Statnamic Test

Basic concept of statnamic load test

The main principle of Statnamic load testing is based on launching reaction masses from a pile top by releasing high pressure gases from a cylinder. The reaction force required to launch the reaction masses upward acts equally downward on the pile, and drives the pile into the ground. The high pressure gasses are produced by the burning solid fuel within the cylinder assembly. Using Newton's second law of acceleration, the reaction masses are accelerated upward at 20g where a force acts downwards onto the pile will be 20 times the reaction masses weight. Thus, only 5% of the required test load is required for the reaction masses assembly. Loading of the pile is monitored using a calibrated load cell and displacement is monitored using a photo voltaic cell laser sensor. All the data recorded are digitized and stored in a portable computer.

The duration of a Statnamic load testing is in the order of 120 to 150 millisecond. This produces a dynamic load on the pile top which is enough to allow the pile react as a rigid body without the influence of stress wave propagation within the pile. The soil is in turn loaded with minimum inertial effects and damping. However, in highly viscoelastic soils, some rate effects are inevitable and influence the interpretation of the test response.

Procedures of statnamic load test

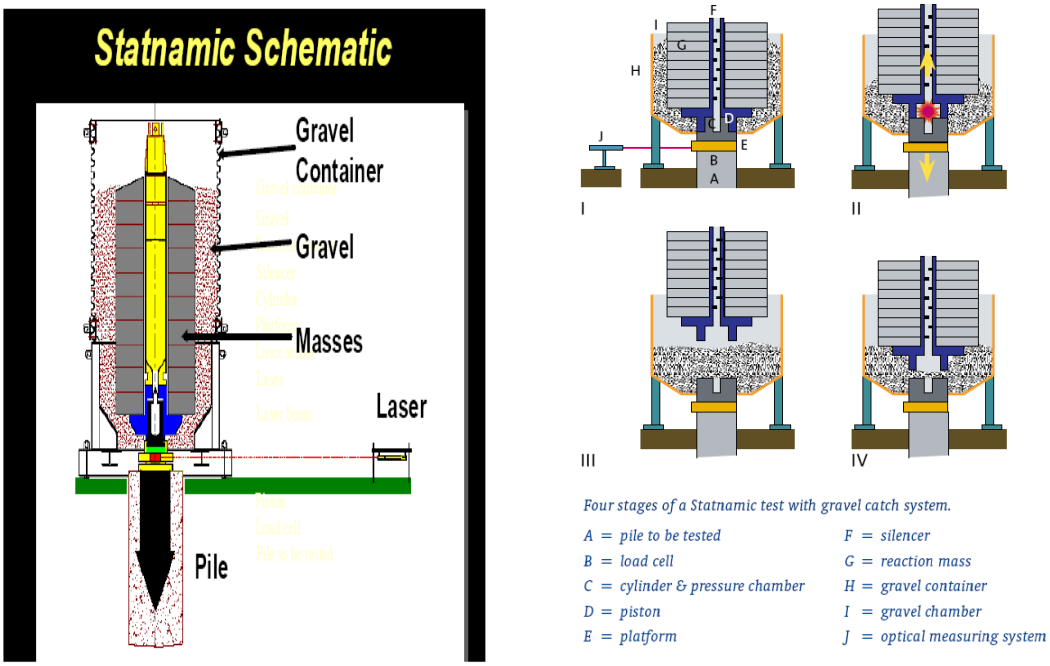

Figure 1. Statnamic Schematic

Phase Ⅰ

A cylinder with pressure chamber has been connected to the pile head and the reaction mass has been placed over the piston.

Phase Ⅱ

The solid fuel propellant is ignited inside the pressure chamber, generating high-pressure gases and accelerating the reaction mass. At this stage the actual loading of the pile takes place, as an equal and opposite reaction force gently loads the pile.

Phase Ⅲ

The applied pile force, displacement and acceleration are directly monitored. The upward movement of the reaction mass results in space, which is filled by the gravel.

Phase Ⅳ

Gravity causes the gravel to flow over the pile head as a layer, catching the reaction mass and transferring impact forces to the subsoil.

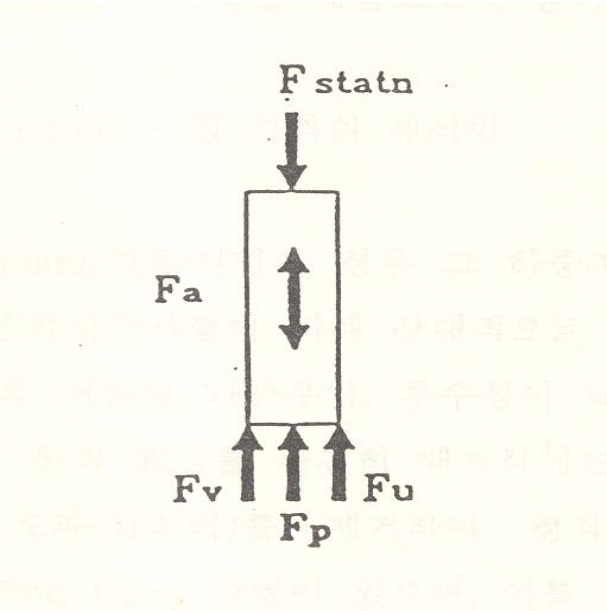

Figure 1. Modelling of pile and soil during statnamic loading

$$F_{stn}(t) = F_u(t) + F_v(t) + F_a(t)$$
$$= F_u(t) + C \cdot v(t) + m \cdot a(t) \quad (1)$$

where, $F_{stn}(t)$ is the statnamic applied loading

$F_u(t)$ is the static soil resistance

$F_v(t) = C \cdot v(t)$ is the damping force of the soils due to dynamic effects and determined as the product of the damping coefficient (C) and the velocity of the pile (v)

$F_a(t) = m \cdot a(t)$ is the inertia force and is determined from the product of pile acceleration and the mass of the pile.

Rewriting Equation 1, for the static pile capacity or static soil resistance $F_u(t)$:

$$F_u(t) = F_{stn}(t) - C \cdot v(t) - m \cdot a(t) \quad (2)$$

Assembly of Statnamic test equipment (Azmi, 2005)

Figure 1. Installation of piston and oil application

Figure 2. Piston and oil installation

Figure 3. Ignition System

Figure 4. Fuel Cage

Figure 5. Loading of Statnamic fuel

Figure 6. Closing of the piston

Figure 7: Installation of base plate

Figure 8: Installation of cylinder

Figure 9: Installation of cylinder

Figure 10: Installation of weight

Figure 11: Installation of weight

Figure 12: Installation of weight

Figure 13. After installation of weight mass

Figure 14. Placing the gravel structure non-supporting panels

Figure 15. Closing of the structure panels and installation of gravel

Figure 16: Portable computer and data logging device

Figure 17. cell laser source

Figure 18. After testing