URBAN UNDERGROUND SPACE

Underground Solutions Provider

CREG TBM

Make Tunnelling Safer, Better and Faster

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Underground Solutions Provider

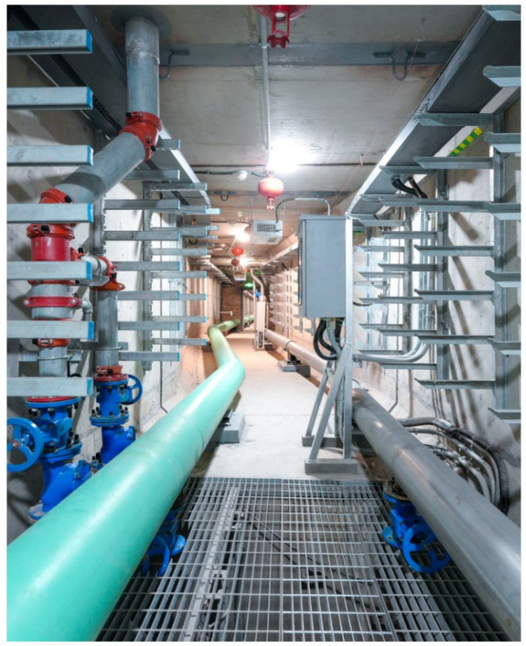
Underground space is a valuable spatial resource in cities. With the continuous development of cities, the utilization of underground space has become increasingly important. Urban underground public facilities such as underground pipe networks, underground streets, sidewalks, subways, urban highway tunnels, and civil air defense facilities have increasingly become indispensable components of modern cities. The efficient development and rational utilization of urban underground space resources can save urban space, improve the urban environment, alleviate urban traffic pressure, and enhance the city's ability to prevent and mitigate disasters. It serves as an important means to address urban problems, reserves space for the future development of cities, and has become an inevitable choice to alleviate the shortage of urban spatial resources.

China Railway Engineering Equipment Group Co., Ltd. (CREG) is committed to making tunnel construction safer, better and faster. As an enterprise engaged in the R&D, manufacturing, and comprehensive services of underground engineering equipment, CREG focuses on various application scenarios of underground space development. It provides global customers with green, low-carbon, stable, and efficient diversified solutions in underground space development fields such as municipal tunnels, highway tunnels, metro projects, and underground engineering. Relying on its outstanding technical strength, rich project experience, and efficient service system, CREG works with global customers to address various challenges in tunnel construction, ensuring the safe operation and efficient progress of projects and creating maximum value for its customers.

Cover photo:
Development of underground space helps break through spatiallimitations and enhance the overall carrying capacity of cities.

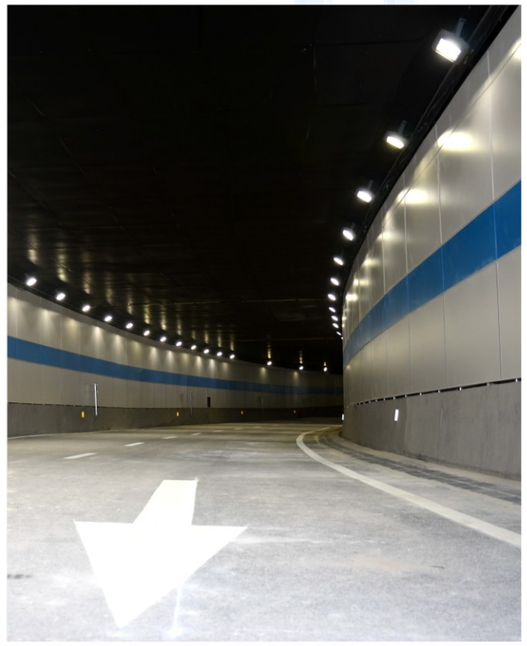
CREG cross-section rectangular pipe jacking machine (CREC 1179) is pioneeringly applied in the construction of metro stations.

APPLICATION



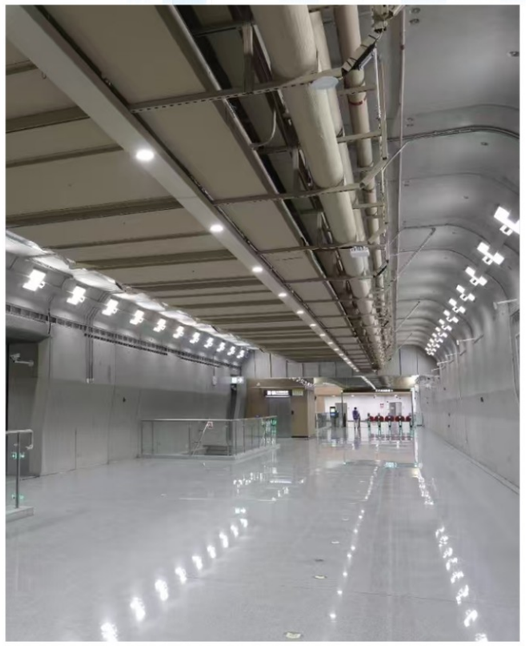
Municipal Field

- Utility Tunnels
- Drainage Pipe Gallery
- Water Supply Pipe Gallery
- Power Pipe Gallery



Urban Traffic Field

- Highway Tunnels
- Underground Pedestrian Walkways



Metro Field

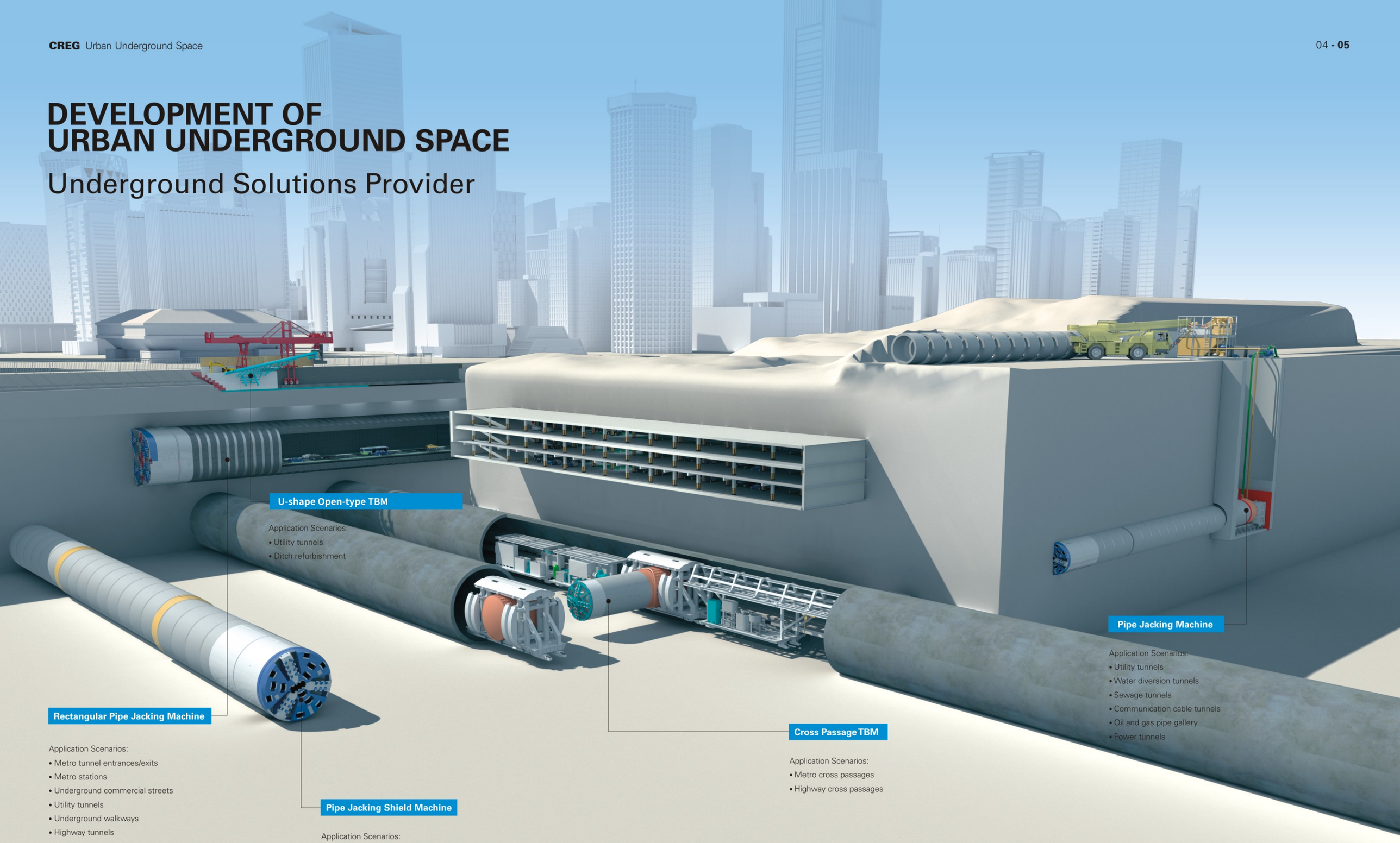
- Metro Stations
- Metro Tunnel Entrances/Exits
- Metro Cross Passage

Underground Engineering

- Underground Parking Lot
- Underground Civil Air Defense Project
- Underground Commercial Complex

DEVELOPMENT OF URBAN UNDERGROUND SPACE

Underground Solutions Provider



U-shape Open-type TBM

Application Scenarios:
- Utility tunnels
- Ditch refurbishment

Rectangular Pipe Jacking Machine

Application Scenarios:
- Metro tunnel entrances/exits
- Metro stations
- Underground commercial streets
- Utility tunnels
- Underground walkways
- Highway tunnels
- Underground parking lots
- Civil air defense works

Pipe Jacking Shield Machine

Application Scenarios:
- Medium and long municipal tunnels

Cross Passage TBM

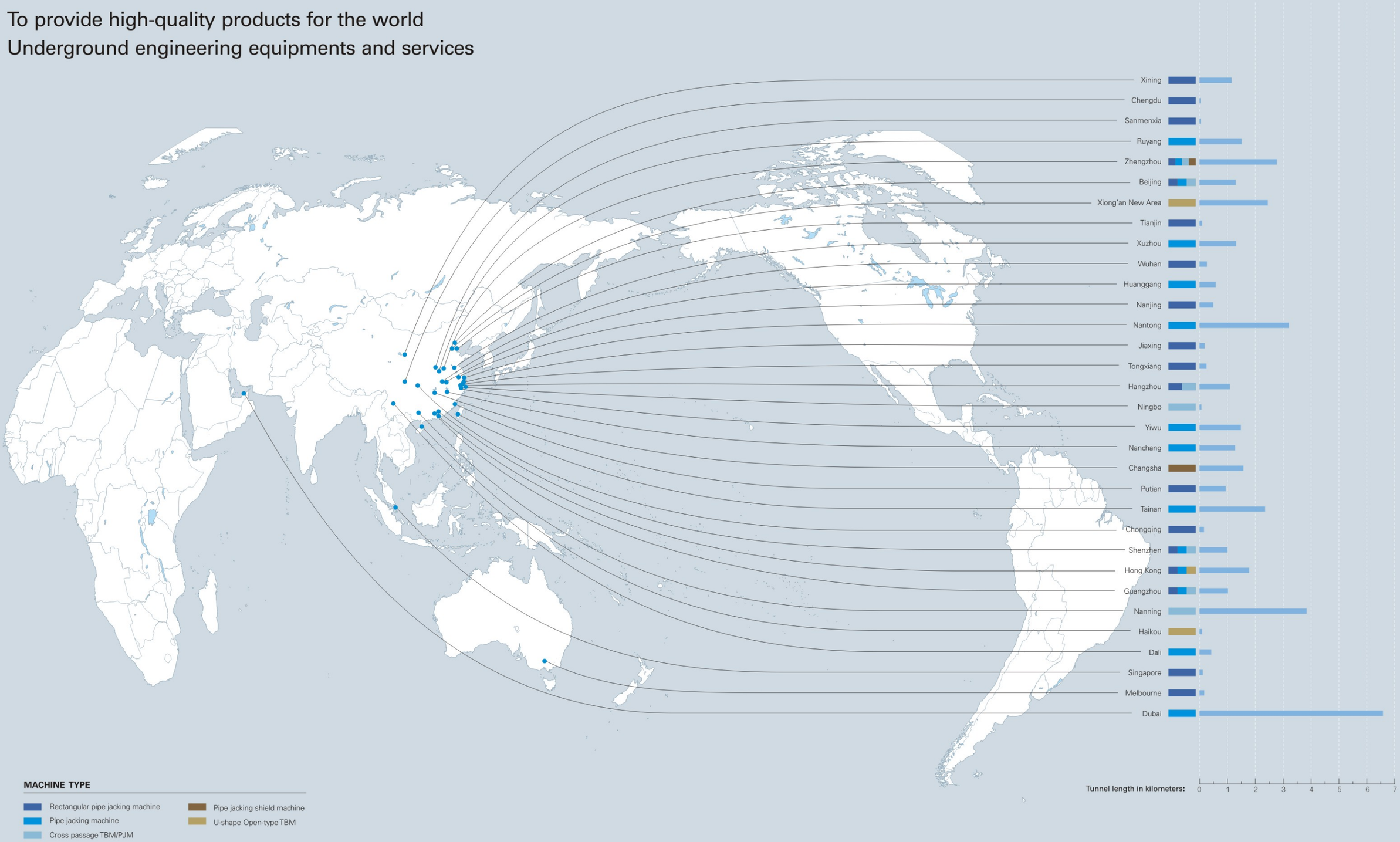
Application Scenarios:
- Metro cross passages
- Highway cross passages

Pipe Jacking Machine

Application Scenarios:
- Utility tunnels
- Water diversion tunnels
- Sewage tunnels
- Communication cable tunnels
- Oil and gas pipe gallery
- Power tunnels

GLOBAL VISION

To provide high-quality products for the world
Underground engineering equipments and services



CREG Headquarters' Underground Parking Lot Project

China's First Underground Parking Lot Pilot Project Utilizing Pipe Jacking Method

The project features the use of a rectangular pipe jacking machine to construct an underground parking lot in a densely built-up area. The construction utilized a combined rectangular pipe jacking machine independently developed by CREG. Each unit has an excavation size of 2.87m× 5.02m, while the combined configuration expands it to 5.74m× 5.02m. This versatility allows for both single-unit and combined advancement methods. Ultimately, the project successfully excavated a total underground parking area of 3,267 square meters.

Project Information

- Project type: underground parking lot
- Excavation area: 3,267 square meters
- Geology: silty clay
- Contractor: China Railway Tunnel Group Second Division Co., Ltd.

Parameters

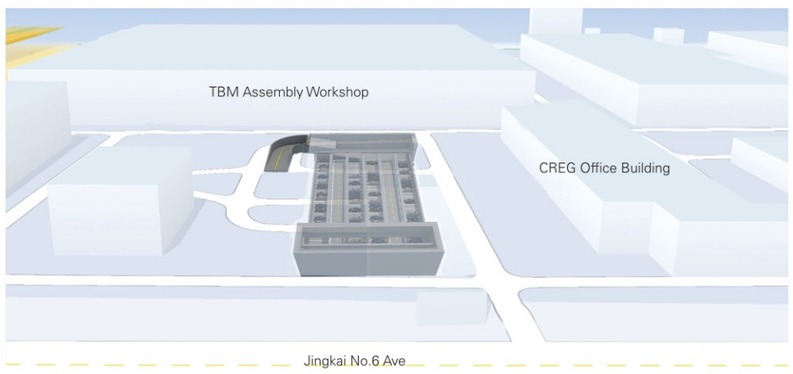
- RPJM type: rectangular pipe jacking machine
- RPJM S/N: CREC 358
- Cutterhead section:
  single 2,870mm×5,020mm
  combination 5,740mm×5,020mm
- Main drive power: 330 kW
- Launch time: April 2017

Project Characteristics

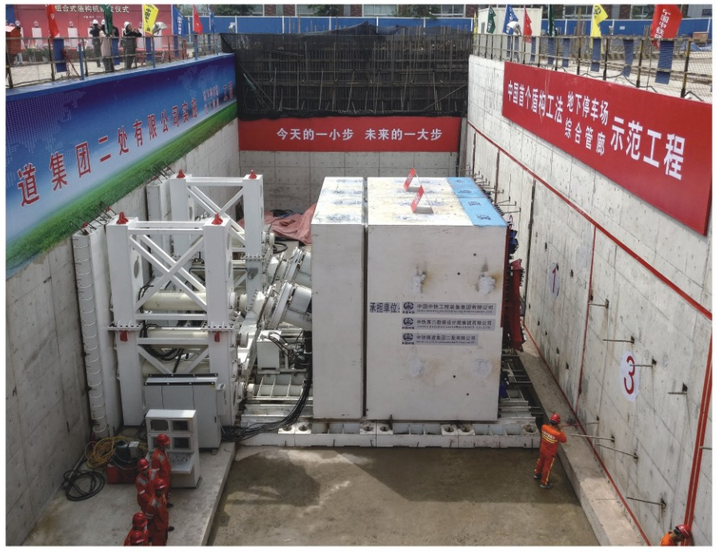
- It is China's first underground parking lot constructed by using the pipe jacking method and undercutting method;
- The site features shallow overburden, with less than 3m of soil under the ground surface.

Project Background

This is a new-type construction concept for underground parking lots. It addresses the problems of the open-cut method, such as significant environmental damage, adverse impacts on traffic and disruptions to residents' lives, and provides a more environmentally friendly, safer, and more efficient construction method. It is conducive to solving the construction challenges of underground projects such as parking lots in older urban areas.



Schematic diagram of underground parking lot project in CREG headquarters, Zhengzhou



Commissioning preparation for the combined rectangular pipe jacking machine before launching.

Underground parking lot after completion.

Thomson-East Coast Line T221 Pedestrian Underpass Project in Singapore

Underground Pedestrian Underpass Using Rectangular Pipe Jacking Machine

The machine is utilized for the construction of the entrance of the T221 MRT station in Singapore, featuring a cross-sectional size of 7.62m× 5.645m and a jacking length of 156m, with an overburden ranging from 5.4 to 7.2m. During the excavation process, the machine successfully navigated through an area with pipeline obstacles. The cutter head effectively broke through the cast iron pipelines, discharging hundreds of iron blocks along with other objects, including auger drill bits.

Project Information

- Project type: pedestrian underpass
- Tunneling length: 156m
- Geology: carbon mud, marine silt
- Contractor: China Railway Tunnel Stock Co., Ltd.

Parameters

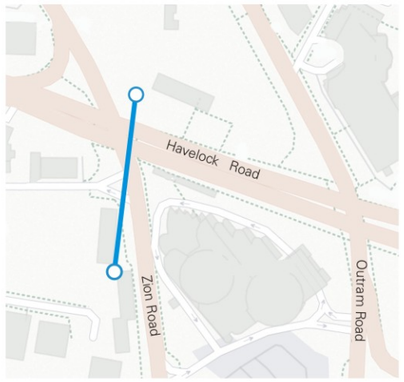
- RPJM type: rectangular pipe jacking machine
- RPJM S/N: CREC 236
- Cutterhead section: 7,620mm×5,645mm
- Main drive power: 540 kW
- Launch time: February 2016

Project Characteristics

- The tunnel is long, featuring a pipe jacking section of 156m;
- The minimum distance between the tunnel and key structures is 15m;
- The stratum contains obstacles, including cast iron pipelines.

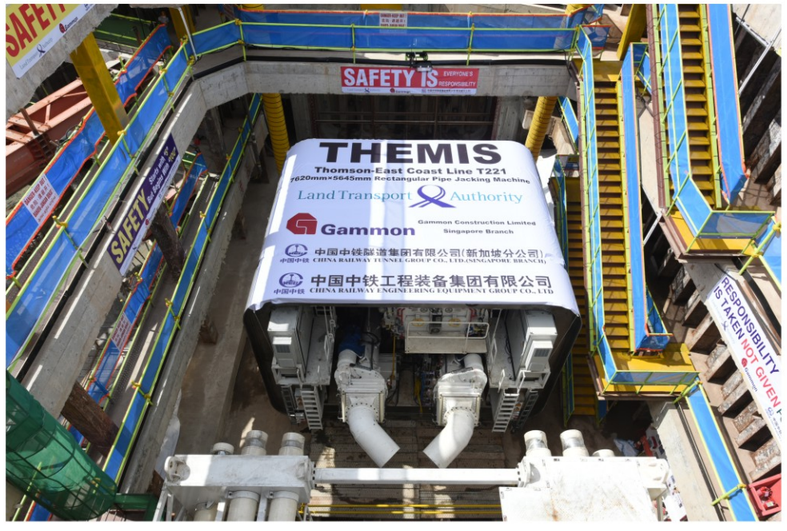
Project Background

As the first project in Singapore to adopt the large-section rectangular pipe jacking technology introduced by the Singaporean government, it holds significant importance for the development of Singapore's underground engineering. The T221 contract section of the project was successfully completed in November 2016 and also won Singapore's Project Management Gold Award of that year. Subsequently, this machine was used again in Singapore's T216 project for the construction of the underground passage connecting Exit D and Exit C. The tunnel has a total length of 63.86m, with the excavation direction from north to south, passing under 2 highways, 1 viaduct and 1 river channel. Excavation work began on October 28, 2017, and the maximum daily advance rate reached 2 rings.



Singapore T221 Pedestrian Underpasss Project Route

The project implemented standardized management and was awarded the Singapore Project Management Gold Award in 2016.



Launch preparation for the rectangular pipe jacking machine.

Super-large Section Tunnel Underpassing Nanhu Avenue in Jiaxing City

Rectangular Pipe Jacking Machine Used for Constructing 3-Lane Highway Tunnels

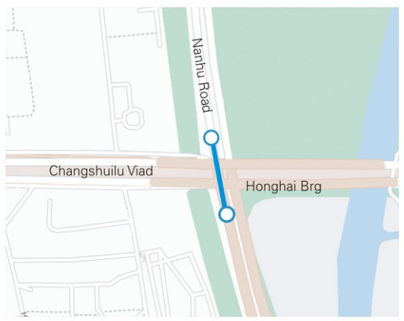
The project involves an urban highway tunnel featuring six lanes in two directions, with a single tunnel length of 100.5m. According to the project requirements, the rectangular pipe jacking machine (CREC 798) is designed with an excavation size of 14.82m×9.446m. It features a multi-cutter head combined excavation design, utilizing 6 front cutter heads and 8 rear cutter heads, along with an optimized shield section design. This configuration enables one-time excavation and formation, while effectively managing the main machine's attitude and ground settlement during the construction of super-large cross-section rectangular pipe jacking projects. Key advantages of this machine include minimal traffic disruption, reduced environmental impact, and enhanced safety and efficiency during operation. During the construction process, a maximum daily advance rate of 4.5m was achieved, with a total duration of 4 months from the launch of the project to the breakthrough.

Project Information

- Project type: highway tunnel
- Tunneling length: 100.5+100.5m
- Geology: silty clay
- Contractor: China Railway Tunnel Group First Division Co., Ltd.

Parameters

- RPJM type: rectangular pipe jacking machine
- RPJM S/N: CREC 798
- Cutterhead section: 14,820mm×9,446mm
- Main drive power: 1,770 kW
- Launch time: June 2020
- Best performance: 4.5m per day, 87m per month



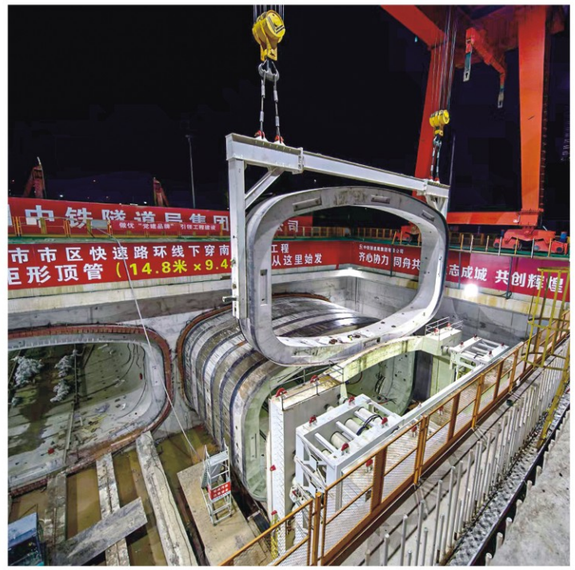
Underpassing Nanhu Avenue Project Route in Jiaxing City

Project Characteristics

- The rectangular pipe jacking machine is designed for the construction of three-lane tunnels;
- The maximum span of the structure is 14.8m;
- The distance between the two tunnels is 1.2m;
- The tunnel has a shallow overburden of only 6m.

Project Background

This project marks the pioneering successful application of rectangular RPJM technology in the construction of a 3-lane rectangular tunnel. For an extended period, CREG has prioritized the research and development of rectangular pipe jacking machines. The project titled "Key Technologies and Applications for the Design and Manufacturing of Non-Circular Full Face Tunnel Boring Machines," led by CREG, was awarded the second prize of China's National Science and Technology Progress Award in 2018. To date, CREG has designed and manufactured over 30 rectangular pipe jacking machines, which are widely employed in the construction of urban highway tunnels, underpass tunnels, utility tunnels, underground parking lots, and various other applications. These innovations have established CREG as a leader in technological advancement in the field of underground space development, contributing significantly to the construction of urban underground infrastructure.



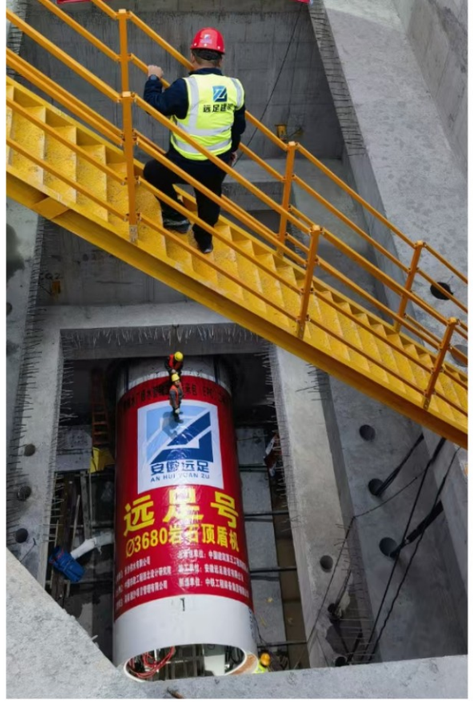
A super-large pipe for the three-lane highway tunnel is being lowered into the shaft.

Successful breakthrough of the super-large cross-section rectangular pipe jacking machine.

Changsha Leifeng Water Plant Raw Water Pipeline Project

Pipe Jacking Shield Machine Solutions for Challenges in Super-long Water Diversion Tunnel Construction

Given the super-long distance and high abrasiveness of the project, the TBM features a specialized pipe jacking shield machine design. It initially employs a pipe jacking mode for single jacking, and once the jacking force reaches its limit, it switches to the TBM mode to maintain construction progress, effectively fulfilling the requirements of long-distance tunneling tasks. During the actual construction process, the machine advanced 1,136m in pipe jacking mode before reaching its maximum jacking force. It then switched to TBM mode to complete the remaining 451m, ultimately achieving a breakthrough for the entire project line.



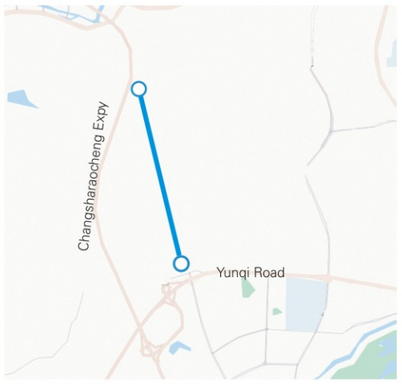
The pipe jacking shield machine meets the needs of long-distance municipal pipe gallery excavation.

Project Information

- Project type: municipal water diversion tunnel
- Tunneling length: 1,587m
- Geology: moderately weathered quartz sandstone, moderately weathered fine sandstone, with maximum rock strength of 164MPa
- Constructor: Anhui Yuanzu Construction Co., Ltd.

Parameters

- Machine type: pipe jacking shield machine
- Machine S/N: CREC 1268
- Cutterhead diameter: ϕ3,680mm
- Main drive power: 360 kW
- Launch time: February 2023
- Best performance: 19.2m per day



Changsha Leifeng water plant raw water pipeline project route

Project Characteristics

- The machine advanced a total of 1,587m in total; The maximum rock strength is 164MPa;
- The site features abundant groundwater and is
- connected to underground rivers.

Project Background

This project is a key livelihood initiative in Changsha City, primarily aimed at addressing the water supply challenges faced by districts on the west bank of the Xiangjiang River due to the city's westward expansion. It holds significant strategic importance for ensuring the safety and reliability of the water supply in this area. The pipe jacking shield machine method employed in this construction section effectively addresses the specific requirements of non-excavation, small diameter, long-distance, and curved jacking for urban underground pipe network construction. In the future, it is anticipated to be extensively used in the development of underground pipe networks for urban drainage, electricity, and gas, thereby significantly improving the mechanization of urban underground infrastructure projects.

Pipe jacking shield machine "CREC 1268" rolled off the production line.

Yuen Long South Open Channel Reconstruction Project in Hong Kong

Innovative Tunneling Technology Supporting Utility Tunnel Construction

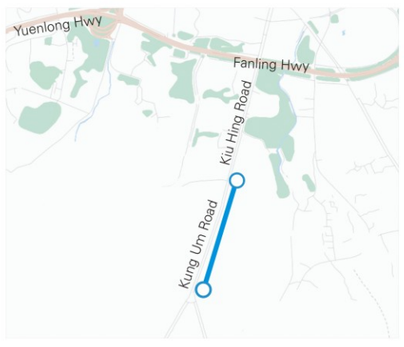
The BC04 section of the box culvert laying project for the reconstruction of the Yuen Long South Open Channel in Hong Kong includes a box culvert cross-section measuring 4.85m in width and 6.65m in height, with a segment ring width of 2m. The construction employed a CREG U-shaped Open-type TBM. The equipment combines the mobile support technology of a shield tunneling machine with the precision assembly technology of an erecting machine to achieve integrated control over various processes, including foundation pit support, excavation, equipment jacking, box culvert erection, and synchronous road surface backfill and restoration. Compared to traditional construction methods, the U-shape Open-type TBM significantly reduces on-site labor by 60%, saves 25% in land width, minimizes construction vibration and noise, and exerts minimal impact on the surrounding environment.

Project Information

- Project type: open channel reconstruction, box culvert laying
- Tunneling length: 1000m
- Geology: silty clay, containing sand
- Contractor: China Railway Group Limited Consortium

Parameters

- Machine type: U-shape Open-type TBM
- Machine S/N: CREC 1508
- Maximum applicable longitudinal slope: 5%
- Maximum applicable cross slope: 2%
- Launch time: March 2025



South Open Channel Reconstruction Project Route in Yuen Long, Hong Kong

Project Characteristics

- It features control over excavation posture during operations with a small turning radius (R220m);
- Construction is carried out in water-rich soft ground;
- Posture control is sustained under conditions of unbalanced groundwater and earth pressure.

Project Background

In response to the limitations of traditional utility tunnel construction methods, which often involve complex procedures and low efficiency, CREG has integrated new concepts, technologies, and specialized equipment from both domestic and international sources. This initiative aims to develop a comprehensive system for intelligent, low-carbon, and mechanized prefabricated utility tunnel construction technology.

The project has created a new method of construction for open-cut tunnels.

The machine and new construction method have attracted extensive attention.

Hangzhou Airport Rail Express Cross Passage Project

Mechanized Cross Passage Construction

The CREG cross passage TBM is utilized for the construction of five cross passages between West Lake Cultural Square Station and Hangzhoudong Railway Station on the Hangzhou Airport Rail Express. The total spacing between tunnel axes is 63.55m, with a maximum burial depth of 40m and water pressure reaching 5.4 bar. During the construction, the main machine commenced jacking from the launch side, navigated through complex strata, and arrived at the receiving end to complete the tunneling. This method is characterized by several advantages, including fast construction speed, stable and high-quality structural formation, and safe and controllable working environment.

Project Information

- Project type: metro cross passage
- Tunneling length: 63.55m
- Geology: silty clay
- Contractor: China Railway No.10 Engineering Group Co., Ltd.

Parameters

- TBM type: cross passage TBM
- TBM S/N: CREC 1062/1063/1104/1115
- Cutterhead diameter: ϕ3,290mm
- Main drive power: 222 kW
- Launch time: February 2022
- Best performance: 3m per day

Project Characteristics

- The maximum buried depth is 40m, and the water pressure reaches 5.4 bar;
- The project traverses areas with a high density of pipelines.

Project Background

The Hangzhou Airport Rail Express is a key supporting project for the Hangzhou 2022 Asian Games. It connects major areas of the city, including the Hangzhou Future Sci-Tech City, the residential areas in the western part of the city, Chengdong New Town, Xiaoshan Innovation Polis, and Airport New Town. This rail express facilitates the interconnection of crucial external transportation hubs in Hangzhou, such as Hangzhouxi Railway Station, Hangzhoudong Railway Station, and Xiaoshan International Airport, further optimizing the city's urban transportation network.

Hangzhou Airport Rail Express Cross Passage Project Route

Machine construction in a formed metro tunnel.

It creates a new construction method for metro cross passages.

Sichuan University Pedestrian Underpass Project in Chengdu

Application of Rectangular Pipe Jacking Machine in Sandy Gravel Strata

A rectangular pipe jacking machine, measuring 6.02m in width and 4.52m in height, is being used for the construction of a pedestrian underpass in Chengdu. With an invert depth of approximately 9m below ground, the underpass spans a total length of 68.7m It crosses an in-service metro line, positioned just 3.1m above the top of the metro tunnel. Furthermore, there are about 15 municipal pipelines located between the underpass and the ground surface.

Project Information

- Project type: pedestrian underpass
- Tunneling length: 68.7m
- Geology: sand stratum and gravel stratum
- Contractor: Chengdu Construction Engineering Group Co., Ltd.

Project Characteristics

- This project marks the first application of a rectangular pipe jacking machine in sandy gravel strata;
- The distance between the underpass and the metro line is approximately 3.1m to 3.2m;
- The project involves undercrossing 15 municipal pipelines at a short distance, with a minimum spacing of 0.5m.

Parameters

- RPJM type: rectangular pipe jacking machine
- RPJM S/N: CREC 242
- Cutterhead section: 6,020mm×4,520mm
- Main drive power: 486 kW
- Launch time: June 2016

Project Background

This project marks the world's first application of the rectangular pipe jacking machine with Earth Pressure Balance, specifically designed for construction in composite strata with shallow overburden. The geological structure of the underpass is notably complex, consisting of silty clay, a fine sand layer, and a gravel layer from top to bottom. The high water table and strong permeability increase the risk of soil disturbance, heightening the potential for collapses. The unique geographical location and complex geological structure impose stringent safety requirements, making the construction process particularly challenging. The successful implementation of the rectangular pipe jacking machine with Earth Pressure Balance, specifically designed for composite strata, sets a new precedent for using rectangular pipe jacking machines to excavate sandy gravel strata.

Pedestrian Underpass Project Route in Sichuan University, Chengdu

Tunnel after completion.

Machine is entering sandy gravel strata for construction.

Huanggang Utility Tunnel Project

Large-diameter Circular Pipe Jacking for Long-distance Utility Tunnel Construction

The pipe jacking machine (CREC 849) is a large-diameter hard-rock-slurry machine designed for operation in composite strata. The project geology primarily features highly and moderately weathered sandstone. With a single jacking distance of 350m and a diameter of 4.8m, the PJM successfully tunneled beneath the main urban road without disrupting ground traffic. The average daily advance rate was approximately 10m, demonstrating high construction efficiency.

Project Information

- Project type: utility tunnel
- Tunneling length: 684m
- Geology: highly weathered sandstone and moderately weathered sandstone
- Contractor: Hubei Pingju Construction Engineering Co., Ltd.

Parameters

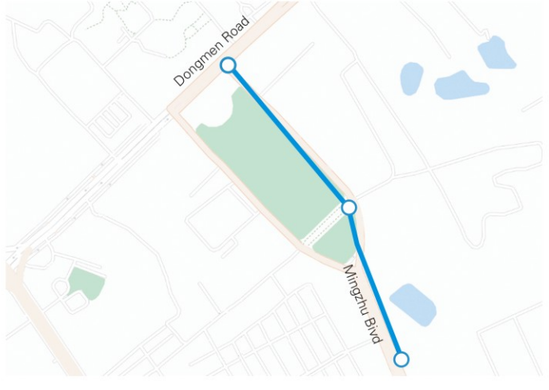
- PJM type: Pipe jacking machine
- PJM S/N: CREC 849
- Cutterhead diameter: Φ4,860mm
- Main drive power: 440 kW
- Launch time: June 2020
- Best performance: 12.5m per day, with an average advance rate of 10m per day

Project Characteristics

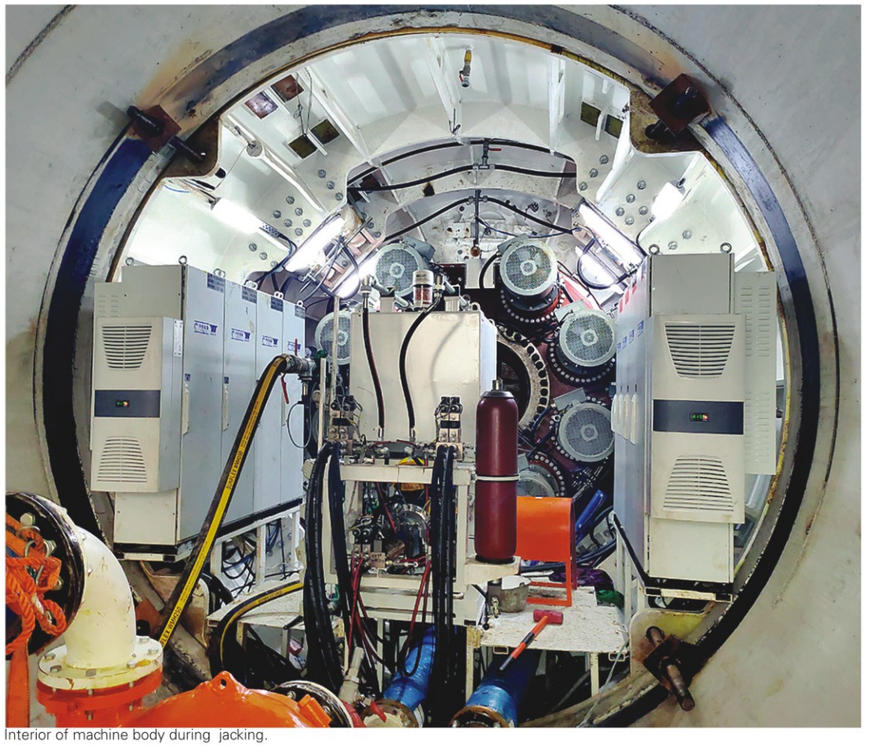
- The project involves a large-diameter utility tunnel with a diameter of 4.8m;
- The single jacking distance is 350m.

Project Background

The new utility tunnel of the Huanggang project spans 33.92km, making it the longest and largest-diameter utility tunnel project in China constructed using the pipe jacking method. This tunnel integrates power, communication, water supply, reclaimed water, and other pipelines. Upon completion, it will significantly enhance the city's overall capacity, ensure the safety of essential services, and promote high-quality development.



Huanggang utility tunnel project route



Interior of machine body during jacking.

Large-section pipe jacking machine broke through.

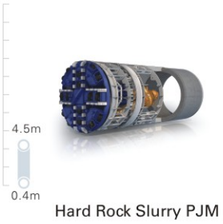
Product portfolio for urban underground space

Tunnelling technology suitable for various geological conditions and diameters

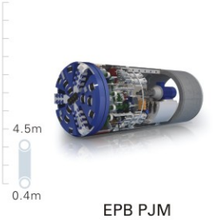
CREG is the only underground solutions provider that offers a comprehensive range of tunneling technologies suitable for various diameters and geological conditions. Furthermore, each CREG machine is specifically customised according to the geological, hydrological and other parameters of the project. Consequently, our products are recognized for their durability, reliability and performance. We are dedicated to providing exceptional customer service, and we constantly strive to exceed customer expectations.

Product Portfolio

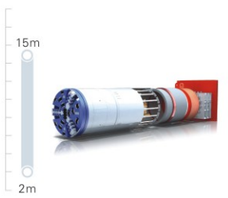
Soft Soil Slurry PJM



Hard Rock Slurry PJM



EPB PJM



Pipe Jacking Shield Machine

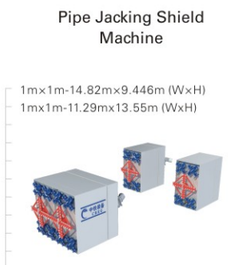
1m×1m-14.82m×9.446m (W×H)
1m×1m-11.29m×13.55m (WxH)

Rectangular PJM

1m×1m-14.82m×9.446m (W×H)
1m×1m-11.29m×13.55m (WxH)

Sandy Cobble Stratum Rectangular PJM

1m×1m-14.82m×9.446m (W×H)
1m×1m-11.29m×13.55m (WxH)



Combined Rectangular PJM

Custom-tailored

Cross Passage TBM

Custom-tailored

U-shape Open-type TBM

For more information of CREG, please refer to contacts at back cover.

CREG headquarters

CREG

Underground Solutions Provider

China Railway Engineering Equipment Group Co., Ltd. (referred to as "CREG") is a worldwide underground solutions provider for a full spectrum of mechanized tunnelling technology and services. The company's headquarters is located in Zhengzhou, the capital city of Henan province. We draw together more than 4,500 employees including over 700 designers to design and manufacture TBMs and associated equipment. As the largest TBM supplier in the world, CREG boasts outstanding productivity, product performance, product safety and geological adaptability, impressive R&D competence, a number of invention patents, as well as excellent after-sales service and support.

CREG has 16 production bases with an annual production capacity of more than 300 TBMs. We have supplied TBMs ranging from ϕ2m to ϕ18m used in all kinds of ground conditions, including hard rock, soft soil and complex geology. Our products consist of Single/Double Shield TBM, Gripper TBM, EPB TBM, Rectangular TBM, Slurry TBM, Horseshoe-shaped EPB TBM, U-shaped Shield Pipe Erecting Machine, Pipe Jacking Machine, Shaft Boring Machine, Reamer TBM and Inclined Shaft TBM. CREG is committed to every client as an efficient and reliable partner in the tunnel construction field. Until now, CREG has exported more than 140 TBMs and equipment to 34 countries and regions including Doha, Singapore, France, Italy, Australia, Lebanon, Poland, Denmark, South Korea and Austria etc.

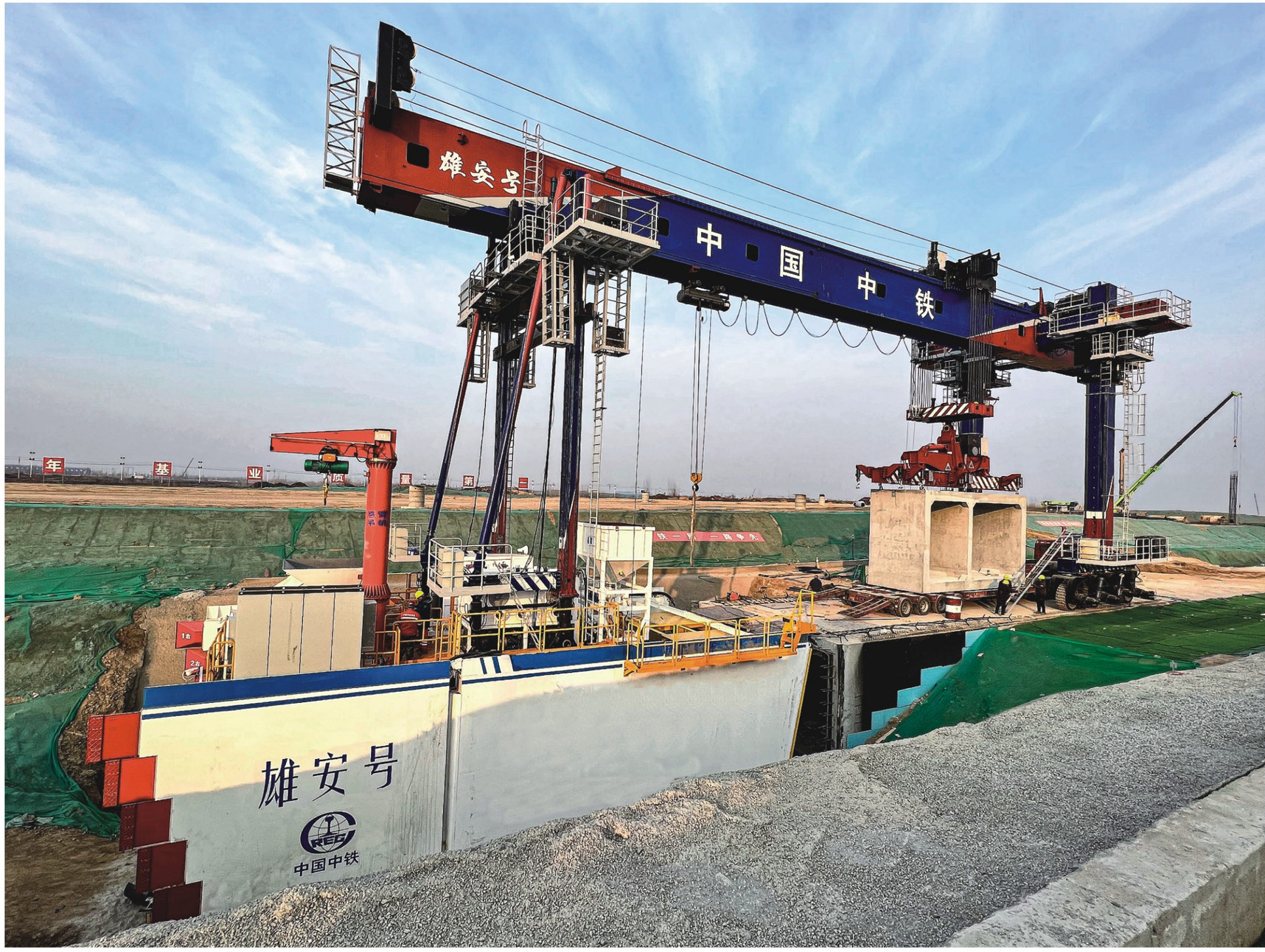
With our extensive research and practical experience, CREG offers a series of auxiliary mechanized tunnelling equipment and service packages. In addition to various types of TBMs, CREG also designs and manufactures, Cutters, Rolling Stock, Roadheaders, Three-boom Drill Jumbos, and Wet Shotcrete Machines etc. We provide a full range of tunneling equipment and all-around solutions.

Overseas Business and R&D institutions

- CREG TBM Germany GmbH
- CREG Co., Ltd. Singapore Branch
- CREG Co., Ltd. South Korea Branch
- CREG Co., Ltd. Italy Branch
- カレグ・テクノロジー日本株式会社

Full Range Services

CREG also provides high value-added customized services, including design, consultancy, tunnelling service, maintenance, remanufacturing, mechanical & electrical installation, technical service, spare parts, etc. CREG establishes remote support system for delivered TBMs to facilitate CREG rendering quick troubleshooting and real-time monitoring during tunnelling.



U-shape Open-type TBM performs well in Xiongan New Area, achieving a maximum monthly advance rate of 407 m.