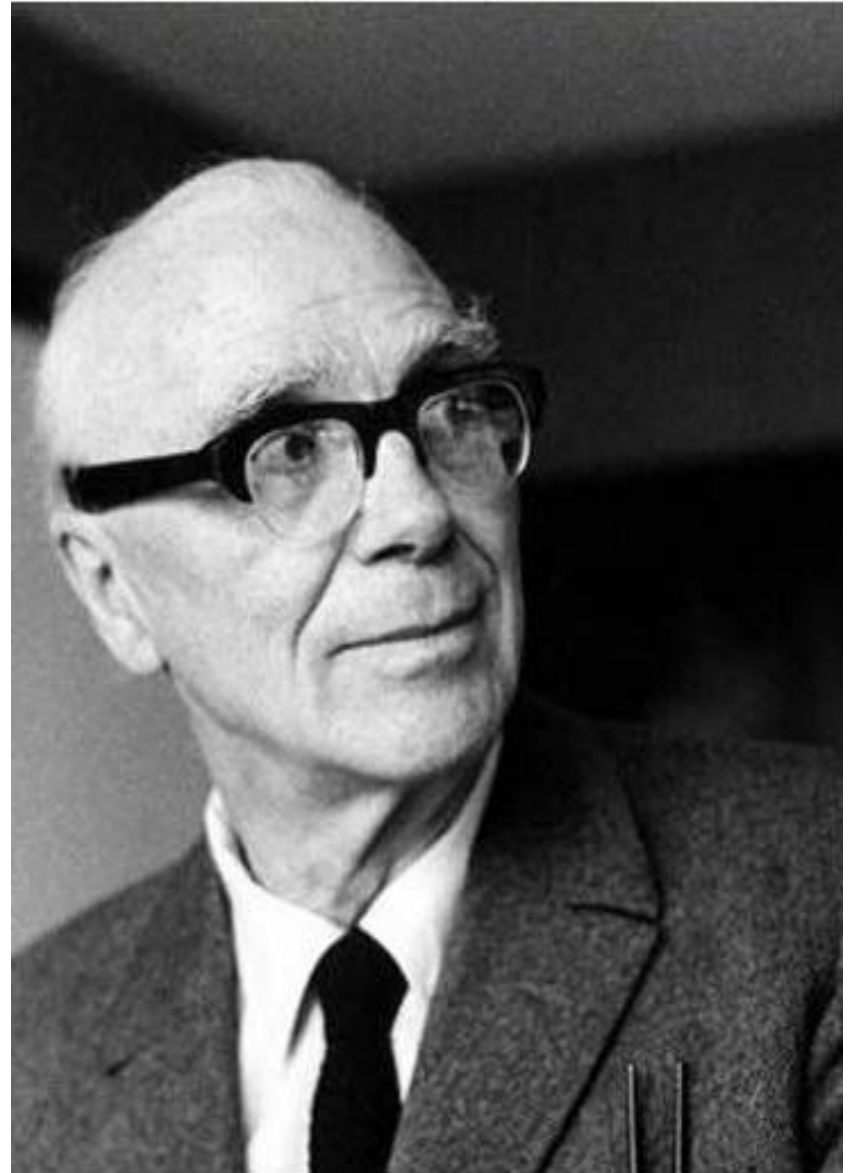


Transport Solutions Seminar

Ian Taylor | Director of Infrastructure

- Founded in 1946 by Sir Ove Arup
- A global firm of 12,000 engineers, designers, planners and business consultants
- Working on up to 10,000 project at any one time
- Held in trust for the benefit of all employees



Sir Ove Arup





St. Francis Shangri-La – 212m

It is the first property in the world to employ the Arup Damped Outrigger System™.



MB Center – 226m

A 66 storey hotel and office building using the performance based design approach and the Arup Damped Outrigger System™.



The Block – 226m

A 57 storey mix-used development using the performance based design approach and the Arup Damped Outrigger System™.



The One Central – 173m

A 50-storey boomerang-shaped residential building w/ 5 basements using performance based design approach.



The Shang Grand Tower - 175m

Detailed structural design using pushover analysis



The Enterprise Centre – 148m

Detailed structural and geotechnical design

Highways



Stonecutters Bridge, Hong Kong



Route 8 Nam Wan Tunnel, Hong Kong



Deep Bay Link, Hong Kong, China



©Hong Kong Highways Department

©Hong Kong Highways Department



Central Kowloon Route, Hong Kong, China

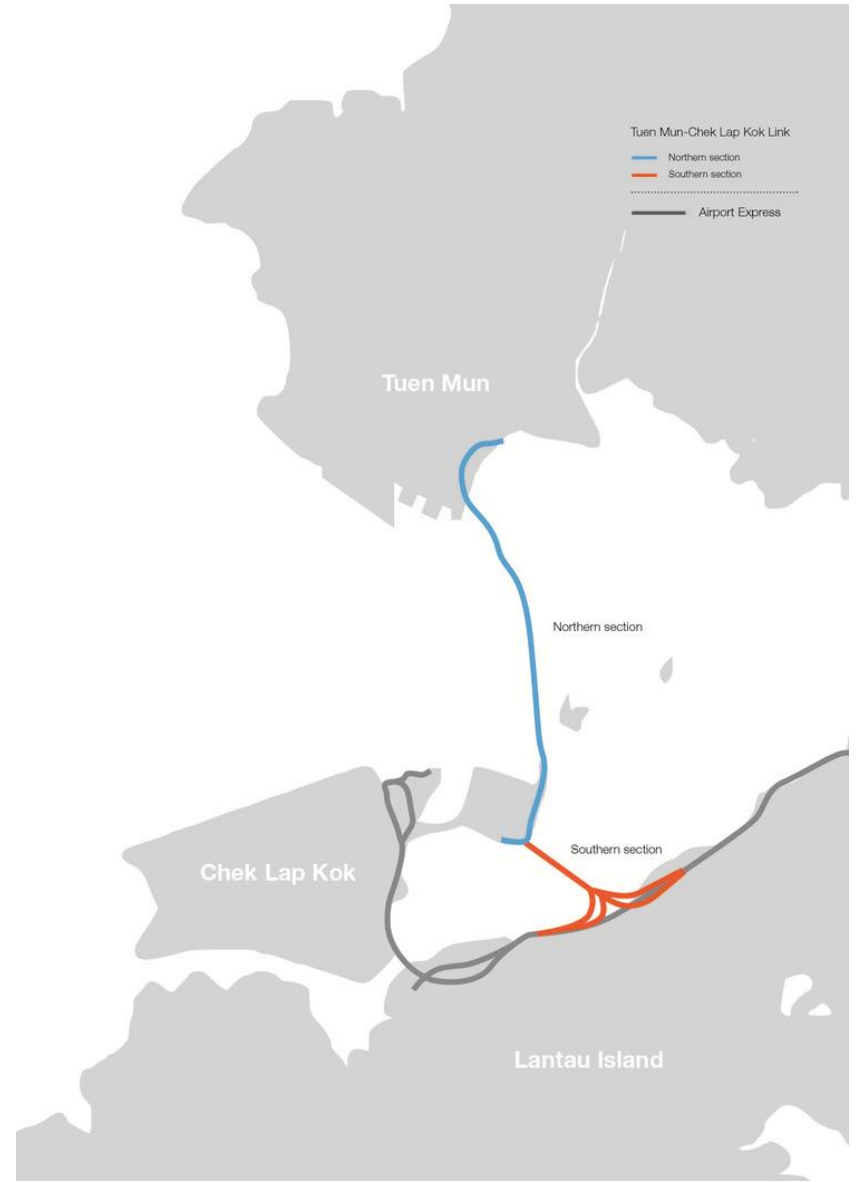
©Hong Kong Highways Department



Tuen Mun-Chek Lap Kok Link- Southern Section



Tuen Mun-Chek Lap Kok Link- Southern Section



Tuen Mun-Chek Lap Kok Link- Northern Section

Aviation

Arup's Aviation Business

Strategy

Business planning
Master planning
Economic impact assessment
Environmental impact assessment
Transaction advice
Corporate social responsibility
Commercial management
Procurement and sourcing

Projects

Technology design and consulting
(Baggage, IT, Security)
Engineering design
(Civil, Structure, Services)
Engineering specialists:
(Fire, acoustics, facades)
Programme management:
(Governance, Planning, risk, transition)

Operations

Operational readiness
Change management
Organisational design
Operational improvement
Transformational change
Leadership development
Continuous improvement
Control room
Passenger processes improvement
Wayfinding

Passenger Terminals | Cargo Terminals | MRO Facilities | Control Towers

Airside Infrastructure | Landside Access | Airport Cities



Kunming Changshui



BCIA T3



Bangalore T1 expansion



Beijing New Airport (Competition)



London Heathrow T5



RGIA, Hyderabad



HKIA Midfield Development



Abu Dhabi Midfield Terminal

More than 50 years' experience in aviation projects



JFK JetBlue



Dublin T2



Manchester, UK



Perth Western Australia



O R Tambo- J'burg

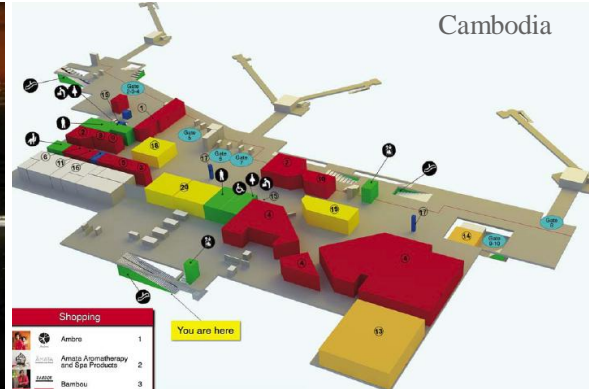
Large and small projects



Lester B Pearson, Toronto



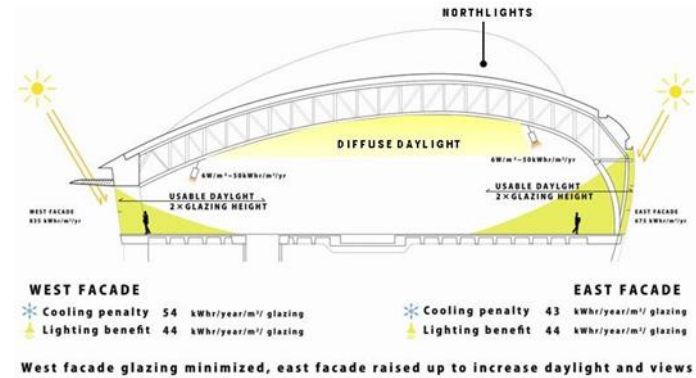
King Abdul Aziz, Jeddah



Cambodia

- New passenger concourse development
- 110,000m², five-storey building with 20 bridged stands and 10 remote stands
- JV partner /Lead Consultant
- Arup scope includes:

- Roof Structure
- APM tunnel extension
- BHS at MFC and T1
- Airport Systems
- Acoustics, fire sustainability
- MEP



- Scheme design for the new third runway infrastructure and related concourse
- Increase the airport capacity to meet future demand of 120 MPPA
- Arup scope:
 - Terminal planning
 - IT and Comms
 - Security
 - Acoustics
 - Fire Engineering
 - BHS
 - Automated People Mover
 - Tunnel engineering
 - Geotechnics
 - Building services
 - Roof structures



Rail

Arup Rail Business

MODE

Intercity rail	High speed rail Heavy rail / Inter-urban rail
Urban rail	Suburban / Commuter Rail Metro / Mass transit / Subway Light rail Street Running Tram Tram / Train Automated People Mover (APM) Monorail Guided bus Personal Rapid Transit (PRT)
Freight	Heavy haul freight Distribution

SCOPE

Strategic advice & management
Project creation & PFI
Business case & appraisal
Feasibility studies
Detail design
Design & build
Implementation & commissioning
Asset management

SERVICES

Planning	Route location Revenue & demand forecasting Environmental assessment Operational assessment & capacity Station planning Systems integration Business case appraisal Rail strategy Asset management Performance modelling & simulation
Project Delivery & Control	Programme management Project management Interface management Value management Construction management & supervision Safety in design Commissioning
Infrastructure Design	Track Bridges Tunnels Transport architecture Stations Depots Freight terminals Control centres Ventilation Mechanical & electrical Noise & vibration Civil engineering Geotechnics Utilities diversions
Systems	Signalling & communications Control & data systems Traction power & power supply Customer information systems Systems engineering & assurance
Safety & Reliability	Safety management RAMS Fire engineering Risk assessment
Technology	Research and development Wheel-rail interfaces Crashworthiness Vehicle styling & design Aerodynamic simulation
Management Consulting	Organisational change Human factors Funding procurement & transaction advice Industry structure and regulation

A sample of our rail projects around the world

Metrolinx Electrification, Canada

Study of the electrical options for the Ontario province to provide clean and reliable power systems and an effective methodology to implement electrification across the network.

Spaxina Metro Stations, Canada

A new 8.6km line that will include both tunnels and cut-and-cover sections with 6 new passenger stations and a new transit hub.

Transbay Transit Centre, USA

Asp's state-of-the-art design for the multi-modal hub. It will have three 1,000-foot long train platforms, providing four terminal tracks for the new High-Speed Rail service and two tracks for the commuter rail service.

California High Speed Rail Project, USA

Linking all the major cities in California with a state-of-the-art new high-speed line. The project comprises the design and construction of a 1,000-mile project, linking Los Angeles and San Francisco.

Fulton Street Transit Center, USA

A transit-oriented development to improve existing infrastructure between 4 stations, plus new links to 2 others, serving a total of 9 subway lines.

Second Avenue Subway, USA

The 13km subway will be the first major new subway development in New York City for 60 years, incorporating 10 new underground stations.

High Speed 1, London-Kent, UK

108km high-speed line (320km/h) between London St Pancras and the Channel Tunnel at Ashford. The project also included the complete provision of the High-Speed Terminal, St Pancras International.

King's Cross Station and Underground, UK

Redevelopment to create new interchange facilities with London Underground and Northern England. Includes a new award-winning concourse, associated facilities and refurbishment of existing buildings.

High Speed 2, UK

Design for a new High-Speed Railway from London to West Midlands and Northern England. Examination of route options, various public, environmental impact, costs and business cases.

Doeklaan Light Railway (DLR), UK

Increasing the capacity on the Doeklaan Light Railway ahead of the 2012 Olympic Games through refurbishment of stations and platform extensions to accommodate 3000 trains per day.

Crossrail, UK

Crossrail is the new high-frequency, convenient and accessible railway for London and the South East from 2017. Crossrail will link Heathrow Airport, the West End, the City of London and Canary Wharf.

Heathrow PRT, UK

Infrastructure design for the 3.6km long, world-first multi-modal rapid transit system linking Terminal 5, with a car park, involving a new award-winning gateway.

Switch and Crossings, UK

Switches and crossings and new crossings on the network. The project involves the design and construction of new crossings and crossings on the network. The project involves the design and construction of new crossings and crossings on the network.

Tyne & Wear Metro, UK

Over 20 years, our work has included New Metro, an Environmental Assessment for new routes, financial management for substantial extension and advice on procurement.

Cambridge High Speed Rail, UK

Study of the proposed high-speed rail route between St. Leonards and the northern fringe of Cambridge, making it the longest global railway in the world.

Beijing South High Speed Rail Station, China

The multi-modal transport hub is located next to a station in the city's existing station. The total structure is 10m by 20m in size, spanning 17 platforms, with a 40m deep platform providing a column-free structure for the platform.

Shenyang Metro Forecast, China

Asp prepared a strategic and revenue forecast along the route of the line, including the impact of the metro on the city's existing stations. The total structure is 10m by 20m in size, spanning 17 platforms, with a 40m deep platform providing a column-free structure for the platform.

Shenzhen Metro Line 4, China

Line 4 is the 3rd largest metro project in China. The project comprises 3 underground and 4 elevated stations, 16km of tunnel and 10km of viaduct, as well as a depot with a 1km long property development.

Westrail, Hong Kong

The Westrail station in West Kowloon, including stations at Yuen Long, Long Ping and Shek Wan. The station is a multi-modal transport hub, providing a high-speed rail service for the West Kowloon and 15 km of rail system and stations with the LRT system.

Express Rail Link, Hong Kong

26km of new tunnel from a new terminus station in West Kowloon to the existing station at Shek Wan. The station is a multi-modal transport hub, providing a high-speed rail service for the West Kowloon and 15 km of rail system and stations with the LRT system.

West Island Line, Hong Kong

Multi-disciplinary consulting in civil works with Alstom China Ltd. for two deep cut-and-cover stations at Sha Tin and University, each with significant lengths of pedestrian subway connections and 1.8km of twin track.

Florence TAV, Italy

The new 4,000m Suburban railway station is an open-air hub with platforms 20m below ground to serve the Italian High-Speed Rail Network.

Copenhagen Cityringen, Denmark

A new metro, stationing and connecting passenger connections to existing metro and heavy rail systems. The 11km metro is a double-track system with twin tunnels and 17 underground stations, forming a circle line around the centre of Copenhagen.

Zal Prah, Barcelona, Spain

Planning for a new rail high-speed terminal in the Port of Barcelona, allowing for the integration of port activity into the transport network.

TOM Mediterranean, France

Technical evaluation of the Galimatras route for the extension of the French High-Speed Rail System (TGV) from Valence, south of Lyons, to Marseille and Montpellier on the Mediterranean coast.

STAB LRT, Malaysia

Study of 3rd largest metro project in China. The project comprises 3 underground and 4 elevated stations, 16km of tunnel and 10km of viaduct, as well as a depot with a 1km long property development.

Bangkok MRTA, Thailand

10km of mass rapid transit railway, underground stations, 3.6km of twin-bore tunnel with access tunnels and surface structures.

North East Line Metro, Singapore

The 20km North East Line incorporates 10 stations, 10m maintenance shops and heavy repair workshops.

Singapore Metro Downtown Line (DTL), Singapore

The 36km DTL with 23 stations in Singapore's CBD and will be implemented in three stages - DTL 1, DTL 2 and DTL 3.

Surbury Electrification, Australia

Asp was the lead designer and responsible for the multi-disciplinary work on track, civil, structural, bio-environmental, value management, safety, and geotechnical engineering.

Sao Paulo Metro, Brazil

Surviving as London Independent Engineer for the operating and maintenance dimension on the 13km subway with 11 stations in São Paulo, Brazil. System currently carrying over 670,000 passengers daily with patronage expected to grow to over one million passengers per day.

Metro de Santiago, Chile

Asp leads the concept design of 11 stations in Santiago. The scope covers some of the most challenging stations on the new line, being built and installed in existing buildings with existing lines on the same network.

Trans Africa Rail Pre-feasibility study, South Africa

Asp was engaged to establish possible routes and the financial case for rail-based transport from South Africa and Victoria to a port in Harare.

PRASA Strategic Rail Plan, South Africa

Transport and rail strategic planning consultancy for the Gautrain Passenger Rail in South Africa. The review and subsequent report established what is needed for the future of multi-modal passenger systems in South Africa and PRASA.

Gautrain, South Africa

Independent Consultant for the Gautrain Rapid Rail Link which connects O.R. Tambo International Airport to the cities of Johannesburg and Pretoria.

Integrated Railway Project, Qatar

High-level review of the project to assess the business, operational and capital programme risks that need to be addressed in order to deliver the projects with private investment.

Ethab Rail, UAE

New 100km mixed traffic railway in the UAE, connecting to Saudi Arabia and Oman. Designed to 140km double-track, contact gauge and 22.5 ton axle load. In a variety of terrain, including desert, mountains, urban and coastal.

Abu Dhabi Integrated Public Transport Network, UAE

Planning, environmental and engineering support to assist Abu Dhabi Department of Transport with managing the operation of the Integrated Public Transport Network, passenger rail, metro, light rail, bus, water transport.

New Delhi Railway Station, India

Redevelopment of the station and adjacent railway yard and sidings. The railway yard and sidings are approximately 16 hectares and is proposed to be used under a PFI model to fund the station redevelopment.

Hunter Valley - Maitland to Branston, Australia

The new railway system on the Hunter Valley coast network will be a multi-modal transport hub, providing a high-speed rail service for the West Kowloon and 15 km of rail system and stations with the LRT system.

Gold Coast Rapid Transit, Australia

Asp, as a member of a consortium, delivered the concept design for Stage One involving 10km of modern integrated public transport to reduce road congestion and increase public mobility in urban corridors.

North West Rail Link Options Study, Australia

Asp undertook an extensive feasibility study involving 10km of twin track, two new stations and three existing stations, and 10km of twin track rail bridge. As part of a JV and a public-private partnership to provide a high-speed rail service for the West Kowloon and 15 km of rail system and stations with the LRT system.

Regional Rail Link, Australia

The largest rail project in Victoria and comprises 10km of twin track, two new stations and three existing stations, and 10km of twin track rail bridge. As part of a JV and a public-private partnership to provide a high-speed rail service for the West Kowloon and 15 km of rail system and stations with the LRT system.

Port Melbourne Split Survey, Australia

Preparation consultancy for the Public Transport Authority to conduct a series of surveys designed to quantify current production levels at current stations along the Port Melbourne rail line.

Wagga Wagga Rail, Australia

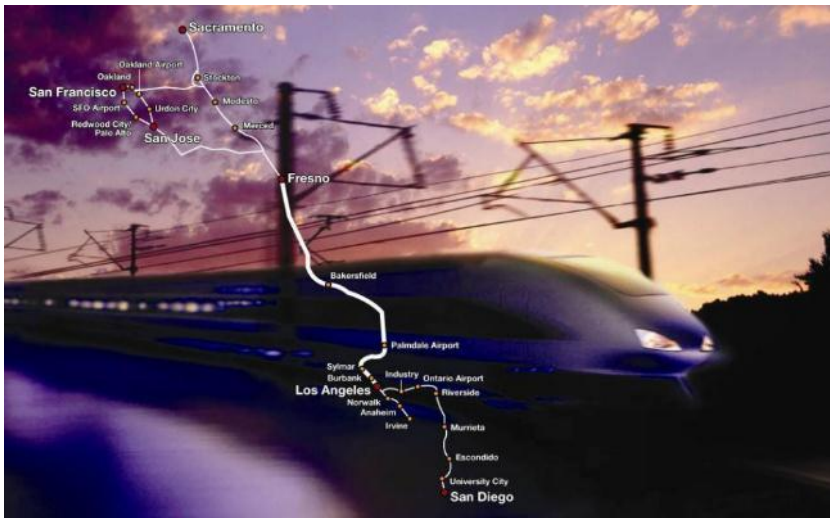
The replacement of the North Coast railway will be the new Wagga Wagga Rail. The project involves the design and construction of a new railway line, including the design and construction of a new railway line, including the design and construction of a new railway line.



Channel Tunnel Rail Link (HS 1) - UK



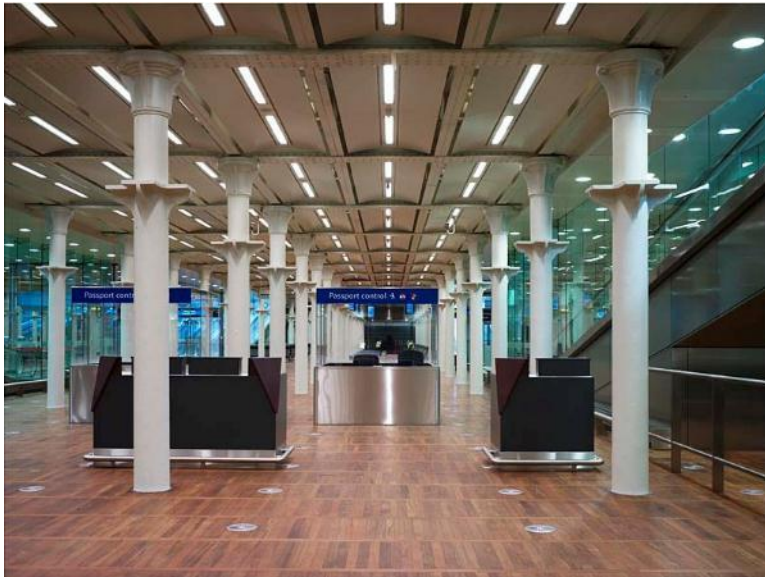
High Speed 2 (HS 2) - UK



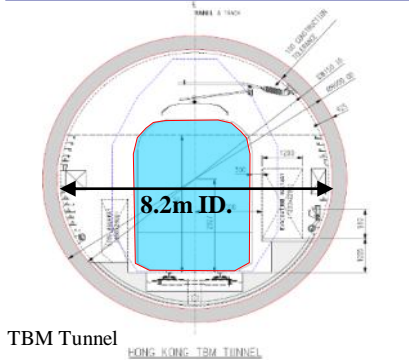
California High Speed Rail - USA



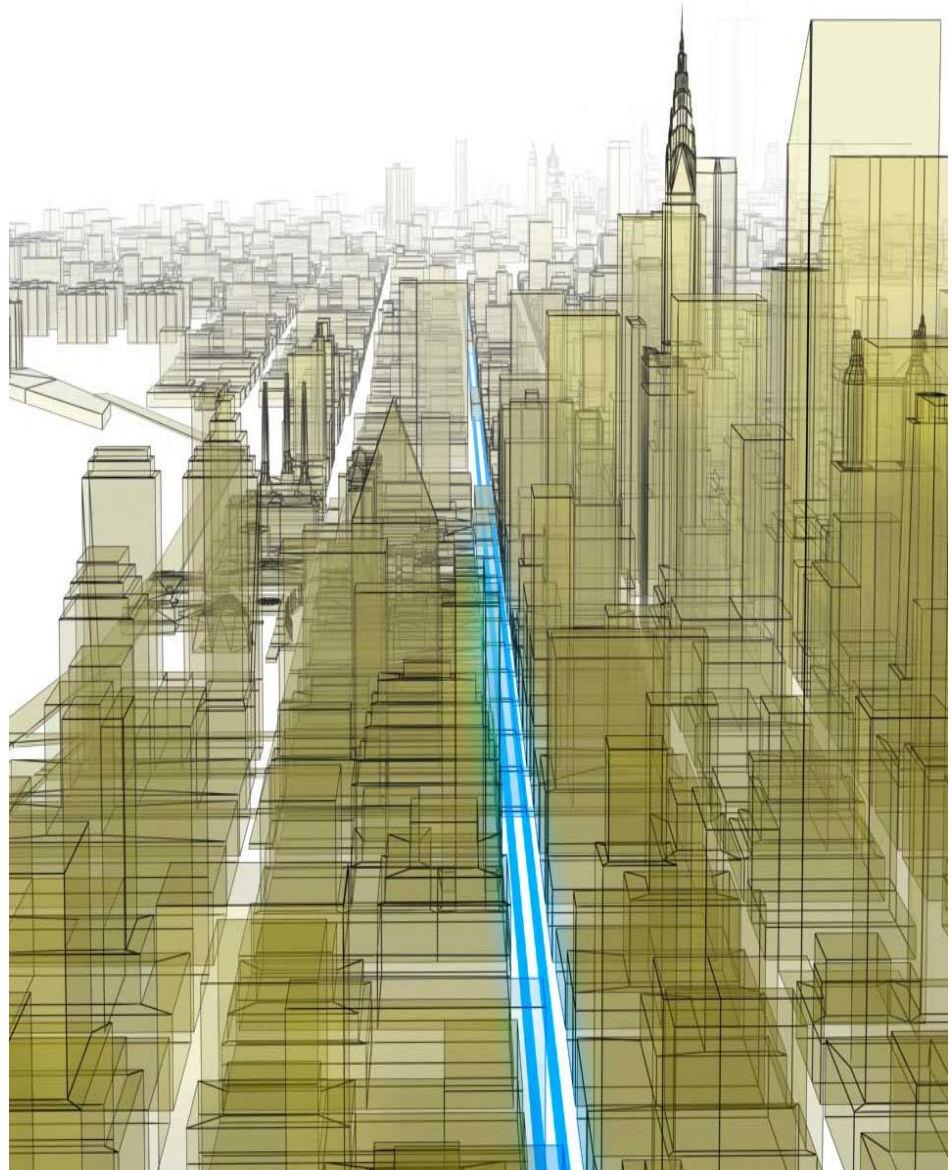
High Speed 2 (HS 2) - UK

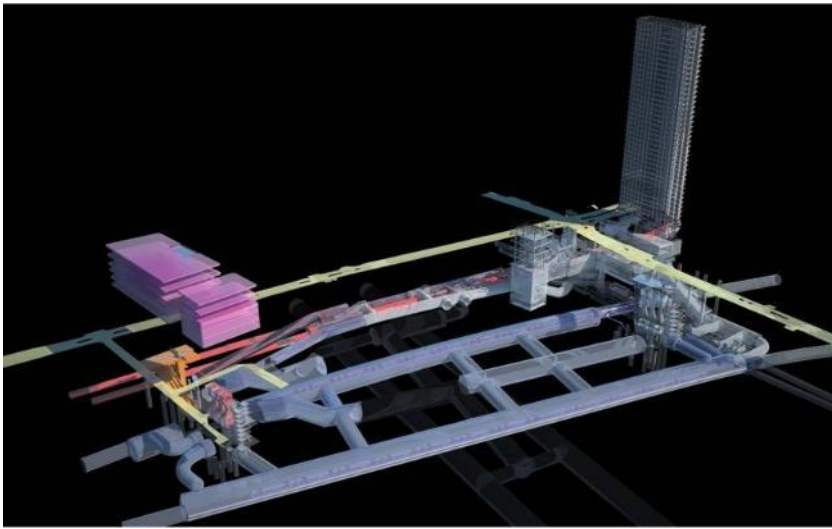






- 26km dedicated HSR
- 200kph in HK, 300kph in Mainland
- All underground in twin tunnels
- 50:50 TBM (soft) and mined (rock)
- 1 terminal station + 1 Emergency Rescue Station + 1 Depot
- 2007 – 2015
- Project Cost: \$60b





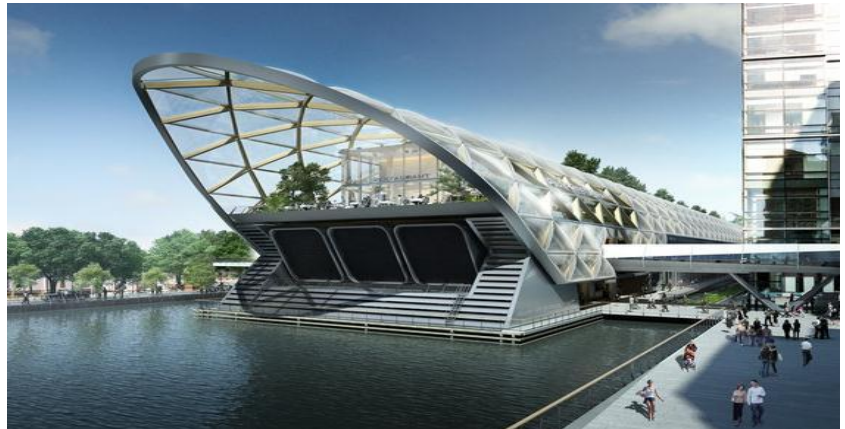
Tottenham Court Road Station



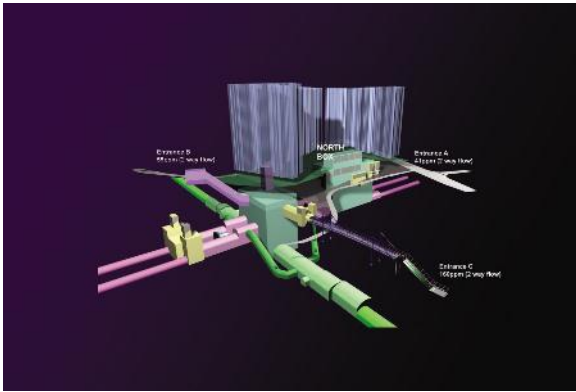
Overview



Tunnel Boring Machine



Docklands Station





Chai Wan Depot - HK



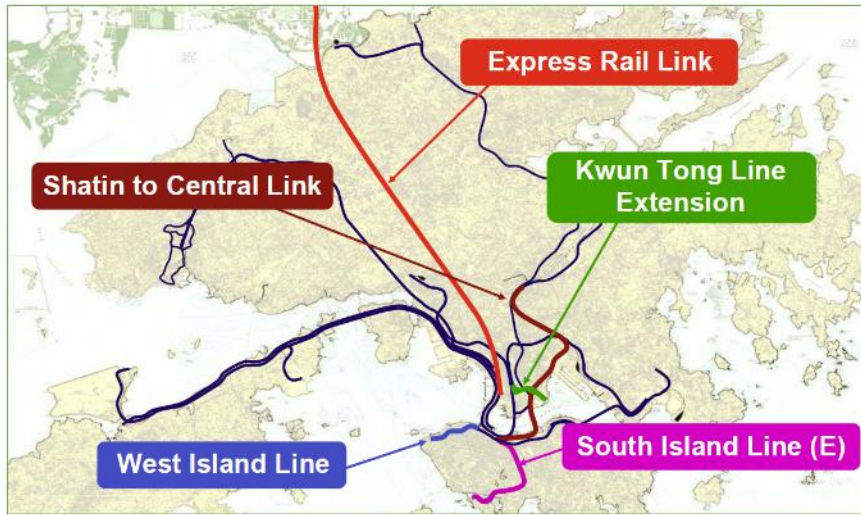
Chai Wan Depot - HK



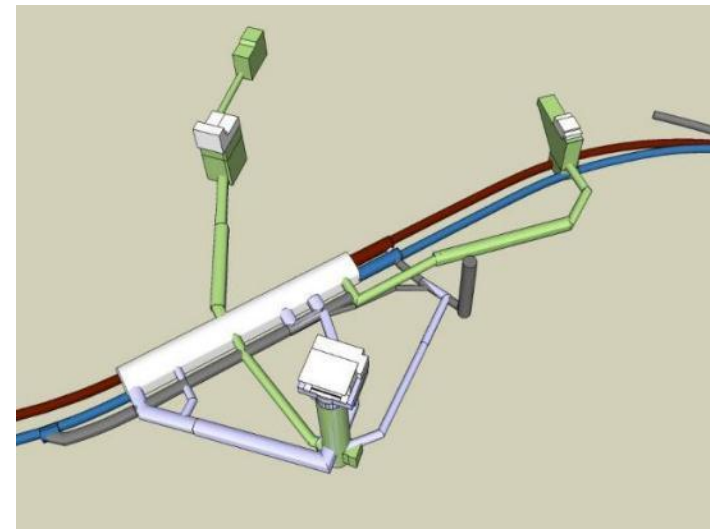
Chai Wan Depot - HK



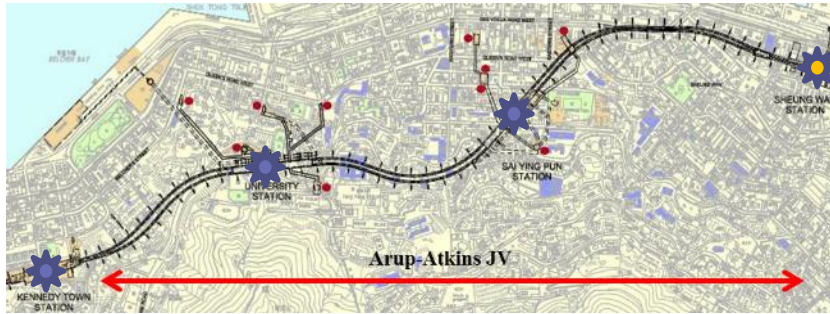
MRT Depot Singapore



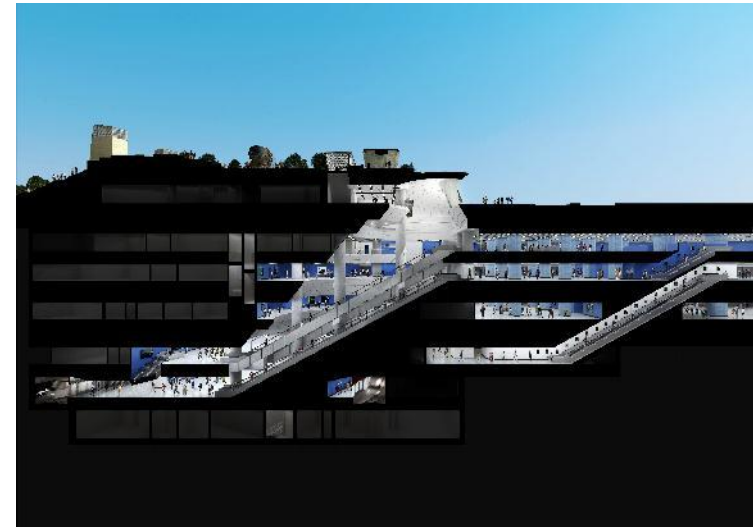
Overview



West Island Line - Sai Ying Pun (SYP) Station



West Island Line



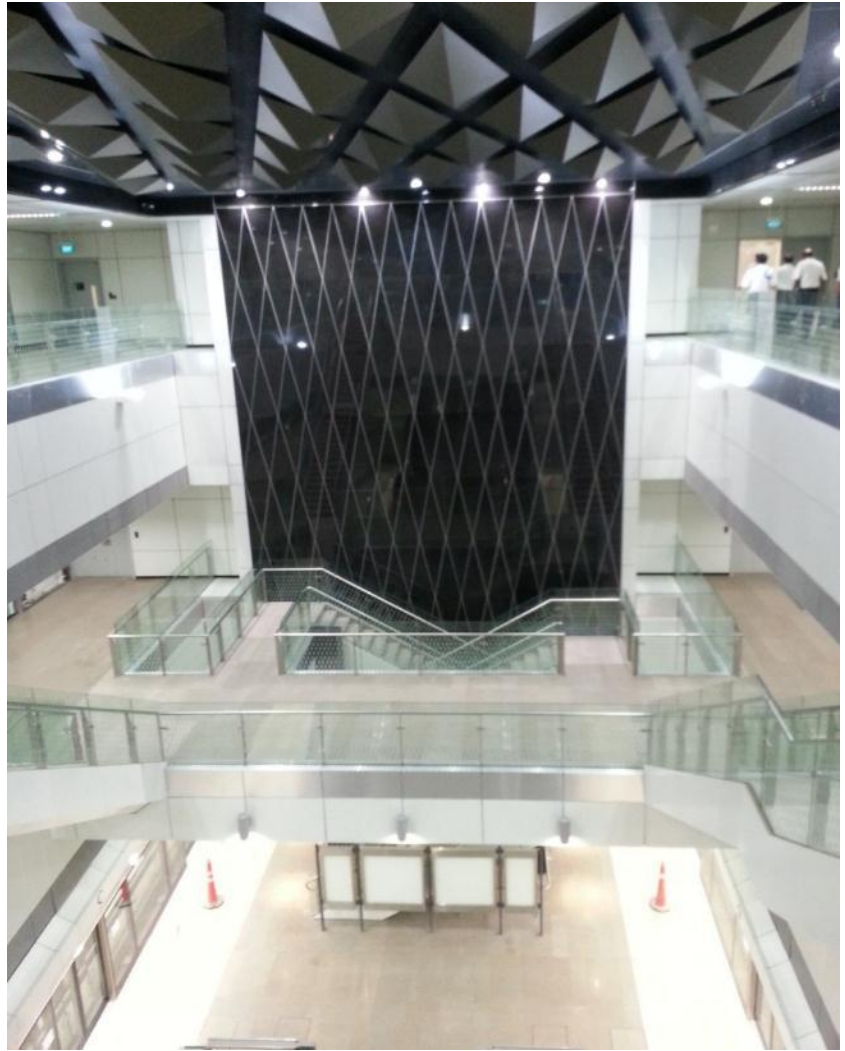
Admiralty Station



DTL1 Bugis Mining under operational station



DTL1 Bugis



DTL1 Bugis

Wo



Downtown line 3 (DTL3)



Downtown line 3 (DTL3)



Downtown line 3 (DTL3)





The World in 2050

- Megacities
- Demographic Change
- Climate Change
- Smart & Integrated
Mobility
- Technology
- Energy & Resources

Arup's ambition is to Shape a Better World. That is why we strive to go further than just delivering the most high quality creative work for our clients. We also aim to leave a lasting and sustainable legacy for the future.

www.arup.com