

# Enlargement Shield Tunneling Method

Expanding space efficiently / Offering wide variations of construction methods

## Characteristics

This method starts an enlarged shield from the starting base at a given point in a shield driven tunnel and excavates the tunnel longitudinally to enlarge the cross section in the tunnel.

1. Cross section can be enlarged for a desired length according to the use of space.
2. Circular cross section created after enlargement ensures structural stability.
3. Eccentric enlargement of cross section is possible in all directions.
4. The method offers even greater economy and shorter construction period in tunneling at greater depths.
5. Work is carried out exclusively in the tunnel with no adverse effects on surface traffic or the environment.

## Variations of construction methods

One of three construction methods can be selected according to the length of the tunnel to be enlarged.

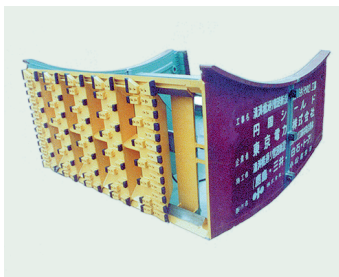
**Type 1:** Combination of circumferential shield tunneling system and enlargement shield tunneling system

**Type 2:** Combination of circumferential shield tunneling system and enlargement excavation system

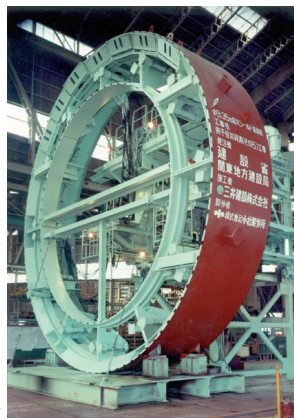
**Type 3:** Circumferential shield tunneling system

In addition to enlarging the cross section, the method can be used for renovating deteriorated conduits without open cutting.

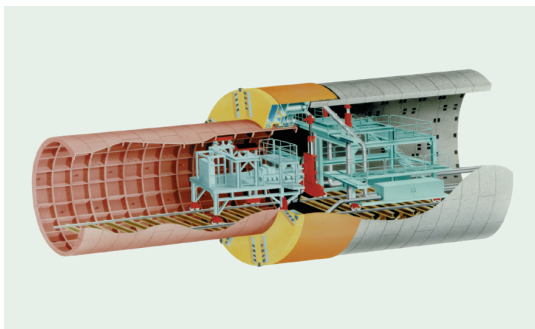
## Examples of tunneling equipment



▲ Circumferential shield machine



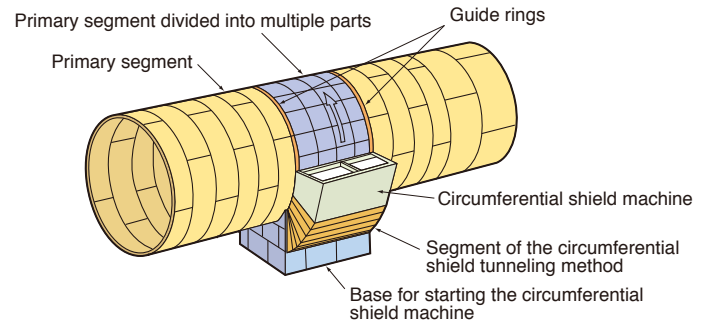
Enlargement shield machine▶



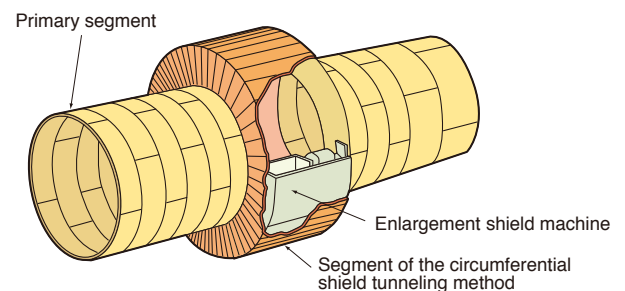
▲ Enlargement slurry shield machine

## Mechanism of tunnel driving

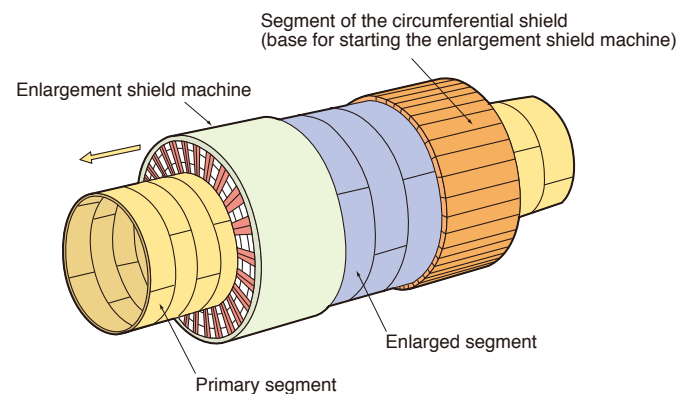
1. Excavation by a circumferential shield machine (construction of the base for starting an enlargement shield machine)



2. Assembly of an enlargement shield machine



3. Tunneling by the enlargement shield machine



## Applications to actual tunneling

Use	Outer diameter (mm)		Length (m)
	Primary segment	Enlarged segment	
Underground cable tunnel	6,600	7,800	24.1
Utility tunnel	6,600	9,200	29.5
Sewer tunnel	6,000	8,709	11.3
	2,000	3,150	2.6