Who is Mott MacDonald?




One of the world's largest management, engineering and development consultancies

Multinational

- Working in over 140 countries
- From 200 permanent offices
- On some 16,000 projects

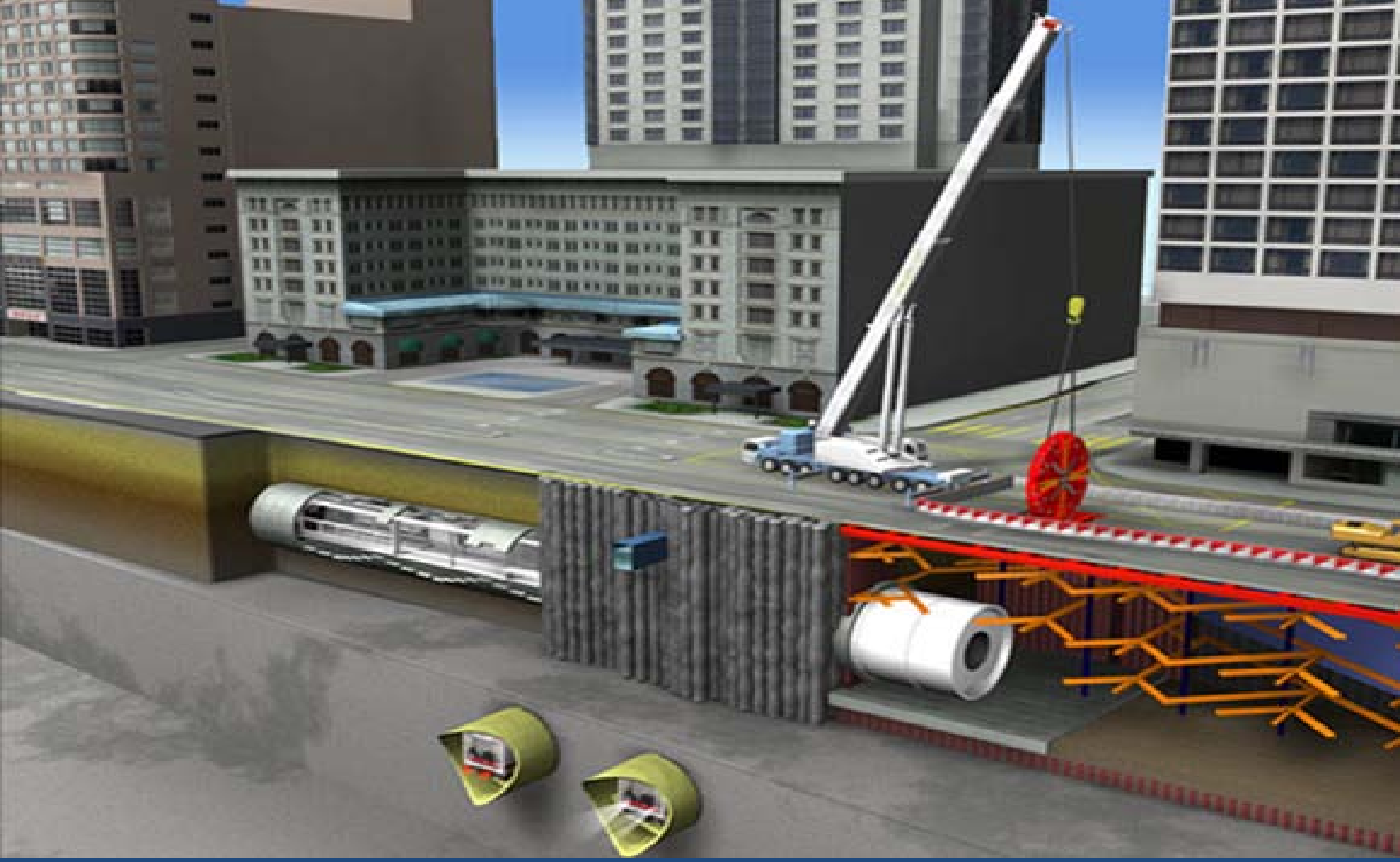
Multisector

It’s the sheer diversity of our work that makes Mott MacDonald unique

Mott MacDonald Project – Hong Kong/Macau

City of Dreams - Macau

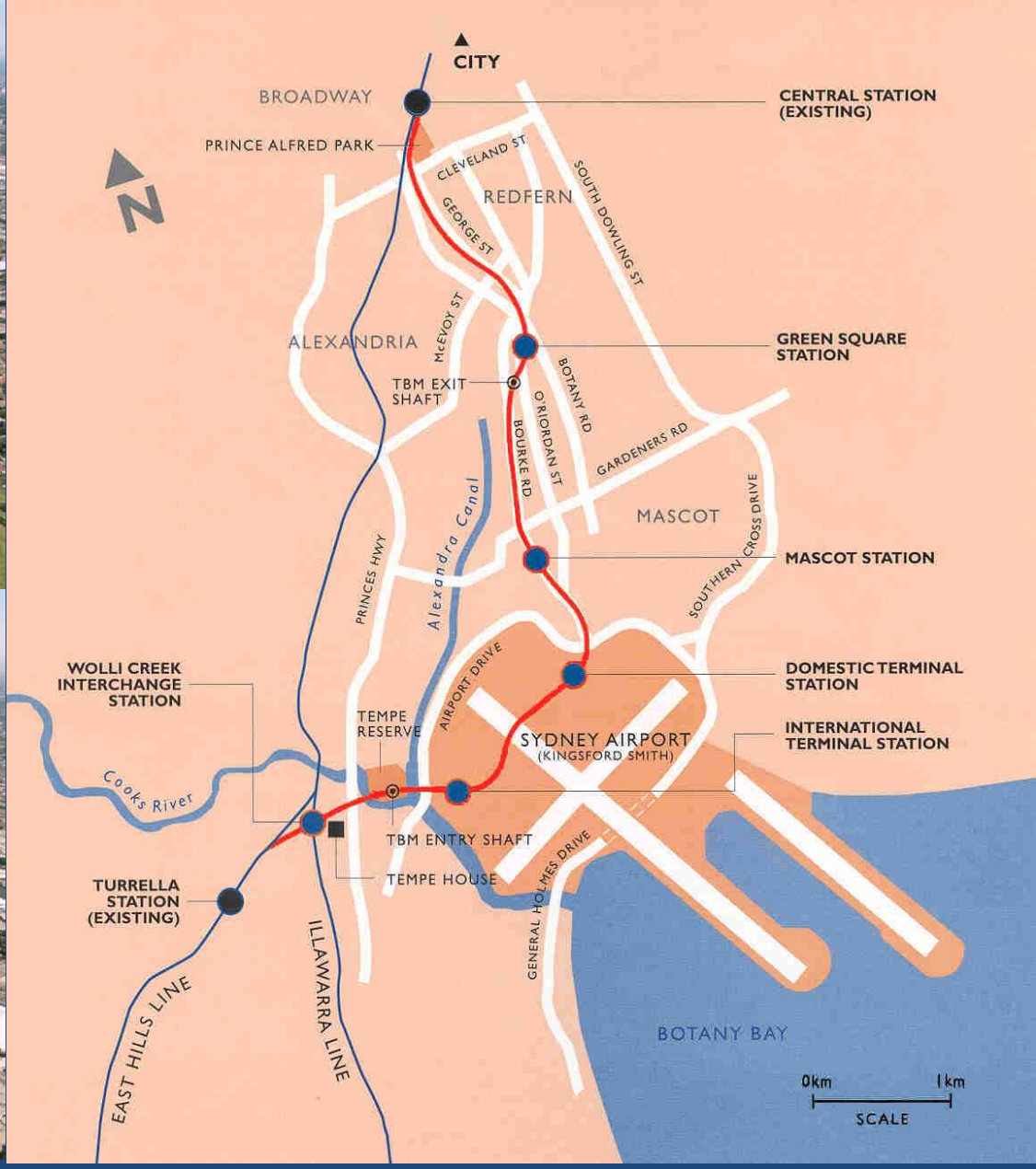
Kowloon Southern Link



South Island Line

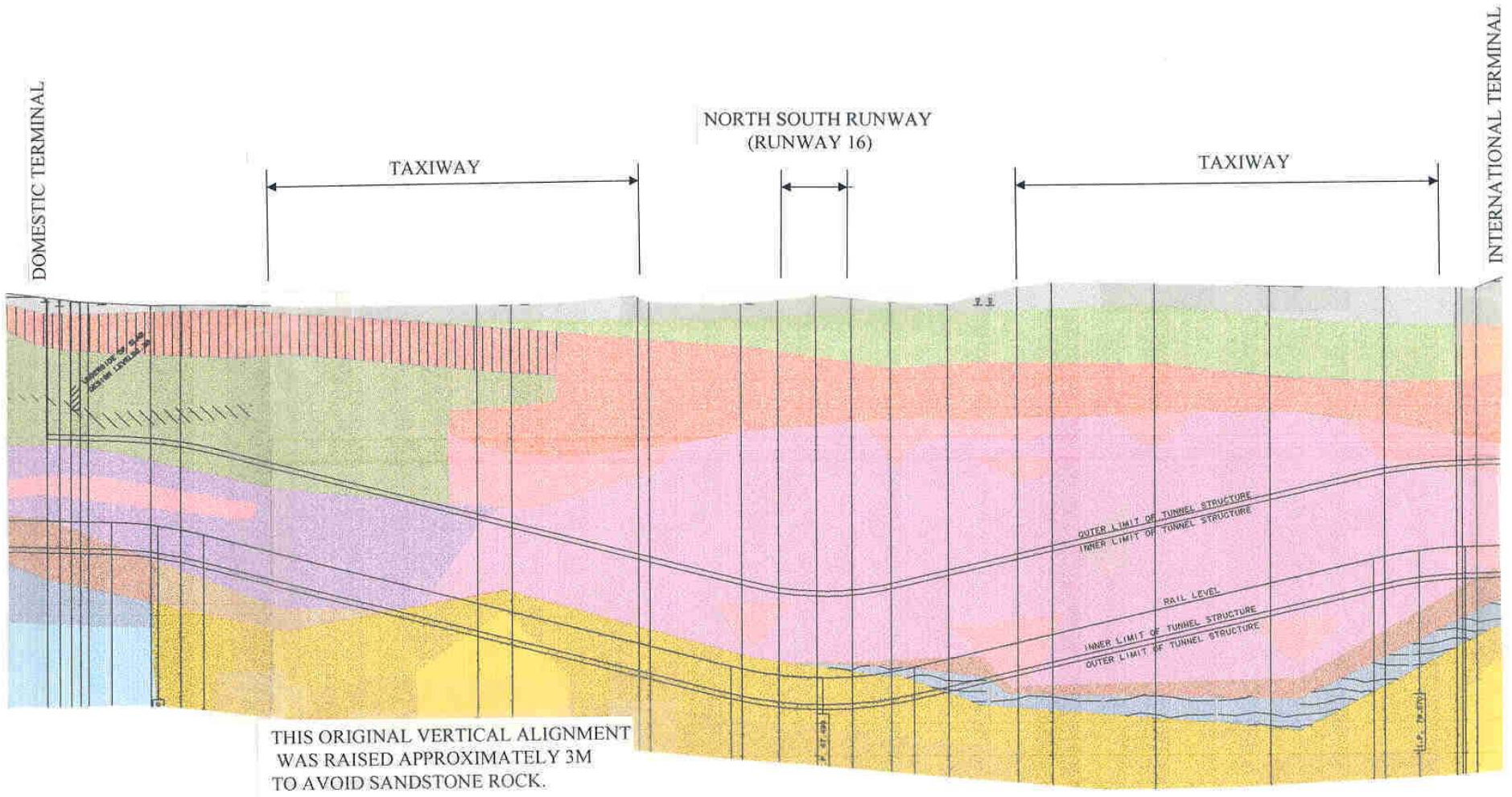
Airport Line - Sydney

(Previously known as the New Southern Railway)

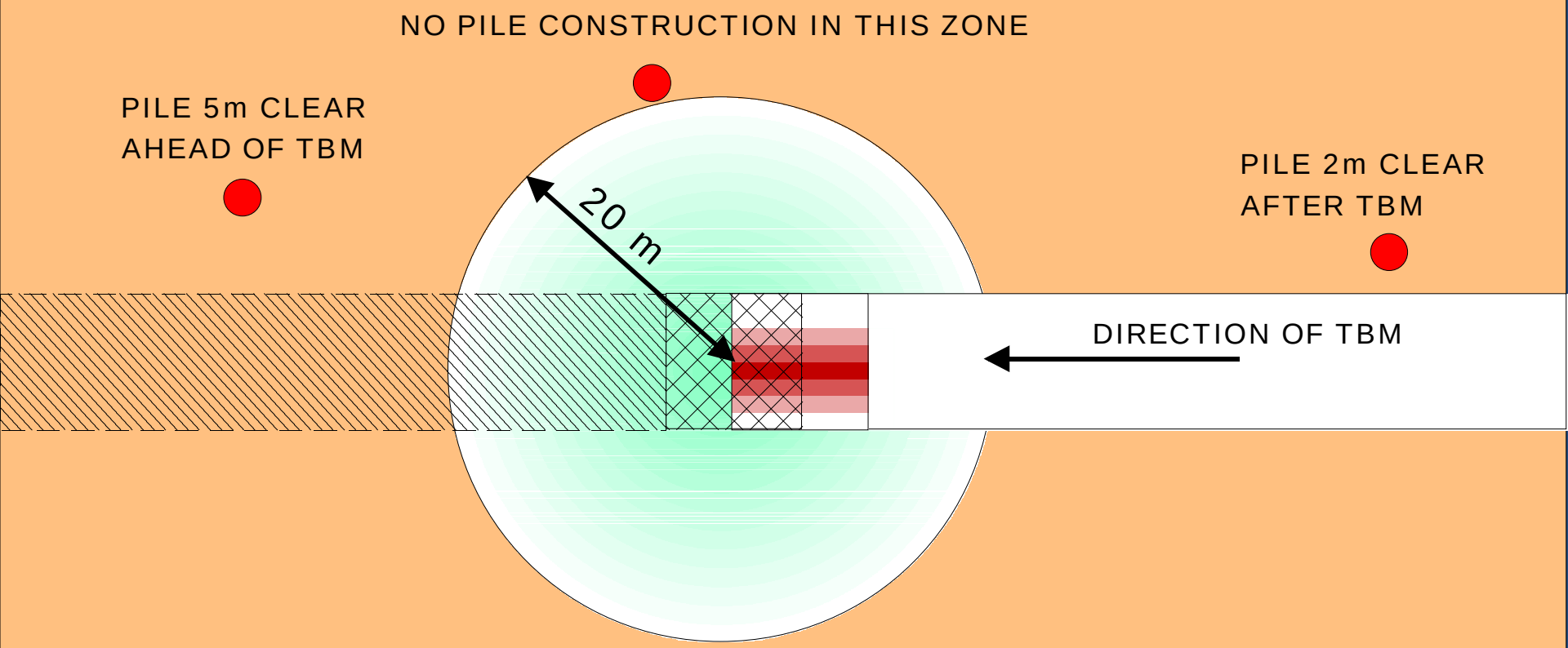


New Southern Railway Alignment

Tunnel Horizontal Alignment Across Main Runway, Sydney Airport



Geological Section Under Airport between the International and Domestic Terminals



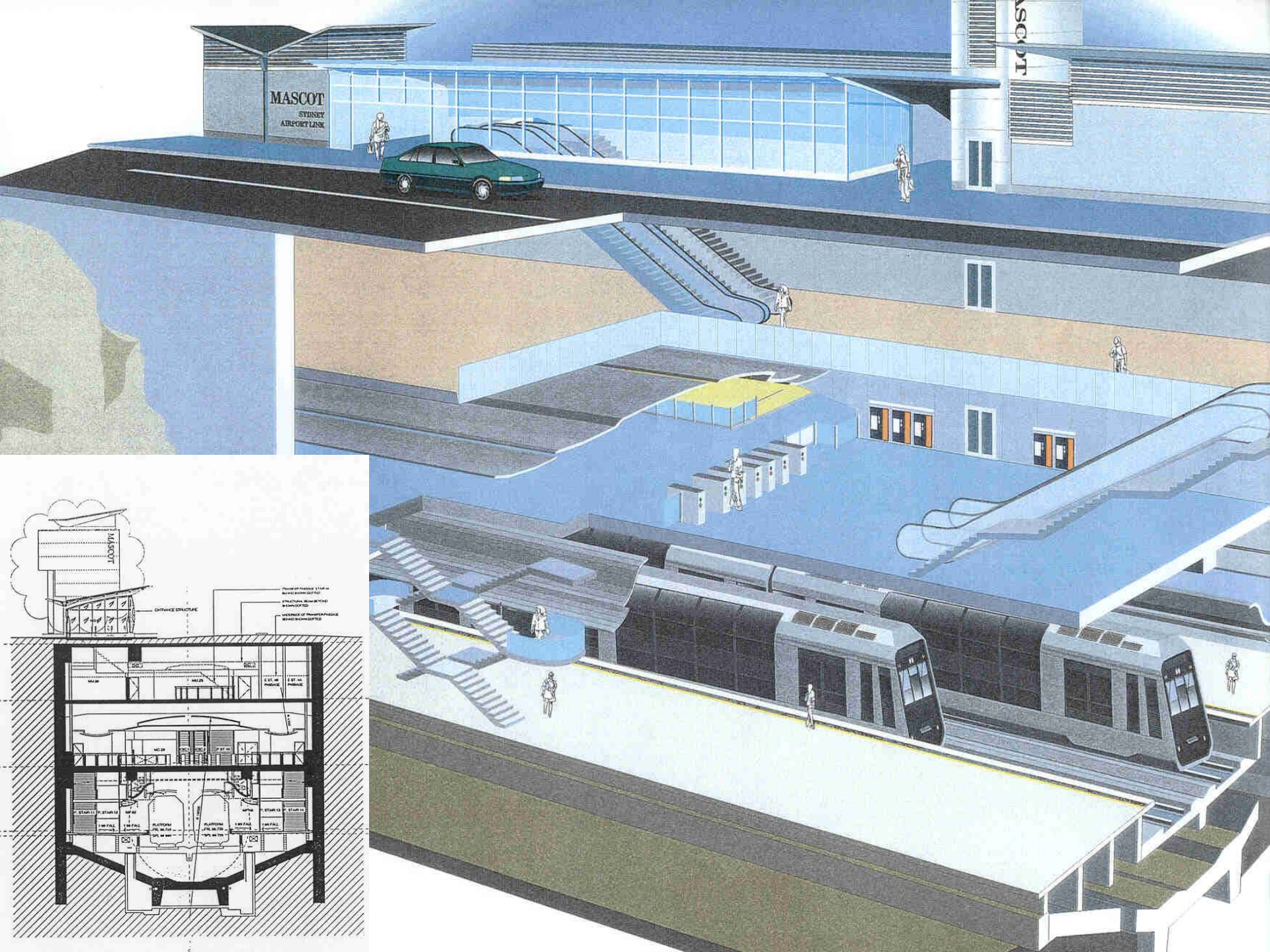
10 X 10M NO HEAVY SURFACE LOADING ZONE

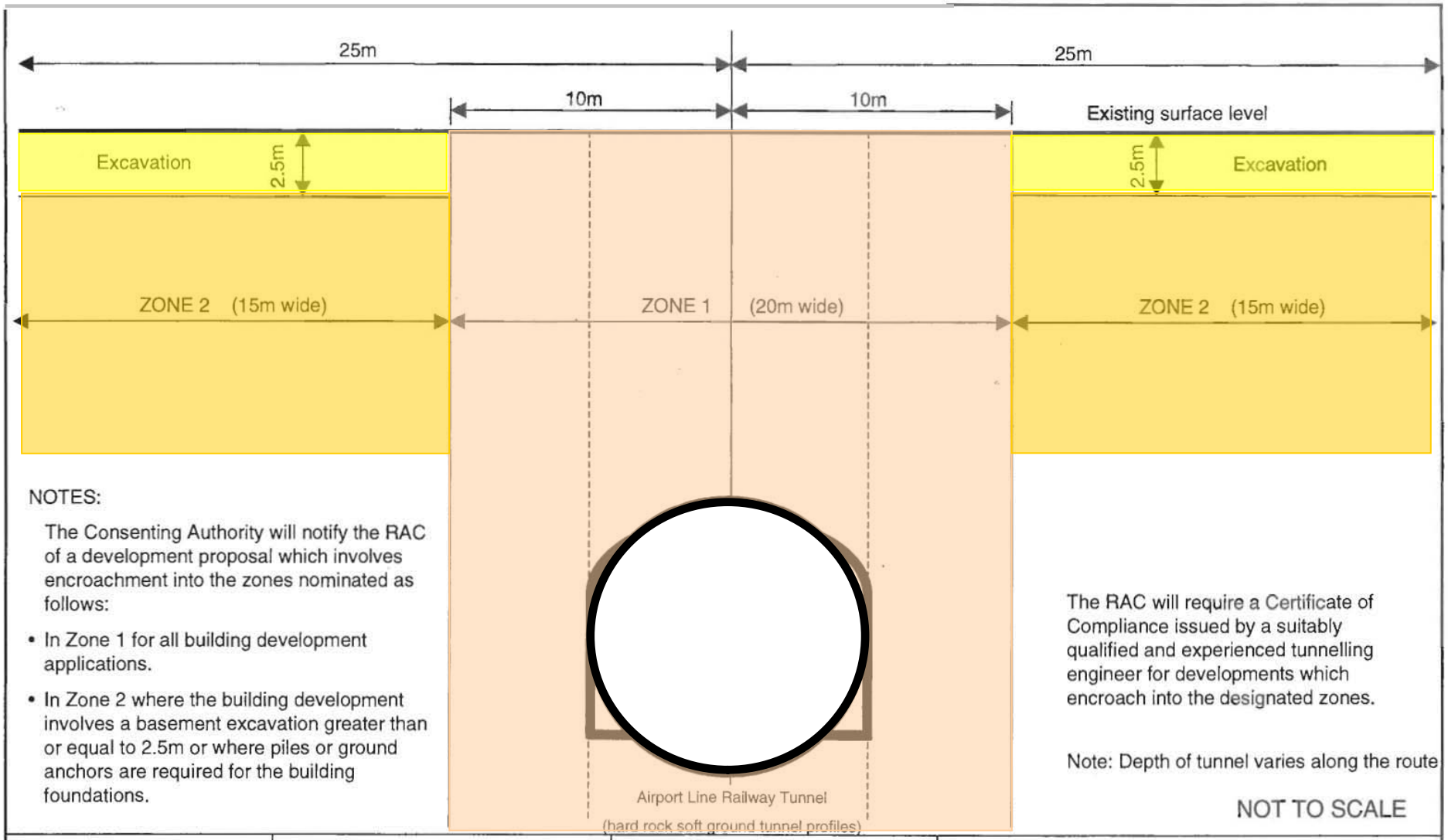
CRITERIA TO PROTECT TUNNEL AND TBM AT THE DOMESTIC TERMINAL ELEVATED ROADWAY

Soft Ground Tunnel - Watertight Concrete Segmental Lining


8,47

Closer view
Tempe Site and Rail, Road and River Crossings


MASCOT
SYDNEY
AIRPORT LINK
MASCOT
ENTRANCE STRUCTURE



NOTES:

The Consenting Authority will notify the RAC of a development proposal which involves encroachment into the zones nominated as follows:

- In Zone 1 for all building development applications.
- In Zone 2 where the building development involves a basement excavation greater than or equal to 2.5m or where piles or ground anchors are required for the building foundations.

The RAC will require a Certificate of Compliance issued by a suitably qualified and experienced tunnelling engineer for developments which encroach into the designated zones.

Note: Depth of tunnel varies along the route

NOT TO SCALE

THIS FIGURE APPLIES TO THE HARD ROCK AND SOFT GROUND BORED TUNNELS AND THE CUT AND COVER TUNNELS

E. J. Nye & Associates Pty Ltd
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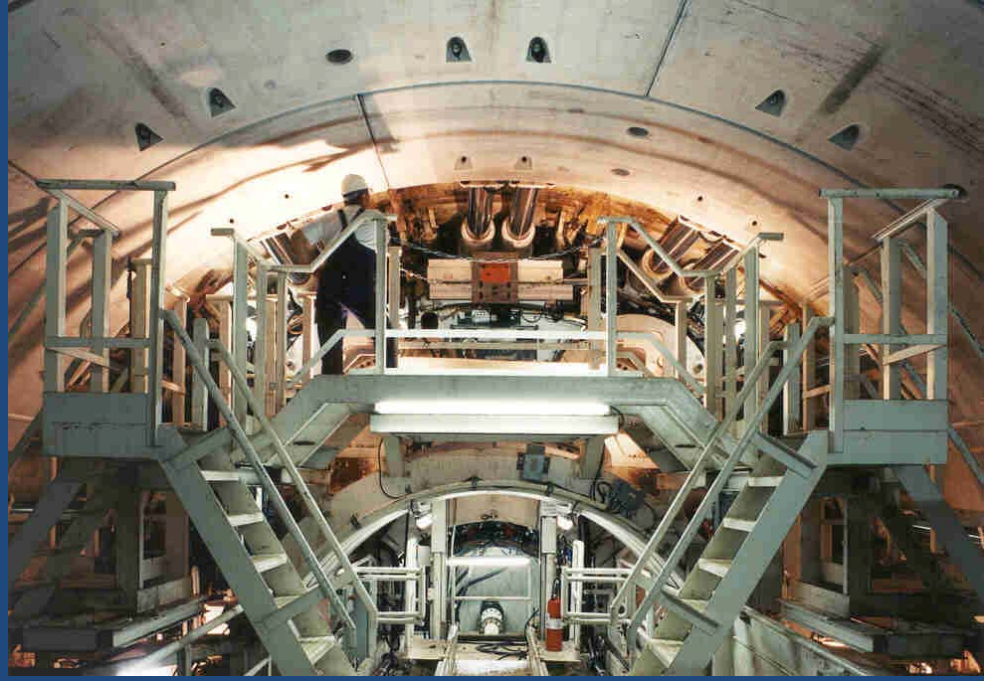
Consulting Engineers
P.O. Box 621
North Sydney NSW 2059

On behalf of
Rail Access Corporation
Level 16
55 Market Street
Sydney NSW 2000

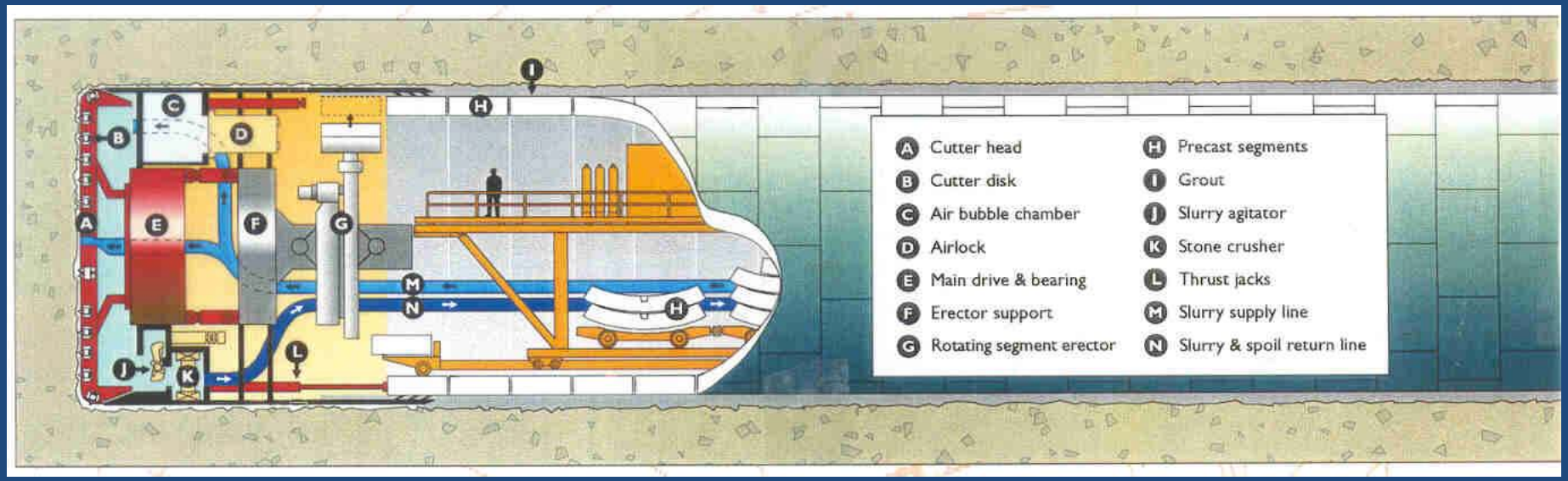
Airport Line Railway
Zone Definitions
Certificate of Compliance

Figure 1, Version 03, April 2000

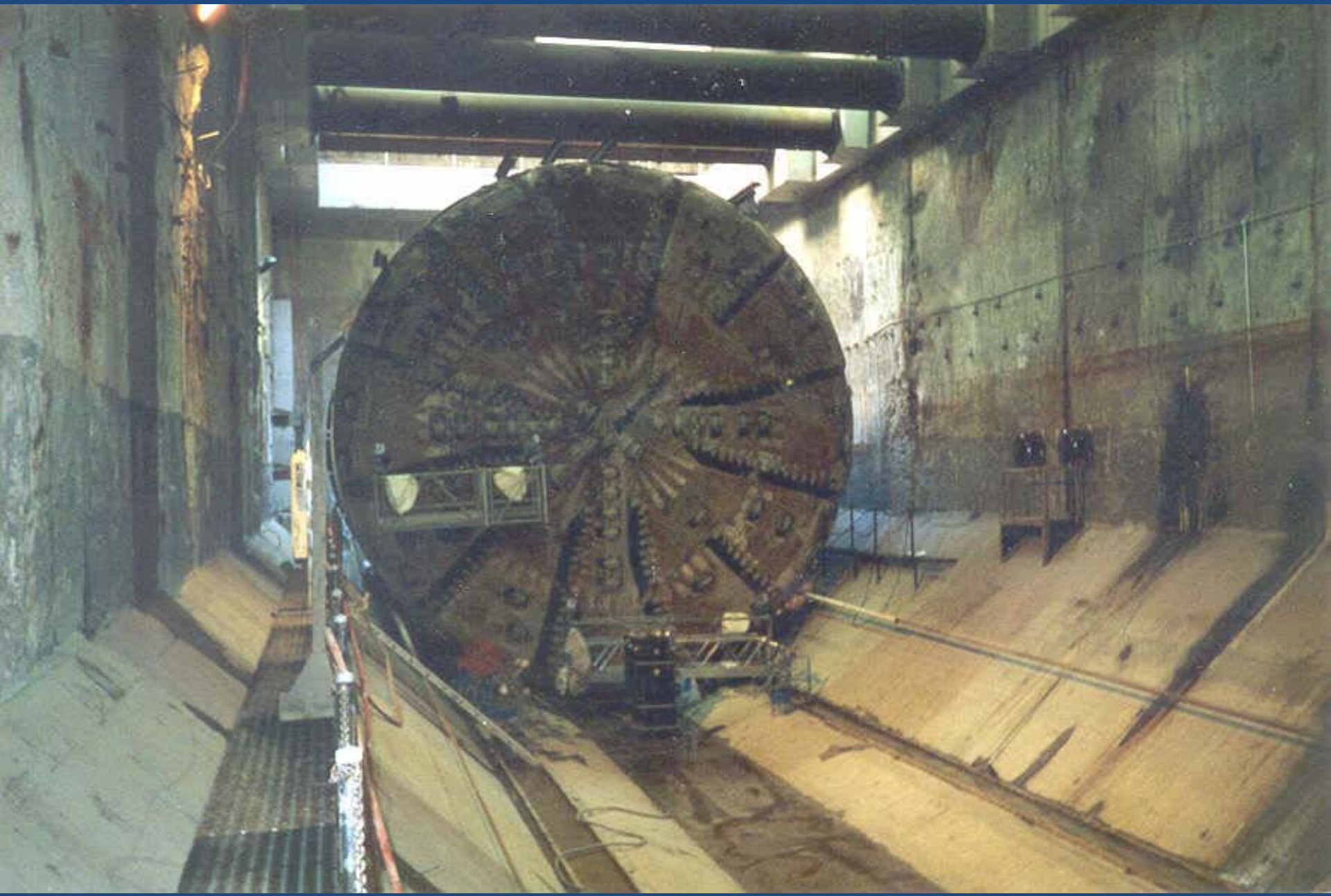
Slurry
TBM Head



Back of
TBM



Section Through Slurry TBM



Event	Probability			Consequences of Disruption			Comments
	Low	Med	High	Low	Med	High	
1. Small Void at cutterhead < $4m^3$			♦	♦			
2. Large void at cutterhead > $4m^3$ during intervention	♦					♦	
3. Segment seal failure (slurry flow in)	♦				♦		
4. Failure of tail shield brushes	♦				♦		
5. Having machine stopped							
1 day			♦	♦			
3 days		♦		♦			
7 days	♦				♦		
1 month	♦				♦		Major mechanical breakdown
3 months	♦					♦	
6. Failure of slurry system pumps							
during intervention	♦					♦	No slurry pipe change and no maintenance on P1.1
during excavation			♦	♦			Check mud quality continuously to reduce risk
7. Failure of Air confining pressure							.
during intervention	♦					♦	Probability is very low because there are 3 compressors including 1 diesel to supply air
during excavation	♦					♦	
8. Slurry Treatment Plant Breakdown			♦	♦			Continuous checking of mud quality.
9. Power Supply Failure			♦	♦			Main supply is on the 705 feeder. Back up 702 feeder immediately available and emergency generator to keep pumps operational. Need to monitor mud quality.
10. Mud Quality							
during intervention	♦					♦	No intervention unless mud quality OK
during excavation	♦				♦		Due to tunnelling in clay
11. Grout System Failure	♦			♦			2 pumps, 4 lines, 8 injection points, 2 in storage (i.e. 5 rings). No excavation if there is no grout.
12. Tree on route	♦			♦			It is highly likely that we have already come across a tree
13. Main Bearing Failure	♦					♦	Continuous monitoring of forces/pressures and analysis of hydraulic fluid.
14. Failure of sealing of articulation	♦					♦	2 seals plus injection of mastic grease and polyurethane foam possible if there is a problem.
15. Unplanned Intervention without void with void $4m^3$	 ♦		♦	♦		 ♦	Monitor/assess data acquisition and grout volumes continuously and especially prior to evacuation of cutter head to determine if OK to do so.

TABLE 1: FAC Land and North Apron Risk/Hazard Analysis

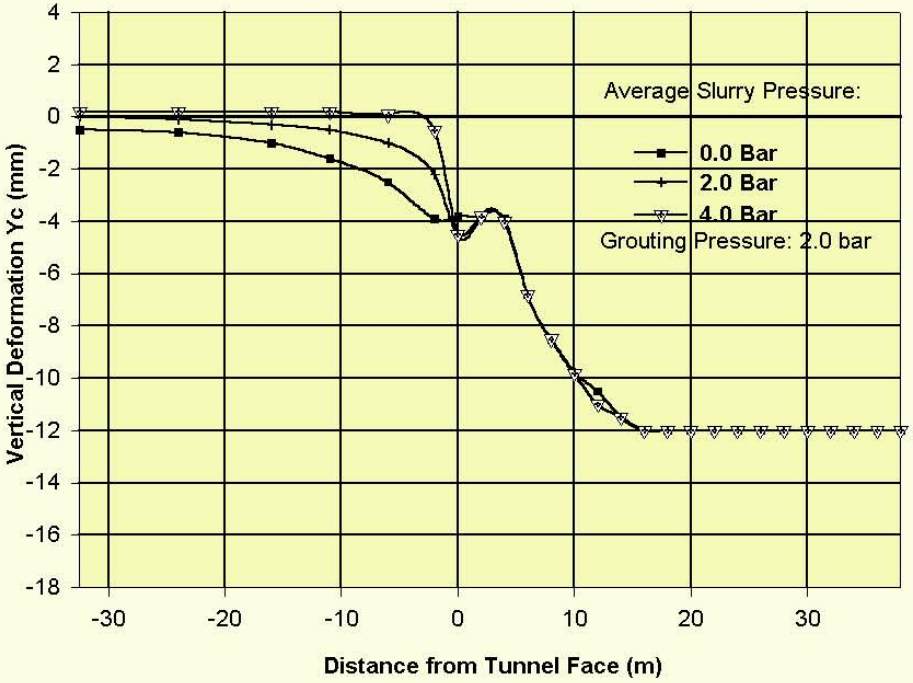


FIGURE 2A: Vertical Deformation Along Crown for Different Values of Average Slurry Pressure

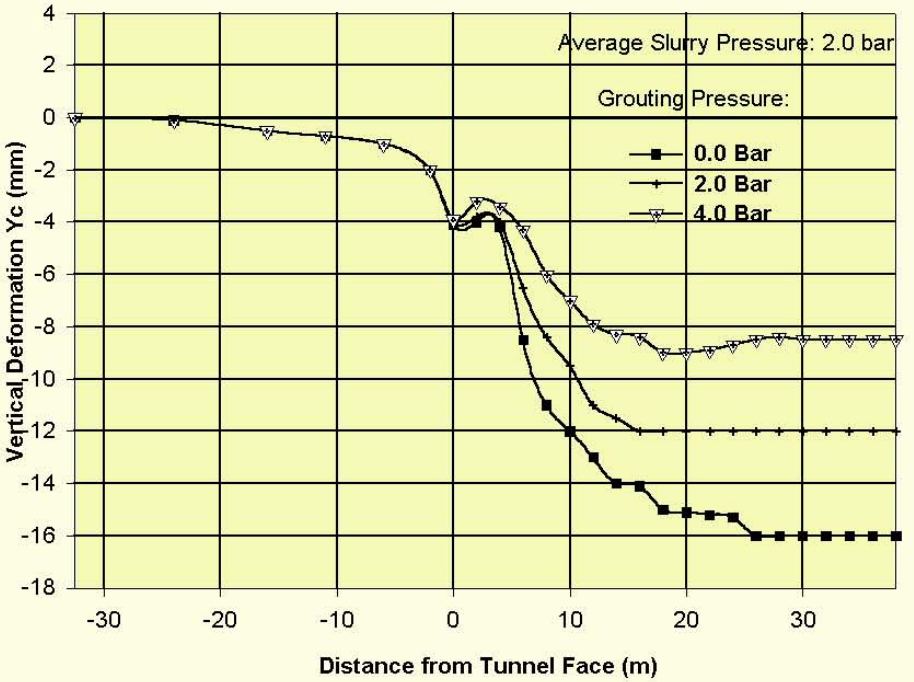
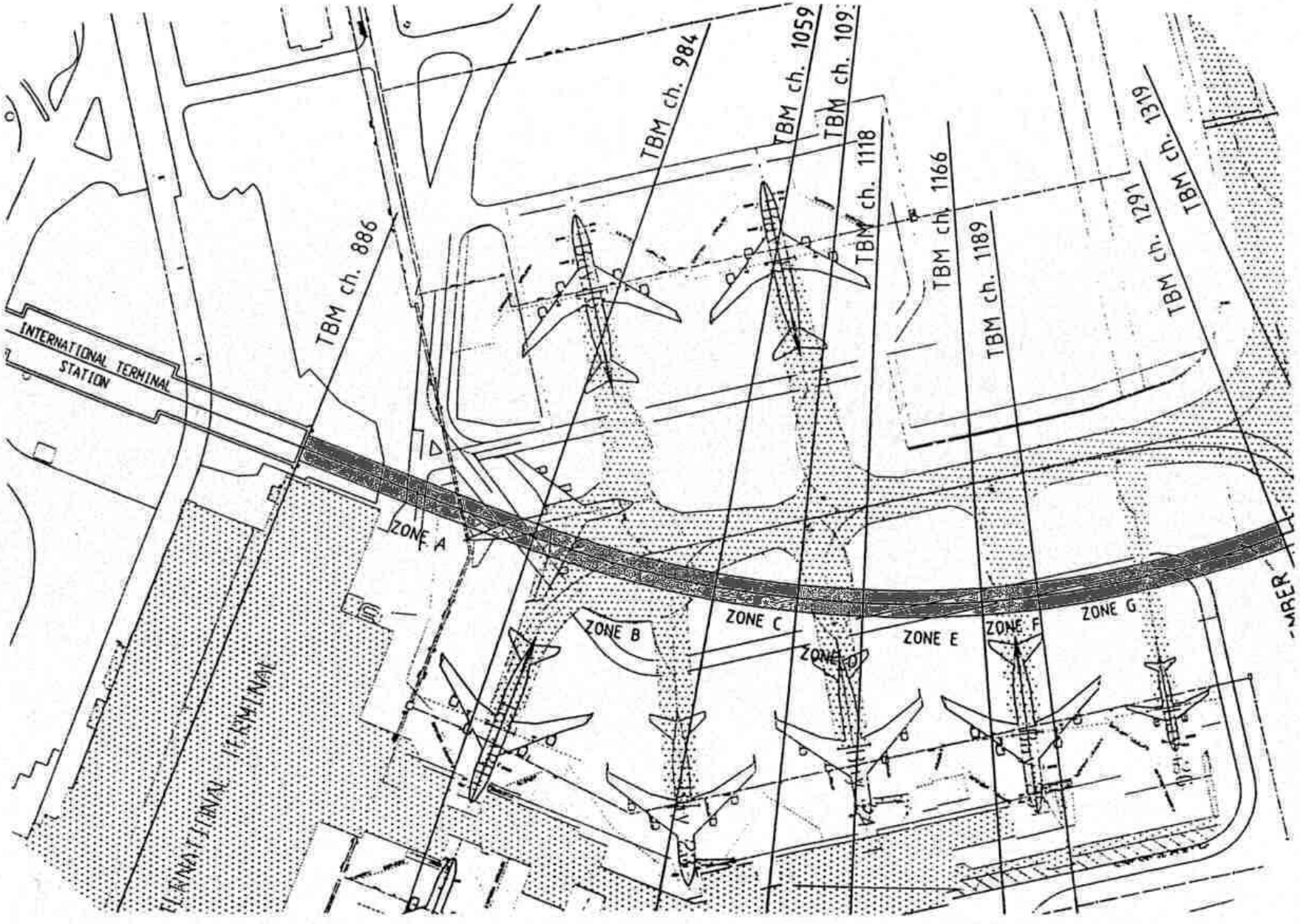


FIGURE 2B: Vertical Deformations Along Crown for Different Values of Grout Pressure



North Apron Plan - Tunnel Alignment

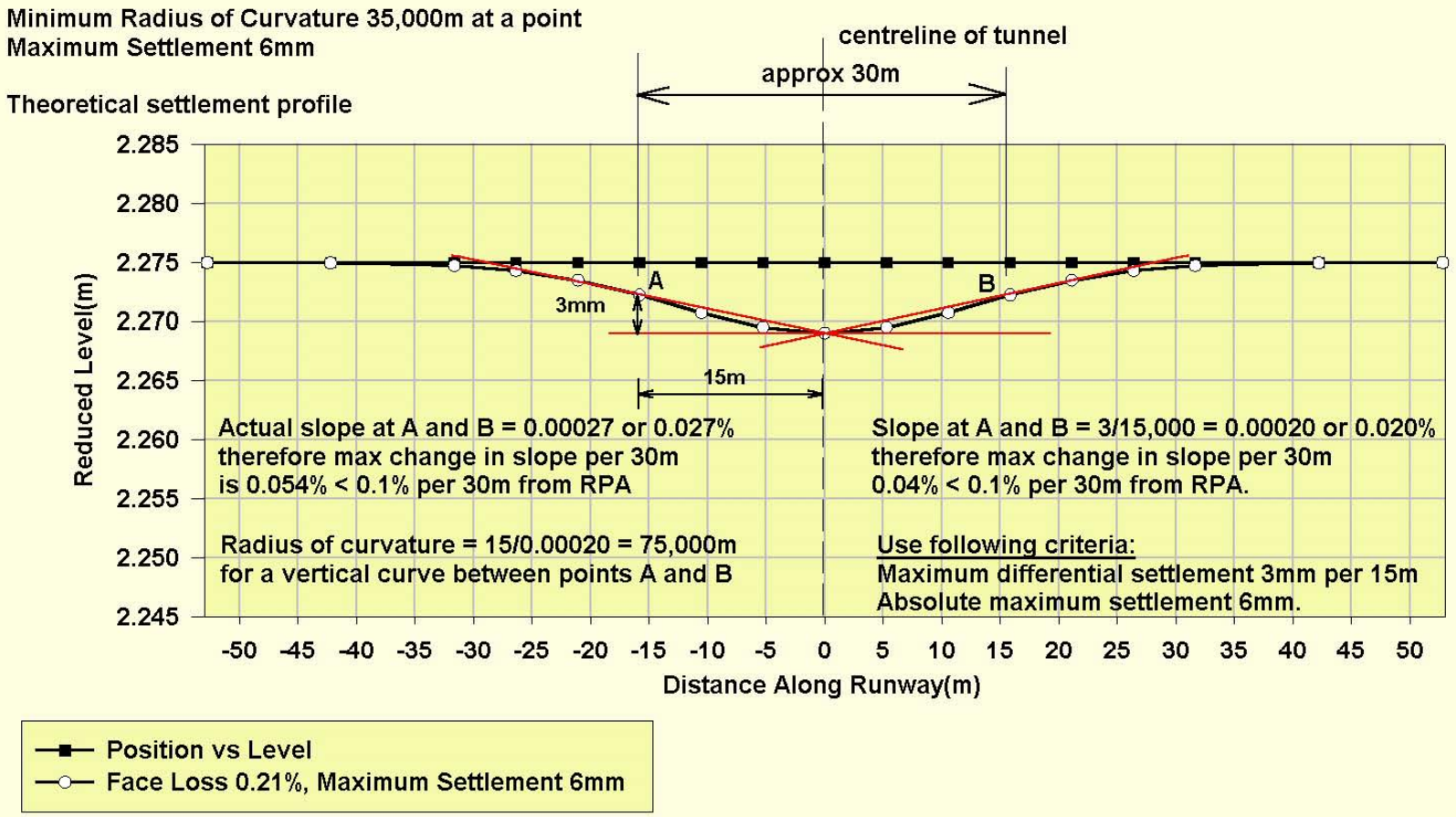


Figure 4: Settlement Criteria to Comply with the Rules and Practices for Aerodromes(RPA).

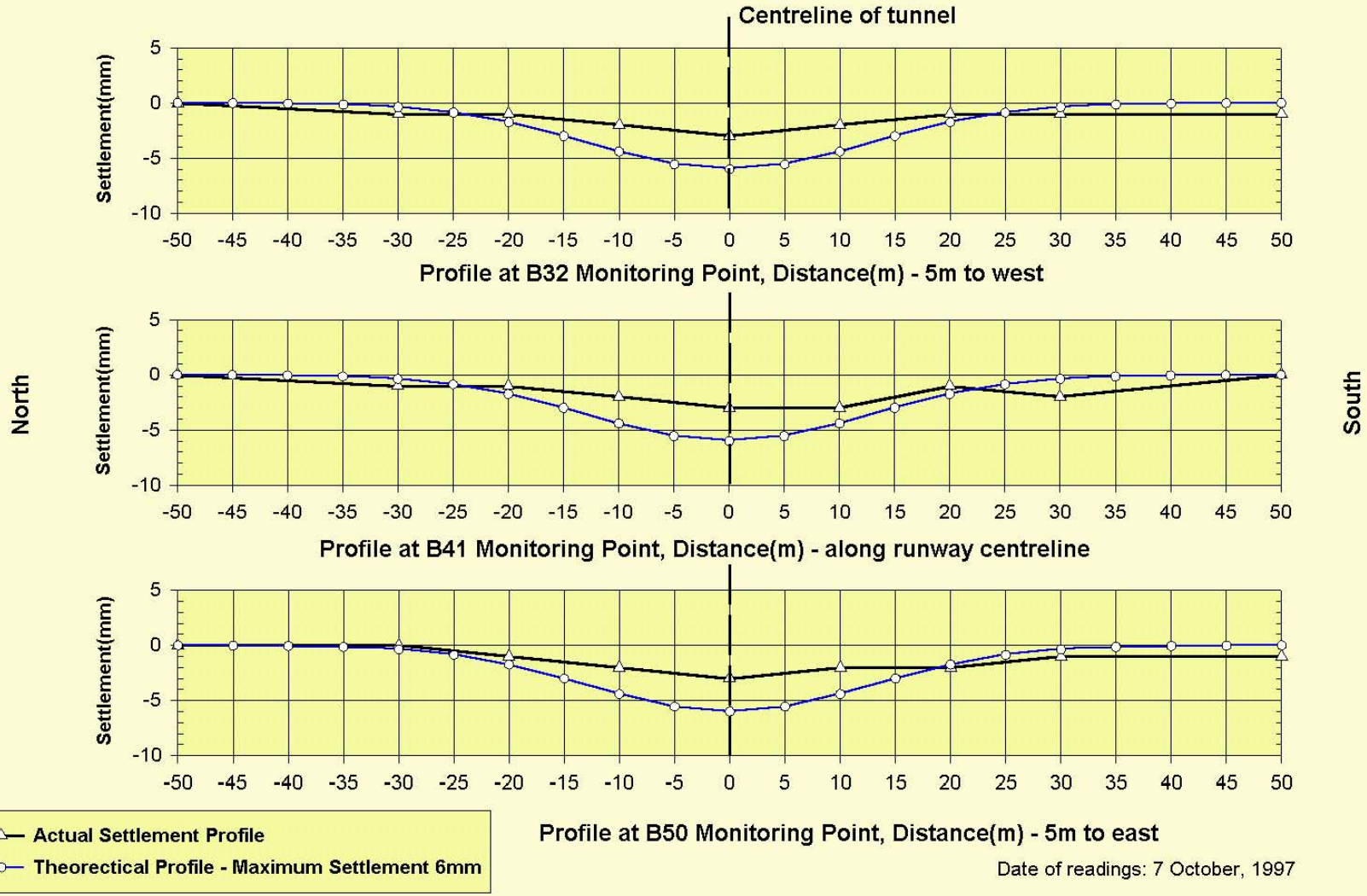


Figure 6: Settlement Profiles Along Runway

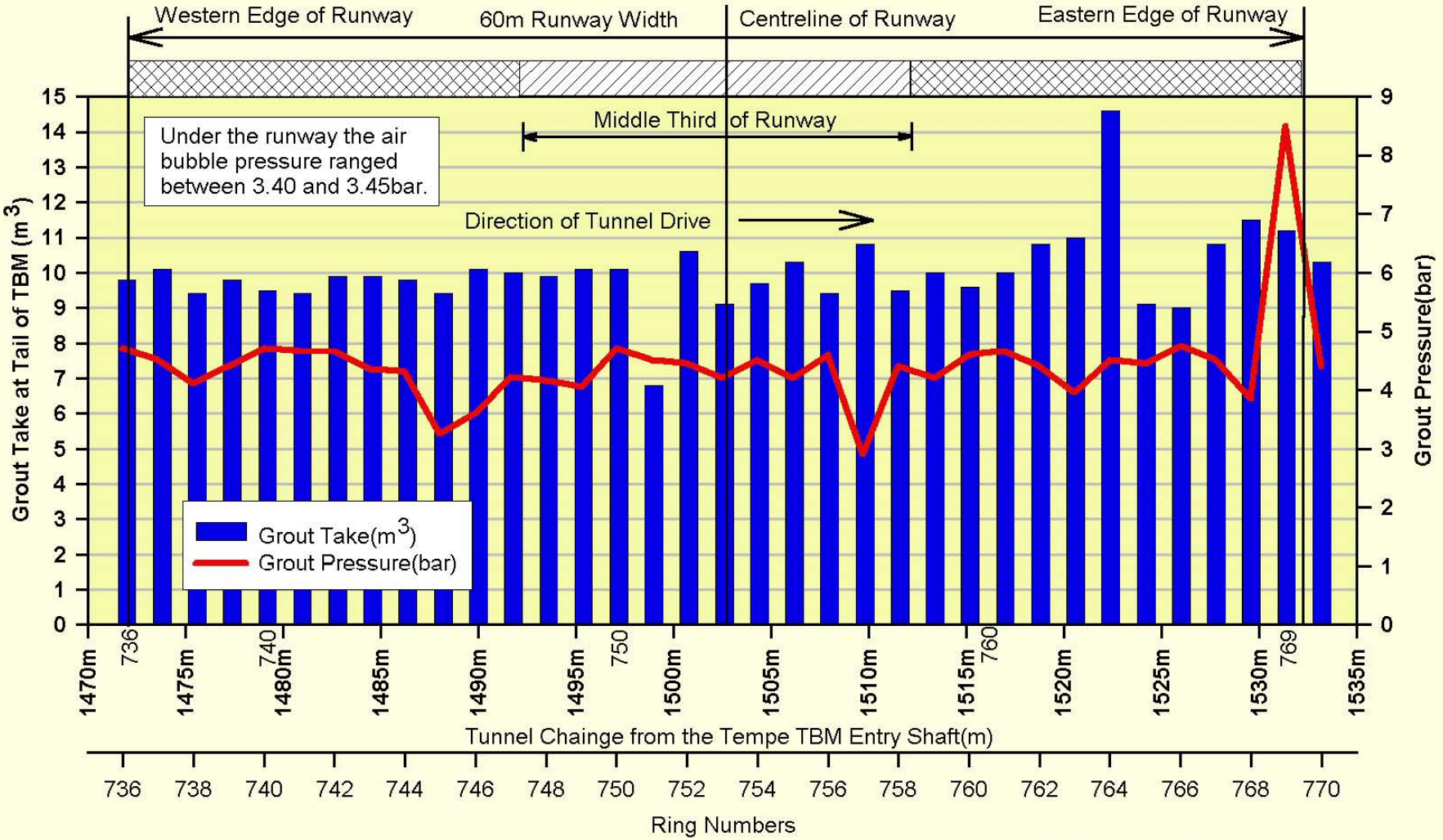


Figure 7: Grout Take Volume(cum) and Grout Pressure(bar) at Tail of TBM Under the Runway (Lining Ring Nos 736 to 770)

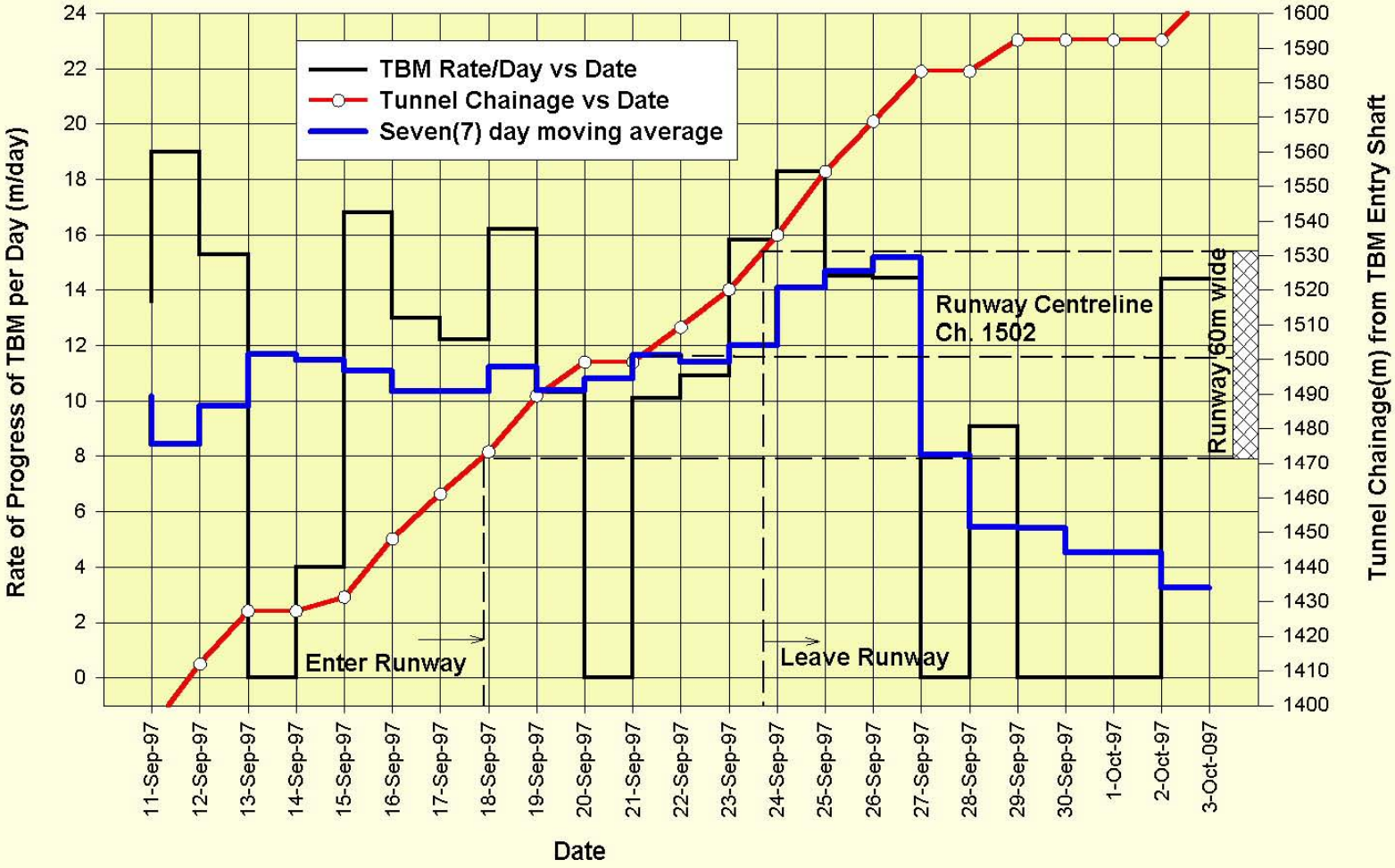
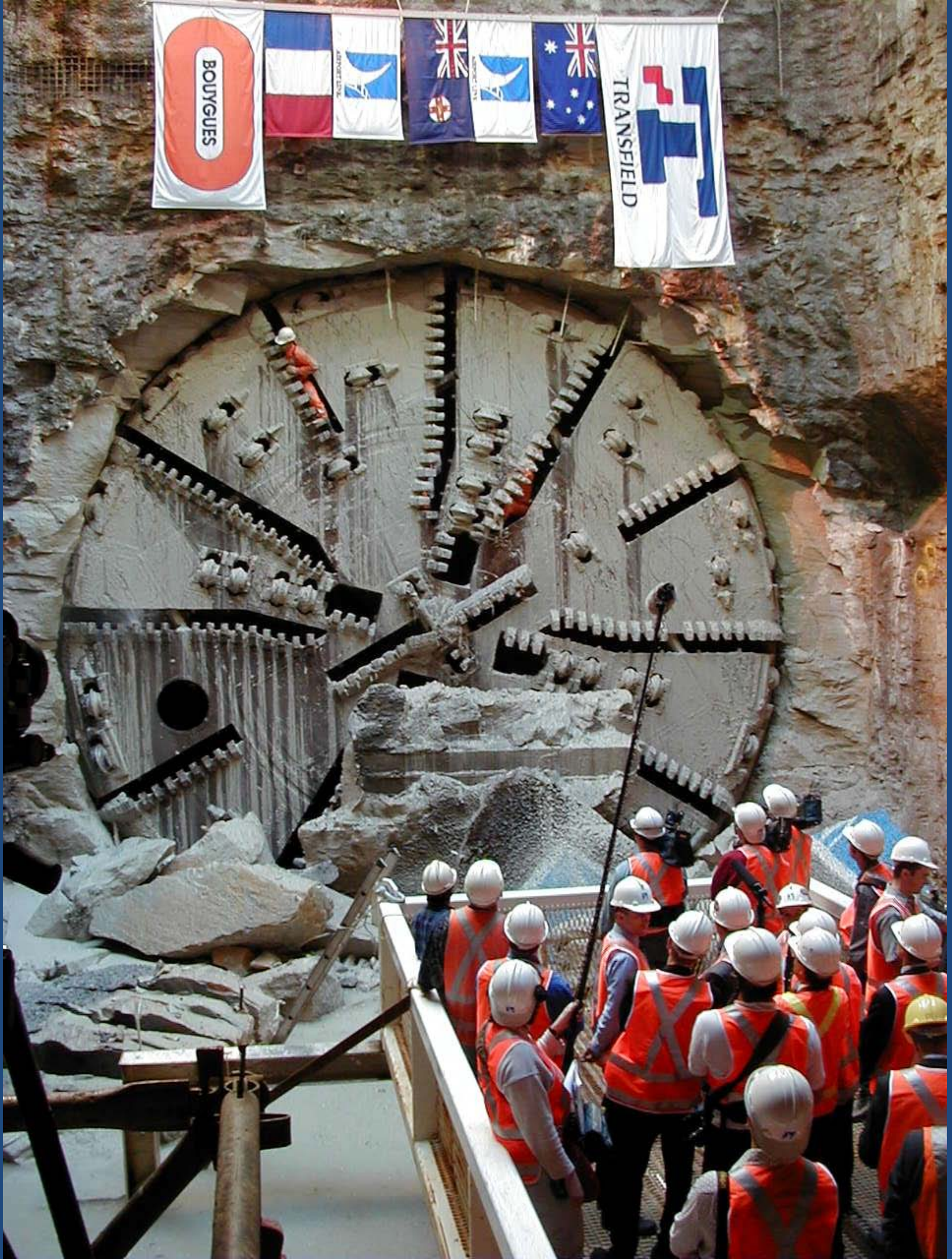
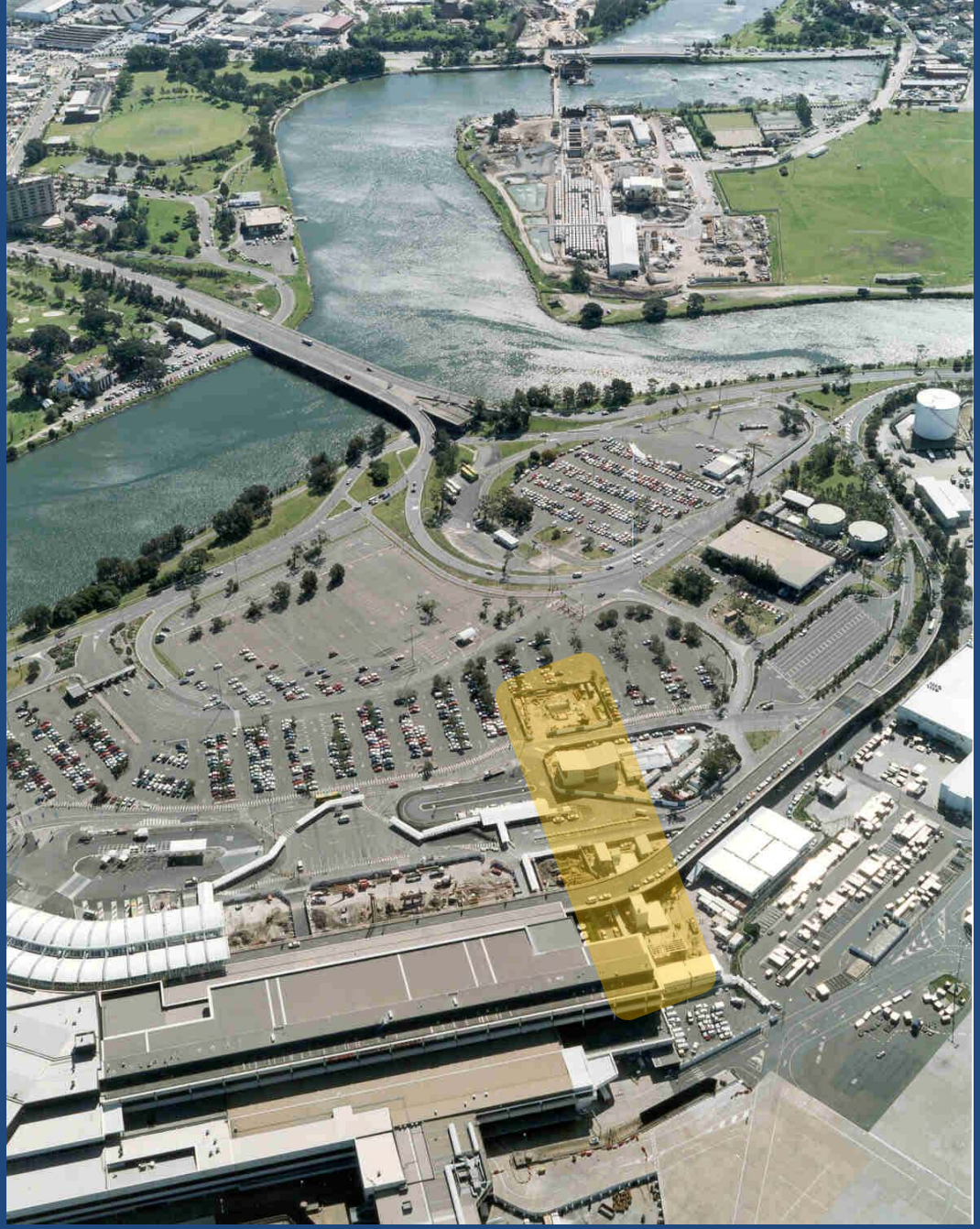


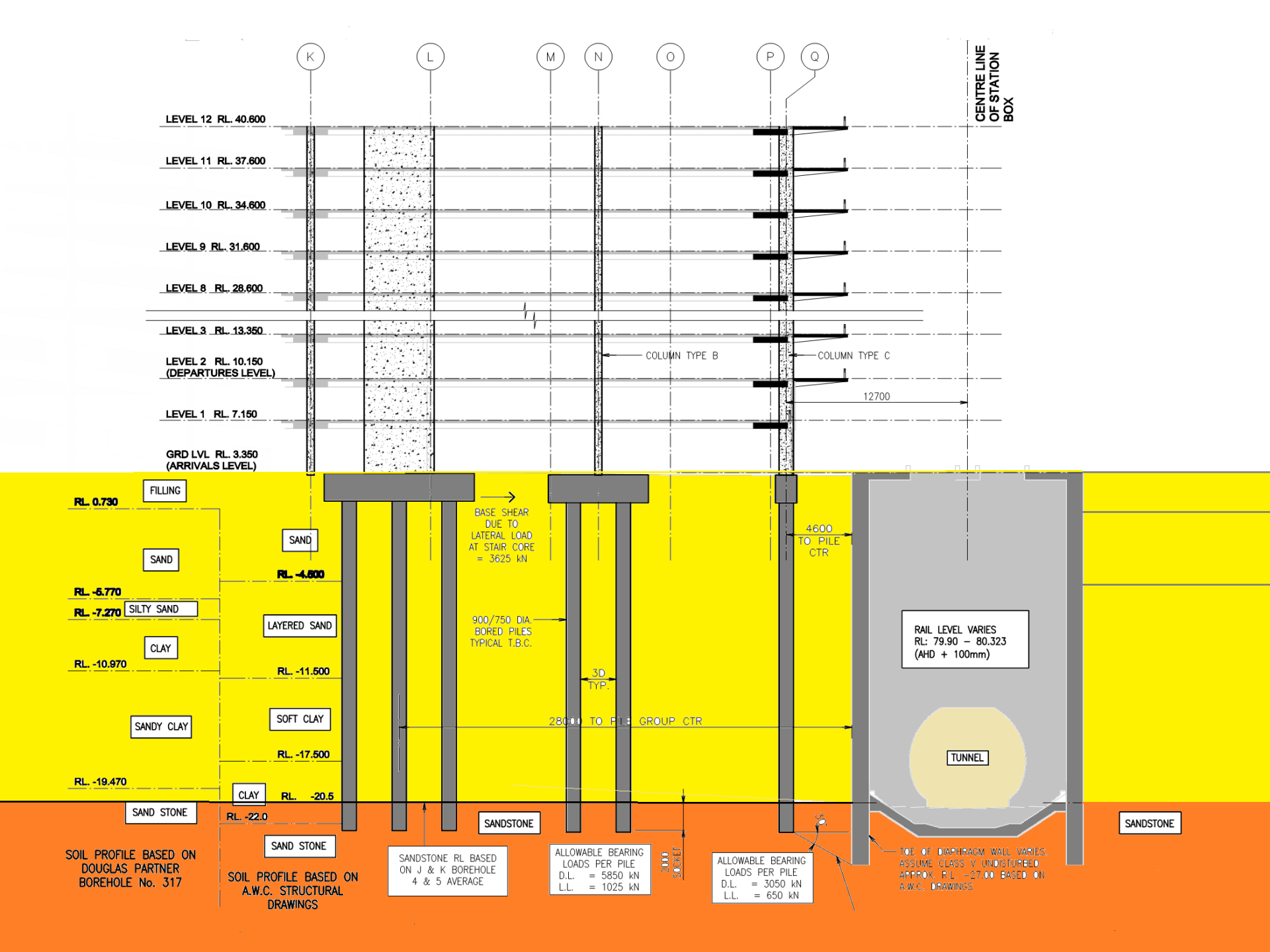
Figure 8: Location and Rate of Progress of Slurry TBM Under the Runway



BOUYGUES
TRANSFIELD



View to and from the International Terminal, Sydney Airport


K
L
M
N
O
P
Q
CENTRE LINE OF STATION BOX
LEVEL 12 RL. 40.600
LEVEL 11 RL. 37.600
LEVEL 10 RL. 34.600
LEVEL 9 RL. 31.600
LEVEL 8 RL. 28.600
LEVEL 3 RL. 13.350
LEVEL 2 RL. 10.150
(DEPARTURES LEVEL)
LEVEL 1 RL. 7.150
GRD LVL RL. 3.350
(ARRIVALS LEVEL)
COLUMN TYPE B
COLUMN TYPE C
12700
FILLING
RL. 0.730
SAND
SAND
RL. -4.600
RL. -5.770
SILTY SAND
RL. -7.270
LAYERED SAND
CLAY
RL. -10.970
RL. -11.500
SANDY CLAY
SOFT CLAY
RL. -17.500
RL. -19.470
CLAY
RL. -20.5
SAND STONE
RL. -22.0
SAND STONE
SANDSTONE
SANDSTONE
BASE SHEAR DUE TO LATERAL LOAD AT STAIR CORE = 3625 kN
4600 TO PILE CTR
900/750 DIA. BORED PILES TYPICAL T.B.C.
3D TYP.
28000 TO PILE GROUP CTR
RAIL LEVEL VARIES
RL: 79.90 – 80.323
(AHD + 100mm)
TUNNEL
2000 SOCKET
TOE OF DIAPHRAGM WALL VARIES. ASSUME CLASS V UNDISTURBED APPROX. R.L. -27.00 BASED ON A.W.C. DRAWINGS
SOIL PROFILE BASED ON DOUGLAS PARTNER BOREHOLE No. 317
SOIL PROFILE BASED ON A.W.C. STRUCTURAL DRAWINGS
SANDSTONE RL BASED ON J & K BOREHOLE 4 & 5 AVERAGE
ALLOWABLE BEARING LOADS PER PILE
D.L. = 5850 kN
L.L. = 1025 kN
ALLOWABLE BEARING LOADS PER PILE
D.L. = 3050 kN
L.L. = 650 kN

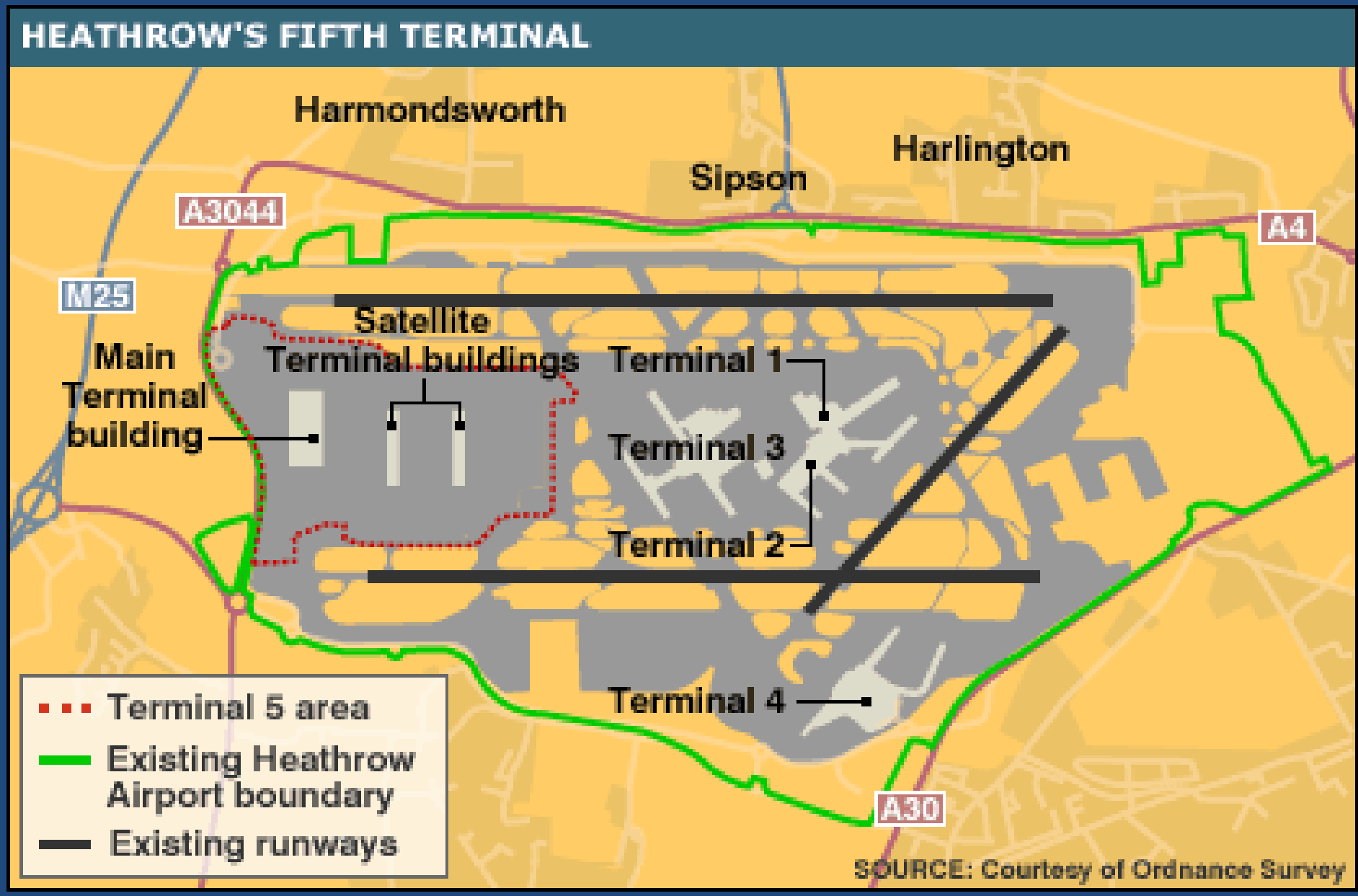

Virgin
now you're
P
P
P
Public Parking
Staff
VALET
TO TERMINAL

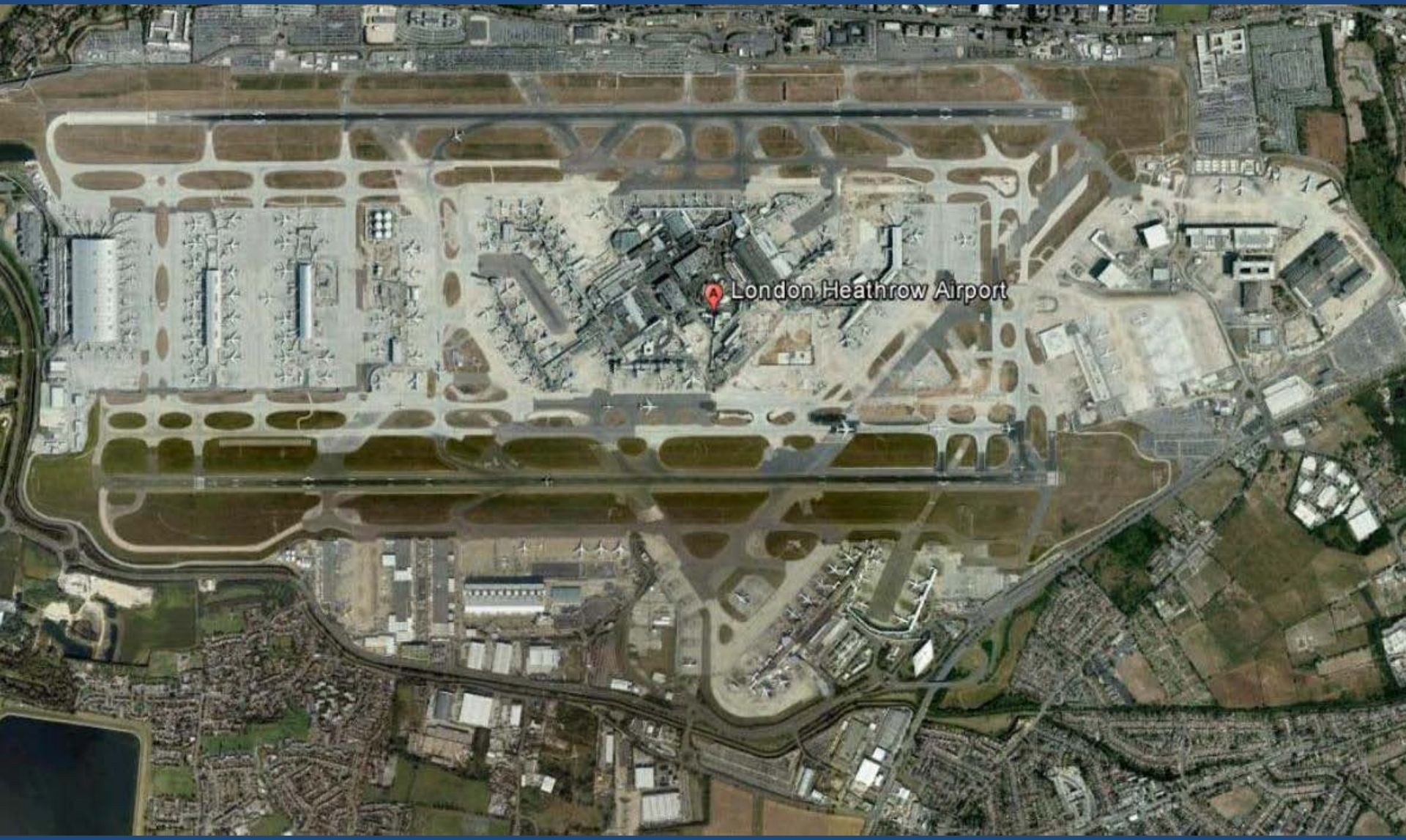

Abigroup


BM 71 ZH
DANGER

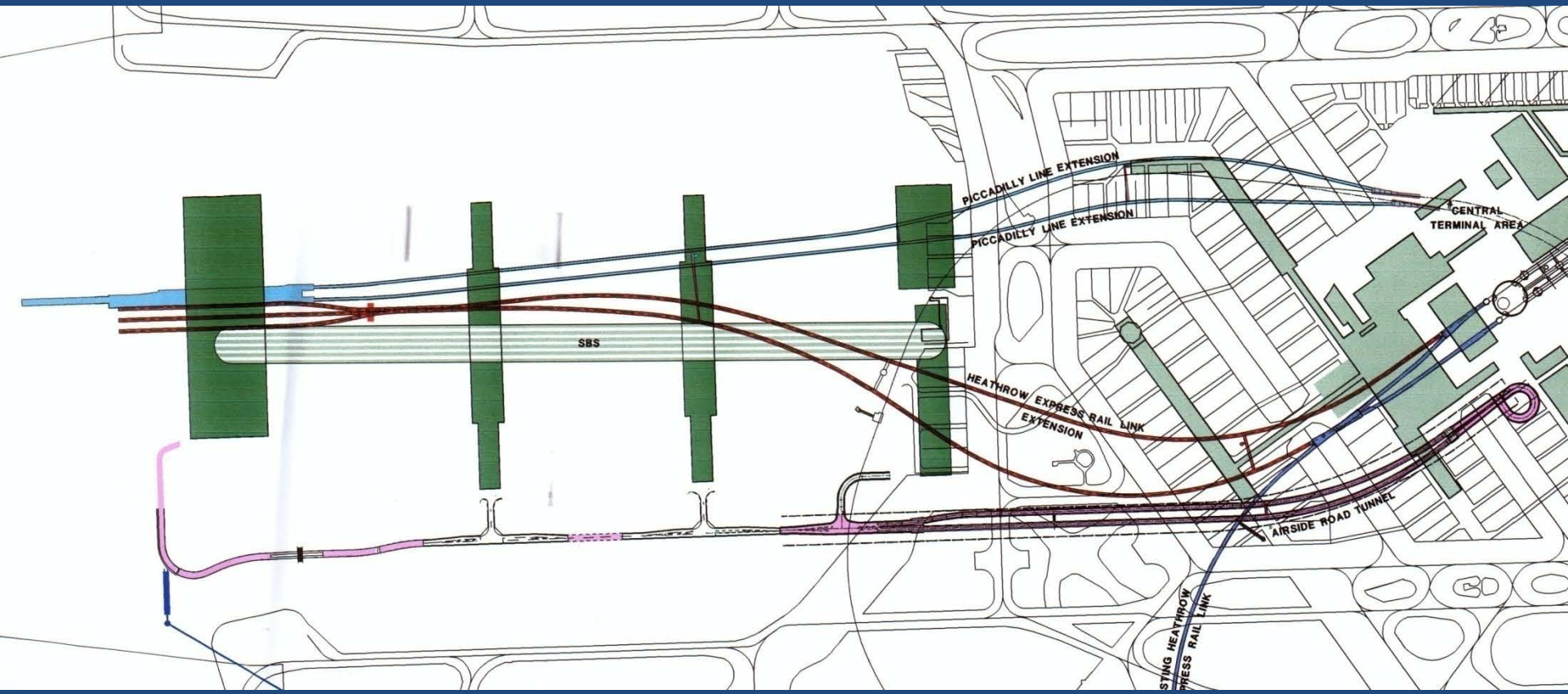

now you're flying, worldwide.
Virgin australia
P

Heathrow Airport – Tunnels (overview)


HEATHROW'S FIFTH TERMINAL
Harmondsworth
Sipson
Harlington
A3044
A4
M25
Satellite
Main Terminal building
Terminal buildings
Terminal 1
Terminal 3
Terminal 2
Terminal 4
A30
Terminal 5 area
Existing Heathrow Airport boundary
Existing runways
SOURCE: Courtesy of Ordnance Survey


London Heathrow Airport

General Overview



The works consisted of more than 14 kilometres of tunnels including the airside road tunnel, the Heathrow express extension, the Piccadilly underground line extension and junction, and storm water outfall and service tunnels. The tunnels had to be driven beneath live airport taxiways and aircraft stands without any disturbance to airport operations.

Technical features

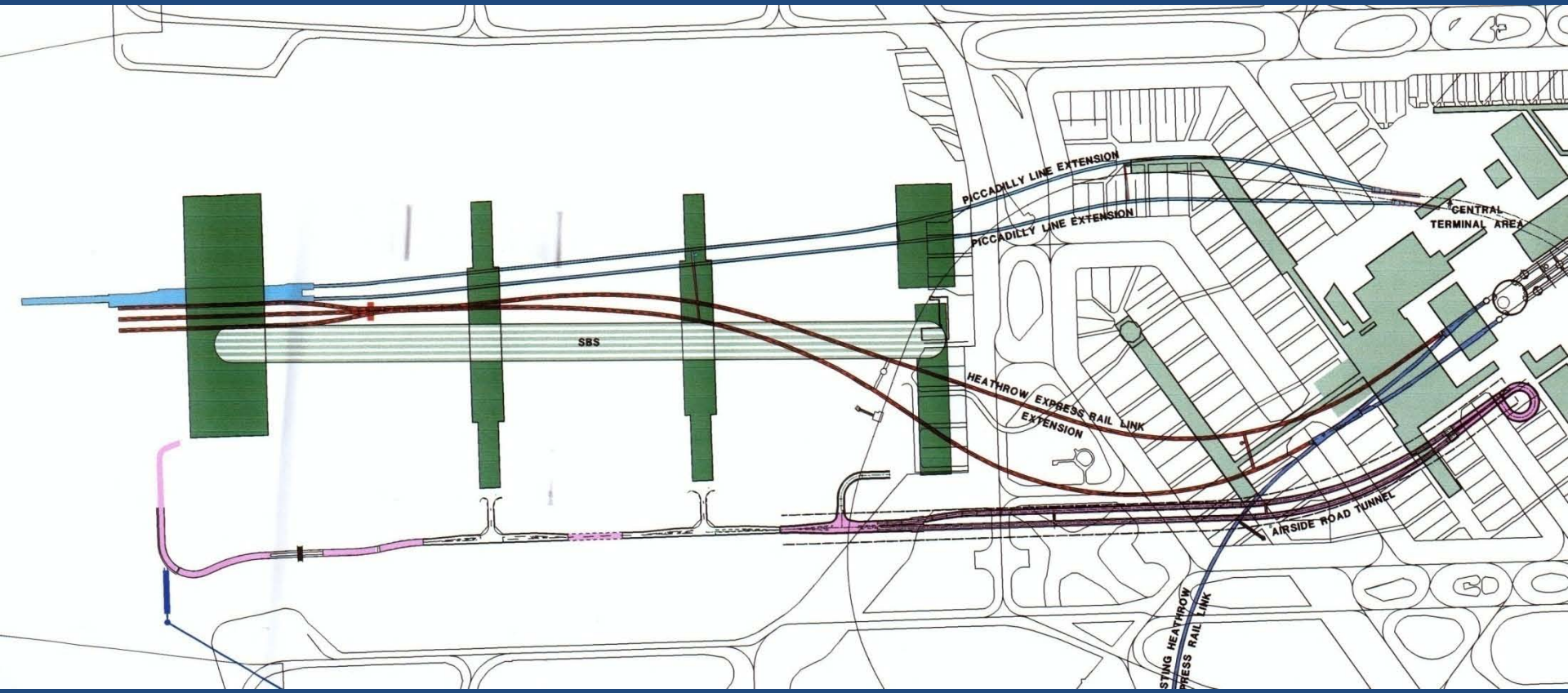
Each of the Terminal 5 tunnels and connections presented its own specific technical challenges. Several factors had to be successfully managed through creative design and advanced mining technology Terminal 5 Tunnels, Heathrow Airport.

Tight surface settlement limits had to be adhered to as most of the tunnelling runs below aircraft stands and taxiways.

The geotechnical characteristics of London clay, through which most of the tunnels were driven, made it critical to prevent any ground movement during excavation.

The new tunnels had to be accommodated in, and connected to, an already intricate network of existing, high-volume tunnels – calling for highly complex geometry within extremely fine tolerances.

Heathrow Airside Road Tunnel (ART)



The Heathrow Airside Road Tunnel (ART) is a tunnel at London Heathrow Airport. It connects the airside roads around Terminals 1, 2 and 3 to the airside roads around Terminal 5. The ART is 1.42 km long, consisting of 60 m of twin-cell cut and cover box at each end, linked by a pair of 1.3 km bored tunnels. The ART was designed and built between 1999 and 2004 by a team of engineers from BAA(who own the tunnel), AMEC, Laing O'Rourke, Morgan- VInci JV and Mott MacDonald.

Each bore contains an unusual road layout, consisting of a single carriageway 6 m wide; just wide enough to allow an airport bus (Cobus 2700) to drive past another bus stopped at the side of the road. The two tunnels are linked by escape cross-passages at intervals of 100–130 m. The tunnel was opened to airside traffic in March 2005 and is used only by vehicles with security clearance to drive airside. Now that Terminal 5 is fully operational, the ART forms the link between it and the other terminals at Heathrow.

The bored tunnels have internal diameter 8.1 m and were driven by a 9.16 m diameter Herrenknecht earth pressure balance TBM. The excavations were lined with a bolted concrete lining 0.45 m thick: these are unusually strong tunnel segments, required because the ART is so close to the surface and, at one point, passes 3 m over the top of the Heathrow Connect tunnel to Terminal 4.

Piccadilly Railway Tunnels

Baggage Transfer Tunnel