CONTINENTAL
ENGINEERING CORP

A MEMBER OF CONTINENTAL HOLDINGS

Tunneling into the future

Excellence meets innovation

Our sterling track record includes numerous complex and highly challenging projects that brought to bear our ingenuity, craftsmanship, and more than seven decades of expertise.

Raising national infrastructure across Asia

Continental Engineering Corporation (CEC) is a major player behind the US$17 billion Taiwan High Speed Rail (THSR), one of the world's largest build-operate-transfer (BOT) projects and a crucial link between north and south Taiwan. Our considerable success has taken us across Asia to other metro projects in India and Malaysia.

Forging underground connections

Drawing on conventional and pioneering methodology, CEC has excavated through some of the world's most technically challenging geological features and congested urban developments, safely forging more than 100 kilometers of tunnels beneath cities, nature reserves and even national heritage monuments in Taiwan, India, Malaysia, and Hong Kong.

An impeccable track record in tunneling works

Our tunnels transform cities, keep people moving safely, and reduce congestion.

- **Substantial experience with all forms of underground construction, including Tunnel Boring Machines (TBM), Drill & Blast methods (NATM), and Cut & Cover tunnels in a variety of environments**
- **Successfully delivered over 30 projects across 4 countries to date, including some of the world's most challenging and innovative tunneling designs**
- **Excavation record totals over 100 kilometers of tunnel, accomplished according to our strict standards even in complex and remote environments**
- **Largest contractor for rail and MRT projects in Taiwan, and one of the major international contractors for MRT projects in India**
- **In-house engineering and technical experts carry out construction planning, temporary-work design, and value engineering from the pre-contract phase until completion**
- **Equipped with self-performing complex tunnel construction capabilities, including TBM procurement and operation**
- **Well-established vendor networks, trusted specialist operators, and TBM crews enable us to design, plan, and execute complex tunnel construction projects**
- **Experienced in-house BIM team allows for more efficient delivery, better communication with our stakeholders, and better project transparency**
- **Strong safety ethos is part of our company DNA**
- **Solid financial backing gives our clients confidence in the certainty of our delivery**

Road Tunnel: Renshui Tunnel of Suhua Highway Improvement Project

Location: Hualian, Taiwan

Renshui Tunnel runs through the pristine nature reserves of Taroko National Park. To minimize the environmental impact, CEC tackled the challenge of excavating a double-wide tube from a single face, making Renshui Tunnel the largest among all provincial highway tunnels in Taiwan. Compounding the challenges were weak geological zones and limited site access, necessitating careful planning to accommodate ventilation, water supply, and power. Despite these challenges, the project was completed around one month ahead of schedule.

Rail Tunnel: Railway through Shanli Tunnel to Taitung Station

Location: Taitung, Taiwan

Shanli Tunnel forms another crucial link in Taiwan, offering a shorter commute between Taipei in the north and Taitung in the east. Its mountainous location presented significant excavation challenges, which were compounded by extreme weather events that necessitated contingency measures. Nonetheless, the project was completed on schedule, shortening the 5-hour drive to just 3.5 hours.

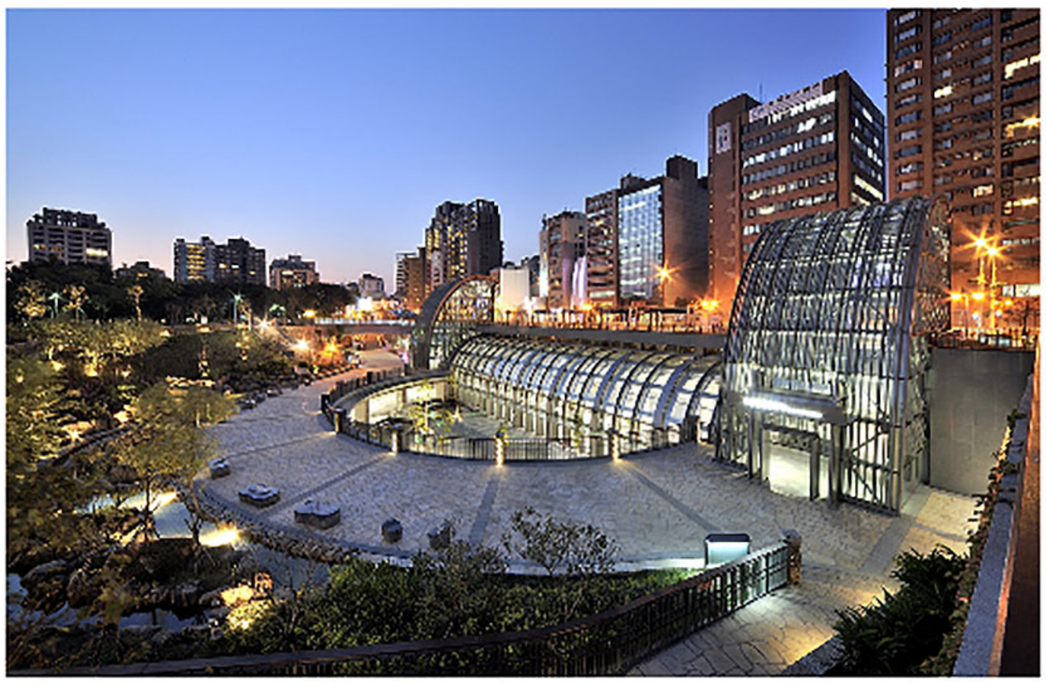
MRT Tunnel: Taiwan's Major Municipalities

Location: Taipei, Taoyuan, and Taichung, Taiwan

As a key partner in the continued expansion of the Taipei Metro, CEC has undertaken numerous complex construction projects including the Neihu, Tucheng, Nangang, Banqiao, Xinyi, Xinzhuang, Wanda, Taoyuan, and Taichung Green lines, as well as the Taiwan Taoyuan International Airport Access. To date, we have completed 12 stations and 2 depots, along with the accompanying tunneling work. We currently also have 29 MRT stations under construction.

The recently completed Xinyi line (project CR580A), which extends the metro line into Taipei's CBD, is a particularly important project in our portfolio. It involved constructing two underground stations, six tunnels, and several ancillary structures beneath a dense metropolis. The construction lay in tackling the notoriously challenging and earthquake-prone zone without compromising surface structures. This project drew on the full force of our expertise and ingenuity, earning us the Public Construction Excellence Award from the Taipei City Government in 2014.

The project included Daan Park Station, which stands today as one of the city's most innovative attractions, featuring a sunken garden and integrated green areas.



Bangalore Metro Rail Projects

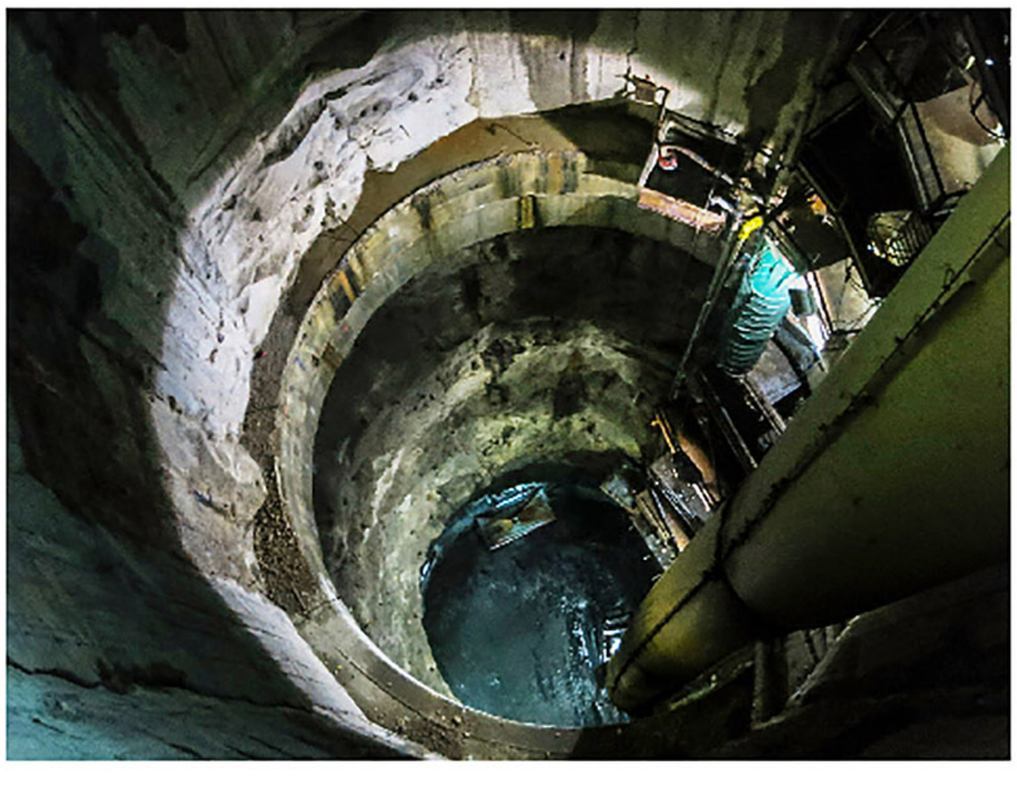
Location: Bangalore, India

CEC completed two tunnels totaling 5.1 kilometers in length in India's third-most populous city, harnessing cutting-edge technology to overcome the area's challenging geological features. Although Bangalore's extreme congestion made each breakthrough particularly challenging, we successfully completed the project without disrupting the city's vital surface-rail services, on which many commuters depend.

Water & Wastewater Tunnel: Stonecutters Island Sewage Treatment Works Project

Location: Stonecutters Island, Hong Kong

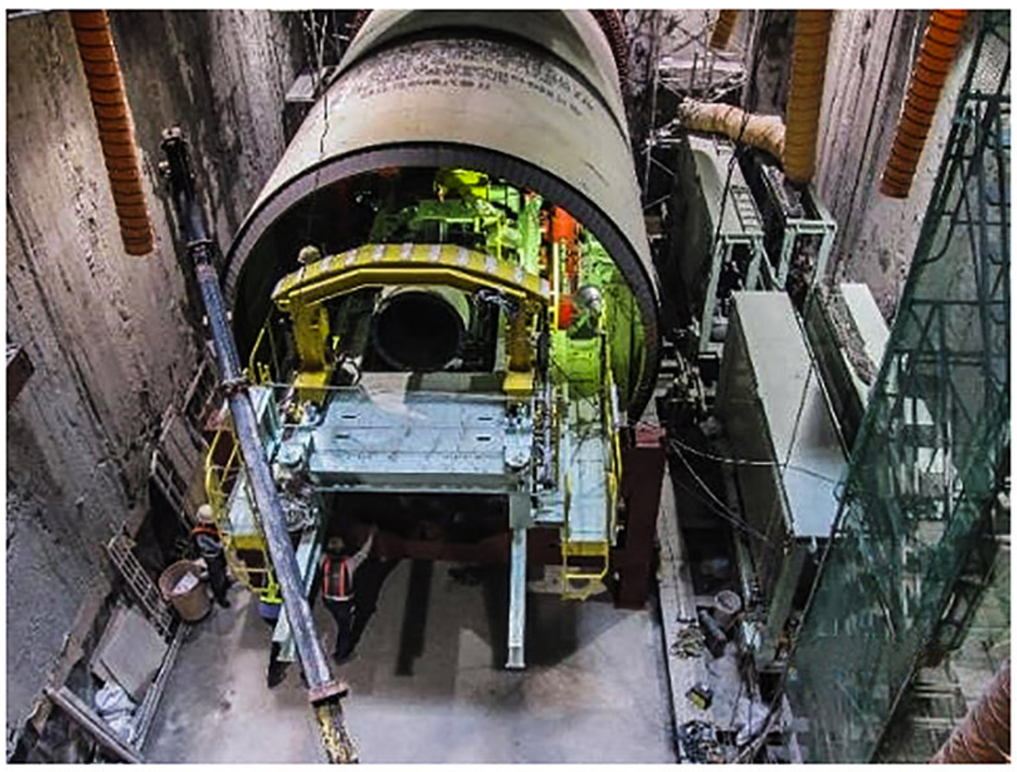
In conjunction with a local partner, CEC excavated an effluent tunnel over 800 meters in length and 8.5 meters in diameter, and constructed the accompanying disinfection facilities.

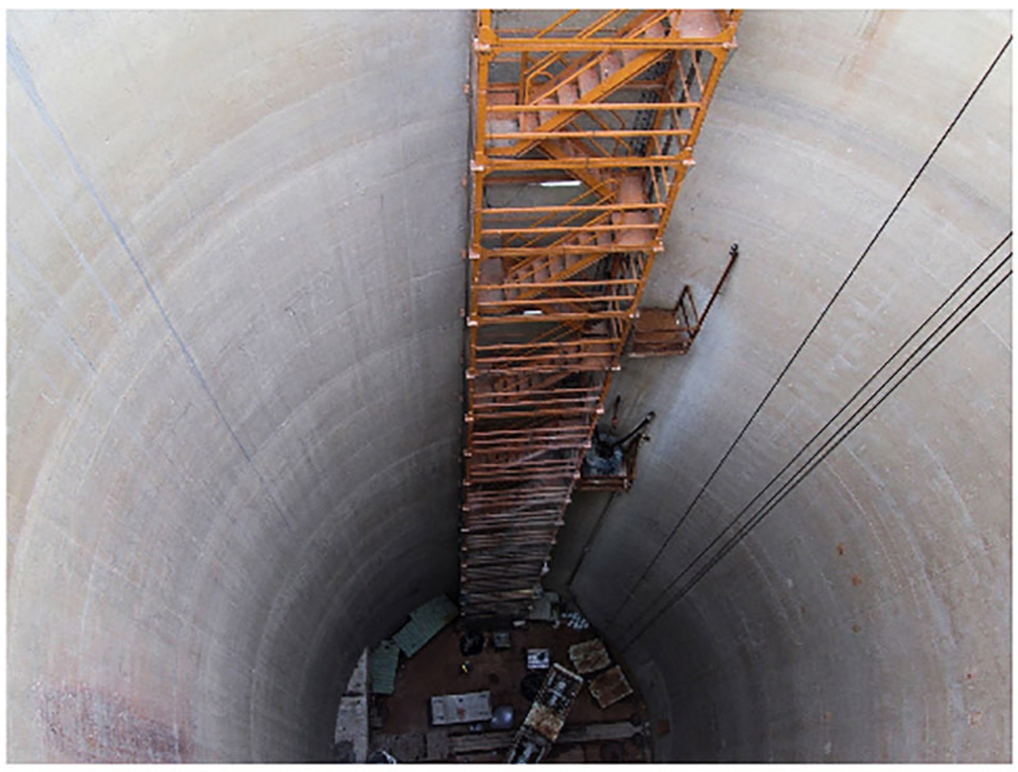


Utilities Tunnel: Underground Shield Tunnels for Power Transmission Lines

Location: Taipei, Taiwan

To meet Taipei's growing demand for power without compromising urban safety, additional high-voltage cables were laid within 4.6 kilometers of underground tunnel. To avoid compromising existing structures like the MacArthur Bridge, metro lines, and railway systems, these were buried more than 50 meters belowground, with the aid of five excavation shafts that were later converted into maintenance tunnels.





Growing from strength to strength

Backed by over seven decades of expertise, we continue to blaze new trails in the construction sector, establishing best practices according to the strictest standards of safety and excellence. By harnessing new technology and innovative methods, we strive to continue optimizing value for our partners and clients across Asia and the rest of the world.

About CEC

With a footprint stretching from Taiwan to Hong Kong, Macau, Malaysia and India, Continental Engineering Corporation (CEC) is globally recognized as a leading pioneer in the civil construction and engineering field, with a superior track record in major infrastructure works as well as industrial, commercial and residential builds.

Since 1945, we have harnessed cutting-edge technology and innovative techniques to deliver exceptional results, especially in heavy civil projects involving viaducts, bridges, and tunnels for major highway, metro, and railway works. Our other areas of expertise include mechanical and electrical projects, while environmental engineering, water supply, and drainage systems are also part of our diverse portfolio.

CEC is a subsidiary of the publicly listed Continental Holdings Corporation (CHC, TSE 3703), which was incorporated in 2010. On the strength of CHC's stable foundations, we are in the perfect position to fulfil our mission of advancing new engineering techniques according to the highest standards of safety and quality management, while creating value for our partners and improving quality of life for the communities in which we operate.

Clients

建築署 Architectural Services Department
BMRCL
CEDD Civil Engineering and Development Department
दिल्ली मेट्रो रेल कॉर्पोरेशन लिमिटेड DELHI METRO RAIL CORPORATION LTD. (भारत सरकार एवं दिल्ली सरकार का संयुक्त उपक्रम) (A JOINT VENTURE OF GOVT. OF INDIA AND GOVT. OF NCT DELHI)
渠務署 Drainage Services Department
GAMUDA
JAIPUR METRO
PWD
交通部鐵道局 Railway Bureau, MOTC
中華民國交通部公路總局 Directorate General of Highways,MOTC
TAIPEI 臺北市政府捷運工程局
桃園市政府捷運工程局 Department of Rapid Transit Systems, Taoyuan
台灣電力公司 Taiwan Power Company

Partners

AECOM
ARCADIS Design & Consultancy for natural and built assets
ARUP
ayesa
BLACK & VEATCH
Build King
CECI CECI Engineering Consultants, Inc., Taiwan
Cem
俊和 CHUN WO
鹿島 KAJIMA CORPORATION
KAPPA
INDUS Consultrans Pvt. Ltd. Transcending your expectations
MAA GROUP
Mott MacDonald
RB 中国路桥工程有限责任公司 CHINA ROAD & BRIDGE CORPORATION
OBAYASHI
SFK Sun Fook Kong Group 新福港集團
SINOTECH ENGINEERING CONSULTANTS,INC.
SMEC
soma
TATA
TATA PROJECTS Simplify.Create
林同棪工程顧問股份有限公司 T·Y·LIN INTERNATIONAL TAIWAN
wsp

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Taiwan- Taoyuan MRT Green Line- Underground Section between G07 Station and Northern Daylighting section, Civil Turnkey- Contract GC03

Client: Department of Rapid Transit Systems, Taoyuan City Government

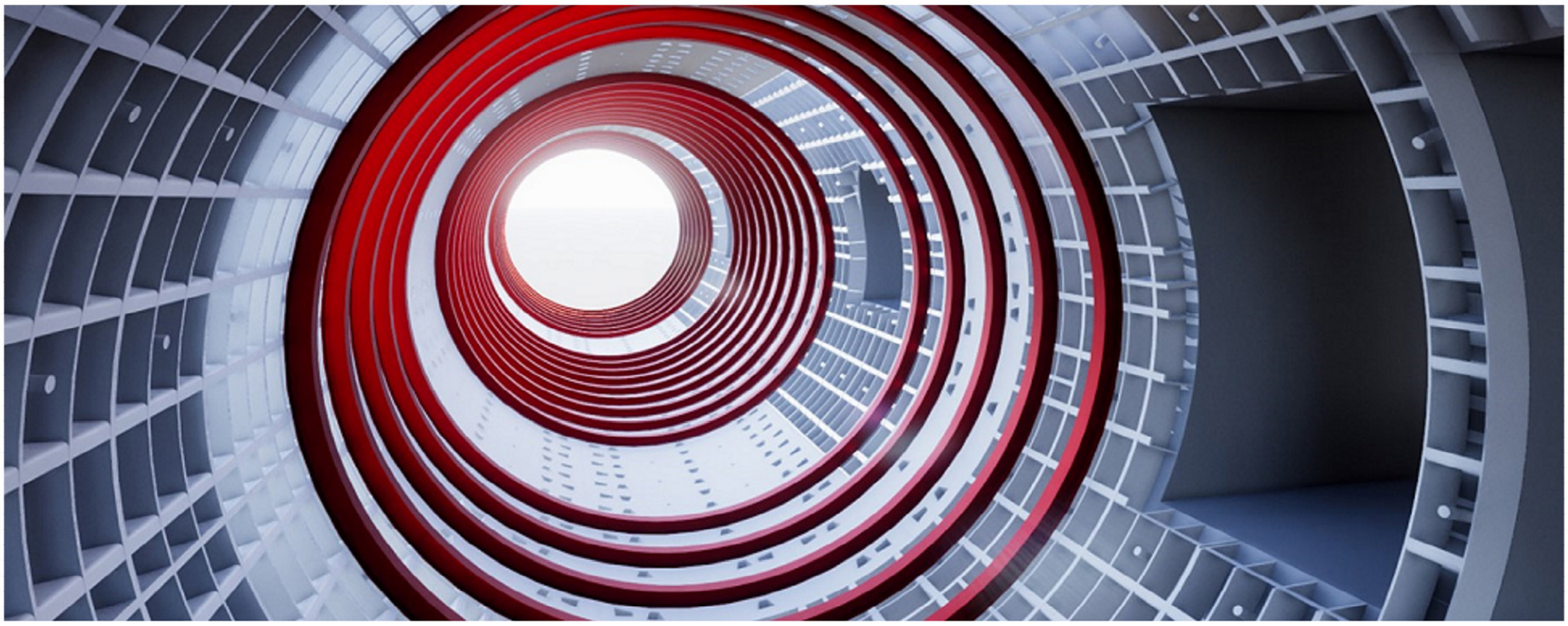
Location: Taoyuan District and Luzhu District, Taoyuan city, Taiwan

Contractor: Fu Tsu-Obayashi-CEC Joint Venture

Scope of work:
- Six underground stations.
- One 5.8 km shield tunnel, including an outer diameter 8.2 m shield tunnel 2.61 km long and an outer diameter 6.1 m shield tunnel 3.19 km long.
- Mechanical and electrical work.
- Misc. underground utility work.

Duration: July 2019 to December 2026

Highlights:
- This project includes construction of the deepest MRT underground station in Taiwan (the G07 station) with an excavation depth of 45 m.
- It includes the first use of an outer diameter 8.2 m TBM for an MRT tunnel in Taiwan.
- It includes the first use of stacking platforms in underground MRT stations in Taiwan (stations G07, G08, and G09).



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Taiwan- Taipei MRT Wanda Line- Contract CQ840

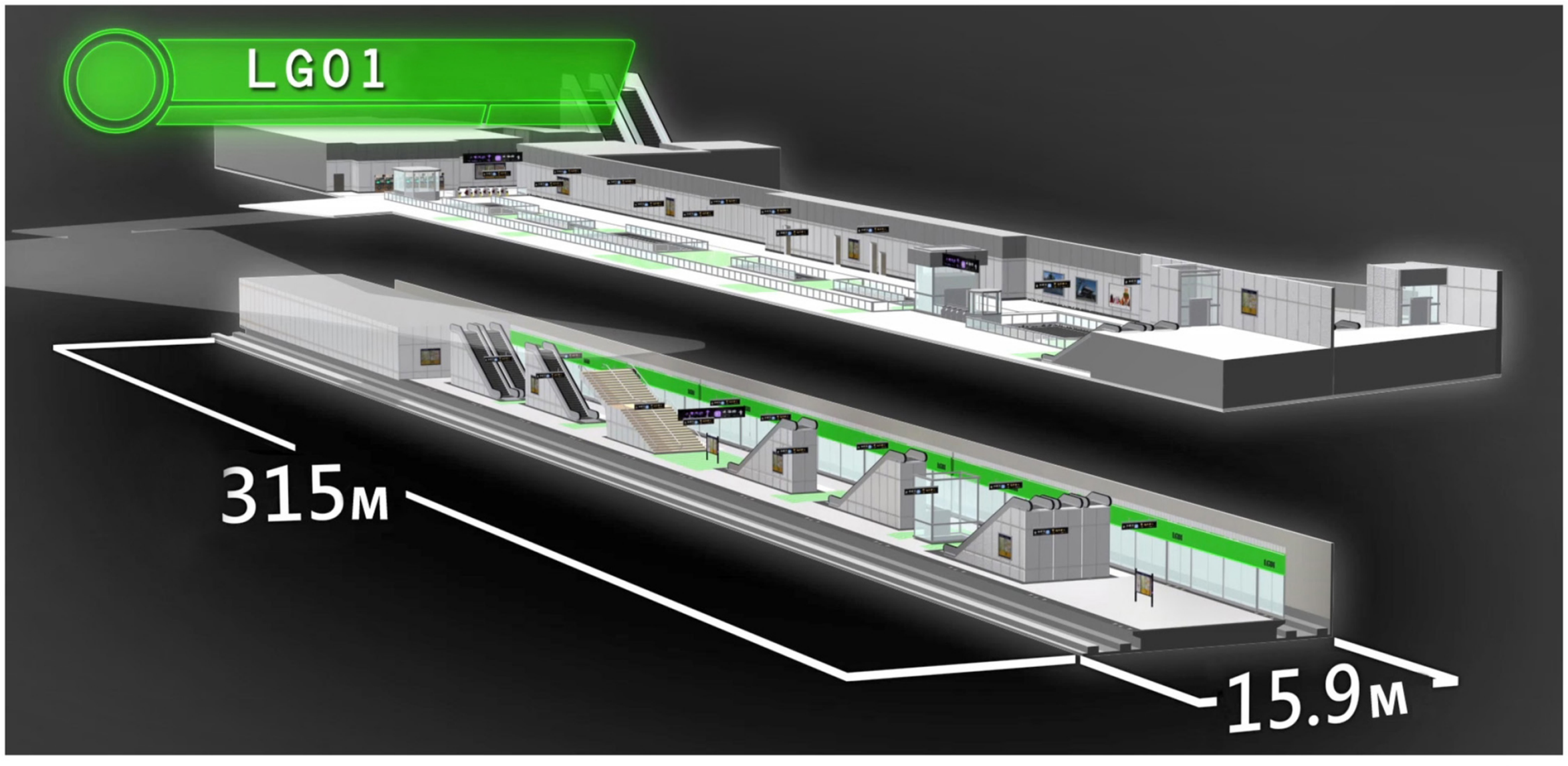
Client: South District Project Office, Department of Rapid Transit Systems, Taipei City Government

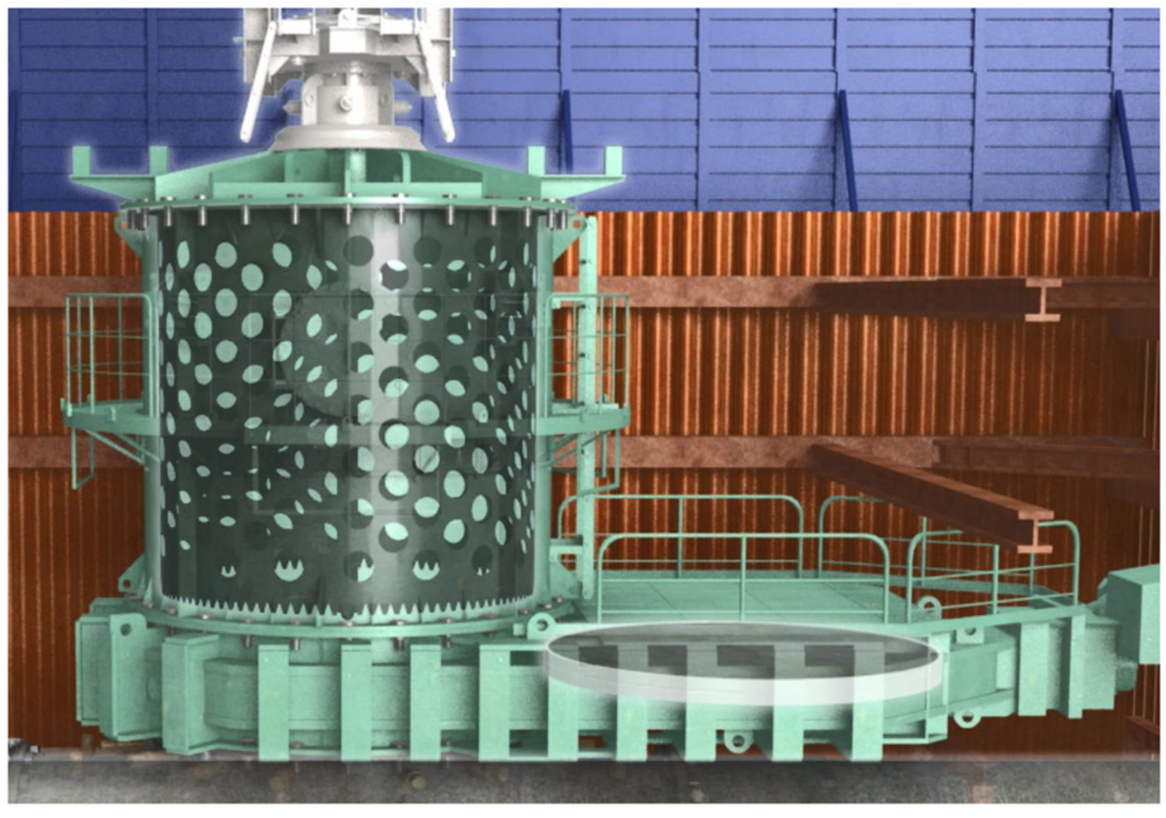
Location: Taipei City, Taiwan

Scope of work:
- The first tunnel section includes twin TBM tunnels from the pocket track area to station LG03. One tunnel is 491 m long and the other is 478 m long, for a total of 969 m.
- The second tunnel section includes twin TBM tunnels from the pocket track area to station LG04. One tunnel is 350 m long and the other is 355 m long, for a total of 705 m.
- The TBM tunnels use precast reinforced-concrete liming segments with an outer diameter of 6.1 m and an inner diameter of 5.6 m.
- The pocket track tunnel and the two underground stations are built using Cut & Cover method.

Duration: February 2017 to February 2025

Highlights: On account of space limitations, the alignment from pocket track to LG03 at the junction of Wanda Road and Xizang Road has a tight curve with a radius of 50 m. A graphite cast-iron lining with enhanced ductility will be adopted to mitigate the possible difficulty.





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Taiwan- Taipei MRT Wanda Line- Contract CQ850A

Client: South District Project Office, Department of Rapid Transit Systems, Taipei City Government

Location: Wanhua District, Taipei City, and Yonghe District, New Taipei City, Taiwan

Scope of work:
- Twin TBM tunnels with internal diameters of 5.6 m. The tunnels will underpass the Xindian River. One tunnel is 1,716 m long, and the other is 1,701 m long.
- One underground station LG04 using Cut & Cover method.
- Four cross passages connecting the two TBM tunnels (one cross passage uses the Press-in Caisson to facilitate excavation).

Duration: December 2016 to April 2024

Highlights:
- The project uses a tunnel-boring machine to underpass the Xindian River, which is about 400 m wide.
- The construction of the two tunnels is carried out simultaneously using two shield machines with an articulation unit.

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Taiwan- Taipei MRT Wanda Line- Contract CQ842

Client: South District Project Office, Department of Rapid Transit Systems, Taipei City Government

Location: Zhongzheng District, Taipei City, Taiwan

Scope of work:
- LG02 is a three-level underground station with an island platform. The soil cover depth is 4.6 m. The station structure is 126 m long and 18.4 m wide.
- The shield tunnel between LG02 and LG03 stations is 792 m long.
- The shield tunnel between LG02 and LG01 stations is 854 m long.
- Station entrances A and B and vent shafts X and Y are included in the project.
- Station entrance B is built as part of the new activity center for the Mandarin Experimental Elementary School.
- For cultural heritage purposes, an archeological investigation was carried out up to 6 m below ground at the site of the stations, station entrances, and vent shafts, with investigation pits excavated at selected points, some of them within the restoration area of the adjacent Taiwan Forestry Research Institute.

Duration: December 2014 to December 2022

Highlights: The project includes the tunnel from LG01 station (not included) near Roosevelt Road, runs along Nanhai Road to LG02 station, crosses Heping West Road, and runs along Xizang Road to LG03 station (not included). It also includes the foundation of the co-constructed building in the Mandarin Experimental Elementary School, the MRT facility at the Taiwan Forestry Research Institute, and tree transplanting work (included as the sub-contract CQ844A).

Mass Rapid Transit | Tunnel | Underground Station

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Taiwan- Taiwan Taoyuan International Airport MRT Link- Zhongli Extension Contract Package CM01

Client: Bureau of High-Speed Rail, MOTC

Location: Zhongli City, Taoyuan County, Taiwan

Scope of work:
- Conventional civil work Contract CU04.
- Design-and-build track-work contract TR01.
- Construction of underground stations A22 and A23 using Cut & Cover method.
- Construction of a 127 m Cut & Cover tunnel for the crossover tracks for the A23 Station
- Construction of four TBM Tunnels with a total length of 3228 m using two shield machines.
- Construction of two tunnels with a total length of 115 m. One tunnel is built using Cut & Cover method and the other using the pipe-roofing method.

Duration: December 2013 to January 2024

Highlights:
- CU04 includes two major portions: the station and the tunnel.
- Station: Because Taiwan Railway is an underground project, Station A23 and crossover section need to be lower after completion of diaphragm wall; hence, additional full-casing piles are added to the diaphragm wall to allow deeper excavation.
- Tunnel: Two tunnels underpass an existing building, which is about 200 m long with a 150 m radius curve alignment. TBM is equipped with an articulation unit and uses injection of low-plasticity clay material to ensure construction safety.
- TR01 Track-work: The project's adoption of a 99.6% floating-slab track is unique. The slab is T-shaped to allow space for maintenance. The design of the floating-slab track meets the 16-db natural frequency as required by the specification, which is an improvement over the 18-db required by the Taipei MRT.

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Taiwan- Taiwan Taoyuan International Airport MRT Link Project- Contract CU02

Client: Bureau of High Speed Rail, MOTC

Location: Taoyuan City, Taiwan

Scope of work:
- Four two-level underground MRT stations (A12, A13, A14, and A14a).
- One 784 m Cut & Cover tunnel
- Architectural work.
- Mechanical and electrical work.

Duration: October 2007 to January 2016

Highlights: The project is part of the construction of a rapid-transit line that connects the municipalities of Taipei, New Taipei, and Taoyuan with Taoyuan International Airport and provides a more complete and convenient complex transportation network.

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Taiwan- Taipei Metro- The Xinyi Line (CR580A)

Client: Taipei City Government

Location: Taipei, Taiwan

Scope of work:
- Two underground stations
- 4,107 m long TBM tunnel with outer diameter of 6.1 m, including 1,397 m long utility tunnel
- 319 m long Cut & Cover underground tunnel for the pocket track section
- Building services including required mechanical and electrical equipment
- Environment control system
- 1,197 m long utility duct bank

Duration: April 2005 to November 2013

Highlights:
- An innovated mirror face design was adopted to improve safety, prevent from leakage, and shorten construction time.
- Special equipment and measures was adopted for D-wall construction of Daan Station due to limited vertical clearance directly underneath the other elevated MRT Line.
- Three EPB TBM with multiple disc cutters were used to drive nine TBM tunnels.

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Taiwan- Taipei Metro- The Neihu Line (CB420)

Client: Taipei City Government

Location: Taipei, Taiwan

Scope of work: Station:

- Underground R.C. structure with diaphragm wall (1 m thick, 37 m deep)
- MRT underground station (2-story): 163 m length by 22 m width

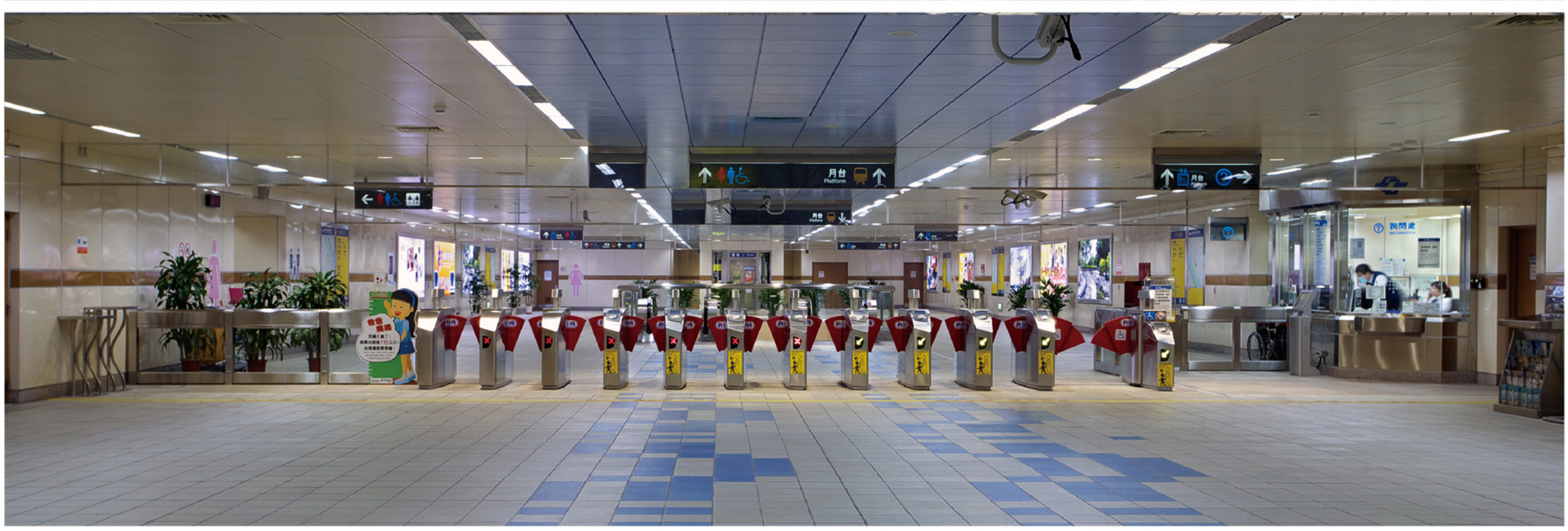
Tunnel:

- Twin-bored tunnel with an outer diameter of 5.6 m, constructed using the TBM method. The total length of TBM tunnel is 5,901 m.
- Cut & Cover tunnel: 112 m long with varied width of 11-20 m
- Precast R.C. lining

Duration: May 2002 to April 2008

Highlights:

- This is the first domestic TBM tunnel crossing underneath an airport runway and taxiway.
- Construction did not have any impact on the normal operation of Songshan Airport.



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Taiwan- Taipei Metro- The Tucheng Line (CD550)

Client: Taipei City Government

Location: New Taipei City, Taiwan

Scope of work: Civil works:

- Two underground R.C. stations, one depot and total 5,680 m of three tunnels constructed by TBM method and a section at cross-over area constructed by Cut & Cover method

General E/M systems:

- Building Services for stations, tunnels and depot, including escalators, elevators, water supply and lighting systems, fire fighting/alarm system, and low-voltage electrical distribution system
- Environment Control System, including tunnel ventilation and air conditioning system

Track works:

- Running tracks: Total length: 25 km
- Third rail installation: Total length: 27 km

System-wide E/M:

- EMU (6 train sets/36 cars), signaling, power supply, communications, automatic fare collection system and depot equipment

Duration: July 1999 to November 2007

Mass Rapid Transit | Tunnel | Underground Station

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Taiwan- Taipei Metro- The Banqiao Line (CP261)

Client: Taipei City Government

Location: Taipei, Taiwan

Scope of work:
- Longshan Temple Station: 372 m long by 21.9 m wide 2-level underground station. Excavation depth is 19 m.
- Twin-bored tunnel constructed by two EPB TBM with outer diameter of 6.1 m. The total TBM tunnel length is 3,296 m.

Duration: September 1992 to January 1999

Highlights:
- EPB TBM with articulated tail section was used because small radius in the tunnel alignment.
- The articulated joint includes 20 additional jacks to control the direction of machine during the tunneling operation.

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Taiwan- Taipei Metro- The Nangang Line (CN256)

Client: Taipei City Government

Location: Taipei, Taiwan

Scope of work:
- Sun Yat-Sen Memorial Hall Station: 256 m long by 21.9 m wide 2-level underground station with central platform. Excavation depth is 18 m.
- Twin-bored tunnel constructed by EPB TBM with outer diameter of 5.9 m. Total TBM tunnel length is 1,920 m.
- Tunnel: Precast concrete lining
- Station: R.C. diaphragm wall: 1 m thick, 34 m deep

Duration: June 1991 to October 1996

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India- Jaipur Metro

Client: Jaipur Metro Rail Corporation Ltd.

Location: Jaipur, India

Contractor: CEC

Scope of work:
- Design and Construction Contract
- A 5.8-diameter twin-bored tunnel between Chandpole and Badi Chouper Stations, plus two underground stations
- The scope of project includes approximately 1.4 km tunneling by EPB TBM method, approximately 0.4 km tunneling construction by cut and cover method, and the construction of two under ground stations by top down construction.

Duration: September 2013 to October 2016

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India- Delhi Metro (CC04)

Client: Delhi Metro Rail Corporation Ltd.

Location: New Delhi, India

Contractor: CEC-CICI JV

Scope of work: Phase III of the construction of Mukundpur – Yamuna Vihar Corridor of Delhi MRTS Design and Construction Contract

Tunnel: 3.5 km x 2 (Twin Tunnels) bored with Shield TBMs; Outer diameter: 6.4 m; Internal diameter of 5.8 m

Station: One underground station at Azadpur

Duration: February 2012 to January 2015

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India- Bangalore Metro (UG2)

Client: Bangalore Metro Rail Corporation Ltd.

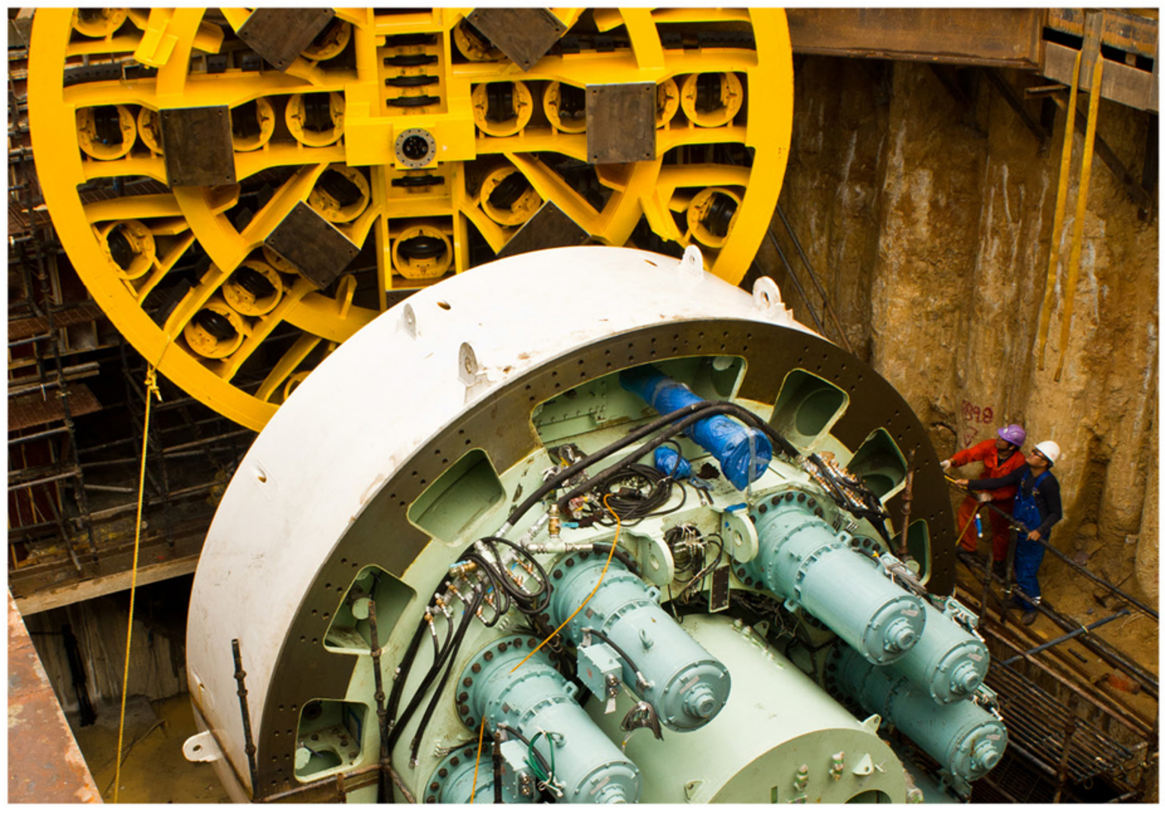
Location: Bangalore, India

Contractor: CEC-SOMA-CICI JV

Scope of work: Design and Construction Contract. Twin tunnels 6.4 m in outer diameter were bored, connecting four stations over a span of 2.5 km (total 5.0 km). Three cross-passages were dug in addition to the tunnels and two 450 m Cut & Cover tunnels connected the tunnels to viaducts at either end of the contract alignment.

Duration: March 2010 to December 2014

Highlights: This project employed the first Hard Rock Slurry TBMs of their kind to be used in India.



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India- Delhi Metro (BC-16)

Client: Delhi Metro Rail Corporation Ltd.

Location: New Delhi, India

Contractor: CEC-SOMA JV
CICI is the prime subcontractor to CEC

Scope of work: Phase II of Delhi MRTS required the design and construction of tunnels (by Shield TBM) and a station (cut and cover method) on the Central Secretariat-Qutab Minar Corridor between Udyog Bhawan and Green Park Stations.

Tunnel: 4 x 2 km (Twin Tunnels) bored with four Shield TBMs;
Outer diameter: 6.25 m

Station: Four underground stations at Race Course,
Jor Bagh, INA and AIIMS

Duration: February 2007 to July 2010

Highlights: This project is often cited by Delhi Metro Rail Corporation Ltd. as exemplary work on Delhi Metro.

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Malaysia- Kuala Lumpur Metro- KVMRT SBK Line Package C

Client: MMC GAMUDA KVMRT (T) SDN BHD

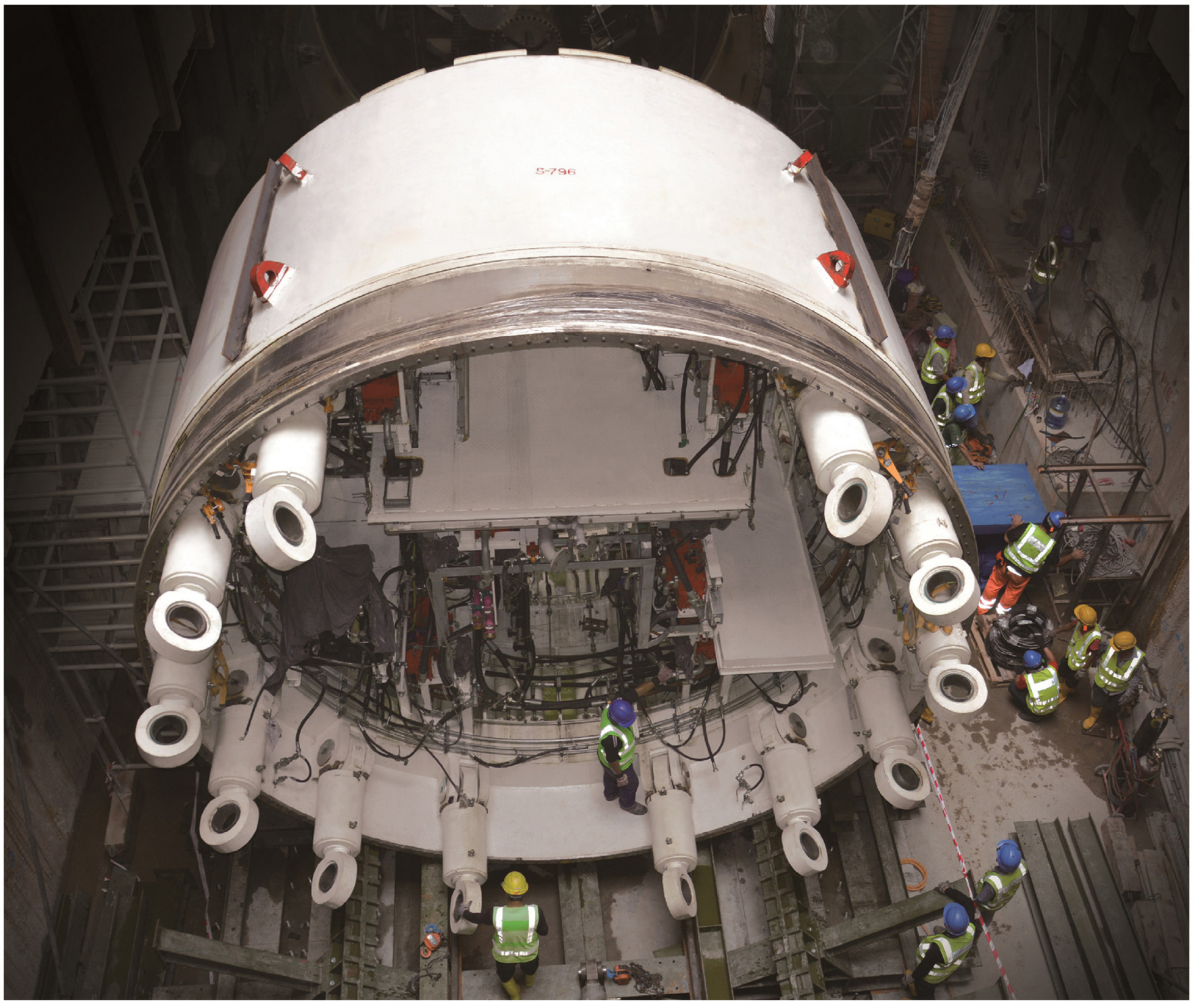
Location: Kuala Lumpur, Malaysia

Contractor: CEC International Malaysia Sdn. Bhd.

Scope of work:
- Construction 864.5 m of twin-bored tunnel (total 1,729 m) from The Pudu Launch Shaft through Merdeka Station to Pasar Seni Station
- Construction of Merdeka Underground Station
- Construction of Pudu Shaft
- Testing and commissioning

Duration: January 2013 to November 2016

Highlights:
- 35 m deep Pudu Shaft will be first used as the EPB TBM launch shaft and then converted to an Escape Shaft.
- Merdeka Station is a 3-level underground R.C. structure by Cut & Cover with bottom up construction method with excavation depth of 31.5 m.



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Taiwan- Taipei MRT Xinzhuang Line Depot- Contract CK570J

Client: Northern District Project Office, Department of Rapid Transit Systems, Taipei City Government

Location: Xinzhuang District, New Taipei City, Taiwan

Scope of work:
- Structure work of depot for Xinzhuang Line, including workshop, stabling yard, bulk-supply substation, steel platform, pedestrian bridge, and spare-parts warehouse.
- Total length of tunnel is 790 m, including 366 m of Drill & Break tunnel and 424 m of Cut & Cover tunnel. Tunnel provides a reversal track to allow MRT train into depot.
- Electrical and mechanical engineering, including power systems, lighting, fire protection, water supply, drainage, sewage systems, and ventilation system in tunnel and depot.

Duration: November 2008 to January 2021

Highlights:
- This project won the Chinese Taipei Tunneling Association's Award for Excellence in Engineering in 2014.
- The tunnel is located in the Xinzhuang fault zone and passes under two schools at a depth of 35 m. A total of 218 monitoring instruments were installed on the school campuses before construction to monitor surface settlement and building displacement. The maximum settlement is found to be only 1.65 mm.

Tunnel | Highway

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Taiwan- Provincial Road No. 9 Suhua Highway- C2 Renshui Tunnel Contract

Client: Suhua Highway Improvement Engineering Office, Directorate General of Highways, MOTC

Location: Xiulin Township, Hualien County, Taiwan

Scope of work:
- Tunnel section: length of two-way single-tube main tunnel, 2,911 m; emergency escape tunnel, 3,021 m.
- Bridge section: two parallel two-span steel-box girder bridges, each 53 m in length (width 14.6~17.22 m.)
- Embankment section: 329.2 m in length (northbound 329.2 m, southbound 93 m)

Duration: June 2014 to December 2019

Highlights:
- Drill & Blast tunnel
- The project is to construct a new route to replace the existing section of the Suhua Highway (Taiwan Provincial Highway No. 9) between 167K+720 and 171K+500.
  This route is located in the restricted area of the Taroko National Park. Most of the road sections are tunnels using Drill & Blast method.
  Once completed, the project will provide a safe and reliable highway passage between the eastern and northern regions.

Tunnel | Railway

CONTINENTAL ENGINEERING CORP
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Taiwan- Construction of Railway through Shanli Tunnel to Taitung Station- Contract CL314

Client: Eastern Region Engineering Office, Railway Reconstruction Bureau, MOTC

Location: Taitung County, Taiwan

Scope of work:
- Single-tube double-track tunnel using Drill & Break method, 5,300 m in length.
- Road work with cut-and-fill section, 2,750 m in length.
- Bridge section: four-span pre-stressed concrete bridge, 160 m in length.

Duration: March 2010 to April 2014

Highlights:
- Double-track railway tunnel.
- The construction site is located in Beinan Township and Taitung City between 147K+940 and 156K+150 of the Huadong Railway, with a total length of 8,210 meters. The project forms part of the double-track electrification project for Huadong Railway from Shanli Tunnel to Taitung Station.

Tunnel | Highway

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Taiwan- East-West Expressway, Bali Hsintien Line-C802Z Guanyin Mountain Tunnel Contract

Client: Taiwan Area National Expressway Engineering Bureau, MOTC

Location: Bali Township, New Taipei City, Taiwan

Scope of work:
- Two parallel expressway tunnels are constructed by Drill & Break method. The eastbound tunnel is 2,950 m in length, and the west bound tunnel is 2,366 m (total length 5,316 m). There are six cross-passages for passengers and one cross-passage for vehicles with a total length of 298 m.
- Four portals are constructed using Cut & Cover method with slope protection.

Duration: September 2004 to February 2009

Highlights: This project won Chinese Taipei Tunneling Association's Award for Excellence in Engineering in 2008.

Tunnel | Highway

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Taiwan- Fuxing North Road Tunnel Underpass Songshan Airport Project

Client: Taipei City Government

Location: Taipei, Taiwan

Scope of work:
- 677 m long underground tunnel including daylighting sections on both sides
- The tunnel structure is a two-cell R.C. box with two lanes each. Total width is 22.2 m and height is 7.8 m
- Pipe roof with Endless Self Advance (ESA) Method was adopted at runway section.
- Other construction methods were used for different sections including:
  1. Pipe roof with conventional supports
  2. Secant pile wall with top down construction method
  3. Cut & Cover with soil mixed pile wall
  4. Open cut with sheet piles

Duration: January 1997 to October 2007

Highlights:
- The first case in the world to underpass the airport runway under normal operation.
- The tunnel is located at airplane landing area.
- Overburden depth at runway section is only 4-5 m.
- By adopting pipe roof with ESA Method, the tunnel at runway section was successfully completed with any impact on the normal operation of the Songshan Airport.

Tunnel | Highway

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Taiwan- Southern Taiwan Second Freeway Project- Contract C348, Lantan Tunnel

Client: Taiwan Area National Expressway Engineering Bureau

Location: Chiayi County, Taiwan

Scope of work:
- Two single-tube highway tunnels: Steel lattice girders, rock bolts, and steel-fiber shotcrete are used as a temporary support system during the excavation; reinforced concrete is used as the permanent lining.
- The tunnels, each three lanes wide, are built using Drill & Break method with an excavated cross section of 170 m. The northbound tunnel is 1,212 m in length, and the southbound tunnel is 1,254.5 m.
- The project also includes a total length of 2.4 km of earthwork and five bridges.

Duration: November 1996 to September 2001

Tunnel | Highway

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Taiwan- Southern Taiwan Second Freeway, Tian-Liao~Yan-Chau Section- C377 Contract for Zhongliao Tunnel

Client: Taiwan Area National Expressway Engineering Bureau, MOTC

Location: Tianliao district, Kaohsiung City, Taiwan

Scope of work:
- Tunnel: Two parallel highway tunnels with three traffic lanes each and excavate cross-section area of 153.9 m^2. The northbound tunnel is 1,838 m, and the southbound tunnel is 1,858 m. The Drill & Break method is used. Steel ribs, rock bolts, and wire mesh with shotcrete are used as the primary support during the excavation. Cast-in-situ reinforced concrete is used for the permanent lining.
- Bridge: Three bridges with a total length of 440 m, 40 m in each span, with bridge width varying from 16.1 m to 32.2 m, are constructed with simply supported pre-stressed concrete I girders.

Duration: January 1995 to March 1999

Highway | Viaduct | Tunnel

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Hong Kong- Liantang/Heung Yuen Wai Boundary Control Point- Site Formation and Infrastructure Works- Contract 6

Client: Civil Engineering and Development Department, the Government of the Hong Kong Special Administrative Region

Location: New Territory, Hong Kong

Contractor: CRBC-CEC-KADEN JV

Scope of work:
- Site formation works for the BCP and the construction of connecting road (northern section)
- A 4.6 km dual two-lane trunk road (with about 0.6 km of grade roads, 3.3 km viaducts, and a 0.7 km tunnel) connecting Sha Tau Kok Road Interchange to BCP
- Associated environmental mitigation measures, landscaping, drainage/sewerage, waterworks, and utilities works
- Drill & blast method for tunnel construction
- Large diameter concrete bored piles of 2 m and 2.5 m will be adopted as the foundation of the viaducts
- The pre-cast segmental method to erect the pre-stressed box girder of the viaducts

Duration: June 2015 to Dec 2017

Highlights: A mega project scheduled to be completed in 30 months. The project aims to significantly improve traffic between Hong Kong and eastern Shenzhen. CEC's viaduct and tunneling track record was a critical factor for winning the contract.

Tunnel | Railway

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Taiwan- Taiwan Railway Tainan City Area Underground Project- North Section- Contract C211

Client: Railway Bureau, MOTC

Location: Tainan City, Taiwan

Scope of work:
- Construction of 1,550 m tunnel using Cut & Cover method; construction of ramps totaling 620 m in length.
- Use of both secant-piling and diaphragm wall methods.
- Construction at a distance of 2.3 m from the existing railway.
- Demolition of 128 buildings within the project area.
- Archeological investigation in the construction area for preservation of cultural heritage.
- Relocation of the railway's overhead catenary system.
- Construction of two pump stations, an emergency exit from the tunnel, and a ventilation shaft.
- Protection of the existing railway using the chemical-churning-pile method.

Duration: October 2017 to February 2023

Highlights: The Tainan Railway Underground Project in the Tainan Urban District is part of the TRA Rapid Transit Systematization project in the metropolitan area. The project is designed to meet urban-renewal needs in the Tainan Station area, integrate city transportation systems, and provide a more convenient and modern transportation system. This high-profile project has a 70-month completion period.

Tunnel | Railway | Underground Station

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Taiwan- Taiwan Railway Tainan City Area Underground Project- Southern Tainan Station Section- Contract C214

Client: Railway Bureau, MOTC

Location: Tainan City, Taiwan

Scope of work:
- One underground station
- One Cut & Cover tunnel 2,065 m in length

Duration: January 2017 to February 2023

Highlights: The project is designed to meet urban-renewal needs in the Tainan City area, integrate city transportation systems, and provide a more convenient and modern transportation system.

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Taiwan- Bihtan Bridge and Hsin Tien Tunnel

Client: Ministry of Transportation and Communications

Location: New Taipei City, Taiwan

Scope of work: Bridge:

- Arch bridge with pre-stressed concrete continuous box girder
- Northbound: 982 m long x 16.4 m wide
- Southbound: 949 m long x 16.4 m wide
- Main span: 160 m

Tunnel:

- Three-lane in both northbound (503 m) and southbound (521 m) tunnels
- 125 m^2 of cross-section area using New Austrian Tunneling Method (NATM)
- Steel ribs, rock bolts, wire mesh, and shotcrete for the primary lining, cast-in-place R.C. for the secondary lining

Duration: September 1990 to December 1996

Highlights: CEC developed "Free sliding 1500T single point slope supporting method" to overcome the difficulties of equipment installation for the Cantilever Bridge Construction Method.

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Taiwan- Taiwan High Speed Railway (C260)

Client: Taiwan High Speed Rail Corporation

Location: Changhua County, Taiwan

Scope of work:
- Design and construction of one section of the Taiwan High Speed Rail Project with total length of 36,615 m
- Seven tunnels constructed by NATM with total length of 9,141 m including the 7,360 m long Paghuashan Tunnel
- 24,358 m long bridge section with maximum span length of 80 m
- 2,897 m cut and fill section

Duration: April 2000 to June 2004

Highlights:
- Tunnels are designed as the un-drained tunnel with strong lattice girders spaced at 1-1.5 m and shotcrete of 175-350 mm thick as the primary support.
- Full-span Precast Launching Method (FPLM) using movable launching gantry was adopted for the superstructure of the typical bridges (30 m and 35 m span). Maximum rate of construction was up to two spans/day.

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Tunnel | Special Project(Cable tunnel)

Taiwan- Design & Build Contract of 345kv Power Cable TBM Tunnels of Song-Hu~Da-An、Shen-Mei~Da-An and associated M & E facilities

Client: Taiwan Power Company

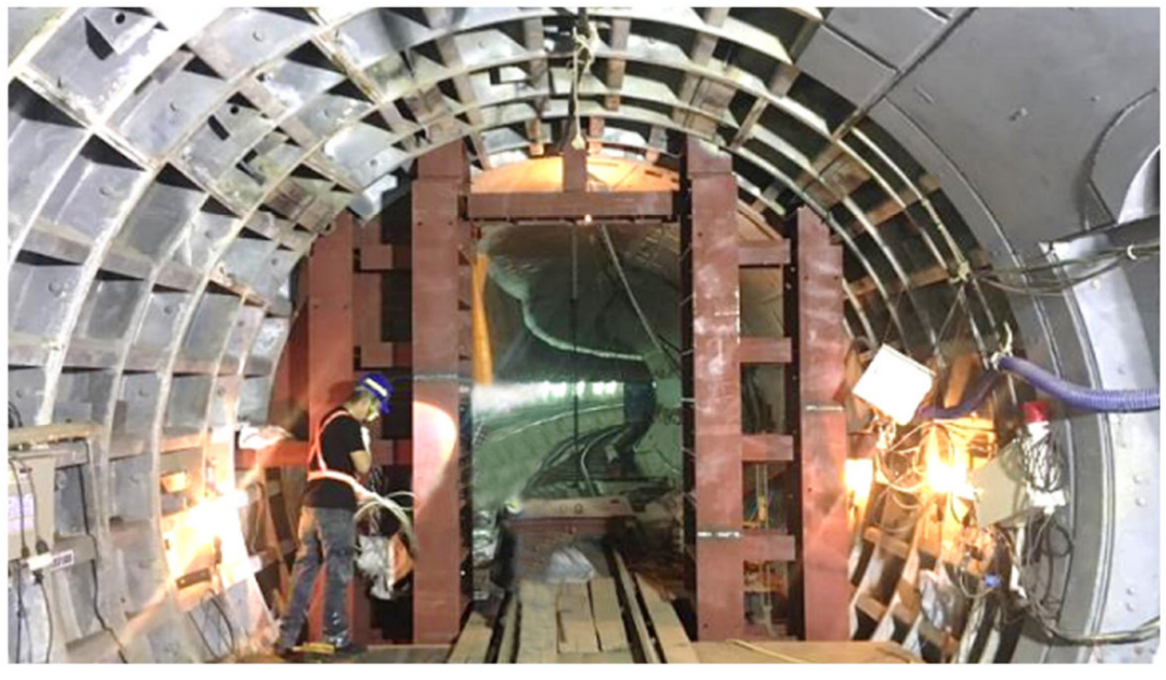
Location: Taipei City, Taiwan

Contractor: KAJIMA and CEC joint venture.

Scope of work:
- The Song-Hu~Da-An cable tunnel has an inner diameter 4.6 m and is 4,639 m in length.
- The Shen-Mei~Da-An cable tunnel has an inner diameter 5.5 m and is 966 m in length.
- The project also includes five vertical shafts, one cooling-equipment room, and associated M & E work.

Duration: October 2012 to June 2024

Highlights: The vertical shaft is located at the green median between traffic lanes. Excavation of a shaft 55.8 m deep within a small space presents a significant technical challenge. The shaft is built using the pressed-in caisson method. During construction, ground settlement and tilting remain within the safe range and the neighboring households do not have any complaints about the noise. The ground freezing method is used to facilitate excavation and construction of the cross passage connecting the tunnels, which is 50.4 m below ground.



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Hong Kong- Stonecutters Island HATS 2A

Client: The Government of the Hong Kong Special Administrative Region

Location: Kowloon, Hong Kong

Contractor: CEC-Chun Wo JV

Scope of work:
- Construction of effluent tunnel (inner diameter = 8.5 m; length = 880 m)
- Construction of connection shafts, correlated disinfection facilities, and other correlated works

Duration: June 2011 to March 2015

Hightlights: The tunnel is at 95 m below ground using drill and blast method.

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