

## Cooperative research on the design and construction by ground freezing technology

Period

1995.1 ~ 1996.3

53P ~ 57P

### ( Purpose )

The ground freezing technology is supplementary construction method for the purpose of safely and surely advancing the construction in the inside of temporary wall constructed with imperviousness of artificially freezing the gap water in the underground or bearing capacity.

In Tokyo Metropolitan Gov., Bureau of Sewerage had constructed the 1 ~ 2 cases every year for the features of this method, groundwater is not polluted have completely imperviousness have adhesion have restoring force. However, the standards and guidelines still have not been established in respect to design and construction management of this method, since it is first constructed in Osaka prefecture Moriguchi City in 1962.

It is considered the trend of long-distance construction due to difficult acquisition of the departure shaft lot, and the great-depth construction due to congesting underground space in the urban area more and more, when future construction environment of shield tunneling is presumed within sewage works. The necessity of the ground freezing technology as supplementary construction method seems to be going to heighten in order to safely and surely conduct the construction under such environment in future . At present, the sewerage relative construction occupies the half of the construction works above with the ground freezing technology until now.

Based on such situations, this cooperative research carried out the various investigations concerned with ground freezing technology, and it made the manual of design and construction on this method.

### ( Result )

The composition of design and construction manual of the ground freezing method on the sewerage is shown in the following.

1. General rules
2. Plan
  - 2.1 Generality
  - 2.2 Construction plan
  - 2.3 Construction facility planning
  - 2.4 Consideration on the plan of ground freezing technology.
3. Investigation and test
  - 3.1 General
  - 3.2 Investigation
  - 3.3 Mechanical test of unfrozen soil, frozen soil
  - 3.4 Heat characteristic test of unfrozen soil and frozen soil.
  - 3.5 Frozen soil and thawing subsidence test
  - 3.6 Investigation test of ground water flow
4. Design of the ground freezing technology.
  - 4.1 Generality
  - 4.2 Design procedure of ground freezing technology
  - 4.3 Theory of the ground freezing
  - 4.4 Freezing range
  - 4.5 Calculation of ripening load
  - 4.6 Prediction of Frost and thawing of underground
  - 4.7 Forecast of impact to ground water flow
  - 4.8 Ground water flow countermeasure
5. Construction
  - 5.1 Schemes of construction
  - 5.2 Ground freezing construction
  - 5.3 Excavation and excavated soil treatment of the frozen soil
  - 5.4 Countermeasure to the approach structure
  - 5.4 Countermeasure to the noise of facilities
6. Construction management
  - 6.1 General management
  - 6.2 Construction management

- 7. Measurement and observation
  - 7.1 Purpose of measurement and observation
  - 7.2 Measurement and observation plan
  - 7.3 Instrumentation control
  - 7.4 Collection of the measuring results
- 8. Safety and health management
  - 8.1 Safety and health management generality
  - 8.2 Security of the work environment
  - 8.3 Health care
  - 8.4 Treatment in the emergency

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