Final Examination Stability Analysis in Geotechnical Engineering

(by Dr J. Takemura)

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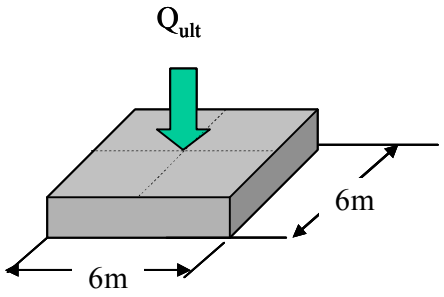
1. Consider a rigid square surface foundation (6m width) on dense dry sand as shown in Fig.1. The sand has specific gravity Gs=2.7, dry unit weight γ_d=16kN/m^3 and effective friction angle ϕ'=40^o. This friction angle was obtained from a **triaxial test**. Assuming unit weight of water γ_w=10kN/m^3, answer the following questions.

(1) How much is the void ratio of the sand?
(2) Evaluate the ultimate bearing load of the foundation in the central vertical loading condition.
(3) If the sand has ground water level at the surface, how much does the bearing capacity of the foundation change?
(4) When the sand is very loose with friction angle is 35^o, how do the failure mechanism, the load - settlement curve and the ultimate bearing capacity change from those of the dense sand? Depict the approximate shape of load-settlement curves.
(5) Which ultimate bearing intensity (stress) is greater, a rigid square footing with width of 6m or a rigid 2D strip foundation with width of 6m? Explain the reason of the answer as well.
(6) How much dose the ultimate bearing capacity of the square foundation decrease from that of the central vertical loading case when the vertical loading with 1m eccentricity from the center is applied as shown in Fig.2.



Dense sand (Gs=2.7)
γ_d=16kN/m^3,
ϕ'=40^o which is evaluated from triaxial test.
γ_w=10KN/m^3

Fig.1

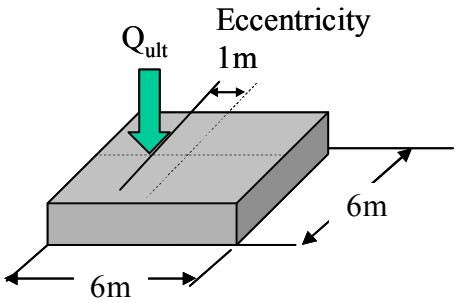


Fig.2

2. Choose either **Fig.3** or **Fig.4** and explain about the construction method applied in the construction of the structure shown, especially about the construction procedures, advantages and disadvantages related to the soil conditions.

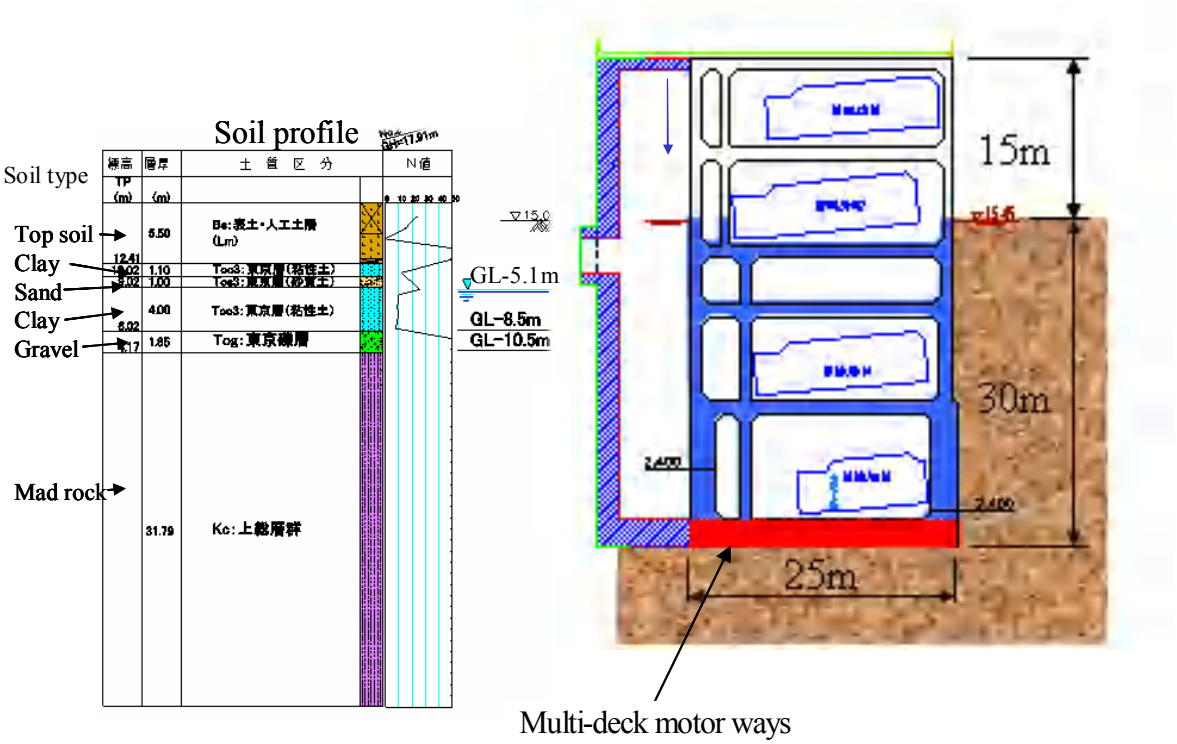
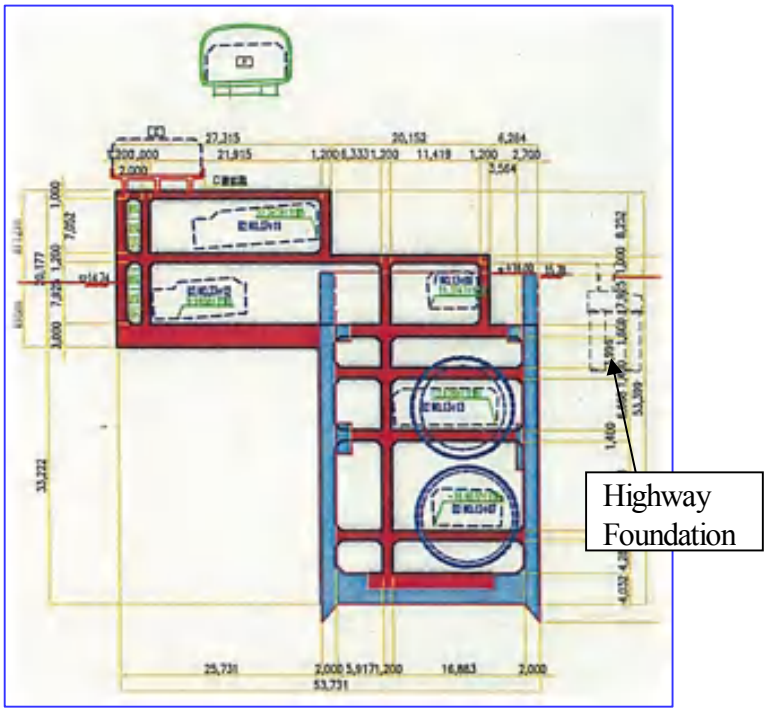


Fig. 3 Retaining wall for deep open excavation adopted at the O-hashi junction construction site



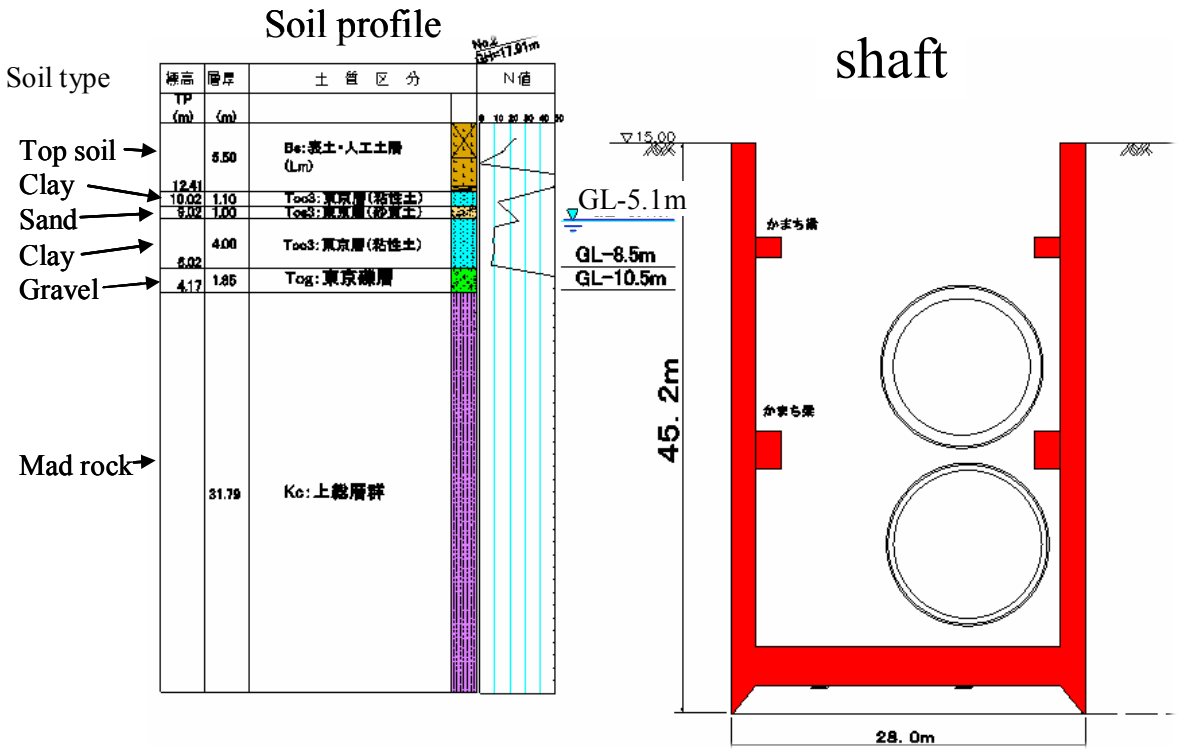


Fig.4 Vertical shaft constructed at the O-hashi junction construction site