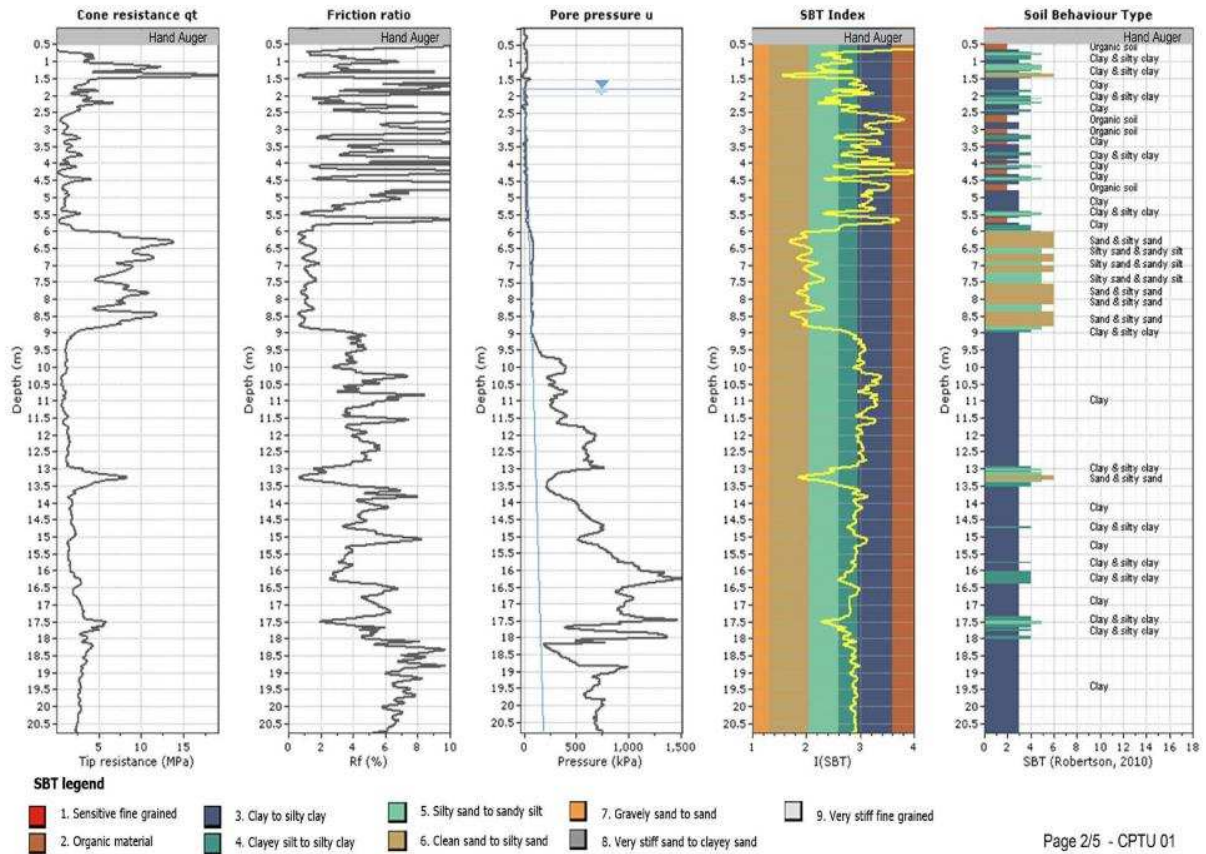
Soil data for Tank 156-TK-001/002/003 which typically represent soil condition of the Tank farm is as follows:

Layer	Description	Elevation (m)		Thickness (m)	E (Oed) MPa
		From	to		
0	Sand Filling for Platform	6	2.7	3.3	40.0
1	Silty clay	2.7	-4.1	6.8	4.47
2	Very soft clay	-4.1	-11.8	7.7	7.46
3	Very stiff clay	-11.8	-15.8	4.0	25.37
4	Silty clay	-15.8	-20.8	5.0	8.95

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## MENARD SOLUTION

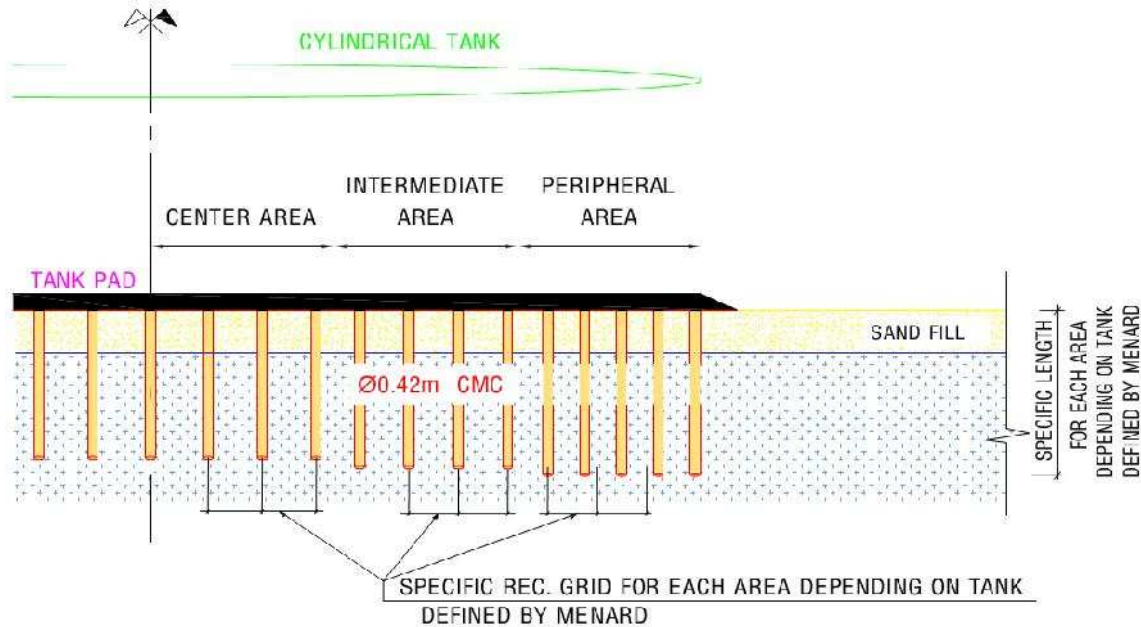
Menard proposed to use their patented Controlled Modulus Columns (CMC). Design of CMC was done specifically for each tank. Length and mesh of CMC depends on tank.

- Length of CMC varies from 5 to 20 m
- Mesh of CMC varies from (1.5 x 1.5m ) to (2.15 x 2.15m)

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Construction sequence:

- (1) Platform preparation and soil investigation to control and update the chosen mesh and the stress acting in the soil;
- (2) Controlled Modulus Column execution; (3) CMC test (Plate Load Test)
- (4) Installation of a Load Transfer Platform (Backfill layer) and final test;
- (5) Tank Load applied.



Figure 2- Menard CMC rigs' operation on site

## QUALITY CONTROL

A total of 49,500 m<sup>2</sup> were improved using Controlled Modulus Columns (CMC).