

Consideration and Strategy behind Design & Construction Requirements

of the Bored Tunnels of the
Marmaray Project

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1. Presentation Agenda

- Outline of the Marmaray Project;
Tunnels & Stations in BC Contract
- Unique Characteristic Environment on Project Site
- Geology and Geotechnical Conditions
- Preliminary Design Concept
- Employer's Requirement for Tunnel Boring Machines
- TBM envisaged to be used by the Contractor

2. Outline of the MARMARAY Project

Total length of the project; 13.6km

Consisting of;

- Immersed tube tunnel; 1.4km
- Bored tunnels; 10.1km, ID=7.04m

Earth pressure balance shield 1

Slurry shield TBMs 2 ,3 4 & 5

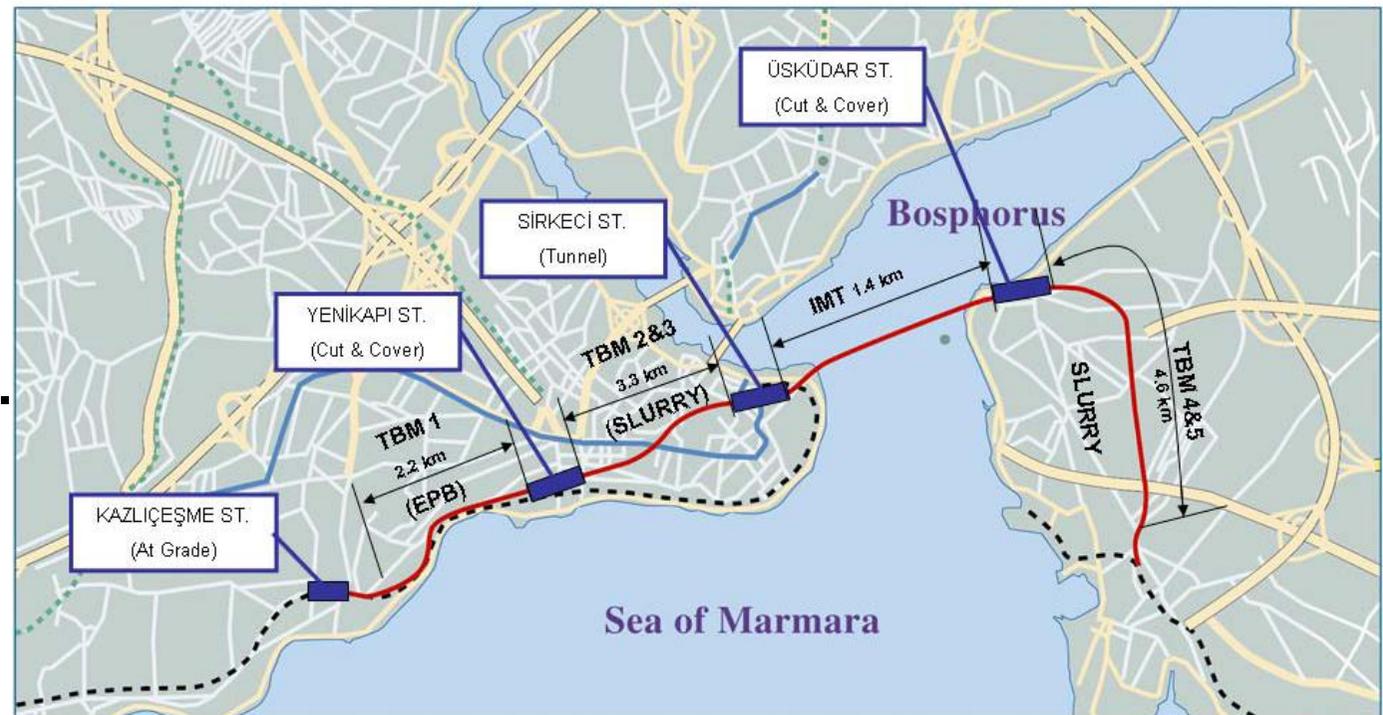
- C & C tunnels; 1.3km

- 4nos. Stations

2nos. C& C Stn.

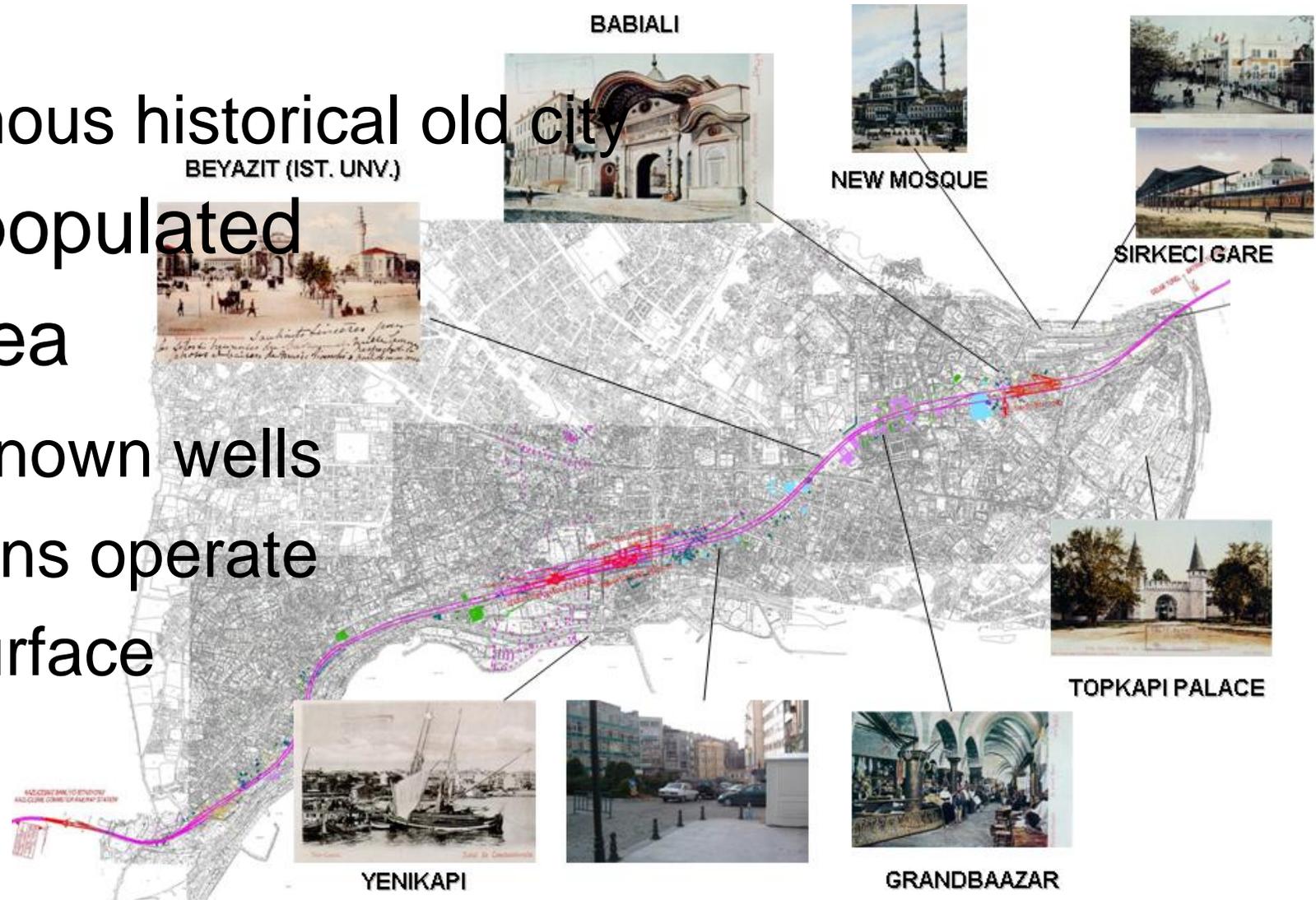
1no. Tunnel Stn.

1no. At grade Stn.



3. Unique Characteristic Environment on Project Site

- World famous historical old city
- Densely populated urban area
- Many unknown wells
- TCDD trains operate on the surface



**MARMARAY PROJESİ
ÜSKÜDAR AKTARMA İSTASYONU
MUHTEMEL TASARIMI.**

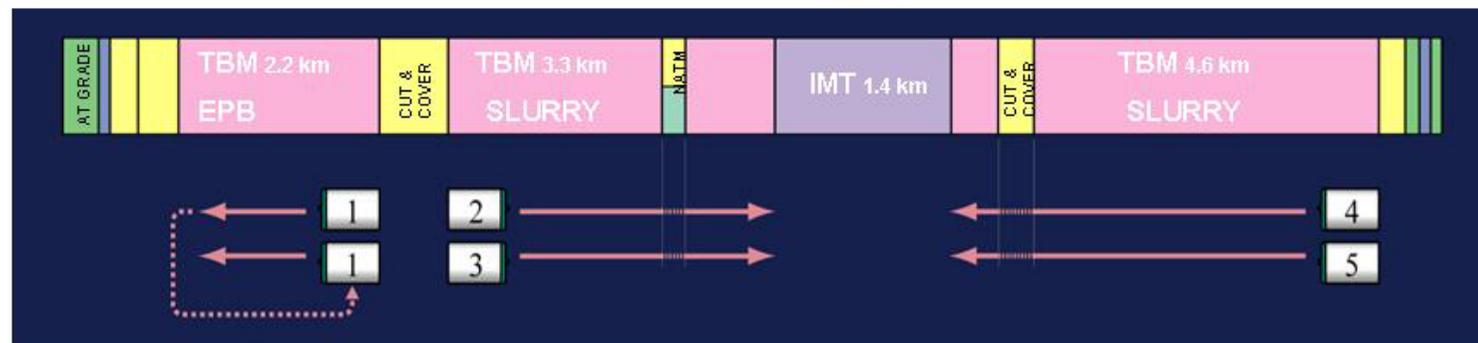
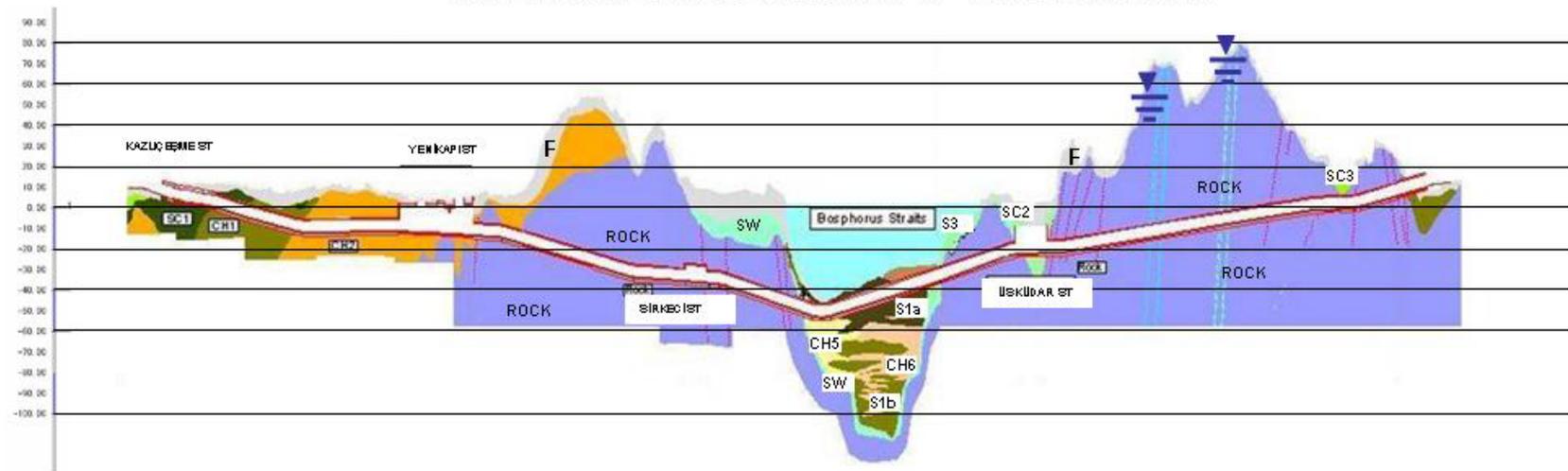
**MARMARAY PROJECT
ÜSKÜDAR TRANSFER STATION
POTENTIAL DESIGN**



4. Geology and Geotechnical Conditions

- Paleozoic sedimentary rock formations
- Tertiary sedimentary formation
- Quaternary sediments
- Artificial fill

LONGITUDINAL CROSS SECTION
GEOLOGICAL PROFILE & TYPE OF CONSTRUCTION



5. Preliminary Design concept

Key points to be considered.

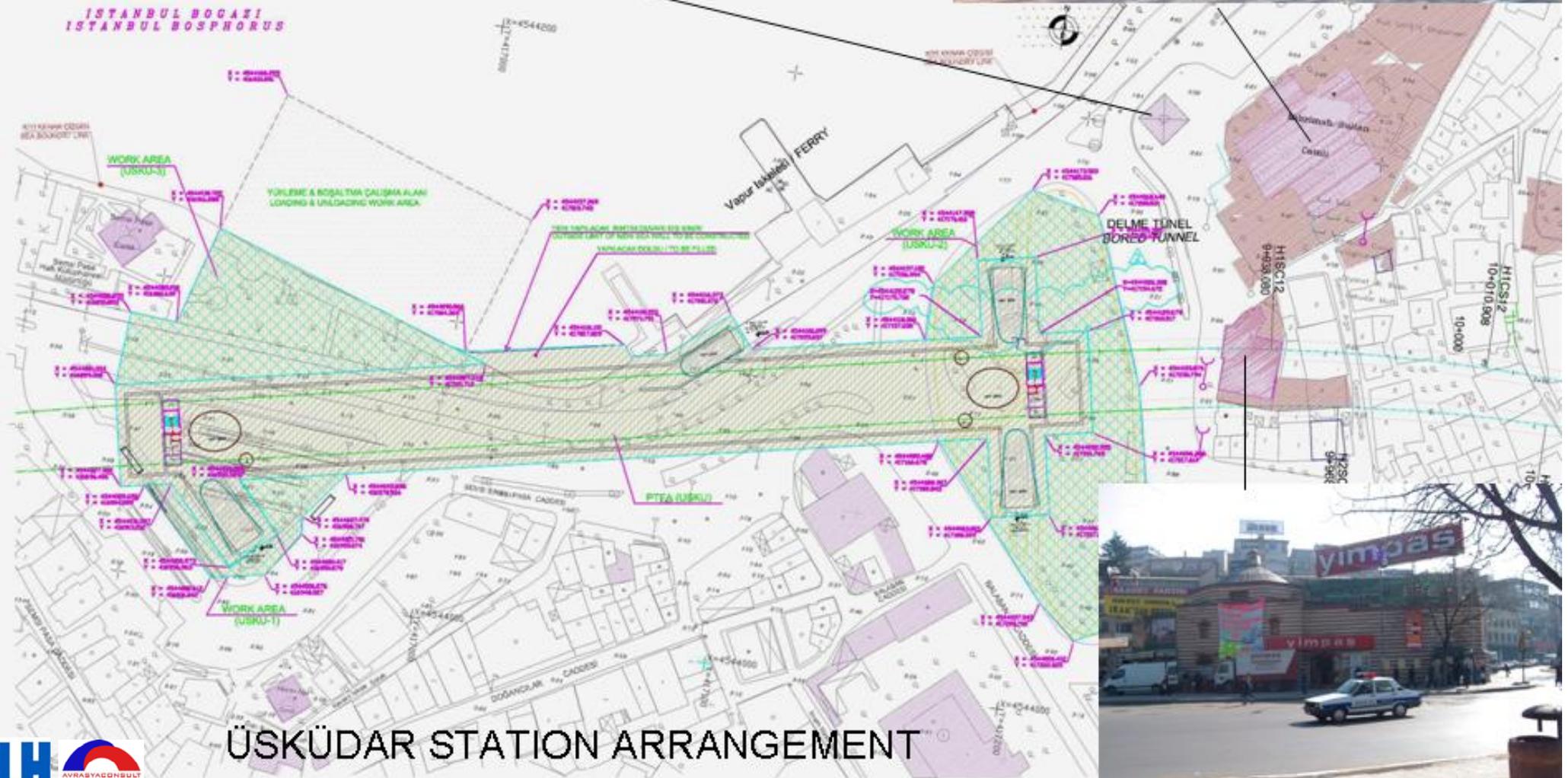
- National and World Heritages
- Many structures and buildings
- There may be some subsurface antiquities
- Limited land availability
- Architectural expression to be in harmony
- Connection with Immersed tube tunnels
- Time constraints
- High ground water level.

Therefore;

- Main running tunnels by TBM with shield shell.
- Closed-face shield TBM where a risk of flooding.
- Non-TBM methods including NATM in limited areas.
- Yenikapı and Üsküdar stations using cut & cover technique.
- Sirkeci station to be deep tunnel station.
- Cut & cover stations located to avoid historical heritages.
- Cut & cover technique used where enough cover not available.



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ÜSKÜDAR STATION ARRANGEMENT



6. Employer's Key Requirements for Tunnel Boring Machines

For Safety Considerations;

- Safe personnel access into the front chamber
- A min. of two tail void seals
- Emergency water stops at the tail and the articulation joint.
- Environmental monitoring system.
- Electric power lines for main supply and for the fire protection system shall be independent.

For Settlement Considerations;

- Controlled pressure on the tunnel face secured.
- Continuous grouting of the tail void.
- Ports and equipment provided for probing and/or ground treatment ahead.

For Flexibility Consideration;

- The cutter head to have a reverse rotation capability and/or to provide for over cutting

For Production Considerations;

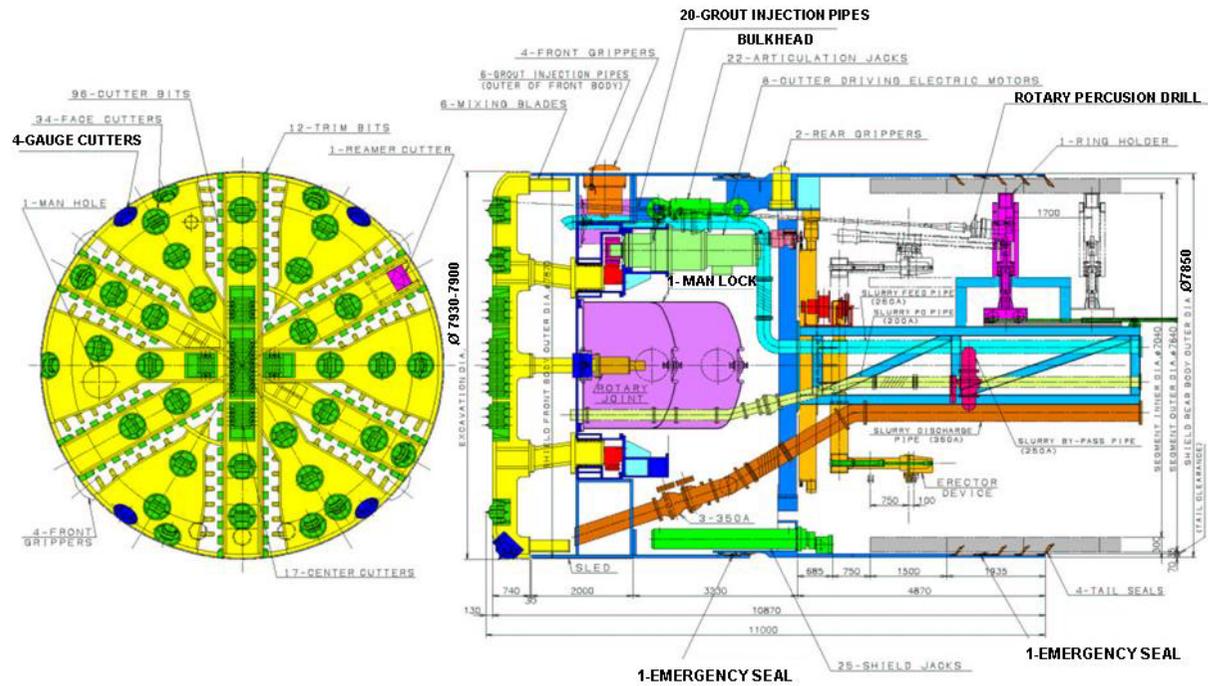
- Articulation of the shield required
- Machine shall cater for various type of ground.
- For earth pressure balance shield it can have dual-mode operation.
- The cutters replaceable from the rear of the cutter head.

7.TBM machines envisaged to be used by the Contractor

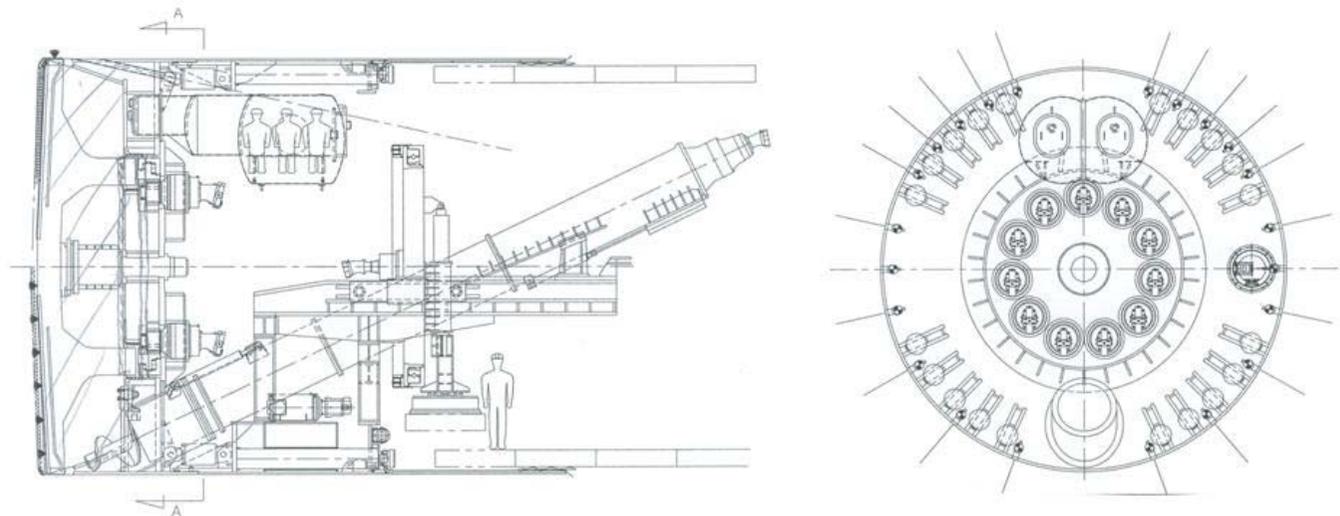
Based on functional requirements the Contractor would use these TBMS.

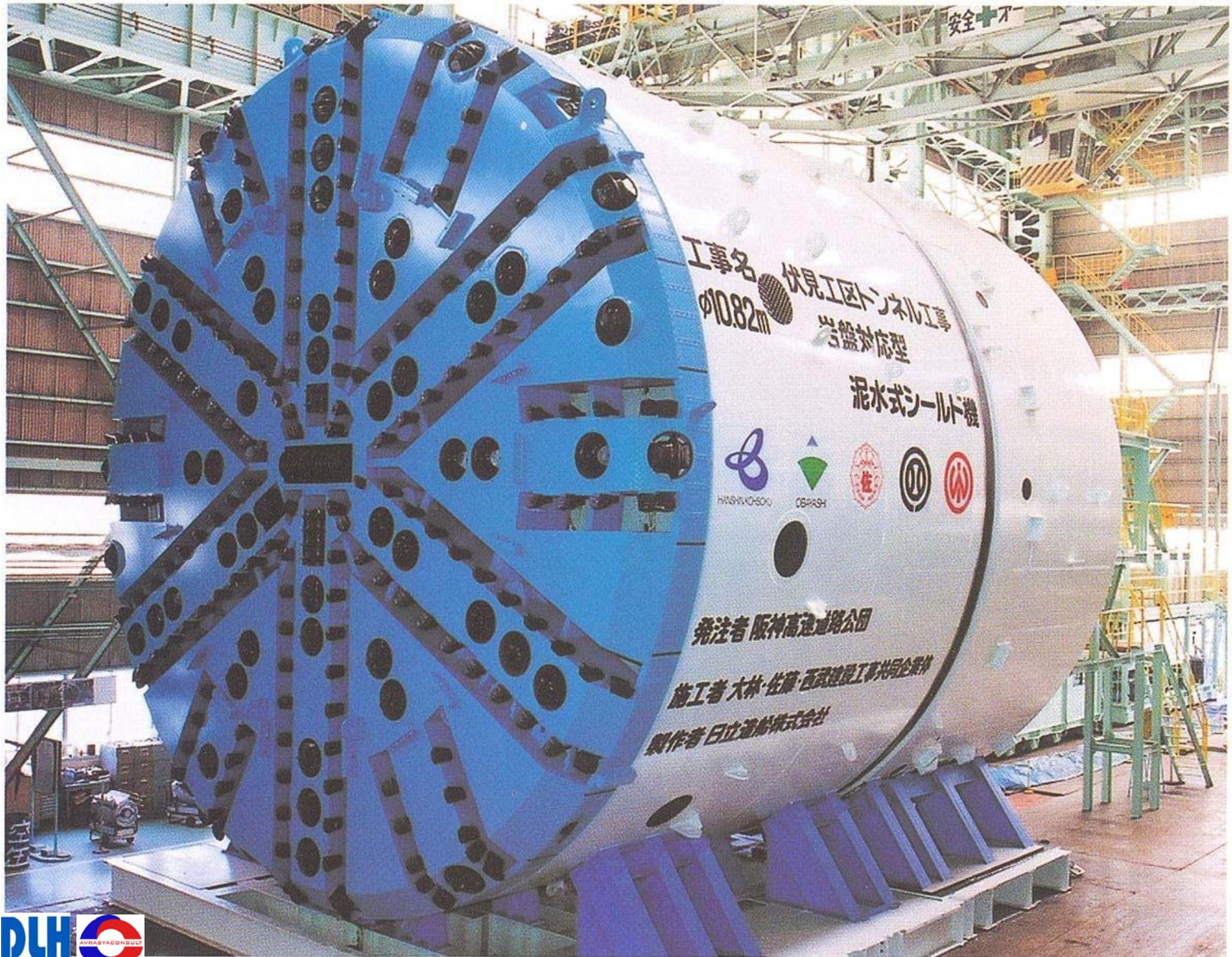
- Hard Formation Slurry Shield TBM
- Earth Pressure Balanced Shield Machine (EPBM)

HARD FORMATION SLURRY SHIELD TBM



EARTH PRESSURE BALANCED SHIELD TBM





安全十

工事名 伏見工区トンネル工事
φ1082mm
当盤対応型

泥水式シールド機



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