

# Multi-circular Face Shield Method

Offering diverse tunnel cross sections using the mechanical properties of a circle

## Characteristics

1. Construction of tunnels of desired cross section by combining various circular sections  
Vertical or horizontal connection of multiple circular sections are effective in congested underground spaces.
2. Use of structurally stable circular shapes  
Tunnels are basically constructed using multiple circular cross sections. Mechanical advantage of a circular shape contributes to structural stability of tunnels.
3. Adoption of closed slurry shield or earth pressure balance shield tunneling  
Either closed slurry shield or earth pressure balanced shield tunneling can be adopted.

## Outline of the method

The Multi-circular-Face Shield Method places cutter heads attached to shield machines at different longitudinal points and overlaps them for driving tunnels of various cross sections.

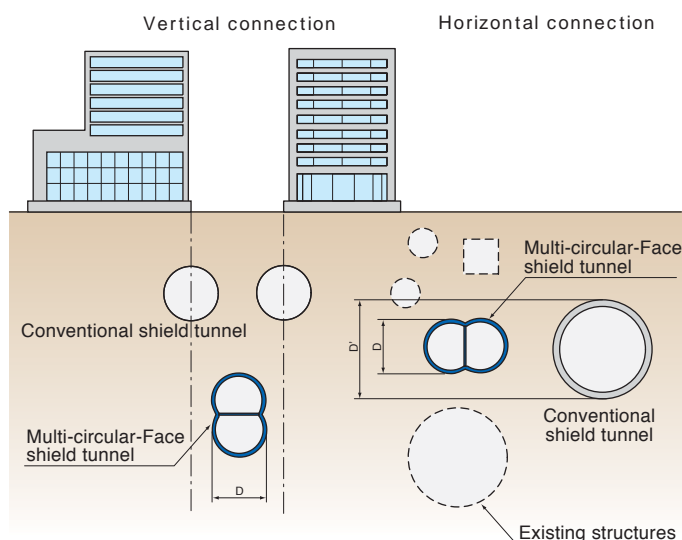
It enables excavation of tunnels of cross section with width longer or shorter than height.

Tunnels of desirable cross section therefore can be excavated where only limited land is available or underground space is congested with structures.

Tunnel cross sections fit for the construction condition or tunnel use can be provided efficiently.

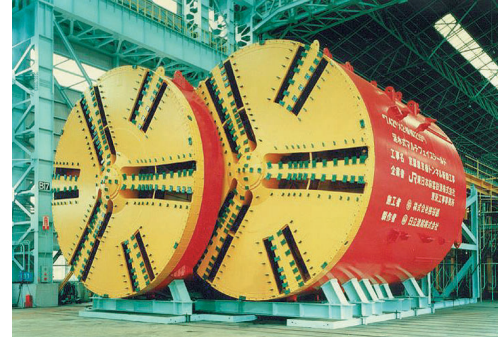
## Flexible choice of tunnel route

Connecting double or triple circular sections, or sections of different cross sections vertically or horizontally could offer tunnels of diverse cross section other than a circular section. This enables simultaneous construction of upper and lower tunnels at a site with limited land under a narrow road by vertically connecting tunnel cross sections occupying a small area. Even in cases under restrictions on vertical space due to existing structures, a multi-circular-face shield method using horizontally connected cross sections can be adopted for tunnel driving.



## Applications to actual tunneling

### 1. Horizontal double circular shield tunneling

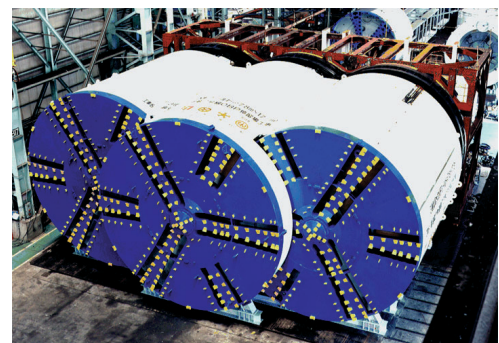


▲ Construction of the Kyobashi Tunnel on the Keiyo metropolitan railway line (cross section: 12.19 m wide and 7.12 m high)



▲ Kyobashi Tunnel

### 2. Horizontal triple circular shield tunneling



▲ Construction of Osaka Business Park station on Osaka municipal subway line No. 7 (cross section: 17.3 m wide and 7.8 m high)



▲ Construction in the lidabashi station work section in a loop on subway line No. 12 (cross section: 17.44 m wide and 8.846 m high)