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Case History of Foundation Design for 50000 m^3 Oil Tank

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SYNOPSIS: This paper introduce the case history of foundation design for 50000m³ 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.: D_1=66.43m; thickness of E.S.F.: H_1=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

1. Constructional engineering:
   50000m³ oil tank;
2. Diameter of tank:
   D=60m ;
3. Height of tank:
   H=19.35m ;
4. Storage:
   Crude oil ;
5. Quantity:
   2 ;
6. 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

1. Geological age:
   Quaternary period , Holocene epoch Q_4 ;
2. Collapsibility of loess:
   Collapsible loess Q_4^1 ;
3. Collapsible type of construction site:
   Self weight non-collapse loess site ;
4. Collapsible class of collapsible loess foundation:
   Class Ⅰ~Ⅱ ;
5. Geological profile:
   See fig. 1 ;
6. Coefficient of collapsibility:
   δ_s=0.0072~0.0369 .

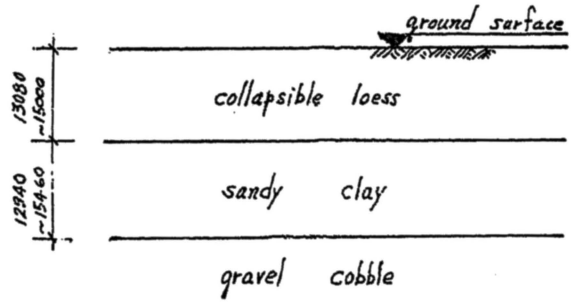

fig. 1: Geological profile

FOUNDATION DESIGN

1. The foundation layout plan see fig. 2 .
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 γ_d of foundation soil are increased.

b. The coefficient of collapsibility of foundation soil:

δ_s=0.0003～0.0024 ,the collapsible loess is changed into the non-collapsing soil.

6. E.S.L.F.:

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 .

7. 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

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.

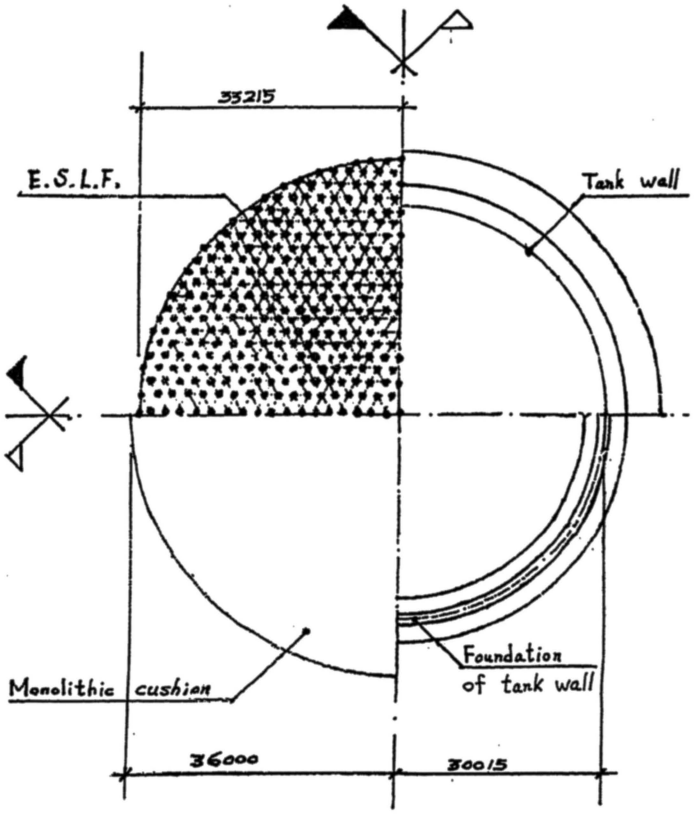

fig. 2: Foundation layout plan

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

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

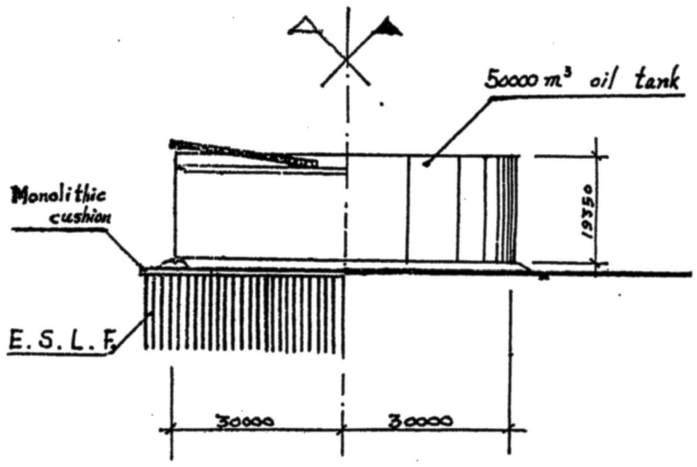

fig. 3: Foundation elevation