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Case History of Foundation Design for 50000 m³ Oil Tank

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SYNOPSIS: This paper introduce the case history of foundation design for $50000m^3$ oil tank in collapsible loess region. After field deep blasting test and laboratory soil test, author design deep Explosion-Squeeze-Foundation under the foundations of two oil tanks in a refinery for refining 5 million tons of crude oil per year. Diameter of E.S.F.:D₁=66.43m; thickness of E.S.F.: H₁=12m . It was the largest engineering practice in collapsible loess region in China in 1979 that deep foundation of 50000 cubic meter oil tanks are builded by explosion squeeze technique first time.

ENGINEERING PROJECT

- Constructional engineering: 50000m³ oil tank;
- Diameter of tank: D=60m ;
- 3. Height of tank: H=19.35m;
- 4. Storage:
 - Crude oil ;
- 5. Quantity:
 2;
- Engineering region:
 Collapsible loess region ;
- 7. Plant:

A refinery for refining 5 million tons of crude oil per year.

- 8. Country:
 - China .

ENGINEERING GEOLOGIC INVESTIGATION

- Geological age: Quaternary period , Holocene epoch Q₄ ;
- 2. Collapsibility of loess:

Collapsible loess Q_4^7 .

- 3. Collapsible type of construction site:
- Self weight non-collapse loess site ;
- 4. Collapsible class of collapsible loess foundation:
 - Class I~I ;

- Geological profile:
 See fig. 1 ;
- 6. Coefficient of collapsibility: $\delta_{z}=0.0072\sim0.0369$.



FOUNDATION DESIGN

The foundation layout plan see fig. 2.
 The subsurface Explosion-Squeeze-Loess-Foundation is a effective artificial foundation to improve deep foundation soil in collapsible loess regions.

3. The main purpose of using Explosion-Squeeze-Loess-Foundation is to eliminate the internal cause of settlement by soaking, thus, preventing the non-uniform settlement of the oil tank and ensuring the safety of the oil tank.

4. Construction process of E.S.L.F. and main achievement of field deep blasting test and laboratory soil test:

See "Deep Explosion Squeeze Loess Foundation" (Ref. 1).

5. Test result:

a. The dry unit weight Y of foundation soil are increased.

b. The coefficient of collapsibility of foundation soil:

 $J_s=0.0003\sim 0.0024$, the collapsible loss is changed into the non-collapsing soil.

6. E.S.L.F.:

7.

8.

a. Diameter of pile:	d=450mm ;
b. Pile spacing:	s=3d ;
c. Material of pile:	lime-soil ;
d. Diameter of E.S.L.F. :	D ₁ =66.43m ;
e. Thickness of E.S.L.F. :	H ₁ =12m .
Monolithic cushion:	
a. Diameter of cushion:	D ₂ =72m ;
b. Thickness of cushion:	H ₂ =0.5m ;
c. Material of cushion:	lime:soil=2:8
E.S.L.F. is also a composite	foundation.

- 9. Foundation elevation see fig. 3.
- 10. Settlement observation:

Settlement and non-uniform settlement of foundation of oil tanks are very small.

CONCLUSION

The constructions are proceeding smoothly. Through 12 years from 1980 to 1992 in use, it shows the foundation design of explosion squeeze technique is successful.

REFERENCE

 Xu, H. R. (1992) "Deep Explosion Squeeze Loess Foundation" International Symposium on Soil Improvement and Pile Foundation, Nanjing, China,







fig. 3 - Foundation elevation

Third International Conference on Case Histories in Geotechnical Engineering Missouri University of Science and Technology 314