Development of an Upward Shield Machine Retrievable Through a Tube

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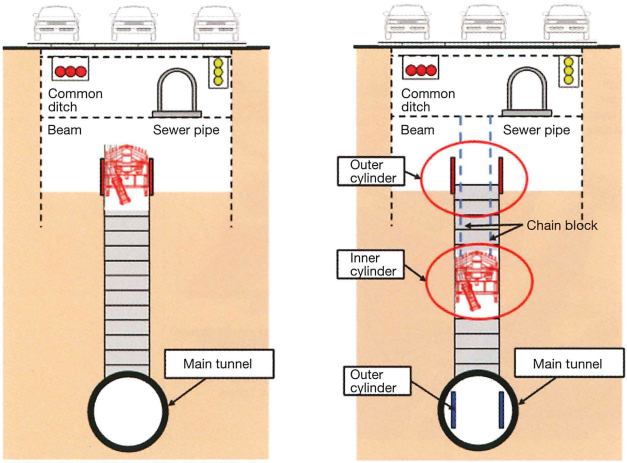
As part of flood prevention project by the city of Osaka, a rainwater reservoir pipeline system with a capacity of 90,000 tons of rainwater is to be constructed for the segment from Shin-Imazato to Teradacho, consisting of a rainwater reserve tunnel and specially designed manhole shafts in a few places. The particular manhole shaft this paper reports about was located in the road in the Osaka Loop Line with 6 lanes (3 lanes in each direction), and there were many residential houses and public facilities such as hospitals in the vicinity, which made it difficult to bore the manhole shaft from the surface.

To accommodate these construction conditions, a special shield machine called "upward boring shield machine of type retrievable into the main tunnel" was developed and deployed at the site. In this process, the shield machine was positioned at a predetermined location in the tunnel to start boring upward up to the ground surface to build a manhole shaft, and then was lowered into the tunnel for recovery. This shield machine consists of an inner cylinder integrating a cutter on the head and a cutter-driving unit inside, and an outer cylinder. After arriving at the top of the connection shaft (as shown in Fig.1-(1)), the inner and outer cylinders which are connected by means of pins are separated from each other. First, the inner cylinder is lowered to the bottom of the tunnel for recover, and then, the outer cylinder in the same step for reuse (as shown Fig. 1-(2), Photo 1).

The boring method has the following features

- The shaft can be built without being affected by embedded obstacles, and disassembling of the shield machine and lowering while suspended are possible even in a narrow space at a site with underground obstacles.
- The outer cylinder can be optionally changed in diameter to fit its size to the bore size.



(1) Boring and arrival just under the embedded object

(2) The outer and inner cylinders are separated from each other to be recovered in the main tunnel.

Fig. 1 Conceptual diagram of the upward shield machine removable through a tube

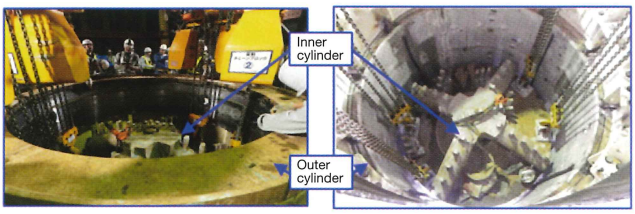


Photo 1 Construction using the upward shield machine