MRT Routes Under Construction

MRT lines under construction include the Tucheng extension to Dingpu, Taiwan Taoyuan International Airport line, Circular line Phase I, Taichung MRT Wuri-Wenxin-Beitun line, Wanda-Zhonghe-Shulin line Phase I, and Xinyi eastern extension.

Tucheng Extension to Dingpu

The Tucheng extension to Dingpu starts from the west end of Yongning Station (excluded), runs west along Zhongyang Rd. sections 3 and 4, and ends at Dingpu Station. Built as a high-capacity underground system, the extension is 1.96 km in length with one station, one crossover section, and two shield tunneling sections. Shield tunnel excavation and station main structures were completed. Station finishing work was underway.

Assemblage of flood prevention deck at track insert opening

Traffic Facility Improvement Plans for Roads Near MRT Stations

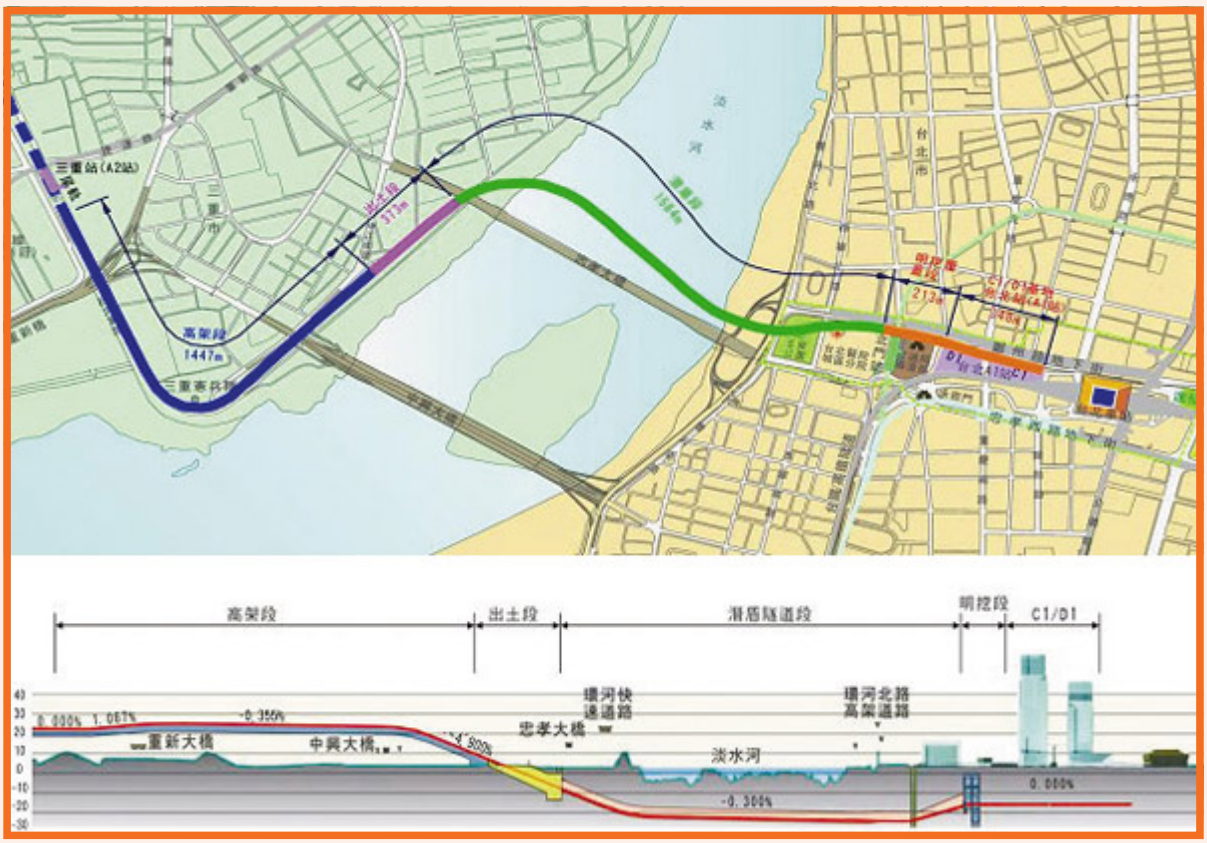
DORTS conducted the station's rehabilitation by broadening sidewalk width, adding bike lanes, adjusting road alignment and transfer facility planning, and increasing motorcycle parking demand in accordance with conclusions of meetings held by the New Taipei City Transportation Department on August 14, October 24, and December 2, 2014.

Sanchong-Taipei Section of the Taiwan Taoyuan International Airport Access MRT System

Construction of the Taipei City section of the Taiwan Taoyuan International Airport Access MRT System (hereinafter called Taiwan Taoyuan Airport MRT line) began from the temporary tail track located at the south of Sanchong Station (A2). The route runs alongside Sanchong Dike, going underground after passing over Zhongxing Bridge, following a shield tunnel beneath Zhongxiao Bridge then turning north, passing beneath the Tamsui River and continuing along both sides of the dike. After entering Taipei, it runs along the south side of Civic Blvd., passes underneath Yuquan Park and across Xining N. Rd. then runs east after intersecting with MRT Songshan line's Beimen Station. It ends at the MRT section of Taipei Main Station (A1), located on Taipei Main Station District Parcel C1 and the east part of D1, west of Taiwan Railways Taipei Main Station. It terminates on the third basement level of Taipei Main Station.

The MRT section of Taipei Main Station (A1) sits on Taipei Main Station District Parcel C1 and the east part of D1, west of the Taiwan Railways section of Taipei Main Station.

The site faces Civic Blvd. to the north, a planned 15-meter-wide road to the south, the west section of Parcel D1 to the west (bordered by Yanping N. Rd.) and the west side of the Taipei Main Station green belt to the east. Parcel C1 and the east part of D1 are separated by Chongqing Rd. Parcel C1 covers an area of 13,078 m^2, and the east part of Parcel D1 is 18,515 m^2. Two commercial buildings will be built above Taipei Main Station (A1): one a 243-meter-high, 56-story building on Parcel C1, and the other a 322-meter-high, 76-story building on the east part of Parcel D1.



Plane and longitudinal section view of the Sanchong-Taipei section of the Taiwan Taoyuan International Airport Line

1. Civil Works of the Taipei City Section from Sanchong Station to Taipei Main Station

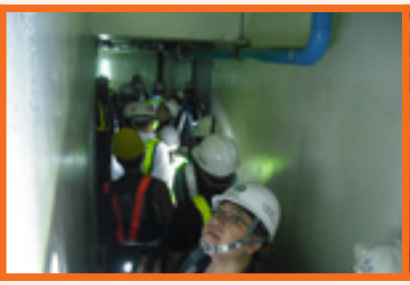
The section of the Taiwan Taoyuan Airport MRT line that runs from Sanchong Station to Taipei Main Station is 3,617 m long. It includes a shield tunnel area that runs beneath the Tamsui River and is the first of its type in Taiwan to use the double-O-tube (DOT) shield tunneling method. Under close cooperation between DORTS' North District Project Office, contractor Da Cin Construction Corporation, and Japan-based Shimizu Corporation, excavation of the 1,585-meter-long tunnel began on December 2, 2009, and was completed on December 5, 2010. Work on the full section was substantially completed on December 22, 2012.

The DOT construction method used in the shield tunnel section between Sanchong Station (A2) and Taipei Main Station (A1) was launched from the work shaft beneath Zhongxiao Bridge in Sanchong. The shield tunnel passes beneath the Huanhe

Expressway viaduct foundation and through the riverbed and dikes on both sides of the Tamsui River before entering Taipei. It then runs beneath Yuquan Park, along the south side of Civic Blvd., and under Taipei Hospital Chengzhong Branch, before ending at the west side of the MRT Songshan line's Beimen Station. The 1,585-meter shield tunnel features a maximum gradient of -4.9% with external and inner diameter widths of 11.4 m and 5.6 m, respectively. The rings, which are 30 cm thick and 1.2 m long, consist of 11 pieces of precast concrete segments in four shapes, including eight pieces labeled shape "A" and one piece each of shapes "B," "C," and "D."

Years of efforts resulted in several awards for the project, identified as Contract CA450B. Following substantial completion on December 22, 2012, in order to maintain E&M system progress work on flood gates was separated as it depended on operational resources provided by the power supply and communication systems. Preliminary and final acceptances of other work items occurred in April and July 2014. No major flaws were found during self-inspection and section inspection conducted in August by DORTS' NDPO and the Bureau of High Speed Rail, respectively. After launch of on-site work was confirmed in October, work on bottom sealing, power control, distance monitoring, and remote control for floodgates was underway. Follow-up will be conducted in conjunction with the entire line's running tests. The contract is scheduled to be completed on March 8, 2015.

Initial acceptance of work on the elevated section



Re-inspection of work on the Taipei end passageway level

Re-inspection of landscaping at the Sanchong end

Construction inspection on the tunnel section

Construction inspection on the elevated section

Construction inspection on the shield tunnel section

2. Traffic Facility Improvement Plans for Roads Surrounding MRT Stations

Transfer facilities and street layout plans for the Taiwan Taoyuan International Airport line Station A1 were reviewed by the Taipei City Road Traffic Safety Supervisory Team at its 6th task force committee meeting on June 23, 2014, and its 10315th and 10401st administrative meetings on September 26, 2014, and January 13, 2015, respectively. Taipei City Government is committed to improving traffic flow and pedestrian movement in the Taipei Main Station District. As Taipei Main Station (A1) is located in a core

area of the district, it must be integrated with surrounding traffic flow. Therefore, modifications will be reviewed and adjusted in line with the Greater Taipei West Area Gateway Plan.

3. Joint Construction of Civil Works for Taipei Main Station (A1) and JD Buildings on Taipei Main Station District Parcels C1 and D1

Civil works of Taipei Main Station (A1) were launched on December 24, 2008. There are four contracts supervised by DORTS' North District Project Office that are related to civil and architectural works, utilities and HVAC systems on B1 and the ground level of Taipei Main Station: 1. Work on diaphragm walls and vegetation relocation at Parcel C1 and the east part of D1, 2. Taipei Main Station civil works, 3. Architectural and finishing work, and 4. Taipei Main Station utilities and HVAC systems. Construction of escalators, elevators, and the moving walkway at Taipei Main Station was supervised by DORTS' Systemwide Electrical & Mechanical Project Office.

Construction of Taipei Main Station was integrated with JD buildings above Parcel C1 and the east part of D1, with a 27-meter-deep excavation and 53-meter-deep diaphragm walls. B4 will be used as a car parking lot and the remaining three basement levels will primarily be used for the terminal station of the airport line. The station will include airline departure check-in counters and provide baggage check-in and boarding pass issuance for passengers bound for Taiwan Taoyuan International Airport, making it an extension of the airport. Civil works for the Taipei City section from Sanchong to Taipei Main Station were completed and handed over to the Bureau of High Speed Rail.

A bird's eye view of Taipei Main Station (A1) taken on December 11, 2014

Stone wall at the ground level wall of Taipei Main Station (A1)

Exterior wall and raised, vaulted ceiling at atrium space with hanging plates at Parcel C1 of Taipei Main Station (A1)

Circular Line Phase I

The Taipei MRT was designed as a downtown grid-shaped network that links main arteries then radiates outward along major transportation corridors. Plans are for the Circular line to connect these radiating corridors into a circle network, thereby making transfers more convenient. Extending across Taipei and New Taipei City, the Circular line, which is 34.8 km in length with 31 stations and two depots, is being built in two phases. The first phase, which is 15.4 km in length and consists of a 1.2-kilometer underground section and 14.2-kilometer elevated section, is under construction. It starts from Dapinglin Station, passes through Xindian, Zhonghe, and Banqiao then ends at New Taipei Industrial Park Station in Xinzhuang. The route includes 14 stations: Dapinglin (Y6), Shisizhang (Y7), Xiulang Bridge (Y8), Jingping (Y9), Jingan (Y10), Zhonghe (Y11), Qiaohe (Y12), Zhongyuan (Y13), Banxin (Y14), Banqiao (Y15), Xinpu Minsheng (Y16), Touqianzhuang (Y17), Xingfu (Y18), and New Taipei Industrial Park (Y19), along with South Depot, which is located at Shisizhang.

When the Executive Yuan approved two-phase construction of the Circular line, it prioritized the first phase. In December 2004, it approved the use of private participation in infrastructure projects (PPIP) financial plans. In August 2005, Taipei County Government (now New Taipei City Government) solicited private investors. After bidders failed to pass qualification reviews, the county conducted a review in accordance with instructions from the MOTC on March 27, 2006, and suggested that construction be handled by the government itself. Modified plans, submitted in June 2006, were approved in April 2006. Based on the concept of cooperation between Taipei City and Taipei County, Taipei City Government was commissioned to construct the Taipei MRT Circular line Phase I and conduct land development.

Circular Line Phase I Station Descriptions

The Circular line will integrate with the grid-shaped network that covers downtown Taipei and other major radial transportation corridors. In the future, through the integration of E&M and ticketing systems, the route will connect to MRT lines that are already in commercial service and other planned routes as part of a comprehensive network. Clockwise from Taipei Zoo Station, it will connect with the following lines: the Wenhu line, Xindian line, Ankeng line (under planning), North-South line (under planning), Zhonghe line, Wanda-Zhonghe-Shulin line, Banqiao line, Xinzhuang line, Taiwan Taoyuan International Airport Access MRT System (hereinafter called Taiwan Taoyuan Airport MRT line), Luzhou line, Shezi line (under planning), Tamsui line, and Wenhu line. The integrated network is expected to connect nearly all corners of Taipei and New Taipei City, helping to enhance international competitiveness.

Circular Line Phase I Station Locations and Styles

Station	Name	Style	Transfer	Location
Y6	Dapinglin	Underground island platform	Transfer for the Xindian line at Station G4 paid area	On the east side of the intersection of Minquan Rd., Beixin Rd. and Zhongxing Rd., Xindian
Y7	Shisizhang	Elevated side platform		In Shisizhang area, to the east of Huanhe Rd. and Xiyuan Rd., Xindian
Y8	Xiulang Bridge	Elevated side platform	Transfer for the North-South line at Station Y44 via an underground passageway	On the east side of the intersection of Jingping Rd. and Xiulang Rd., Zhonghe
Y9	Jingping	Elevated side platform		At No. 123 Jingping Rd., Zhonghe, in front of Special Police Province Headquarters of the National Police Agency
Y10	Jingan	Elevated side platform	Transfer for the Zhonghe line at Jingan Station paid area	At the intersection of Jingping Rd. and Jingan Rd., Zhonghe
Y11	Zhonghe	Elevated stacked platform	Transfer for the Wanda-Zhonghe-Shulin line	At the intersection of Jingping Rd. and Zhongshan Rd. Sec. 2, Zhonghe
Y12	Qiaohe	Elevated stacked platform		On Bannan Rd. between Zhongshan Rd. and Qiaohe Rd., Zhonghe
Y13	Zhongyuan	Elevated stacked platform		Near the intersection of Bannan Rd. and Zhongzheng Rd., Zhonghe; close to Bannan No. 2 Bridge
Y14	Banxin	Elevated side platform		At the intersection of Banxin Rd. and Zhongshan Rd., Banqiao
Y15	Banqiao	Elevated side platform	Transfer for Taiwan Railways, Taiwan High Speed Rail, and the MRT Banqiao line	At the intersection of Xianmin Blvd. and Xinzhan Rd., Banqiao

Station	Name	Style	Transfer	Location
Y16	Xinpu Minsheng	Elevated side platform		On Minsheng Rd. Sec. 3 between Guangwu St. and Guangwu St. Ln. 50 , Banqiao
Y17	Touqianzhuang	Elevated side platform	Transfer for the Xinzhuang line	At the intersection of Siyuan Rd. and Zhongzheng Rd., Xinzhuang
Y18	Xingfu	Elevated side platform		At the intersection of Siyuan Rd. and Xingfu E. Rd., Xinzhuang
Y19	New Taipei Industrial Park	Elevated side platform	Transfer for the Taiwan Taoyuan International Airport line	At the intersection of Wugong Rd. and New Taipei Blvd., Xinzhuang

1. Civil Works

(1) Dapinglin Station Structure:

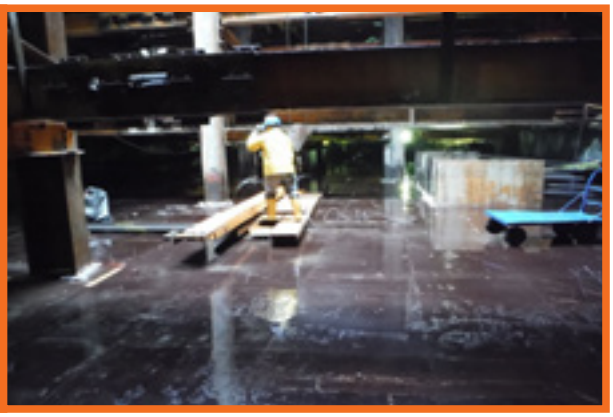
a. Construction of station structures was underway.

b. Scheduled completion progress was 74.270% and actual completion progress was 77.403%

Erecting of 1st equipment floor reinforcing bars

Completed structure at the platform level

Erecting of reinforcing bars on the south side of the 2nd equipment floor



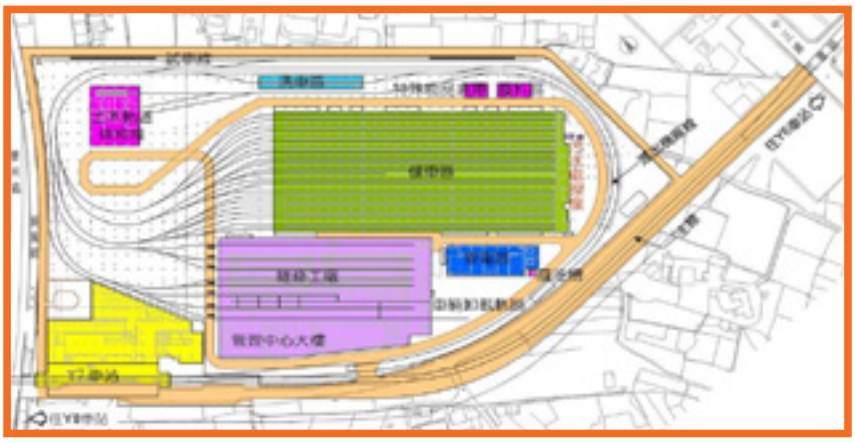
Erecting of concourse level reinforcing bars

2. Construction of South Depot, tunnel sections, daylighting sections and Shisizhang Station:

(1) Civil Works at South Depot:

a. Construction of South Depot workshop buildings and track area structure was underway.

b. Scheduled completion progress was 59.747% and actual completion progress was 62.030%



Construction of Circular Line South Depot

South Depot construction site

Construction of stabling yard structure

Construction of stabling yard structure

Construction of foundation slabs at the South Depot fan-shaped track area

(2) Civil Works at Tunnel Sections and Daylighting Sections:

a. Construction of shield tunnels, cut-and-cover tunnels, and daylighting sections was underway.

b. Scheduled completion progress was 56.774% and actual completion progress was 58.416%

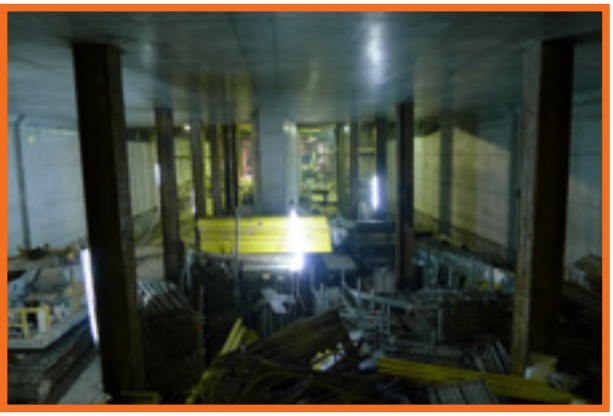
Starting pit at the shield tunnel

Completed shield tunnel down-track line

Shield tunnel arrival well flexible joint

Shield tunnel arrival well horizontal grouting

Assemblage of cut-and-cover tunnel sidewall



Completed cut-and-cover tunnel top slabs

(3) Civil Works at Shisizhang Station:

a. Construction of Shisizhang Station elevated stations and viaduct sections in front of and behind the station was underway.

b. Scheduled completion progress was 65.726% and actual completion progress was 63.771%

Steel work on elevated Shisizhang Station

Elevated Shisizhang Station platform and track levels

Shisizhang Station exit/entrance structural work

Shisizhang Station exit/entrance structural work

Elevated section passing across the Xindian River

3. Construction from Xiulang Bridge Station to Banxin Station:

(1) Civil Works between Xiulang Bridge Station (included) and Zhonghe Station (excluded):

a. Construction of Xiulang Bridge, Jingping, and Jingan stations and inter-station viaduct sections was underway.

b. Scheduled completion progress was 45.245% and actual completion progress was 40.449%

Work on Xiulang Bridge Station platform floor

Pier suspension at Jingping Station

Placement of piers and pier caps across Provincial Highway No. 64

Demolition of existing culverts on the Jingping Rd. exclusive section

Construction of the foundation steel frame on Jingping Rd. exclusive section

Placement of the foundation steel cage on the Jingping Rd. exclusive section

(2) Civil Works between Zhonghe and Banxin Stations:

a. Construction of Zhonghe, Qiaohe, Zhongyuan, and Banxin stations and inter-station viaduct sections was underway.

b. Scheduled completion progress was 57.196% and actual completion progress was 60.282%

Work on Xiulang Bridge Station platform floor

Pier suspension at Jingping Station

Placement of piers and pier caps across Provincial Highway No. 64

Demolition of existing culverts on the Jingping Rd. exclusive section

Construction of the foundation steel frame on Jingping Rd. exclusive section

Placement of the foundation steel cage on the Jingping Rd. exclusive section

(3) Construction between Banqiao and Xinpu Minsheng Stations:

a. Construction of Banqiao and Xinpu Minsheng stations and inter-station viaduct sections was underway.

b. Scheduled completion progress was 6.356% and actual completion progress was 11.406%

Earth excavation at Banqiao Station land development buildings

Construction of diaphragm walls at Xinpu Minsheng Station land development buildings

Construction of an elevated section above Banxin Rd.

(4) Construction between Touqianzhuang and New Taipei Industrial Park Stations:

a. Construction of Touqianzhuang, Xingfu, and New Taipei Industrial Park stations and inter-station viaduct sections was underway.

b. Scheduled completion progress was 35.75% and actual completion progress was 29.10%

Construction of foundation piles and incremental launching at the elevated section across the Dahan River

Steel structure work on the northbound ramp at the Xinzhuang end of Dahan Bridge

Pier construction on the elevated section along Siyuan Rd. in Xinzhuang

4. Financial Planning

Upon approving two-phase construction of the Circular line, the Executive Yuan prioritized the first phase then in December 2004 approved the use of private participation in infrastructure projects (PPIP) financial plans. Taipei County Government issued a public tender in August 2005, all bidders were disqualified though. Following a review request from the MOTC on March 27, 2006, the county suggested that construction be handled by the government and that the MOTC designate Taipei City Government as the competent authority, with DORTS in charge of the project. Taipei County Government submitted modified plans in June 2006 that were approved by the Executive Yuan on April 30, 2008. The project was given a budget of NT$40.118 billion and scheduled to be completed by the end of 2013.

DORTS began construction soon after approval. Gradually it became apparent that space limitations and environmental changes – such as the financial crisis, regulatory and policy changes, and environmental and construction difficulties – meant that the approved budget of NT$40.118 billion was insufficient. DORTS submitted modified plans on May 12, 2010, and, after receiving review results from the MOTC on August 19, 2010, conducted value engineering analysis to review the construction costs and project period. In line with new regulations enacted between April 2011 and December 2012, DORTS supplemented analysis items and related information, including estimated tax increment financing, surrounding land development profits, and estimates of self-redeeming finance based on the self-liquidation ratio.

On April 12, 2013, DORTS submitted modified project plans to the MOTC, in accordance with a New Taipei City Government proposal that the construction period be postponed from 2013 to 2015 with the same construction budget of NT$40.118 billion. The MOTC submitted the plans to the Executive Yuan on April 21, 2013.

Later, DORTS submitted modified plans (that included a construction budget of NT$69.973 billion and completion by the end of 2018) in August and December 2013 and March and May 2014, in accordance with review meeting resolutions. After the

MOTC submitted the plans to the Executive Yuan, the National Development Council held a meeting on June 25, 2014.

In accordance with conclusions reached by the council and MOTC meetings held on September 19 and October 7, Taipei City Government submitted modified plans to the MOTC on October 24 and to the Executive Yuan via the MOTC on December 8. The council was to hold a review meeting on January 14, 2015.

5. Traffic Maintenance Plans

The Circular line Phase I included three section design lots: DF111, DF112 and DF113. The traffic maintenance plan for each lot was as follows:

(1) DF111: The traffic maintenance plan was submitted and approved by the New Taipei City Road Safety Committee on May 5, 2011. Official approval documents were received on July 11.

(2) DF112: The traffic maintenance plan was submitted and approved by the New Taipei City Road Safety Committee on June 29, 2011. Official approval documents were received on August 12.

(3) DF113: The traffic maintenance plan was submitted to the New Taipei City Road Safety Committee on April 12, 2012. As DF113 included two section contracts – CF660A and 660B – that were tendered individually, a separate maintenance management plan was submitted to the New Taipei City Road Safety Committee for approval.

a. Contract CF660B was submitted to the New Taipei City Road Safety Committee on June 15, 2012, and reviewed at two task force meetings held on June 29 and September 21. The task force approved review of the contract at the monthly general meeting of the committee on September 26. Official approval documents were issued on November 21, 2012.

b. Contract CF660A was submitted to the New Taipei City Road Safety Committee for review on March 18, 2013 and approved by a committee task force on April 8. Official approval documents were issued on August 28. A proposal to modify the Huanhe Rd. ramp for Provincial Highway No. 64 was submitted to the DORTS' North District Project Office and approved on April 7, 2014.

6. Circular Line Contract Honors in 2014

(1) Contract CF641 claimed 3rd place in the DORTS' safety and health competition.

(2) Section Contract CF640 won an excellence award at the 8th Public Works Awards organized by the Ministry of Labor.

(3) Section Contract CF640 claimed 3rd place at the 2014 flood prevention drill assessment.

(4) Section Contract CF640 was recognized for its outstanding performance of zero injuries and zero severe accidents for three consecutive years.

(5) Section Contract CF640 claimed 2nd in DORTS' safety and health competition.

(6) Contract CF643A was recognized for outstanding performance when it topped Taipei City Government evaluations with 88 points.

(7) Section Contract CF640 won an extraordinary award at the 3rd New Taipei City Construction Safety Awards.

(8) Contract CF643B won an award for outstanding performance at the 3rd New Taipei City Public Works Awards on October 28.

(9) Contract CF643B scored 86 points at construction inspections conducted by Taipei City Government on August 15.

(10) Contract CF642 scored 87 points at construction inspections conducted by Taipei City Government on October 15.

(11) Section Contract CF650 won an excellence award at the 3rd New Taipei City Construction Safety Awards.

(12) Section Contract CF650 claimed 3rd place in the 2014 pre-flood inspection period public works safety inspections.

(13) Section Contract CF650 was recognized for its outstanding performance of zero injuries and zero severe accidents for three consecutive years.

(14) Contract CF651A scored 82 points in construction inspections conducted by Taipei City Government on August 13.

(15) Contract CF651B scored 82 points in construction inspections conducted by Taipei City Government on July 17.

Taichung MRT Wuri-Wenxin-Beitun Line

The planned route starts in the east from the neighborhood of Songzhu Bridge No. 2 in Beitun District, Taichung then follows a viaduct west along Songzhu Road, crosses Taiwan Railways tracks, turns left onto Beitun Road, right onto Wenxin Road, and travels along Wenxin South Road before turning onto Jianguo Road behind Chung Shan Medical University. After passing over the Huanzhong Road viaduct and running past Zhongzhang Expressway, the route goes along the north side of Taiwan Railways tracks, runs across the Fazi Creek and enters the Taiwan High Speed Rail Taichung Station area.

The project, divided into three section contracts, CJ910, CJ920 and CJ930, is taking place in Taichung's Beitun, North, Xitun, Nantun, South, and Wuxi districts. The 16.71-kilometer route is to be built as a medium-capacity transit system that includes a 15.94-kilometer elevated section and a 0.77-kilometer ground-level section. It comprises 18 stations, 16 elevated and two ground-level, and one depot. The project encompasses roads, drainage, civil works, structure, geography, architecture, land development, landscaping, signals, environmental protection, environmental control, environmental monitoring systems, elevators/escalators and tracks. The work scope of each section contract is described as follows:

1. Section Contract CJ910

The principal maintenance site of Section Contract CJ910 is located on the north side of Songzhu Rd., with the Han River to the east and Jiushe Lane to the west. It covers an area of 19.2 hectares, including a 336-meter viaduct leading to Beitun Depot and one ground-level station (G0).

2. Section Contract CJ920

Section Contract CJ920 starts west of the Han River (near Songzhu Bridge No. 2), runs west along Songzhu Rd., and turns onto Beitun Rd. after crossing Taiwan Railways

tracks. It ends near the intersection of Wenxin Rd. and Shizheng N. 3rd Rd. The contract encompasses an 8.064-kilometer route that includes a viaduct (including a pocket track) and eight elevated stations (G3-G8, G8a and G9).

3. Section Contract CJ930

Section Contract CJ930 starts from the intersection of Wenxin Rd. Sec. 2 and Shizheng N. 3rd Rd., running south from Wenxin Rd. Sec. 2 and crossing Tuku drainage at Wenxin Bridge 2 after passing Wenxin Rd. It turns onto Jianguo N. Rd. and the Daqing Rd. entrance, where Station G13 is located, and continues to run along Jianguo N. Rd., crossing over Huanzhong Viaduct and the Fazi River and passing over the Zhongzhang Expressway and across the vacant space behind Chung Shan Medical University before ending at the Station G17 tail track, which is located in a reserved area of Taiwan Railways Taichung Station. The contract encompasses an 8.69-kilometer route, including a viaduct, eight elevated stations (Stations G10-16 and G10a) and one ground-level station (G17).

Construction contracts of Taichung MRT Wuri-Wenxin-Beitun Line

4. Construction Status of Each Section Contract

(1) Section Contract CJ910: Scheduled completion progress was 12.38% and actual completion progress was 15.14%.

The Beitun Depot section contract, launched on December 31, 2012, was suspended for 204 days due to land acquisition problems. In the first schedule extension, the completion date was moved to June 26, 2018.

Miscellaneous work began on September 23, 2013 after the required building permit was acquired on July 19 of the same year. By the end of 2014, 1,299 meters of sewage pipes, 1,230 meters of drainage culverts, 2,373 meters of retaining walls, 32 pieces of cut-and-cover tunnel decks, 164 columns, and 27 slates were completed. Work finished on the viaduct included the full lower structure and, on the upper structure, three on-site cast girder spans and 1,229 tons of steel structure for the north stabling yard. Construction site ground leveling and road work were underway. After the acquisition of a building permit on May 29, foundational work on Station G0, the principal maintenance depot and the administration building began.

Construction of a cut-and-cover tunnel

Fan-shaped segments of the principal maintenance depot

Foundational work on the bulk supply substation

Construction on the north stabling yard

(2) Section Contract CJ920: Scheduled completion progress was 30.11% and actual completion progress was 32.79%.

Work on Section Contract CJ920, which consists entirely of an elevated MRT design, began on March 15, 2013. Fences were erected surrounding each construction site. By the end of 2014, 310 well foundations, 200 pier caps, 121 precast-girder viaduct spans (242 pieces), 10 on-site cast girder spans, and seven steel box girder units were completed. Work on two on-site cantilever girders was underway.

Precast girder work at elevated sections between Chongde Rd. and Rehe Rd.

Viaduct girder work between Changping Rd. and Xingan Rd.

Steel structure placement of Station G06, located between Hebei and Chongde roads

Elevated precast girder placement between Qingde and Shanxi roads

Completed viaduct structure between Chongde 2nd Rd. and Qiaoxiao St.

Steel box bridge deck work on the depot branch line

(3) Section Contract CJ930: Scheduled completion progress was 24.24% and actual completion progress was 28.48%.

Work on Section Contract CJ930, which consists entirely of an elevated MRT design, was launched on March 1, 2013. Construction fences were erected and work began at all construction sites apart from two locations where land was not yet acquired – a turn section at Station G12-13 and a roadbed culvert segment. By the end of 2014, 312 foundation piles, 228 foundations, 208 piers, and 165 pier caps were completed.

Work on the bulk supply substation and entrances/exits at Stations G12, G14 and G15 began, and steel structure production was on schedule. Several sections of station steel anchors and steel piers were completed and installation of follow-up steel pier caps, track girders, and platform girders was underway. Production of precast U-shaped girders continued, with 198 girders completed and 89 put into place. Work continued on installation of girders using the balanced cantilever method and on-site support bridge method.

Steel rail girders at Station G16

Steel rail girders at Station G15

Steel rail girders at Station G14

Precast girders at an elevated section between Wenxin S. 6th Rd. and Yongchun E. Rd.

Platform steel girder plate work at Station G12

Raft foundation work at Station G12

On-site cantilever girder placement along Dadun 11th St.

(4) E&M System Contract CJ900: Scheduled completion progress was 8.05% and actual completion progress was 5.22%.

Work began on System Contract CJ900 on April 21, 2011, after the contract was awarded on March 9 and signed on April 1 of the same year. The substantial completion date was scheduled as October 3, 2017. According to the contract, E&M parameters were provided to the consultancy responsible for detailed civil engineering design 60 days, 90 days and 120 days after work began.

An EMU model on display

Conceptual design reviews of train operation monitoring and control system and depot maintenance facilities were underway. Detailed design reviews of EMU, power, communications and automatic fare collection systems were underway. A full-sized EMU model was delivered to Taiwan Rolling Stock Co. on October 13 and displayed in the square of Taichung City Hall's Huizhong Building from November 9 to December 7.

5. Amendments to Mid-term and Long-term Plans

Following the 2nd meeting held by the Bureau of Taiwan High Speed Rail to discuss amendments to mid-term and long-term plans for the Taichung MRT Wuri-Wenxin-Beitun line on January 28, 2014, DORTS sent supplemental programming schedules and reasons for delays of each work item to Taichung City Government on February 11 of the same year. DORTS, Taichung City Government, and the Bureau of Taiwan High Speed Rail continued joint discussion. For extension of the Taichung MRT general consultancy contract, Taichung City Government sent a document on June 27 requesting that DORTS consider future manpower demands for land acquisition (land administration), operational strategy analyses (transportation planning), and project management. On September 4 DORTS signed an extension to the general consultancy contract that brought the service period to March 8, 2016. Periodic assessment of entrance/exit location was incorporated into the service scope and reviewed at meetings held on November 6 and December 18, 2014, and January 8, 2015.

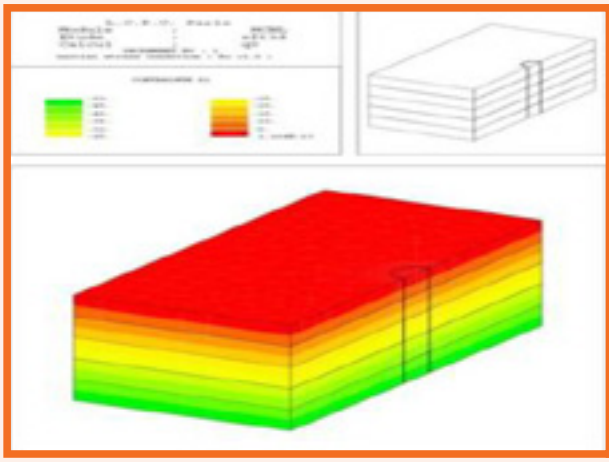
A Quieter, Cleaner, Faster Well Foundation Plan

1. Improving Efficiency and Work Environment of MRT Well Foundation Construction

In order to improve the work efficiency and working environment of well foundation construction on the Taichung MRT CJ920 Contract, an investigation of the entire work process took place (including excavation, retaining wall structure and structural work). Past experience showed that excavation and retaining wall construction would hamper overall progress. Traditional retaining wall construction employed shotcrete – a noisy technique prone to dust creation. Disruption to the environment surrounding the construction site could contribute to dissatisfaction among local residents. Their

opposition would potentially lead to uncertainties and affect construction quality, pipeline diversion plans, workspace and scheduling.

In its desire to balance work efficiency and minimize construction impact, the Central District Office of DORTS began to research improvements. After weighing worksite geological factors and shield tunnel experiences gained on past MRT projects, it decided on a cast-in-place concrete retaining wall plan. This standardized, systematic technique significantly increased construction efficiency and quality while minimizing noise and dust. Besides contributing to energy saving and carbon emission reduction initiatives, it led to a better, safer and more efficient work environment. As a pioneering technique in Taiwan, future construction teams can use it as a model.



Finite element method analysis of well foundation stress

Well foundation retaining wall

2. Construction Methods, Process and Costs

A geological survey of the Taichung MRT CJ920 Contract worksite showed alluvium and gravel levels, with groundwater located 2 m – 40 m beneath the surface. The ground was seen as having a high self-supporting capacity and not prone to soil liquefaction. A well foundation (diameter 5 m – 8.5 m and depth of 12 m – 18 m) was therefore adopted for elevated sections. Advantages of this foundation design included use of cranes to avoid power and telecommunication lines. It minimized traffic impact by limiting road space requirements. For aesthetic purposes, this was also the first time that platform door design utilized all-glass, frameless doors.

(1) Construction Methods and Innovations

Well foundation construction can generally be divided into three stages: excavation, retaining wall construction, and structural work. Traditional retaining wall construction techniques involve ring-type steel beam, wire mesh, and shotcrete reinforcement. Since density variations are common in shotcrete, however, the chances of water seepage, slumping and piping are high. Shotcrete is also noisy and prone to dust creation, which can disturb the construction site environment and contribute to dissatisfaction and a backlash from local residents. For these reasons, construction teams conducted an investigation at the office's request. After considering manpower, machinery and tools, materials, and efficiency, as well as past shield tunnel experience on underground MRT sections, they agreed to replace shotcrete with cast-in-place steel sheath and wire mesh techniques. Standardized, systematic cast-in-place concrete would be

manufactured to specification and adopt a thin-wall cylinder configuration for uniform stress. The steel sheath would serve a temporary retaining and internal grouting function. Following installation of the steel screen, a pump truck would backfill concrete between the sheath and excavation surface to the desired depth. The technique, which had never been conducted in Taiwan, was similar to top-down construction. By reducing noise and dust, it was expected to create a better work environment that was safer and more efficient.

(2) Work teams overcame challenges through on-site testing. Innovative solutions and strategies are summarized as follows:

a. Sliding Form: The original plan, which called for stage 1 steel mold concrete pouring to be followed by excavation and linking of a set of steel mold rings before stage 2 work commenced, would have required two steel rings for each well foundation. Time, cost and ring quantity considerations led to the replacement of this double ring configuration with a single, sliding form steel ring. Uniform stress of the thin-wall cylinder allowed work quality to be maintained and scope expanded. It was a pioneering, innovative method that significantly raised efficiency.

b. Level Access: The high quantity of well foundation structures led to frequent level changes for workers. Original planning, for the workers to be transported via crane, quickly proved inconvenient and inflexible due to the excessive time needed to move the cranes. Following review, tenon joints were fitted into the foundation walls for workers to ascend and descend. These could be adjusted depending on the depth of the well foundation. Their flexibility significantly enhanced work efficiency.

c. Piers: Limited workspace posed another challenge. To maintain traffic, well foundations with diameters of 5, 6 and 8.5 m were surrounded by fencing with a width of 12 m. Some of these well foundations were located directly in traffic corridors. To increase space for traffic, work teams decided to place piers inside pre-excavated well foundations. This allowed for less tearing down of fences and traffic route adjustments, contributing to improved efficiency and lower direct costs.

d. Shear Tenon: Since well foundation walls made using steel molds are smoother than those using shotcrete, in order to increase frictional force, a grouting hole was added every 1.5 m up on the steel mold rings. When the walls were completed, these grouting holes were converted into shear tenons to enhance structural binding.

e. Scaffolding: When conducting well foundation steel bar binding, workers limited to the well opening had difficulty changing levels. Following on-site simulation and research, work teams proposed the "transformer" plan, which involved making the scaffolding adjustable. Besides increasing workspace, this reduced the risk of falls by workers, improving both efficiency and safety.

f. Pouring Equipment: Originally, a concrete pump was to be used for backfilling concrete. Since work was taking place at night in a dense urban area, however, there were concerns about the impact of pump noise. Work teams therefore decided to rely on gravitational acceleration along with large diameter PVC piping. On-site measurements showed that the noise resulting from this method complied with environmental protection laws, and complaints were reduced.

g. Pumping Well: In areas where the underground water was relatively high, original planning called for use of an artificial retaining pile method for pumping wells.

After considering the high self-supporting capacity of the worksite geology, overall safety and efficiency, however, work teams decided on an all-casing method. As the first time this method was used for pumping wells in Taichung, it represented a breakthrough in terms of safety and work results.

(3) Budget and Manpower for Each Stage:

After devising the new well foundation plan, before construction started work teams commissioned local experts to conduct feasibility studies. In terms of mechanics, they used finite element method analysis in order to quantify the best design measurements and determine the most cost-effective strength and thickness of back-filled concrete. To validate design results, they tested theories in an area outside the worksite with similar geology. Experimental results enhanced initial strategies and guidelines relating to manpower, machinery/tools, materials, equipment, and method. Initial design and in situ experimentation took about two months, and the experimental cost was approximately NT$1.9 million. Despite high early outlays in terms of manpower, materials and time, expected benefits, such as reduced noise and dust creation and fast progress, were achieved. Residents who lived near the construction site offered greater support and approval. By applying scientific and mathematic principles, this new plan fulfilled efficiency promises. Progress was on schedule, quality was up to par, costs were in line with expectations, there were no safety concerns, and the work environment was maintained. Overall, the project item was a success.

3. Actual (Forecast) Benefits

(1) Cost-Benefit Analysis (5Ms):

a. Manpower: The new plan involved installation of wire mesh formwork placement concrete pouring lower ring work. It was a relatively straightforward process with a low knowledge threshold. Workers were easy to recruit and manpower adjustments could be made based on requirements at each stage. Labor costs were reduced 30-40 percent compared to the shotcrete plan.

b. Machines: Only common machinery and tools were needed. By eliminating the need for specialized equipment, there were no concerns about a handful of suppliers driving up costs and the process could be replicated in remote areas with limited supplies. Savings were approximately 50%.

c. Materials: The steel molds for use in cast-in-place concrete could be reused, unlike the steel beams of the original plan, which had to be left in the foundation. To aid conservation, the molds were recycled following item completion.

d. Money: Implementing the original shotcrete method in an urban zone would have required significant fees to meet health and environmental requirements, not to mention problems associated with complaints from local residents. By reducing noise and dust creation, the new plan made health and environmental fees commensurate with typical projects.

e. Methods: With work taking place in a congested urban area, there were several benefits to the small well foundation sections and workspaces required for cast-in-place concrete retaining walls. Additional room for movement of machinery during foundation excavation meant work could commence over an expanded area. Resources could be concentrated to reduce construction time and impact on the surrounding environment. Shorter time for equipment manufacture and labor made

it easier to expand resources and accelerate progress depending on scheduling needs. The impact of non-controllable factors on the overall project was lowered, allowing builders to avoid additional costs associated with delays.

(2)Single Well Foundation Work Rate Analysis

The original shotcrete method to be used for the well foundation retaining walls would have resulted in less stable walls. Each level would have required two applications, which would have doubled the work period compared to the cast-in-place concrete method. As for pit hole protection and steel bar binding, since work teams had already devised a work path and binding procedures, further time savings were expected. Overall, the new cast-in-place concrete plan reduced the project item work period by about a third. Since it was a relatively straightforward process with a low knowledge threshold, workers were easy to recruit. Depending on needs, the method could quickly be applied on a large scale. Ease of time management allowed the project item to be completed on time and up to quality standards.

Work Rate Estimate (Well Foundation L = 12 m)	Original Shotcrete Wall Method	Cast-in-Place Concrete Wall Method
Pit Hole Protection Measures	3	2
Machine Excavation and Retaining Wall Support	Excavation of 0.8 m/dig meant 15 digs and 15 rounds of shotcrete. With a half-day each for a dig/shotcrete, required work period was 15 days	Excavation of 1.5 m/dig meant eight digs and eight rounds of concrete backfill. With a half-day each for a dig/backfill, required work period was eight days
Foundation PC Placement	1	1
Steel Bar Binding	2	1
Main Structure Concrete	1	1
Back-fill	0.5	0.5
Miscellaneous	0.5	0.5
Total (Days)	23	14

(3) Quality, Cost, Delivery and Safety:

a. Quality: The difference between retaining walls constructed using the new cast-in-place concrete method and the original shotcrete method lay in the difference between ready-mix concrete and concrete conveyed through a hose. Since material source and quality were easier to control with cast-in-place concrete, construction quality was better. Variables (water seepage, slumping and piping) were significantly reduced. Cast-in-place concrete also lowered noise and dust creation, reducing dissatisfaction and complaints from city residents.

b. Cost: While there was little direct cost benefit from this new method, better progress and quality led to savings of 30-40% on indirect costs, such as manpower, machinery, safety and health, and environmental protection. It also protected fair budget practices by preventing subcontractors from citing project scale in an attempt to inflate prices.

c. Delivery: The new well foundation plan paved the way for use of the cast-in-place

concrete method, a standardized, systematic technique that could be conducted according to specifications. Ease of applying the method quickly on a large scale saved valuable time that could be applied to other challenging tasks. Contractors avoided extra costs associated with project delays while better ensuring safety. Local residents, who could see more work and progress underway, became more supportive of city construction.

d. Safety: Since cast-in-place concrete is denser and stronger than shotcrete, the completed surface had a high self-supporting capacity. By reducing uncertainties, it provided a safer working environment. It also benefitted people in areas near the construction site by offering better protection against collapse or damage to nearby roads.

Wanda-Zhonghe-Shulin Line Phase I

The Wanda-Zhonghe-Shulin line (Wanda line for short) will be implemented in two phases. Phase I, which comprises basic design, urban rezoning, land acquisition, detailed design, and tendering, started in 2010. Phase II, which comprises surrounding land development and financial planning, started in 2012.

Phase I: The section runs underground from Chiang Kai-Shek Memorial Hall Station then turns west along Nanhai Rd. It crosses Heping W. Rd. then follows Xizang Rd., turns onto Wanda Rd. then turns left to pass beneath the Xindian River before reaching Huazhong Bridge. It runs along Baoshun and Baosheng roads then turns onto Zhongshan Rd., Liancheng Rd., and Jincheng Rd. A depot will be built in an agricultural area to the north side of Jincheng Rd. and a branch line station will be built near Juguang Rd. The 9.5-kilometer route consists of an 8.8-kilometer main route and a 0.7-kilometer branch line with nine underground stations and one depot.

Wanda-Zhonghe-Shulin Line Route Map

1. Financial Planning

Amended financial plans for the Wanda-Zhonghe-Shulin line Phase I were submitted to the MOTC for review on November 9, 2011. After a consensus was reached following two meetings held by the finance and budget departments of both Taipei City and New Taipei City governments on May 29 and June 27, 2013, the plans were reviewed and passed by representatives from both cities at the 5th meeting of the Taipei MRT Project and Surrounding Land Development Advisory Committee on August 5. Following further review by the MOTC on May 16 and November 25, 2013, and March 13, 2014, the plans were submitted to the Executive Yuan on March 28, 2014. After the National Development Council conducted a review meeting on May 26, 2014, and passed the plans

at its 6th committee meeting on August 18, 2014, the Executive Yuan gave final approval on September 23, 2014.

2. Urban Rezoning

(1) Urban rezoning for New Taipei City MRT facilities:

a. New Taipei City Government publicly announced on August 24, 2011, that urban rezoning plans would be displayed for 30 days starting August 30, 2011.

b. After review at 12 task force meetings held on October 7, December 2 and 15, 2011, and February 3 and 16, April 27, May 25, August 7 and 23, October 18, and December 13, 2012, and March 18, 2013, the plans were passed at the New Taipei City Urban Planning Committee's 33rd meeting on May 23. After review in four task force team meetings held on September 5 and December 12, 2013, and January 7 and March 21, 2014, the plans were approved by the MOI Urban Planning Committee at its 821st and 827th meetings held on February 18 and May 13, 2014, respectively. As the meeting resolution was different from the original public display, rezoning plan display and public hearings were conducted again in accordance with urban planning regulations. On December 30, 2014, New Taipei City Government publicly announced that urban rezoning plans would be displayed for 30 days starting on January 9, 2015.

(2) Urban rezoning for New Taipei City MRT facilities:

a. On November 25, 2011 Taipei City Government publicly announced that urban rezoning plans would be displayed for 30 day starting on November 28, 2011.

b. After review in four task force team meetings and one task force commission meeting together with on-site surveys held on March 15, April 27, and May 29 (on-site survey), 2012, and August 12, 2013, and March 11 and September 16, 2014, the plans were passed at the Taipei City Urban Planning Committee's 664th meeting held on October 23, 2014.

c. After submission to the MOTC on December 8, 2014, the MOI Urban Planning Committee's 844th meeting made the following conclusion: Negotiation with landowners of Station LG01 should be conducted as soon as possible and rezoning plan display & public hearings should be conducted.

3. MRT Station Planning

(1) Station locations:

a. Station LG01: Near the intersection of Roosevelt and Nanhai roads, Taipei (transfers are available for the Tamsui-Xinyi line and Songshan-Xindian line)

b. Station LG02: Near the intersection of Nanhai and Heping W. roads, Taipei

c. Station LG03: Located near the intersection of Xizang and Zhonghua roads. (Original planning was for the station to be located at the Xizang-Zhonghua intersection. During rezoning, landowners strongly opposed to expropriation or land development participation asked that public land for MRT facilities be prioritized. After the Taipei City Urban Planning Commission requested a public land alternative, DORTS decided to move the station 370 meters to the east on Zhongyi Elementary School land. The Interior Ministry's Urban Planning Commission was reviewing rezoning plans.)

d. Station LG04: Near the intersection of Wanda and Changtai roads. (The station was originally planned to be located at the intersection of Wanda Rd. and Dongyuan

St. However, during urban rezoning, some landowners strongly opposed land expropriation or participating in land development and requested that public land be prioritized. The Taipei City Urban Planning Committee concluded that DORTS should draft an alternative plan. Therefore, the station was to be built 85 meters north of its original site on public land belonging to Dongyuan Elementary School. The MOI Urban Planning Committee was reviewing rezoning plans.)

e. Station LG05: On Baosheng Rd. in front of Yongping Elementary School, Yonghe District, New Taipei City

f. Station LG06: Near the intersection of Liancheng and Jinping roads, Zhonghe District, New Taipei City (transfer available for the Circular line)

g. Station LG07: Near the intersection of Liancheng and Jinhe roads, Zhonghe District, New Taipei City

h. Station LG08: Near the intersection of Liancheng and Yuanshan roads, New Taipei City

i. Station LG8A: On MRT depot land located to the south of Juguang Rd., Zhonghe District, New Taipei City

4. Traffic Maintenance Plans

The Wanda-Zhonghe-Shulin Phase I included four design lots: DQ121, DQ122, DQ123 and DQ124. The traffic maintenance plan for each section design lot is as follows:

(1) DQ121: As Station LG02 involved preservation and relocation of botanical garden historic relics, to avoid schedule delay, station construction had to be launched ahead of schedule. Corresponding traffic maintenance plans were reviewed at the 10,318th administrative meeting held on November 4, 2014.

(2) DQ122: Traffic maintenance plan negotiation meetings for the Taipei and New Taipei City sections were held on July 26 and August 27, 2013, respectively. After pipelines and land acquisition were confirmed, the plans were submitted to the agencies responsible for traffic safety (the Taipei and New Taipei City traffic supervisory teams) for review.

(3) DQ123: After review at meetings held by the Taipei and New Taipei City traffic supervisory teams on February 6 and July 4, 2014, the traffic maintenance plan was approved.

(4) DQ124: A traffic maintenance plan negotiation meeting was held on September 17, 2013. After pipelines and land acquisition are confirmed, the plans will be submitted to New Taipei City traffic supervisory team for review.

(5) Starting in 2014, traffic maintenance plans for main structure construction were submitted to the New Taipei City and Taipei traffic supervisory teams for review and coordination. Traffic maintenance plans for Section Contract CQ850, covering Stations LG06, LG07 and LG08, located on Liancheng Rd., Zhonghe District, New Taipei City, were approved at the New Taipei City traffic supervisory team meeting held on October 6, 2014.

5. Construction Status

Work on Taipei Section Contract CQ842, covering shield tunnel civil works at Stations LG02, LG02-03, and LG02-01, was launched on December 11, 2014. Work on New Taipei

City Section Contract CQ861, covering Station LG06, was launched on December 2, 2014.

Xinyi Eastern Extension

Plans are for the route to extend from the Xinyi line's Xiangshan Station (R05) and run along Xinyi Rd. Sec. 6. Station R04 will be located between Lane 26 and 76, and Station R03 and a crossover will be located in front of Guangci Care Home on Fude St. A shield tunnel will extend east from Fude St. along Dadao Rd. and Zhongpo S. Rd. before ending at Yucheng Park. The 1.54-kilometer extension includes two underground stations and a tail track for operational train dispatch.

1. Financial Planning

Amended financial plans for the Xinyi eastern extension were submitted to the MOTC on November 15, 2011. Following review by the MOTC and the Executive Yuan, DORTS further amended the plans and resubmitted them to the MOTC on December 25, 2013. The MOTC then submitted the plans to the Executive Yuan on February 20, 2014, for review by the National Development Council. DORTS then made additional modifications in accordance with review results then submitted the plans to the central government on May 23. Approval was received on September 24, 2014.

2. Urban Rezoning

(1) On December 6, 2011, Taipei City Government publicly announced that urban rezoning plans would be displayed for 30 days starting December 7, 2011, and a public hearing would be held at Song Shan High School of Commerce and Home Economics on December 21, 2011.

(2) On January 19, 2012, the Taipei City Urban Planning Committee, in its 632nd meeting, requested that the plans be reviewed by a task force.

(3) The plans were reviewed at five task force team meetings held by the Taipei City Urban Planning Committee on March 16, June 7, and July 9, 2012, August 1, 2013, and February 21, 2014 (including one on-site survey). They were approved at the 661st meeting held on July 24, 2014.

(4) The plans were reviewed by the Ministry of Interior Urban Planning Committee at its 838th meeting held on October 28, 2014. The following conclusions were reached: 1. DORTS should communicate with petitioners to the MOI by January 2015, 2. The plans should be resubmitted to the MOI following amendment. On December 10 and 11, 2014, DORTS held two discussion meetings with petitioners to the MOI.

3. MRT Station Planning

Station locations:

a. Station R04: Located beneath Xinyi Rd. Sec. 6 between Lanes 26 and 76

b. Station R03: Located beneath Fude Rd. in front of Guangci Care Home

4. Traffic Maintenance Plan

The first review of the traffic maintenance plan was completed in conjunction with detailed design operations. Follow-up detailed design, traffic maintenance planning, and departmental coordination will be conducted after land acquisition procedures for MRT facilities are completed.