



The BOOM-TYPE HEADING TBM WITH COMPRESSED AIR CSM Bessac

Suitable for urban environmental constraints (curved alignment, likelihood of meeting obstacles, varying grounds).



Among the CSM BESSAC range of tunnel boring machines, the boom-type header with compressed air TBM is particularly suited to very tight spaces, to short and curvy alignments and to the high probability of meeting obstructions.

- **Suitable for an urban environment**



- Tight working spaces
- Clean, disturbance-free jobsites
- No surface impact
- Proximity to sensitive areas

- **All types of grounds**



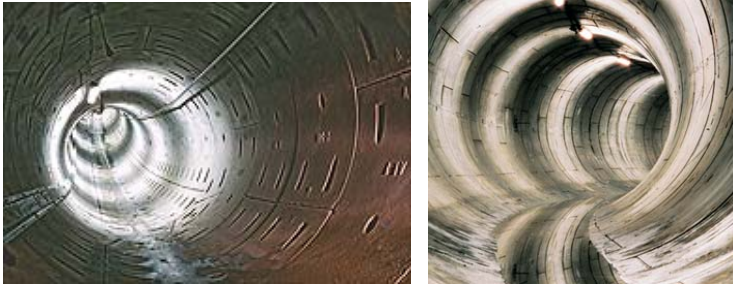
- Terrains meubles, immergés, à forte perméabilité
- Terrains compacts ou plastiques
- Terrains hétérogènes
- Passage ponctuel en terrain à forte dureté

- **Obstructions mastered**



- Immediate visual detection, blocks, foundations, piles, tie rods
- Safe and speedy intervention in the excavation chamber
- Easy elimination of obstacles from the tunnel boring machine

▪ Sections, profiles and specific alignments



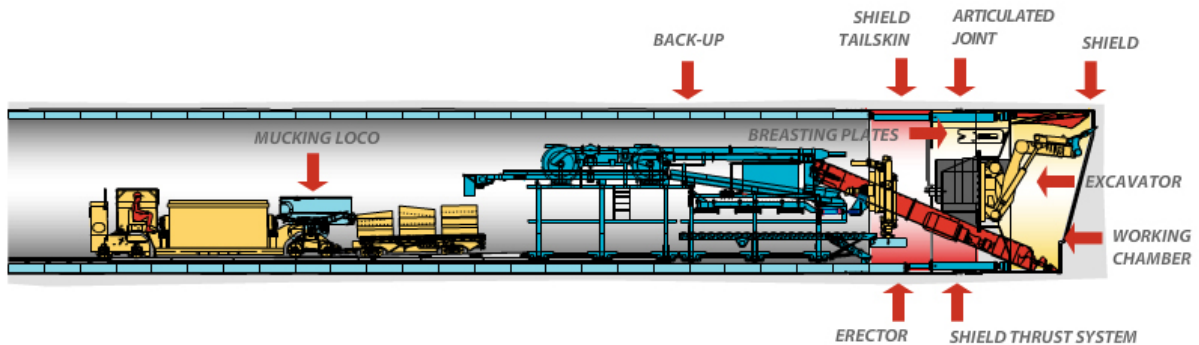
- Diametres from Ø 1.80 m to 6.00 m
- Lengths from a few dozen metres to several kilometres
- Curvy alignments and tight curves
- Slopes from 0 to 60 %
- Very little cover or great depths

▪ Lining



- Reinforced concrete segments
- Pipes installed by horizontal jacking
- Steel ribs and wood lagging

Diagram of the TBM



COMPRESSED AIR BOOM HEAD SHIELD

This is an articulated closed-face machine with hydraulic shield incorporating an excavating machine. The ground is excavated by a boom in the working chamber with provision for easy man-entry. Air pressure in the chamber allows the shield to operate safely in water-bearing ground. The operator controls the shield from the unpressurised section. He has a direct view of the working face at all times.

MUCKING LOCO

- Electric tractor/truck with hydraulic transmission
- One or more side-tipping muck skips
- Mortar lorry with mixer and mortar pump
- Lining segment car with automatic segment handling system

BACK-UP

The shield itself is equipped with all the items needed for its operation, and only simple back-up is needed.

It simply fulfils the function of interfacing between the shield and the mucking train. It is joined to the shield and comprises:

- A belt conveyor collecting spoil from the screw conveyor and discharging it into the muck skips
- A lining segment transporter which unloads, stores and transfers the segments
- A segment feeder passing segments from the transporter to the erector
- Lubrication system which continuously lubricates the shield machinery and a tailskin sealant injection system.

BREASTING PLATES

A sort of temporary steel lining can be set in place ahead of the face by means of breasting plates. These triangular plates are hinged near the cutting edge of the shield and operated by hydraulic cylinders. They are deployed to secure the working face when men are working in the pressurised chamber and at times when driving is suspended.

SHIELD TAILSKIN

The tailskin, behind and connected to the shield, is a space used for assembling the lining rings. There is a complex seal system between the tailskin and the previously installed lining. In pipe jacking operations, it interfaces between the first pipe jacked and the tunnelling machine.

ARTICULATED JOINT

The junction between the shield and tailskin is engineered to allow relative movements between the two parts. This is the articulated joint by which the machine can be steered around curves.

The joint has an adjustable seal, excluding water when working in saturated ground.

EXCAVATOR

The excavator incorporated in the shield consists of the excavator proper and associated mucking screw conveyor, both hydraulically powered and controlled from the operator's cab in the unpressurised section of the machine. The operator can see the working face through his portholes. The telescopic, articulated excavator arm is mounted on a fully rotating turret on the pressure bulkhead centreline. The cutting tool at the end of the arm is either a bucket or boom cutter. The mucking screw conveyor moves spoil from the working face to the rear. A hydraulically operated end gate controls throughput. The ribbon screw is designed to take cobbles and boulders and large fragments of excavated material.

SHIELD

The shield at the front carries most of the components of the machine. Towards the middle, there is an airtight pressure bulkhead which carries the excavator boom and separates the WORKING CHAMBER from the rear section. There is a cutting edge at top front. Thrust cylinders force the shield and cutting edge into the soil, supporting the working face and preventing overcutting outside the design lines.

SHIELD THRUST SYSTEM

The thrust system consists of hydraulic rams arranged around the tailskin periphery. The rams are attached at the front end to the shield ring beam. They take their reaction against the last lining ring installed, bearing on protective pads. The shield advances as excavation is proceeding.

ERECTOR

The segments are assembled inside the tailskin by means of an erector which picks them off the back-up train. It consists of a swivelling hydraulic arm mounted on the screw conveyor. The combination of a 6DOF segment gripping system and proportional control on all six motions allows the segments to be positioned accurately and smoothly.

SHIELD

The shield at the front carries most of the components of the machine. Towards the middle, there is an airtight pressure bulkhead which carries the excavator boom and separates the working chamber from the rear section. There is a cutting edge at top front. Thrust cylinders force the shield and cutting edge into the soil, supporting the working face and preventing overcutting outside the design lines.