

「日內瓦國際發明展」銀獎

SILVER AWARDS AT INTERNATIONAL EXHIBITION OF INVENTIONS OF GENEVA 2022



「日內瓦國際發明展」是發明界的全球年度盛會，由本工程團隊與香港生產力促進局共同研發的「智能隧道質量檢測系統」，今年在約800項參展發明中勇奪銀獎。

這是香港首個採用無人機搭載人工智能處理技術的隧道質量檢測系統，大大提升施工安全和生產力，並促進行業數碼化。



利用人工智能即時處理數據及提供檢測結果
AI data processing instantly and generates results automatically.



智能隧道質量
檢測系統影像
3S Tunnel Defect
Inspector Image

The "Geneva International Exhibition of Inventions" is a remarkable annual global event devoted exclusively to invention. The 3S Tunnel Defect Detector, jointly developed by T2 project team and the Hong Kong Productivity Council, won a silver award among about 800 exhibitors this year.

This is the first tunnel inspection system ever in Hong Kong using drone with on-board Artificial Intelligence (AI) processing technologies which greatly enhances construction safety, digitization and productivity.

校園分享系列

SCHOOL SHARING ACTIVITY

雖然疫情影響了校園生活，但工程團隊仍積極透過不同渠道如網上活動，持續與公眾分享工程知識。

Although school life has been affected by the pandemic, the project team has continued to share project knowledge with the public actively through various channels such as online activities.



向中學生講解測量師的工作範疇
Introduced Surveyors roles to secondary students



為大專學生舉辦職業分享講座
Organised careers seminar to college students

工程進度

PROJECT PROGRESS

1 進口車道

Approach Road

- 結構工程
- Structural works

2 西面通風大樓

West Ventilation Building

- 地基工程
- Foundation works

3 海底隧道

Sub-sea Tunnel

- 隧道鑽挖機進行隧道工程
- Tunnelling works by Tunnel Boring Machines

4 茶果嶺隧道

Cha Kwo Ling Tunnel

- 隧道挖掘工程
- Tunnel excavation

5 東面通風大樓

East Ventilation Building

- 地基工程
- Foundation works



如欲查閱更多有關T2主幹路及茶果嶺隧道的資料，請瀏覽網站：

Please visit the Trunk Road T2 and Cha Kwo Ling Tunnel project website for more project information:

感謝閣下瀏覽《進程》。若對我們工程有任何意見，請將意見電郵至：

Welcome to our newsletter Track. If you have any views on our project, please email us at:

www.trunkroadt2.hk

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香港特別行政區政府 土木工程拓展署
Civil Engineering and Development Department
The Government of the Hong Kong Special Administrative Region



2022

1 月 JAN

隧道壁首圈安裝完成
First tunnel lining ring installed.

4 月 APR

西面通風大樓地基工程展開
Foundation works of West Ventilation Building commenced.

8 月 AUG

東面通風大樓地基工程展開
Foundation works of East Ventilation Building commenced.



Track 進程

T2 主幹路及茶果嶺隧道
TRUNK ROAD T2 AND CHA KWO LING TUNNEL



第四期 ISSUE 4 12/2022

隧道鑽挖機全速投入工程

Tunnel Boring Machine Moving Full Speed Ahead

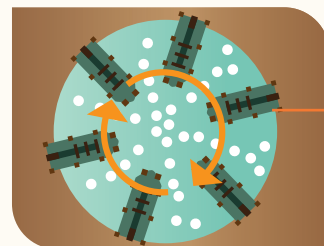
隧道建造四步曲

THE FOUR STEPS OF TUNNEL CONSTRUCTION

1

挖掘 Excavation

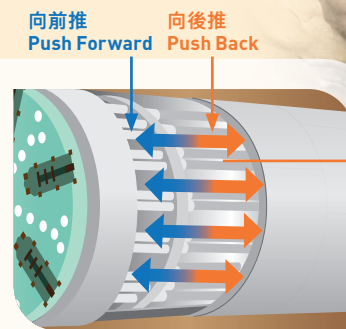
隧道鑽挖機前端的巨大刀盤配備多個刀頭，以旋轉同時施壓的方式挖掘前方泥土。
A huge cutterhead equipped with cutters at the front of the TBM rotates and applies pressure concurrently to excavate the soil and rock ahead.



4

推進 Pushing Forward

圓筒推動器推向後方的隧道壁環，驅動鑽挖機向前推進。
Using thrust cylinders to drive the TBM forward by pushing against the tunnel ring to the rear.



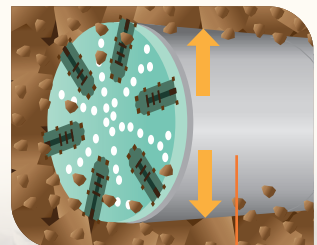
隧道鑽挖機正在24小時無間斷地進行海底隧道建造工作。這兩部高度自動化的機器，利用不斷循環的四項步驟，一步步穿越避風塘海床下的泥石層，建造兩條結構穩固安全的圓形隧道。

The tunnel boring machines (TBMs) are now operating around the clock for sub-sea tunnel construction. These two highly automatic machines repeatedly use the four steps, passing through gradually the soil and rock layers underneath the seabed of Kwun Tong Typhoon Shelter to construct two circular tunnels with stable and safe structure.

2

臨時支撐 Temporary Support

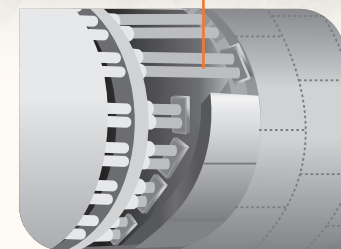
鑽挖機的護盾臨時支撐挖掘後的隧道。
The shield of the TBM serves as a temporary support of the excavation.



3

安裝隧道壁 Tunnel Lining Installation

安裝預製混凝土組件組成隧道壁環，建成永久隧道結構。
Install precast concrete lining segments ring by ring to constitute the permanent tunnel structure.



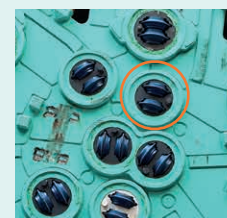
隧道鑽挖機刀盤設計

TUNNEL BORING MACHINE CUTTERHEAD DESIGN

隧道鑽挖機前端裝備的鋼製刀盤，是負責挖掘工序的最重要組件。配合隧道走線泥石夾雜的地質，刀盤同時配備了**36個雙滾刀**和**166個刮刀**。

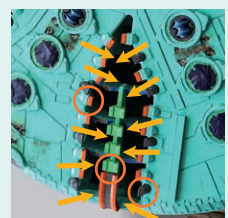
With a rotating steel cutterhead which equipped with **36 twin disc cutters** and **166 scrapers** at the front, the TBM uses to excavate tunnels cutting through diverse geology from hard rock to soft and mixed ground.

雙滾刀 Twin Disc Cutters



滾刀可將石屑及大件石塊切割成碎石。
The disc cutters can break and crush the rock layer and large stones into gravels.

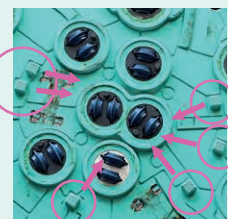
刮刀 Scrapers



刮刀可切削泥土。
The scraper will shed the excavated spoil.

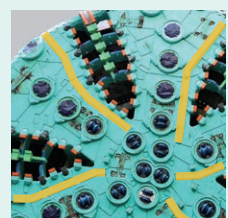
噴嘴 Nozzles

刀盤中央位置設有噴嘴，可噴水沖洗黏在刀盤上的泥土，以保持刀盤運作暢順。
To avoid clogging cutterhead, the flushing nozzles are mounted on the cutterhead to remove mud cake from it.

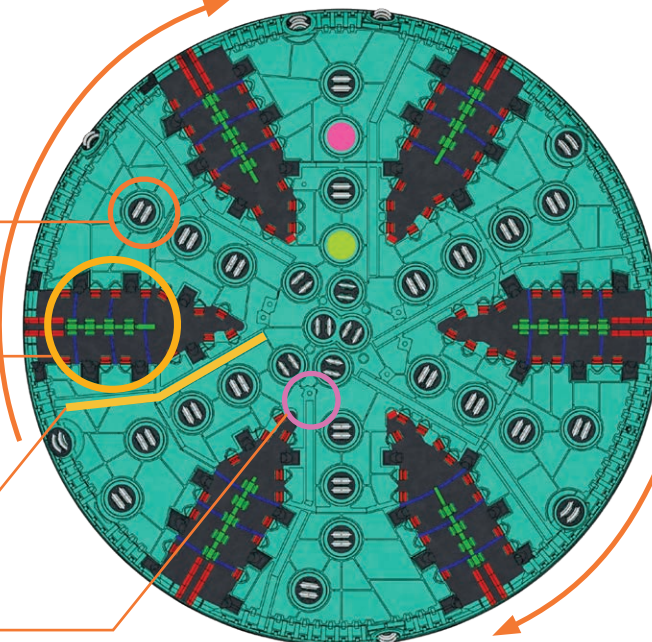


磨損檢測管道 Detection Duct

刀盤內備有磨損檢測管道，監測刀盤因長期挖掘而可能造成的磨損狀況。
Wear detection ducts are built into the cutterhead for monitoring its condition.



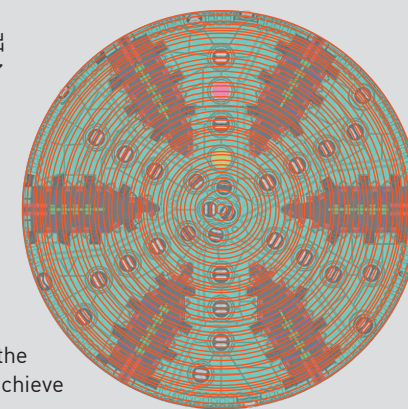
刀盤 Cutterhead



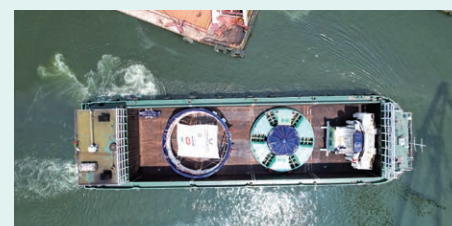
滾刀軌跡 Disc Cutter Track

隨著刀盤旋轉，滾刀在挖掘面上切割出一個個同心圓軌跡以破碎石塊。利用了兩種不同尺寸(17吋和19吋)的雙滾刀，滾刀在刀盤上的分佈更為靈活，達至最佳的碎石效果。

As the cutterhead rotates, the disc cutters cut to form **concentric circular tracks** across the excavation face to break up rocks. Using two different sizes (17-inch and 19-inch) of twin disc cutters, their distribution on the cutterhead becomes more flexible to achieve a better rock-breaking effect.



刀盤運送 Cutterhead Delivery



刀盤的質量與做工，對挖掘效能尤為重要。有別於隧道鑽挖機的其他部件需分拆運送來港，**重480公噸**的刀盤在**中國內地**完成裝嵌和測試後便**整件付運**到工地，是運送過程中最重的組件。

The quality and workmanship of the cutterhead is of particularly importance for digging performance.

Unlike other components of the Tunnel Boring Machine, which were disassembled into parts and delivered to Hong Kong, the cutterhead, **weighing 480 tonnes**, was delivered to site **in single piece** upon the completion of the assembly and testing works in **Mainland China**.

It is the heaviest part during the transportation process.

岩土工程監測

GEOTECHNICAL MONITORING



為了在隧道鑽挖期間，緊密監控工程對周邊設施可能產生的影響，我們引進了創新岩土工程監測，運用全球導航衛星系統定位(GNSS)技術實時三維監測情況，在任何天氣情況下提供可靠的全天候監測數據，以提升監測精確度及可靠性。

To closely monitor various aspects of the possible impact of the project on surrounding facilities during the tunneling works, we have introduced innovative geotechnical monitoring, using Global Navigation Satellite System (GNSS) Positioning technique for real time 3D monitoring, which provided reliable 24-hour/7-day monitoring under all weather conditions with improved accuracy and reliability.