Study on the Construction of Rainwater Reserve Facility With Unmanned Pneumatic Caisson Method

| Whole term | 2006. 4〜2008. 3 |

(Purpose)

Recently, the discharge volume of rain water is increasing caused by urbanization, and the flood damages are occurred frequently because of extraordinary heavy rain – caused by typhoon or localized torrential downpour – much over the planed rainfall standard. In order to overcome these damages, the “Rainwater Reservoir Facility” is paid attention as a kind of solution for this issue. However, it is very difficult to keep the necessary area to construct this facility as the densely built-in area and the concentration of underground embedded facilities in urban area. Therefore, it is required as a system to the method of rational construction and management for the facilities having enough rainwater storage at a confined area.

The purpose of this joint study is to contribute the rational construction of vertical rainwater reserve facility utilizing with the establishment of design and work performance method for rational underground water reserve facility targeting on vertical shape and at deep place with using unmanned pneumatic caisson method adopted at urban area, and with the study of the total effective manage & maintenance system for the facilities.

(Results)

The study is consisting of four parts as 1. to establish design and work performance method for rational underground water reserve facility targeting at deep place, 2. to examine the total effective manage & maintenance system, 3. to clarify the problems and issues coming from actual work experiences, and 4. to do some case-study through trial design examination models.

(1) The study for facility design

1) Scale and specification of reserve facilities; capacity of the facility utilizing pneumatic caisson is 10,000 – 30,000m$^3$ and its depth is 20 – 60m. The facilities are composed of drainage, ventilation, deodorization, electrical and lighting system
2) Efficiency of structure requirement; arranging the efficiency of structure requirement for fluctuations water pressure and repetition of dry-wet condition against used standards.
3) Workable area of caisson; the minimum area is 113m$^2$, maximum is 4,900m$^2$ and the deepest depth is 70m.
4) Effective drainage method; It is possible to drain effectively with pumps combination or devising storage method. 5 kind of effective alternatives of drainage plans are offered.

(2) The study of endurance

5) Waterproofing method of underground water reserve facility; arranging clack prevention and waterproofing method and indicating its attention points.
6) Prolongation of life time for structure due to measure of deterioration; the method of deterioration measurement is examined and the plan of deterioration measurement is made.

(3) The study of work performance

7) Work procedure and performance method; the area of necessary working yard for unmanned pneumatic caisson Method which is suitable for narrow area, is about 70% of its area for diaphragm wall.
8) Construction cost reduction; as a result of cost calculation through a case study, the ratio of cost comparison between conventional method and unmanned pneumatic caisson Method is 1.0 and 0.95. The ratio of construction cost concerning with soil hardness and softness is 1.0 and 1.47.
(Study schedule)
The questionnaire result of existing underground water reserve facility will be summarized, and the study of maintenance such as 9). discharging method of sediment and settled sand, 10). dewatering method, 11). ventilation and lighting system. The technical manual will be prepared.

Collaborator: Japan Institute of Wastewater Engineering Technology,
Original Engineering Consultants Co., LTD.,
Japan XYPEX Co., LTD.,
Daiho Corporation,
Tsurumi Manufacturing Co., LTD.,
Nippon Civic Consulting Engineers Co., LTD.
Researcher: Masayuki Matsuura, Toru Meguro, Seijirou Matsumoto, Takeshi Okamoto

Key words: rainwater reserve facility, unmanned pneumatic caisson method, dewatering, maintenance, great depth, prolonging life time of structures