



REGIONAL RAIL LINK MELBOURNE WIDENING OF RAIL BRIDGE FLYOVER STRUCTURE

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Limited Access:

No access via the 200m long cutting,

One track only could be shut down at night with a 5 hour window

Limited Access

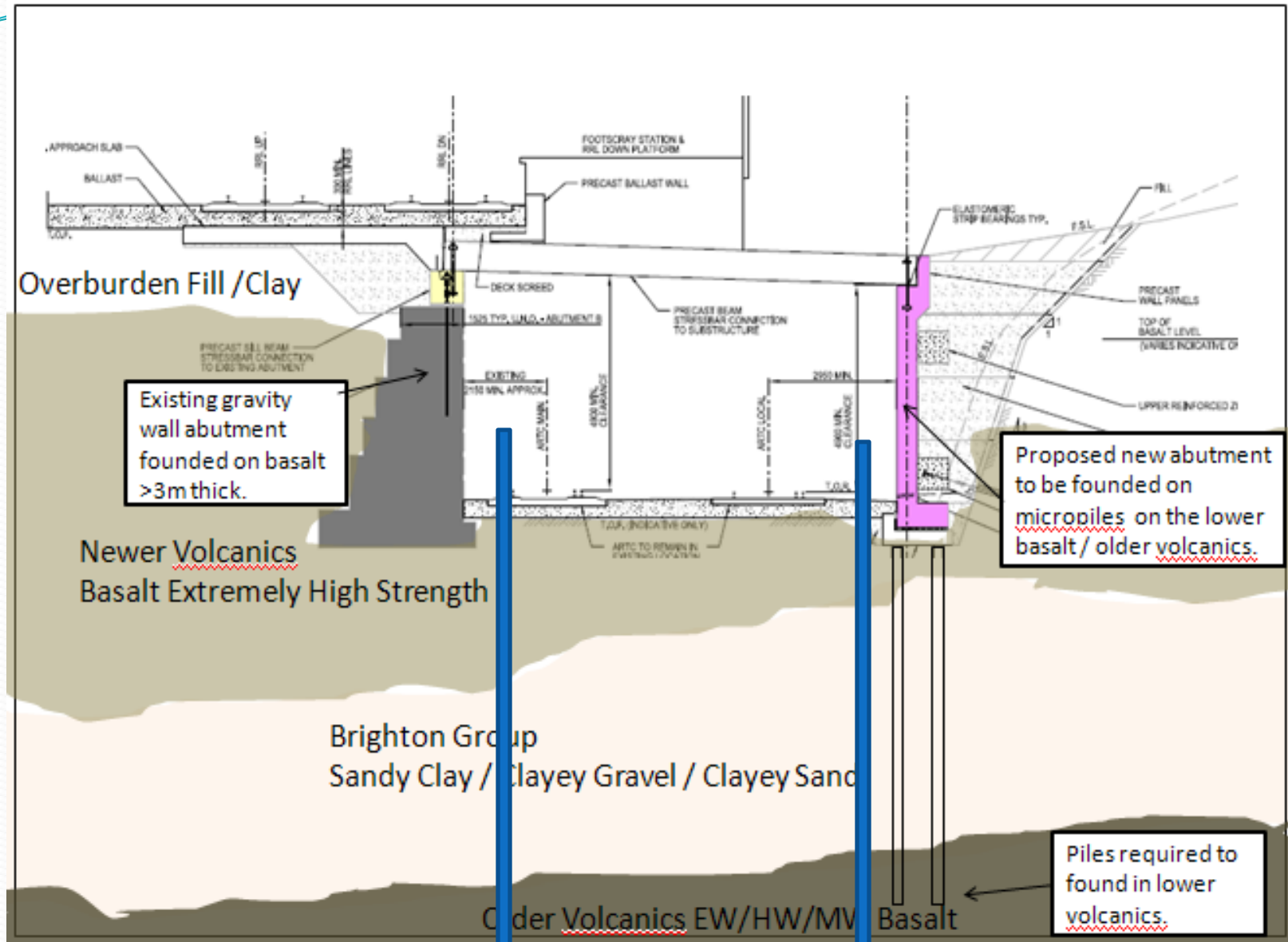
- Height of Cutting was up to 6m
- Only access was 200m along the cutting, only rubber tracked vehicles were allowed.
- Occupation of one track only could be provided with a full track crew required from the rail authority, the other had to remain open
- Work could only start 1 hour after last train and had to finish 1 hour before 1st train, this left a 5 hour window on week nights and an 8 hour window Saturday night
- Only 1 week of access could be provided for each abutment, next window would be 3 months away.
- At any time for train requirements the track would need to be able to be cleared in 20minutes
- For craning the electrified lines on the overhead bridge had to be shut down due to close proximity at the bridge end of the piling.

New Planks
for New Rail
Bridge

Section of
abutment to
be piled.

Section of
abutment to
be piled.





Existing gravity wall abutment founded on basalt >3m thick.

Proposed new abutment to be founded on micropiles on the lower basalt / older volcanics.

Piles required to be found in lower volcanics.

Newer Volcanics Basalt Extremely High Strength

Brighton Group Sandy Clay / Clayey Gravel / Clayey Sand

Older Volcanics EW/HW/MV Basalt

BH 7

BH 8

BH 7 Thick Layer Rock

Sandy Gravels
Potentially
collapsing

Drive to here
(Older
volcanics)



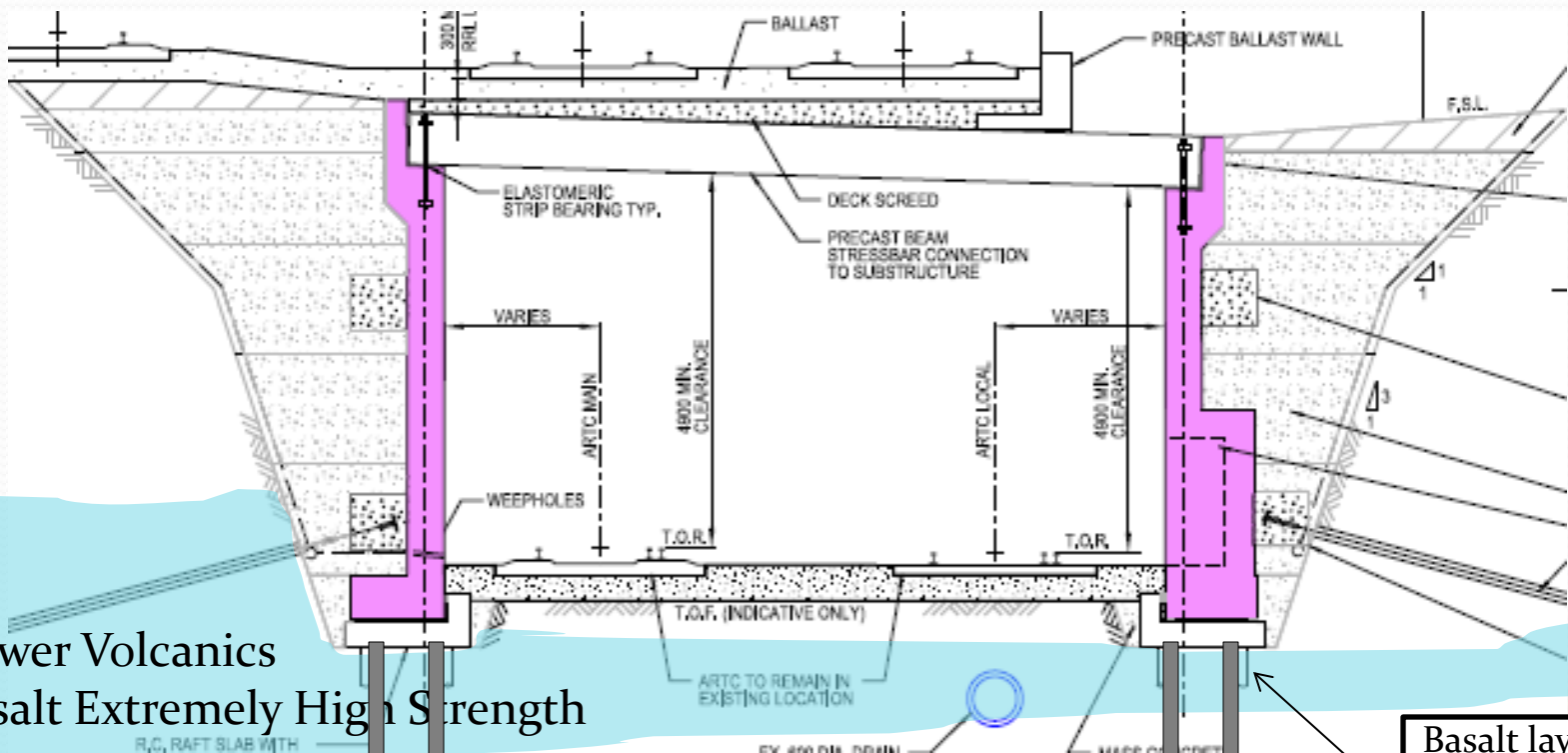
Predrill to here,
underside of
newer volcanic.

BH 8 Thick Layer Rock

Predrill to here,
underside of
newer volcanic.

Sandy Gravels
which collapsed
during drilling.

Drive to
approximately here
(Older volcanics)



Newer Volcanics
Basalt Extremely High Strength

Brighton Group
Sandy Clay / Clayey Gravel /
Clayey Sand.

Older Volcanics EW/HW/MW Basalt

Basalt layer. Less than 3m thick, unsuitable for founding.

Piles required to found in lower volcanics.

The Alternative Solution

Predrilled Driven Steel Tubes

Advantages

- The driven tubes could be installed in the limited access, and time frames required.
- Risk of collapsing ground and groundwater meant casing would be required, creating programming risk
- Verification of load capacity could be provided immediately on completion of driving by PDA testing. (Conventional micropiles could not be testing as quickly)
- Given the extremely variable ground conditions every pile is driven to a set which can be calibrated against the dynamic testing to provide assurance of pile capacity.
- Most of the work could be done out of the cutting , from above.

The Alternative Solution



Lifting rigs in from upper works area for the predrilling stage.





Note:

The damage to the rock face caused during the excavation of the original cutting. (There was concern the basalt under the footing may have experienced the same damage.)

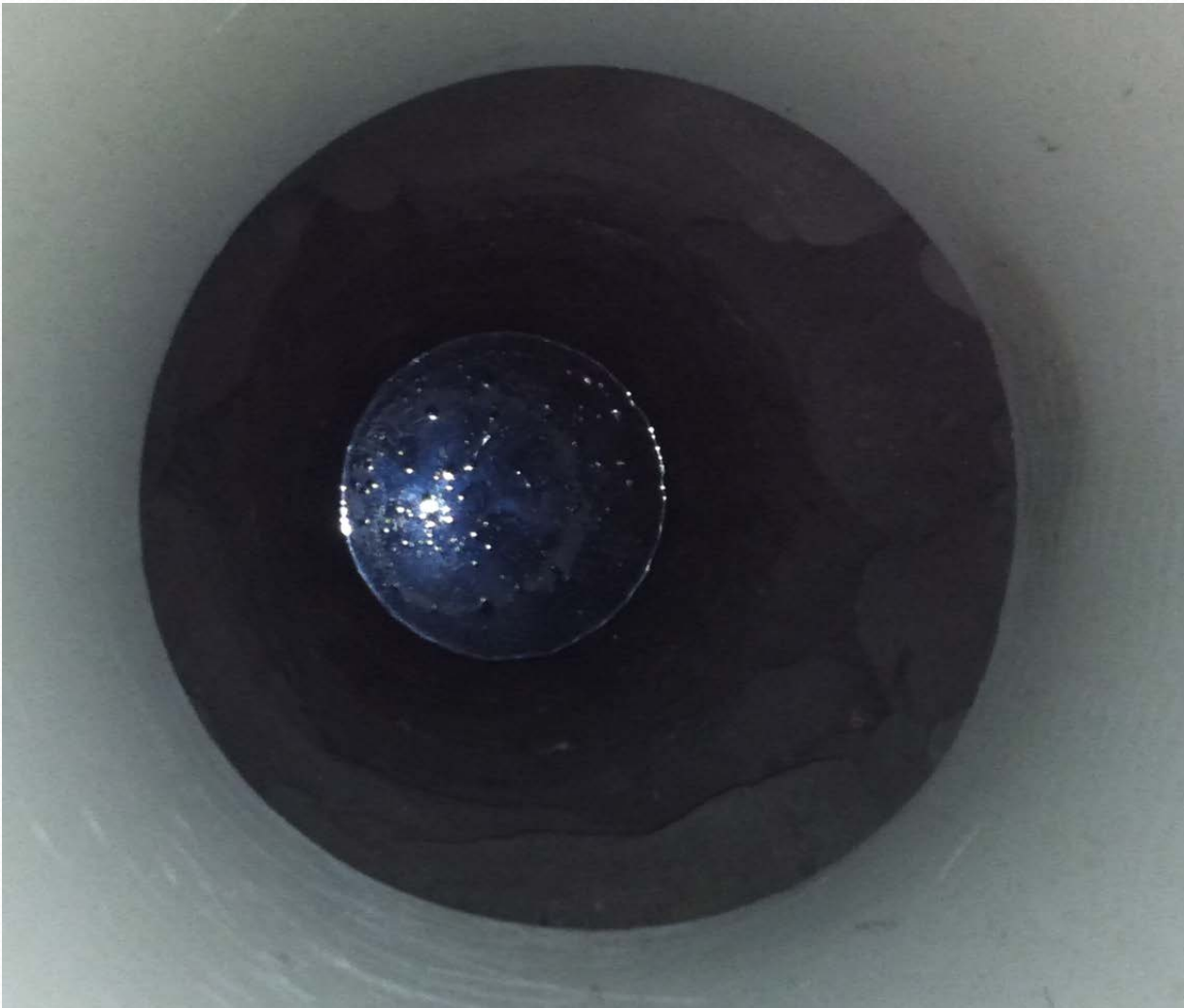
Compressor (900cfm and Klemm 802) lifted in and out each shift. Trak to be able to be cleared within 30min at any stage.

Predrilling the upper basalt.



Note:
Trains still passing on
opposite track, occupation of
one track only.
3 train track personell
required for track safety
requirements.





Looking down the predrilled hole.

Can see top fractured basalt possibly from excavation of original cutting.

Groundwater present.

Electric overheads
needed to be shut
down when within 3m
of lines.



Depth Below Grade m	Unit Resist. (Area) kPa	(Area) kPa
	Pile B14	Pile A12
-0.2	0.00*	7.68*
0.8	3.45	13.05
1.8	6.25	23.05
2.8	14.38	47.94
3.8	25.13	84.51
4.8	125.09	132.46
5.8	320.21	236.33
6.8	383.85	485.88
7.8	447.63	487.11
8.0		488.03
9.8		488.03

Pile No.	FMX (kN)	DMX (mm)	VMX (m/s)	EMX (kNm)	RMX (kN)	Case J	N* (kN)	R.U.Cap † (kN)
B14	2104	10.3	4.75	13.00	1901	0.70	1220	1743
A12	2152	9.6	4.18	12.10	2058	0.75	1220	1743

Toe Capacity 1,048 kN 615 kN
 (27.5MPa) (16.2MPa)

Dynamic Testing



Table 1 - Pile Installation Summary

Pile No.	Length (m)	Penetration (m)	Pile Size (mm)	Driving Date	Stroke (mm)	Set (mm)	T.C. (mm)
B14	12.5	7.8	219.1OD x 14.1	23/10/12	500	2.8	4.0
A12	12.5	9.4	219.1OD x 14.3	06/03/13	500	0.8	10.0

CAPWAP Analysis Summary

Pile No.	Shaft Resistance (kN)	Toe Resistance (kN)	Total Resistance (kN)	N*	R.U.Cap (kN)
B14	912	1048	1960	1220	1743
A12	1623	615	2238	1220	1743

Pile Head Movement Summary

Pile No.	Movement at 0.75 x N* (mm)	Movement at 1.1 x N* (mm)	Movement at Total Resistance (mm)
B14	4.65	6.93	11.43
A12	3.86	5.98	11.46

In Summary

Micropiles are generally associated with drilled shafts ,driven micropiles can also be a quick cost effective solution.

The alternate solution provided the following advantages

- removed the risk of groundwater
- Removed risk of collapsing ground
- Provided a quick and sound method for verifying pile capacity immediately after pile construction.
- Minimised program risks in very tight access and limited working time.



Thank You

