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## *An Overview of Hong Kong's First Express Rail Link Project*

Presented by Fung Wai Chung\*

Senior Liaison Engineer

MTR Corporation

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The Australian Consulate General, Hong Kong, "The Wombat Hole" 24/F Harbour Centre,  
25 Harbour Road, Wanchai, Hong Kong

Following an introduction by EAHK President Scott Smith, MTR Corporation's Senior Liaison Engineer, Fung Wai Chung proceeded to entertain and inform an audience of 50 Members and Guests with an overview of the design and construction of the Guangzhou-Shenzhen-HK Express Rail Link (Hong Kong Section) Project currently being undertaken by the MTR Corporation.



**Overview:** The Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) is part of the 16,000Km National High-speed Rail Network. The Mainland section of the XRL is 124Km long and contains four stations. The Hong Kong section is 26km long and operates in its own dedicated tunnels which are constructed by TBM and Drill & Blast Method. The Hong Kong Section of the XRL is designed to operate at a maximum speed of





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200km/hr. Although the current definition of High Speed Rail is for trains traveling at 300km/hr, we still call it High Speed Rail because of its capability to run at 300km/hr – the China section will run at the higher speed. In addition to its terminus located in the core area of West Kowloon, stabling sidings are located at Shek Kong.



**In Detail:** Wai Chung then went on to describe the rail link using a set of slides that covered the following areas:

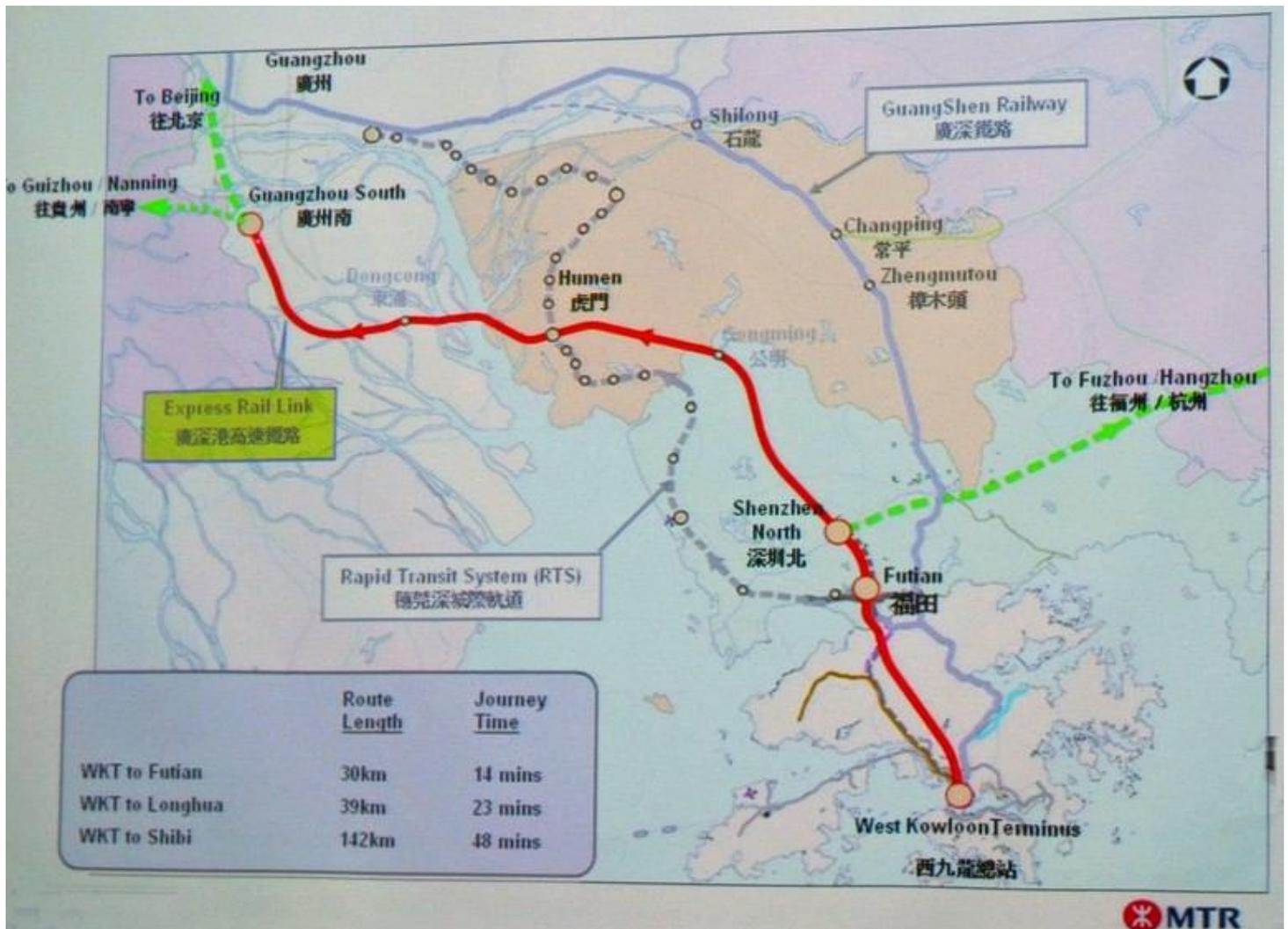
**An overview of the National High-speed Rail Network.** This covers around 16,000Km essentially in a layout of four north-south and four east-west lines, connecting 16 major cities directly. With this new link, Hong Kong can connect with these cities which represent a significant portion of China's population. There will be significant economic benefits arising from this link to Hong Kong.

**Details of the Guangzhou-Shenzhen-Hong Kong Rail Link.** The Line terminates at the Guangzhou South Station with connections on to Beijing and Guizhou / Nanning. Other mainland stations are at Humen, Shenzhen North and Futian which also link to other high speed rail networks and local passenger lines to many parts of the Pearl River Delta region, which will become accessible within one hour from Hong Kong. Within four hours we can



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go to the Wuhan region. The line proceeds through Hong Kong's New Territories to terminate at the West Kowloon Terminus. The journey time from West Kowloon to Futian is 14 minutes, Shenzhen North (Longhua) is 23 minutes and Guangzhou South (Shibi) is 48 minutes.

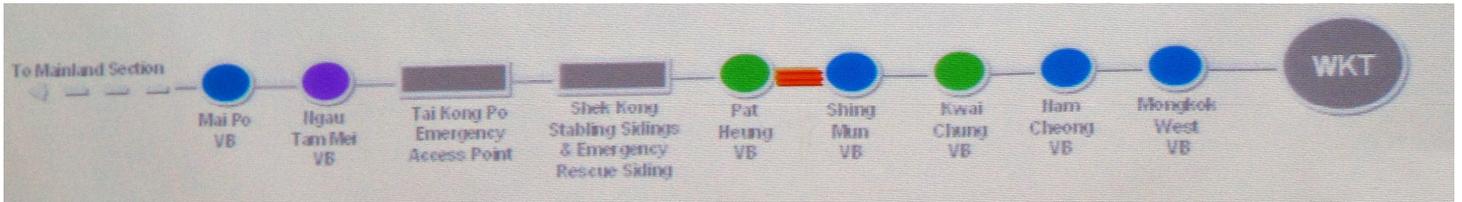


The Hong Kong Section is 26Km in length and operates in dedicated railway tunnels. The maximum operating speed in HK is 200km/hr with a maximum design speed of 250Km/hr. The underground terminus at West Kowloon has 6 short haul and 9 long haul platforms. Stabling Sidings and Emergency Rescue Siding are located at Shek Kong. Level 1 and 2 maintenance may be done in Hong Kong with heavy maintenance done on the Mainland side. There are 7 Ventilation Buildings and 1 Emergency Access Point. The Hong Kong Fire



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Services Department has imposed a one train per tunnel section rule and this is the reason why there are more ventilation buildings.

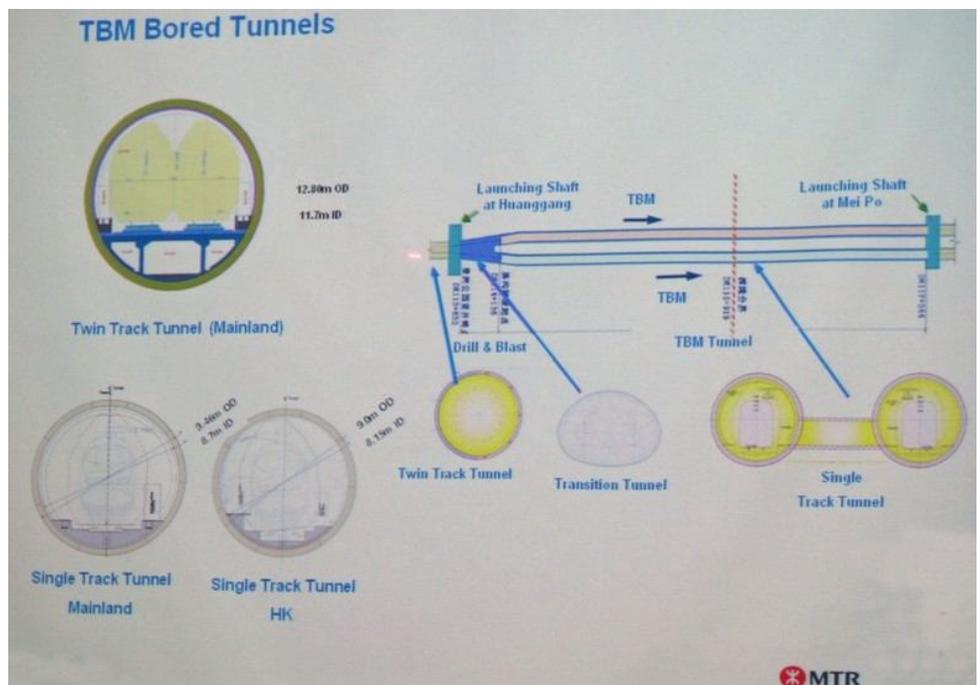


**Overall Project Progress.** Excavation is progressing on the West Kowloon Terminus and concreting for the basement slab is underway. 3 Tunnel Boring Machines (TBMs) – Mai Po and Nam Cheong (S/B & N/B) are in operation. Tunnel blasting activities are occurring at 4 work sites – Kwai Chung, Shek Yam, Pat Heung and Tai Kong Po. All major E&M contracts have been awarded including those for Rolling Stock and Signaling.

**Tunnel Alignment and Facilities.** Tunnel Boring Machines, Drill & Blast and Cut & Cover construction methods are used for different sections.

**Major Tunnel Contracts are:** 820 – Mei Lai Road to Hoi Ting Road, 821 – Shek Yam to Mei Lai Road, 822 – Tse Uk Tsuen to Shek Yam, 824 – Ngau Tam Mei to Tai Kong Po, 825 – Mai Po to Ngau Tam Mei, 826 – Huanggang to Mai Po. Tunnels are some 250meters apart with emergency (cross passage) access tunnels installed, as required by the Fire Services Department.

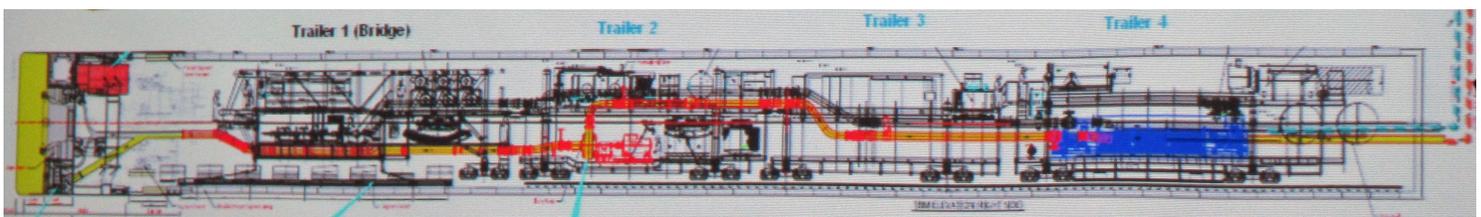
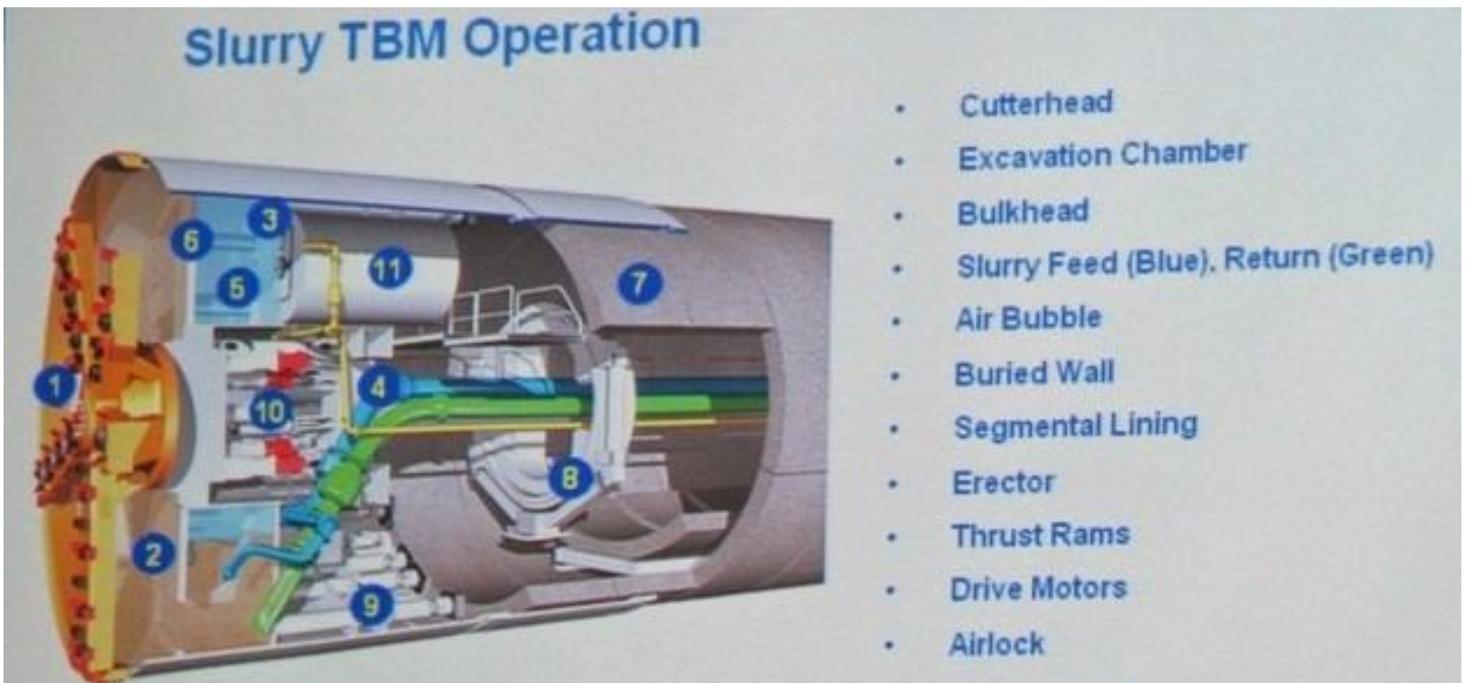
**TBM Bored Tunnels.** On the Mainland, a Twin Track Tunnel design is used with 12.80m OD and 11.3m ID. For Hong Kong, starting at Huanggang, Single Track Tunnels are used, as a requirement of the Fire Services Department. The tunnel dimensions are 9.46m OD and 8.7m ID (Mainland) and 9.0m OD and 8.15m ID (HK).





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**Slurry TBM Operation.** The slurry is used to provide pressure at the cutter head to balance the pressure of underground water as well as carry the excavated material back above ground to the Slurry Treatment Plant. The material is removed and the slurry recycled back to the cutter head. An erector is used to lift the precast concrete segments to form the tunnel linings.



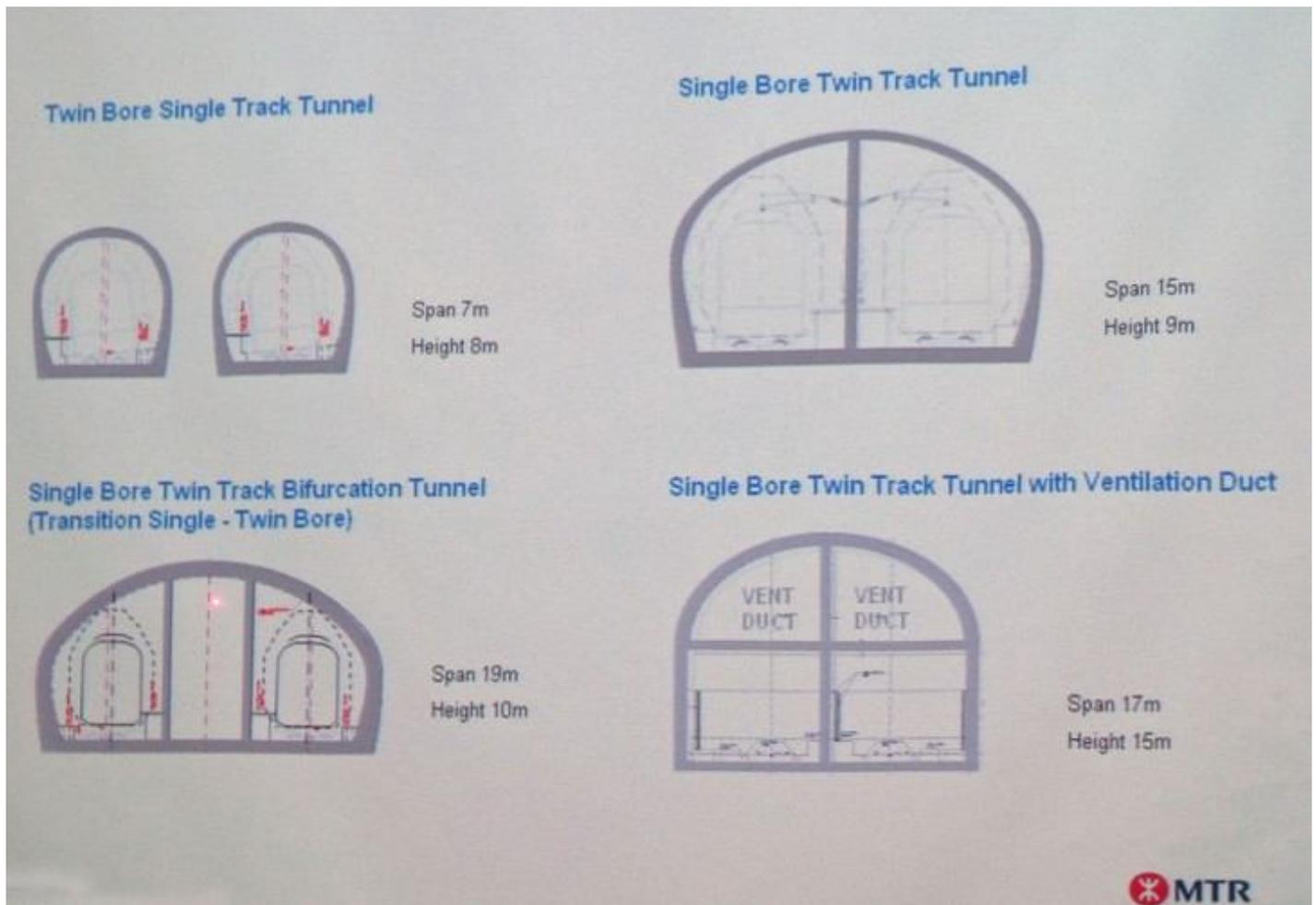
**Slurry TBM Operation Setup.** At the Nam Cheong worksite, there are two Tunnel Boring Machines in operation. Slurry is not treated on site, but transferred via 4 pipelines to the treatment plant erected near the barging point. This eliminates the need for transportation by lorries which reduces environmental impact on the surrounding areas.

**Earth Pressure Balance (EPB) TBM Operation.** Instead of slurry, this method makes use of its own excavated material to provide pressure against the excavated face. The excavated material is carried by conveyor for removal.



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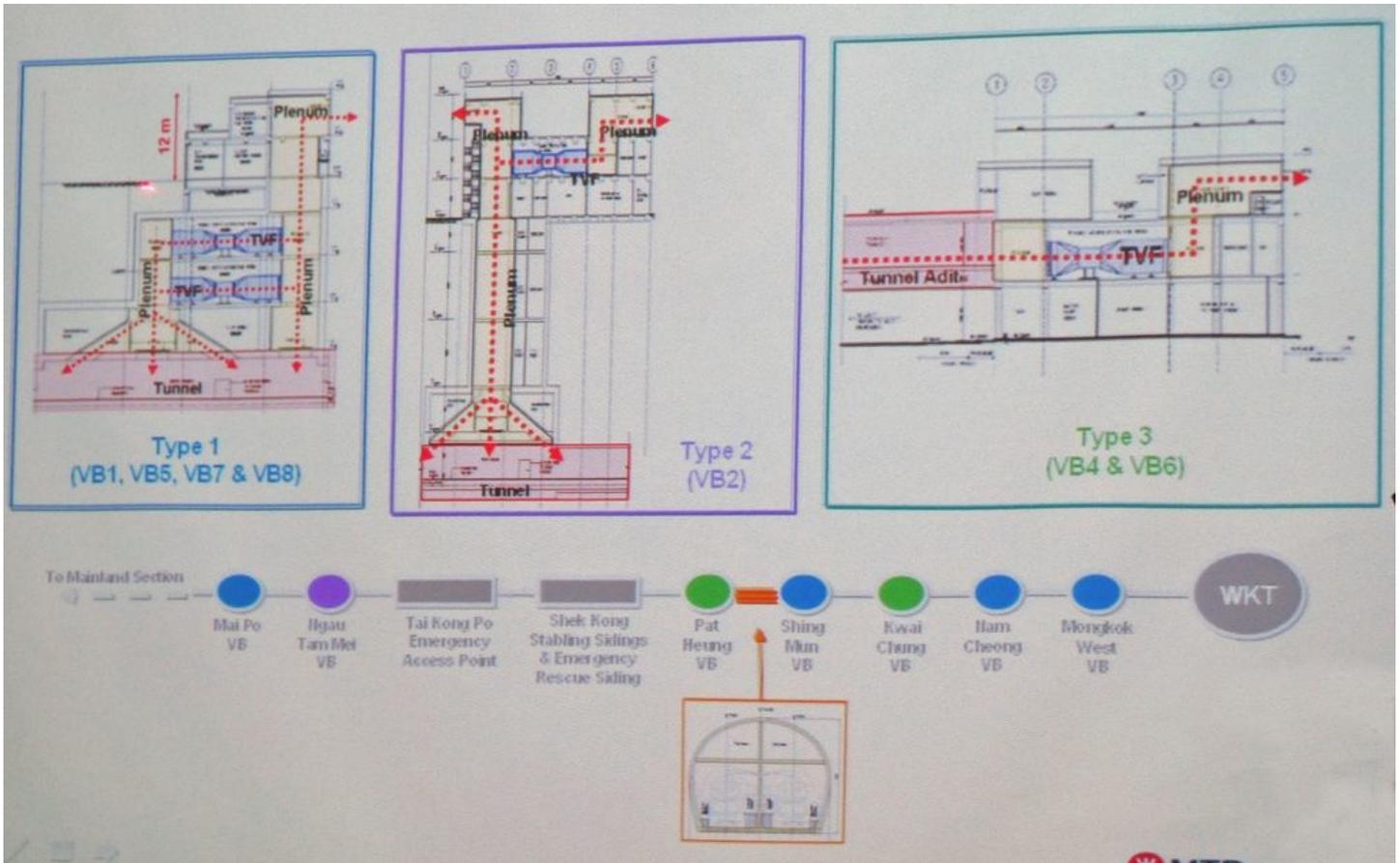
**Drill and Blast Tunnels.** Configurations are basically horseshoe-shaped, with variations to incorporate air ducts or separating walls depending on location. Rock crusher is also included in one of the major tunnels where crushed rocks are transported off-site as recycled material. For construction of tunnel lining, movable steel forms are deployed as they can provide obstruction-free access for trucks to pass back and forth during lining and water proofing construction.



**Tunnel Ventilation Buildings.** Normally, tunnels are 30 meters below ground and ventilation building can be built directly on top of the tunnel. However, for those tunnels located down below the hills, deep shafts have to be constructed to connect the tunnel.



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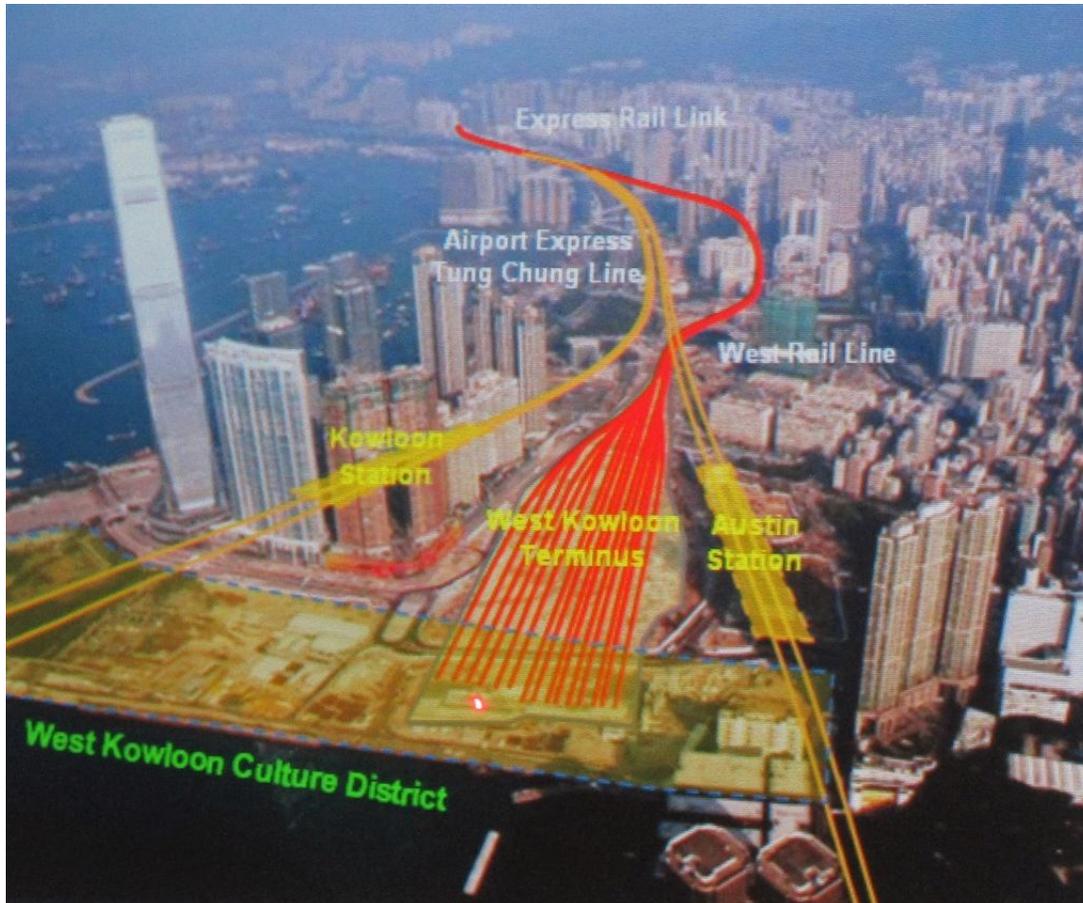


**Shek Kong Stabling Sidings / Emergency Rescue Siding** In case of emergency, Shek Kong, located in the middle of other at-grade access points between Futian and West Kowloon, will serve as an emergency access point. Trains can also be stabled at Shek Kong for inspection and cleaning. The diversion of Kam Tin River is also included in the construction.

**West Kowloon Terminus** site area is 11 hectares and is located in West Kowloon, near heart of the City Center. The Terminus will be connected to the Airport Express Rail at Kowloon Station and to the West Rail Line via Austin Station. It is located next to the proposed West Kowloon Cultural District and connected to Public Transport Interchange, Western Harbour Crossing and Route 3. With a maximum of two interchanges, It is possible to go anywhere within the Hong Kong rail network. Within a 5Km circle it covers around 50% of the Hong Kong working population and 30% of the living population.



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**West Kowloon Terminus Arrival and Departure Flow.** This is a large station design to separate the arriving and departing passenger flow. As the station is underground, the space above ground can be released for public use. Glazed façade will enable the admission of natural sunlight into the station, as well as making it possible for arriving passengers to have a view of the ridge line of the Hong Kong Island, making them feel like they have “arrived in Hong Kong” even though they are physically still underground.

**Terminus Contracts: TBM Tunnel** – Approaching Tunnel – 811A and 811B, West Kowloon Terminus 810A and 810B, Foundation Contracts – 803A to D.

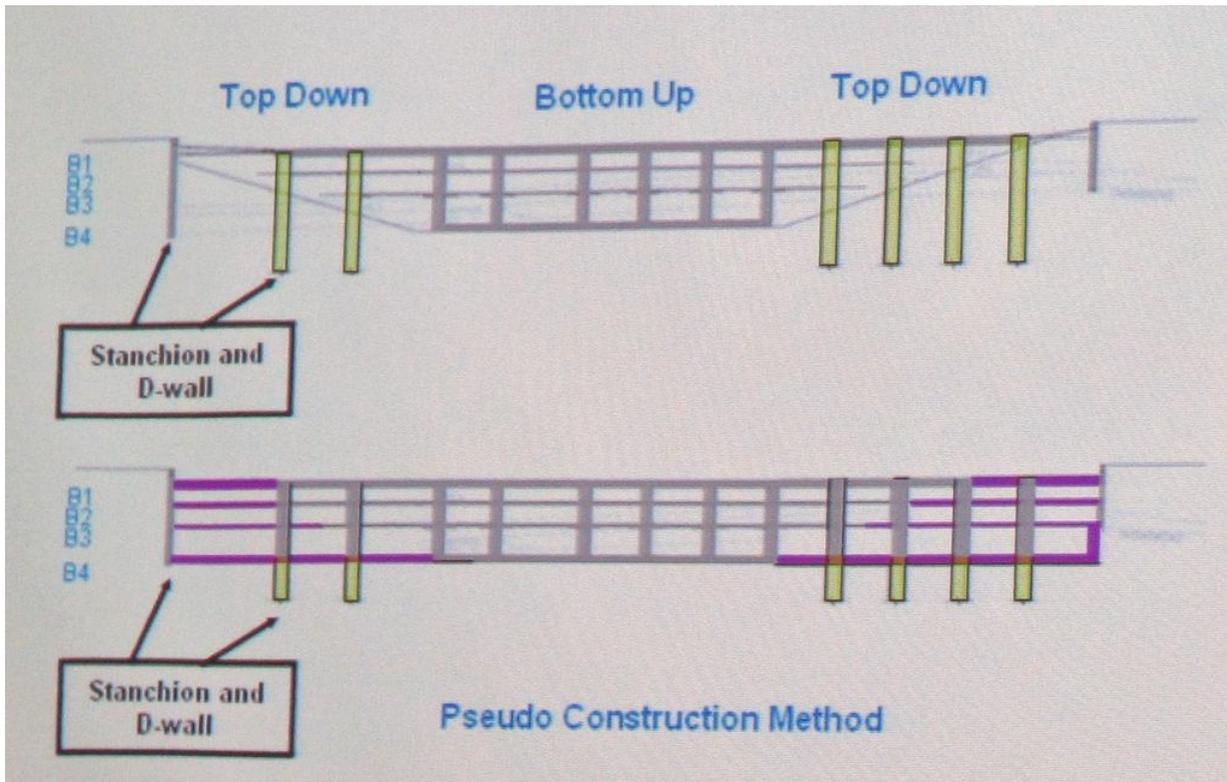
**Terminus** - Major Activities – Diaphragm Wall (2,500m run), Bulk Excavation (5 million cubic meters, 31m depth), Bored piling (approx 500 nos.), Socket H Piling (approx 5,000 no.), Substructure (4 Levels), Concrete (1 million cubic meters).

**Terminus – Excavation Strategy.** Traditional top-down at the southern end and Pseudo Construction Method. Open excavation as deep as possible and then traditional bottom up construction methods with top down construction at the perimeter. This allows early access



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to parts of the construction. Cut and Cover construction is also used in the approach tunnel.



**Progress Overview.** Referring to the slide showing site development progress.





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Following Wai Chung's presentation various questions from the audience were answered including:

1. "What provisions are there for fire services inside the tunnel and if there is a problem, will passengers need to walk all the way to the Kowloon Terminus/Shek Kong/Futian?" During a train incident, the normal practice is for passengers to stay on a train and be evacuated at the station. The train is of certain fire rating. Another train will push or pull the incident train. If passengers really need to evacuate, they may use the cross passage and board the rescue train. Ventilation fans are installed for push or pull mode in case of fire to allow passenger to escape away from the direction of smoke flow.



2. "How to control groundwater seepage into TBM tunnels?" We use advanced grouting to improve soil quality to strengthen reclaimed areas. To reduce water seepage into the excavated tunnel, the TBM will carefully control slurry pressure to counterbalance the underground water pressure. Tunnel lining will be installed immediately with grouting to fill the gaps between the tunnel and the excavation to reduce seepage and ground loss.

3. "You control the ground water below or above the tunnel?" The ground water level is monitored during the boring.

4. "With one slurry plant are all TBMs using the single slurry plant?" This is not exactly the case, each slurry TBM normally has its associated slurry treatment plant. The one erected at the barging point in the presentation is used with the two TBMs in the urban areas.

5. "Why, in deep tunnels, drill and blast is used rather than TBM?" If a TBM breaks down or encounters some other problem under a mountain, it is not possible to have a very deep shaft to remove the TBM. Therefore the alignment would have to be abandoned.



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**6.** "In the Mainland, twin track is used but in Hong Kong, single track must be used, what is your opinion on their advantages and disadvantages?" It's based on the recommendations and experience of the Fire Services Department in rescue operation. The rescue philosophy is different on the Mainland. The single track tunnel can have the advantage of using separate tunnel for people to escape into or allowing rescue train to get in.

**7.** "The whole Hong Kong section is underground (up to Futian) and travels at 200Km/hr?" Yes. "Is 30Km underground train tunnel long?" Someone in the audience commented that it's in the list of "world's top ten longest".

**8.** "How is the cost comparison between the twin tunnel and single larger tunnel?" The figures are not available but comparison can be made in terms of using smaller versus larger TBMs.

**9.** "Contract started over one year, how is progress, finish in 2015?" Commenced January 2010, now more than 20% completed and targeted for 2015 completion.

**10.** "Any emergency rescue sidings in mainland?" Beyond Futian, train is running above ground.

**11.** "What are the main environmental objections?" Major environmental organizations support the project as we have gone through the consultation process. Some others may have concern on the Project's impact on ground water, agriculture etc.

**12.** "What happens to the slurry?" Recycled after removing the residual.



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In conclusion Scott thanked Wai Chung for a very informative presentation and presented him with a bottle of special EAHK 10th Anniversary red wine. Applause!



**\* *Speaker: Mr. FUNG Wai Chung***

Fung Wai Chung is a Senior Engineer in the MTR Corporation, responsible for the liaison and public consultations of the Guangzhou-Shenzhen-HK Express Rail Link (Hong Kong Section) Project. He is a chartered builder and surveyor who has achieved twenty five years experience in engineering practice with an emphasis on railway works. Mr Fung has been based in Hong Kong and employed by MTR Corporation since 1992 and he has worked on the Kowloon Southern Link, Ma On Shan Line, Tseung Kwan O Extension and the Lantau and Airport Railway Projects.