CS-216

The Methods for Removal of Sewer pipes without Excavation and Subsequent hole refill (T.U.Method) *

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1. Introduction

The sewer system in The Tokyo metropolitan area efficiently serves almost all locations citywide. However in some place, these facilities (sewer pipes for instance) are old and need to be replaced and made more efficient. For this reason it become necessary to remove or replace a number of sewer pipes, and some of the pipes were constructed by the thrust tunnel method or the shield tunnel method. These pipes were big and deeply buried making it difficult to remove them, using "open cut method" as this method requires the large sheathing wall and long construction term.

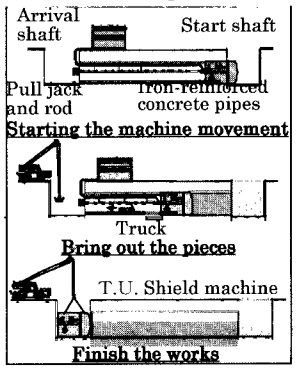


Figure 1 the working order

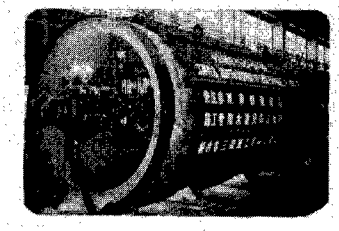
Since the large sheathing wall and the long construction term would cause the traffic problems, and deep excavation could possibly affect the surrounding ground enough to require cost, extensive soil digging.

By the authors a method to solve these difficulties was proposed and used on the job-site The authors developed the T.U. method to solve these difficulties and used on the job-site from July 1997 to April 1998 in Edogawa Ward, Tokyo. These papers summarize the T.U. method and the result of the job.

2. The T.U. method

2. 1. Summary of the T.U. method

AT first, we made the two shafts on both sides of the sewer pipe that we wanted to remove. The T. U. shield machine was put into the one side shaft. After pulling the machine upward, we placed the skin-plate around the sewer pipe. In the machine, We cut the sewer pipe to the pieces by the wall saw and brought out the pieces, and pull the shield machine upward again, filling the holes with fillers. (see Figure 1)



Photograph 1 T.U.shield machine

* *T. U. :An abbreviation for Tekkyo-Umemodosi in Japanese, meaning "to bury the hole"*

2. 2. T.U. shield-machine

(1) Main-Equipment of shield-machine (sea the figure6)

・Wall saw 2sets ・Elector ・Buck jack(55 t×1250 s×310 kg/cm^2) 4 set ・Slide juke(55 t×100 s×310

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kg/cm^2) 4 sets ・Injection hole(Φ50 mm) 4 holes ・Water jet(12 sets) ・Tale brash

(2) Characteristic of T.U. shield machine

① The machine was pulled (not pushed as conventional shield machines are)。

② When the machine moved, it meet resistance not only through side-face friction but also through soil resistance on the front face. Therefore, the resistance was greater than that encountered by conventional.

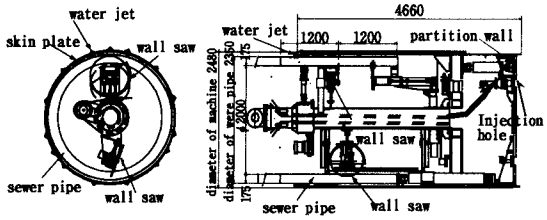

Figure 2 T.U. shield-machine

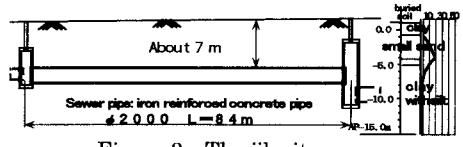

Figure 3 The jib site

3. Out line of the job

(1) The job-site

The pipe was located at a depth of 7 m under ground.

The diameter of the pipe was Φ=2000 mm. The pipe length is 84.0 m. (See figure3)

(2) Cutting the pipe

The pipes cut by two wall saw. One cut the pipe along the axis. The other saw cut the pipe along its circumference. The pipes were divided into 6 pieces that were brought out through the pipe.

(3) Traction of shield machine

The oil-pressure jack, which was set in the shaft and traction rods, pulled the shield machine.

(4) Filling up the hole

The filler was made by the surface-level manufacturer, and sent to the shield machine through the small pipe. Moreover the filler was poured into from the rear part of the machine. The filler was made of two liquid, and these liquids were mixed just before the hole was filled .

4. Displacement of ground surface

Figure 4 shows the relation between the displacement of ground surface and the distance from the measuring point to the shield machine. We could see the effect of the machine from the surface, when the machine rose to a distance of 10 m from the measuring point. The ground rose up as the shield machine moved, and when the machine stopped, the movement of the ground subsided, The ground rose up about a maximum of 10 mm, when the machine came directly under the measuring point, after that the ground sank down about a maximum of 10 mm. After the machine was moved from the site, the displacement became stable in a few days. (See figure 4.)

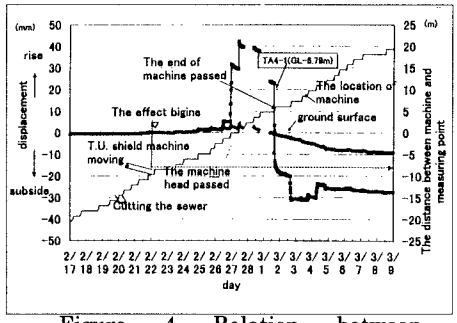

Figure 4 Relation between displacement of ground and the distance from the shield machine

5. Conclusion

Adopting the T.U. method reduced the construction period of works, the displacement, cost of the work required by this project. And so we concluded that the method was useful.

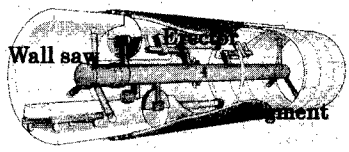

Figure 6 The image of T.U. shield-machine for pipe replacement.

Father more the method can be not only useful to remove the pipe but also in its replacement, if we can add the planed new mechanism. We hope the T.U. method will become a useful method for the renewal and rebuilding the pipelines in the feature.