ROM BRIDGE FOOTING REMEDIATION

WA Mine site

Ground Rehabilitation, Re-leveling & Re-supporting
Using Uretek Expanding Structural Resin Injection

November 2015

Tom Bailey
Roads and Infrastructure Manager

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Mainmark Uretek Worldwide Global Family

- ESTABLISHED IN EUROPE 1975,
- USA 1985 … AND AUSTRALIA 1995 …
- AND BY 2014 -
  - Over 60 COUNTRIES worldwide
  - 300 TRUCKS Worldwide
  - 230+ PEOPLE (AUST & NZ)
  - 25 Uretek Rigs / crews
  - 3 JOG Rigs
  - Permeation crew
  - Encap6 crew
  - Terefil crew

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Our Technologies

- Mainmark Uretek - Tailoring technologies for different ground and structure types:
  - Void filling & Slab-Lifting
  - Compaction/ ground improvement
  - PowerPile – Grout injected piles
  - JOG Integrated Computerised Grouting
  - Jet Grouting
  - LMG – Compaction Grouting
  - PUR Mining grouting
  - Permeation Grouting / Sand into Rock
  - Terefil
  - Encap6
  - Other resins

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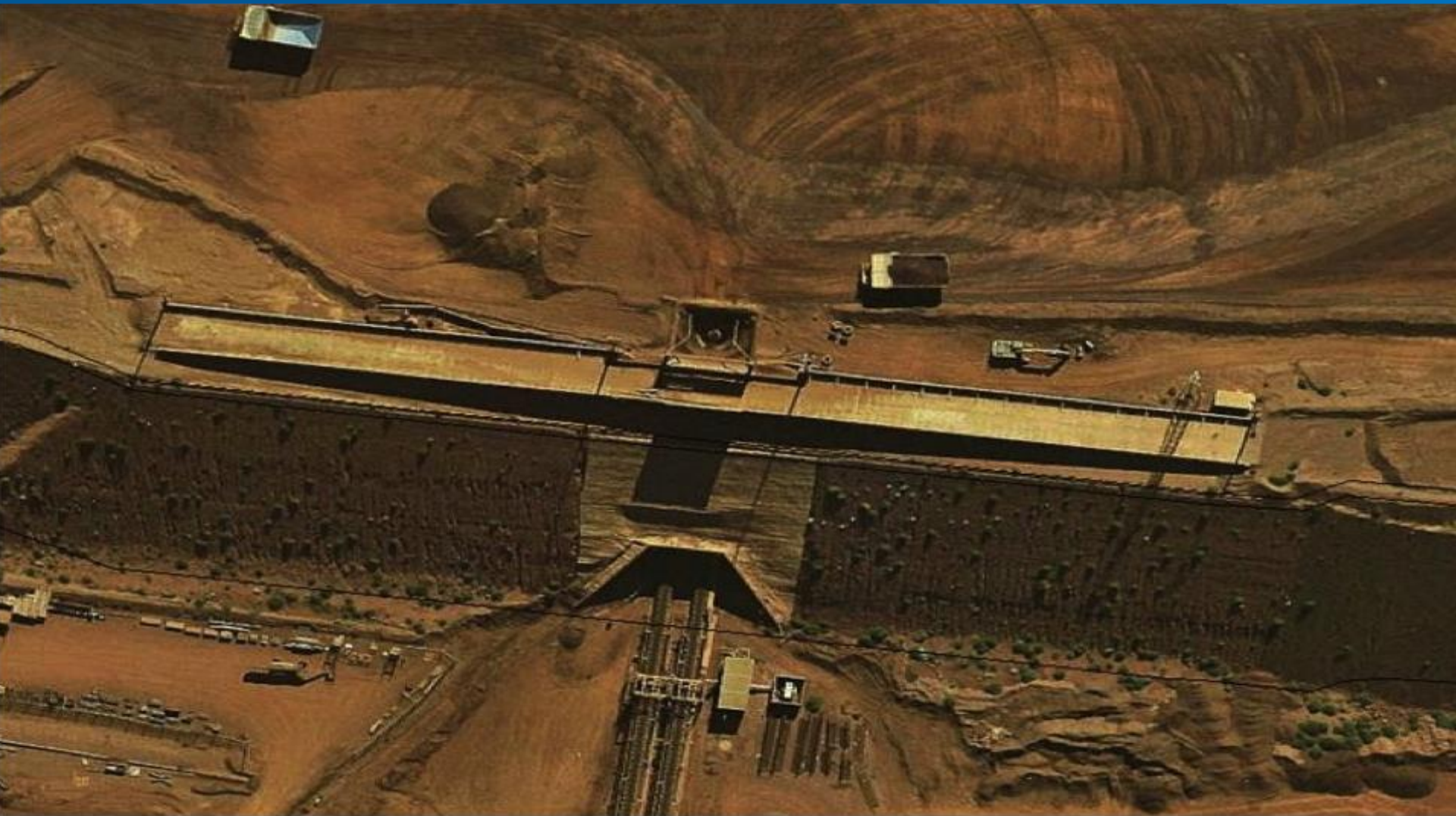
Overview



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Overview

- Rom Side Tipper Bridge OPF Pilbara
- In situ footings piers
- Precast beams / bridge deck
- Piers subsided adjacent to Crusher
- Settling over 4 years (since built
- Cost effective solution required

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Project Challenges

Project Challenges

- Center of operations for a working mine
- Crusher in service
- Remote location
- Safety
- Heat (ave 44 degrees)
- Dust
- Mine procedures / paperwork
- Cyclones
- Environmental

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Remote Location

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Safety, Heat, Dust

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Problem

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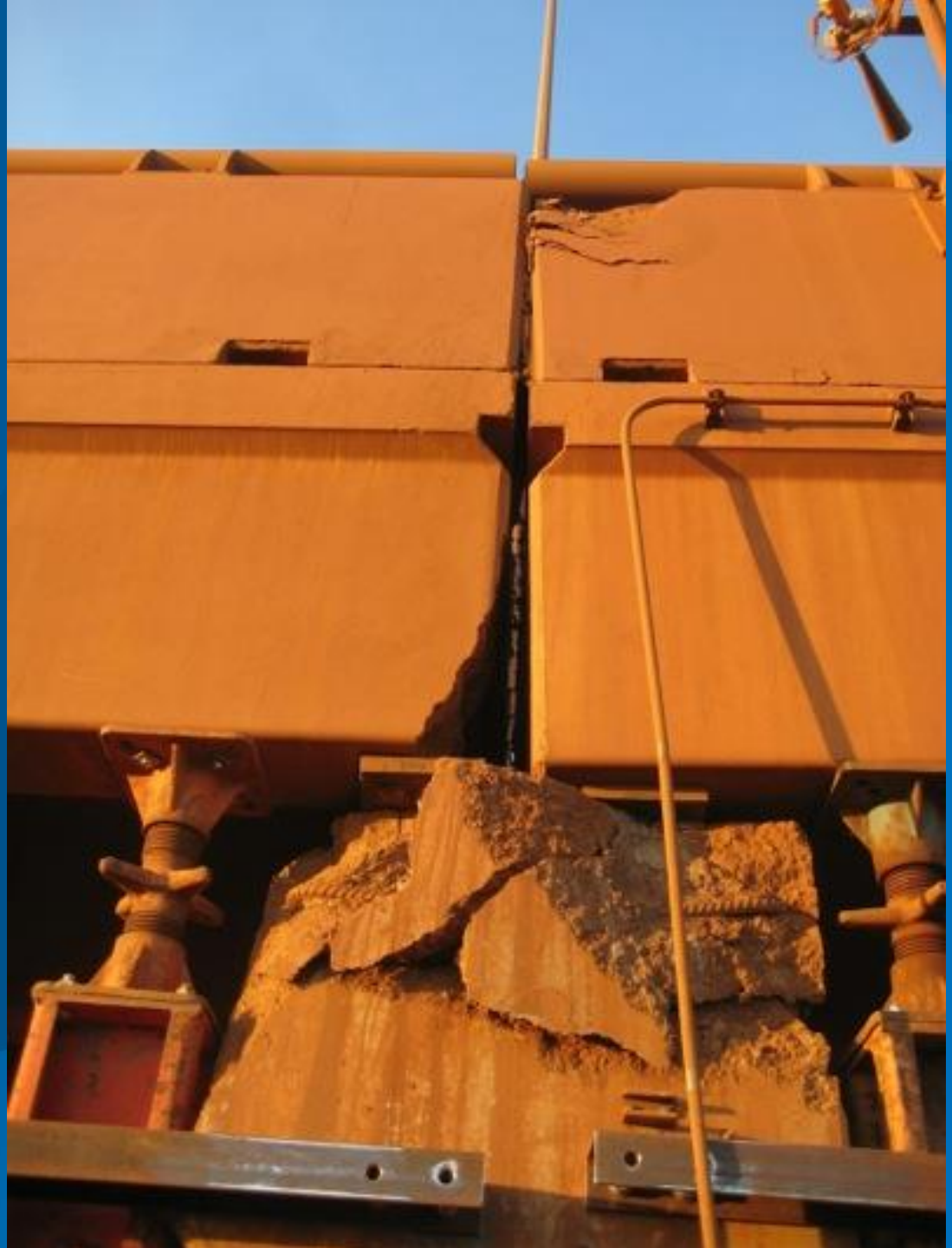

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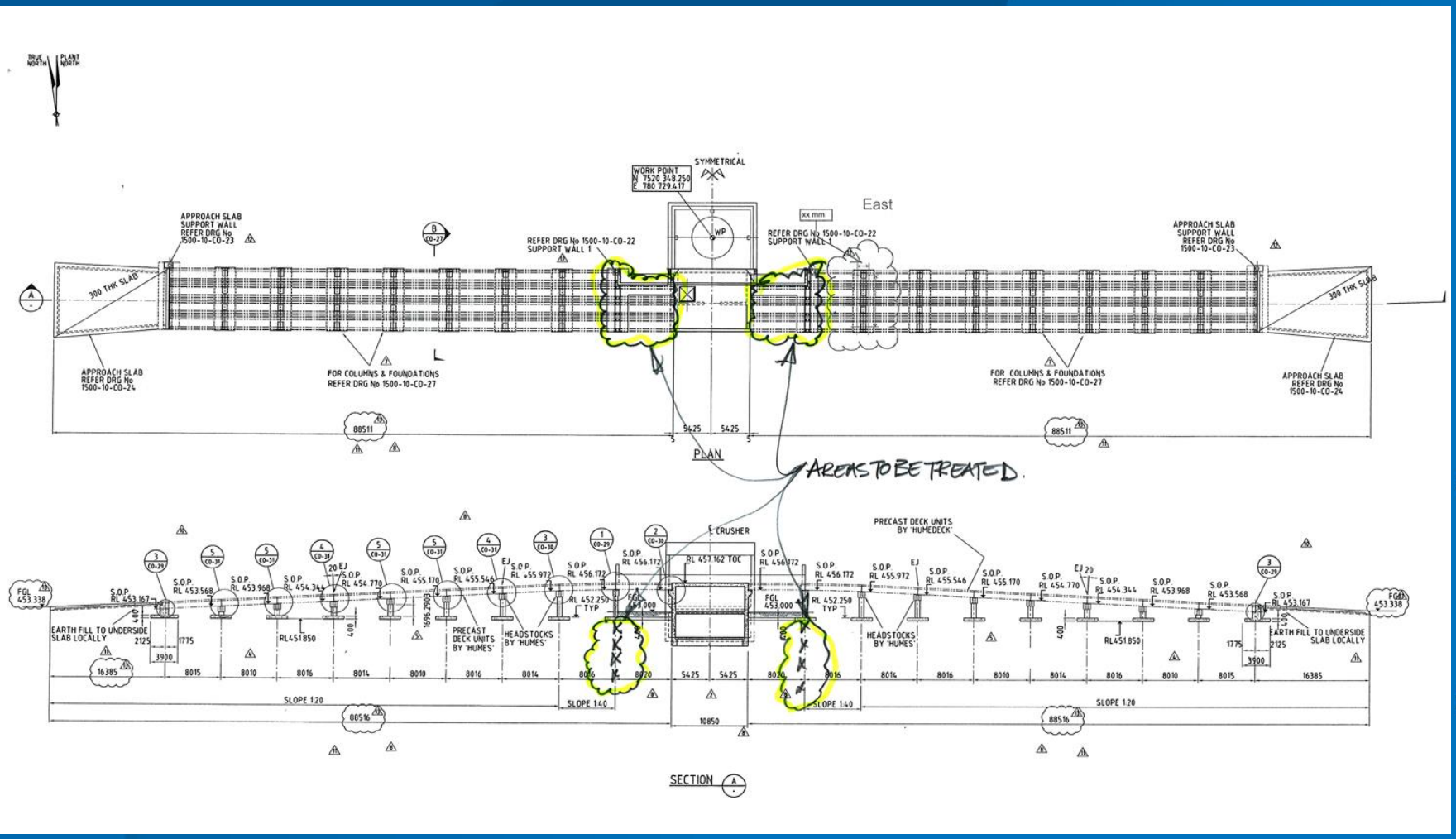
Solution


TRUE NORTH
PLANT NORTH
SYMMETRICAL
WORK POINT
N 7520 348.250
E 780 729.417
East
xx mm
APPROACH SLAB SUPPORT WALL REFER DRG No 1500-10-CO-23
REFER DRG No 1500-10-CO-22 SUPPORT WALL 1
300 THK SLAB
APPROACH SLAB REFER DRG No 1500-10-CO-24
FOR COLUMNS & FOUNDATIONS REFER DRG No 1500-10-CO-27
5425
PLAN
AREAS TO BE TREATED.
CRUSHER
RL 457.162 TOC
PRECAST DECK UNITS BY 'HUMEDECK'
HEADSTOCKS BY 'HUMES'
PRECAST DECK UNITS BY 'HUMES'
EARTH FILL TO UNDERSIDE SLAB LOCALLY
FGL 453.338
FGL 453.000
RL 452.250 TYP
RL451850
SLOPE 1:20
SLOPE 1:40
10850
SECTION

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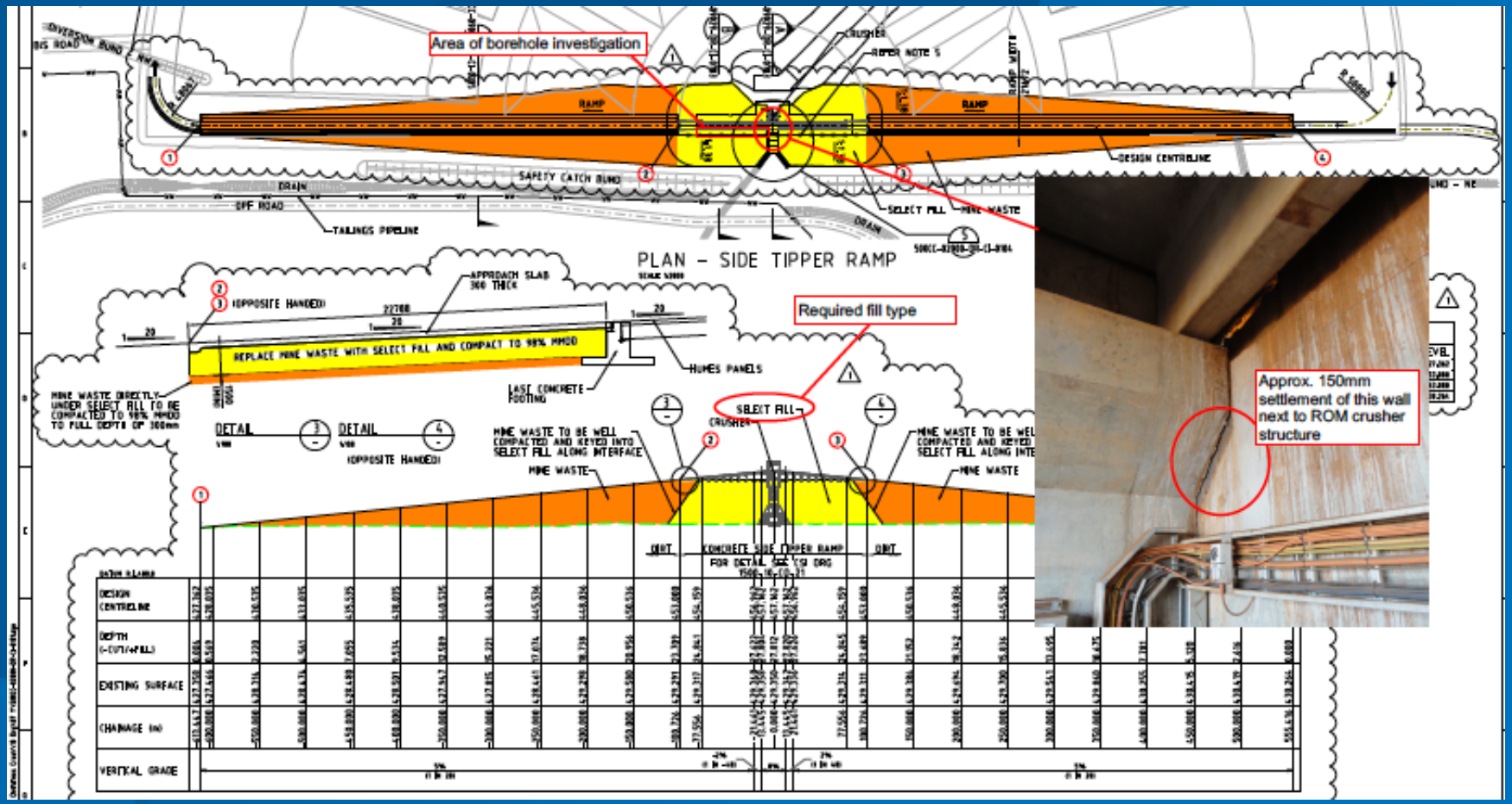
Area of borehole investigation
PLAN - SIDE TIPPER RAMP
Required fill type
Approx. 150mm settlement of this wall next to ROM crusher structure
RAMP
SAFETY CATCH BUND
DRAIN
OFF ROAD
TAILINGS PIPELINE
DESIGN CENTRELINE
SELECT FILL
MINE WASTE
CRUSHER
REFER NOTE 5
APPROACH SLAB 300 THICK
(OPPOSITE HANDED)
REPLACE MINE WASTE WITH SELECT FILL AND COMPACT TO 98% MMDD
HUMES PANELS
LAST CONCRETE FOOTING
MINE WASTE DIRECTLY UNDER SELECT FILL TO BE COMPACTED TO 98% MMDD TO FULL DEPTH OF 300mm
DETAIL
MINE WASTE TO BE WELL COMPACTED AND KEYED INTO SELECT FILL ALONG INTERFACE
DIRT
CONCRETE SIDE TIPPER RAMP
DESIGN CENTRELINE
DEPTH (-CUT/+FILL)
EXISTING SURFACE
CHAINAGE (m)
VERTICAL GRADE

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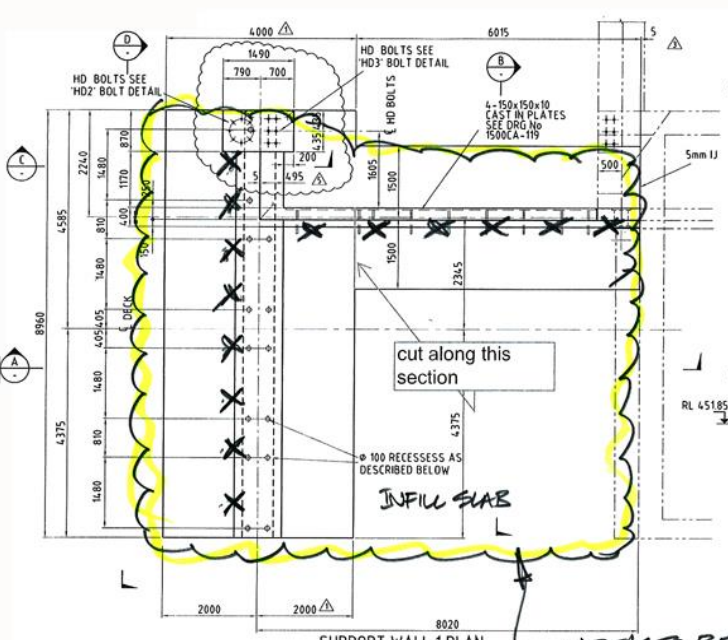
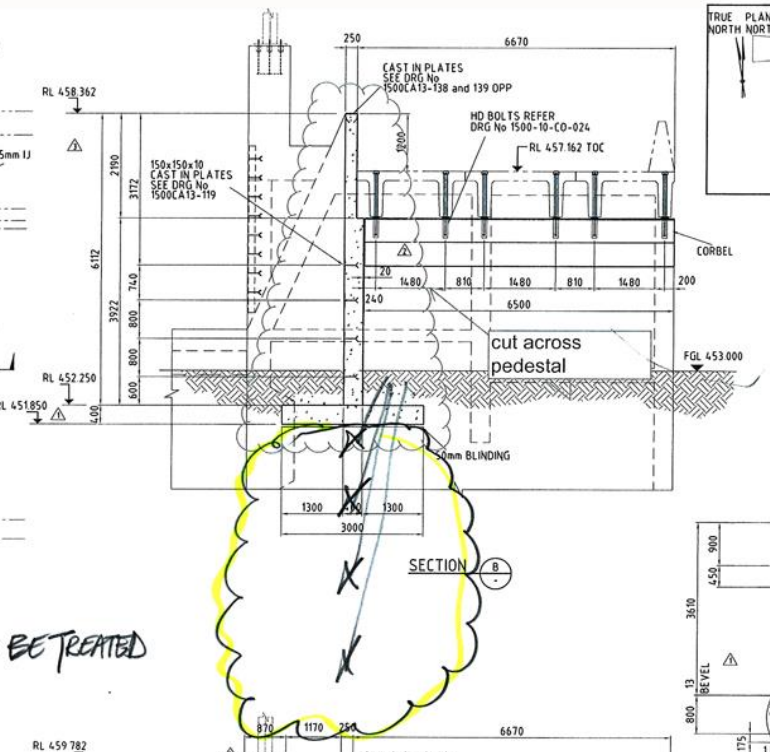
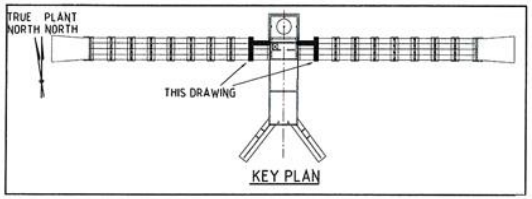


SUPPORT WALL 1 PLAN
1 REQ'D - AS DRAWN
1 REQ'D - OPP. HAND

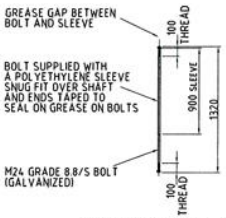


SECTION B

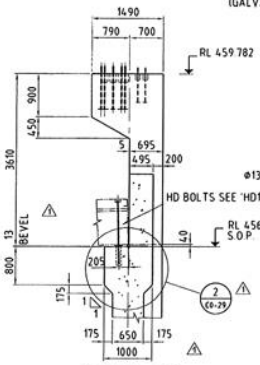


KEY PLAN

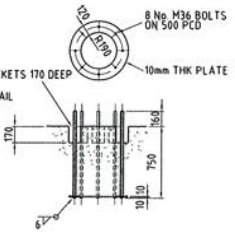
NOTE:
FOR CONCRETE NOTES REFER DRG No 1500-10-CO-021



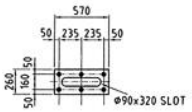
'HD1' BOLT DETAIL -28 REQ'D
SCALE 1:25

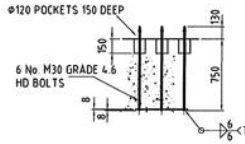


SECTION C

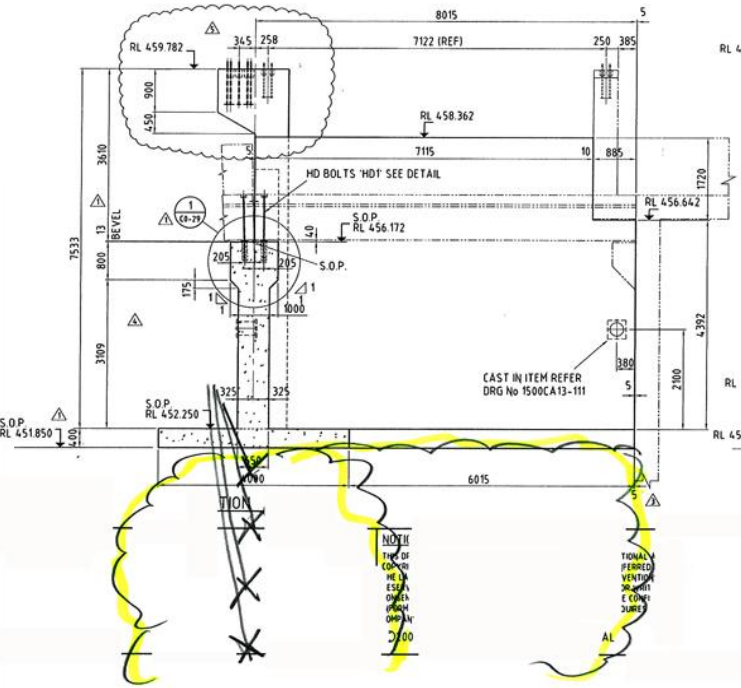


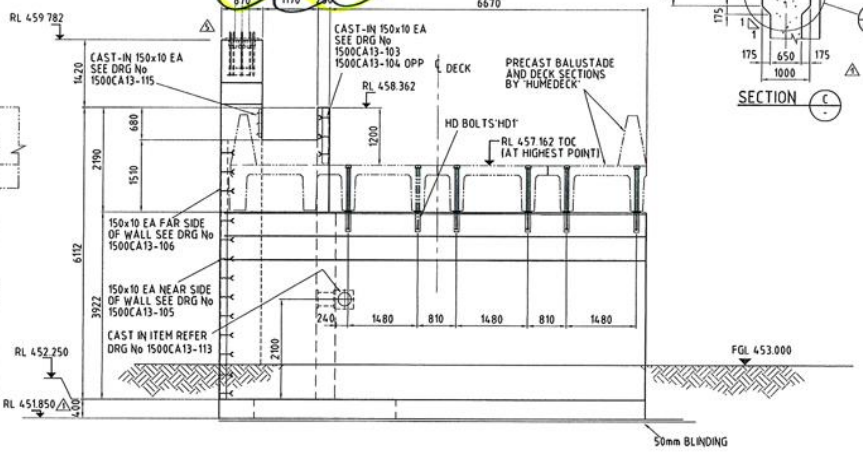
HD BOLT 'HD 2' DETAIL -2 REQ'D





HD BOLT 'HD 3' DETAIL -2 REQ'D





Solution

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Temporarily Propped

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Results

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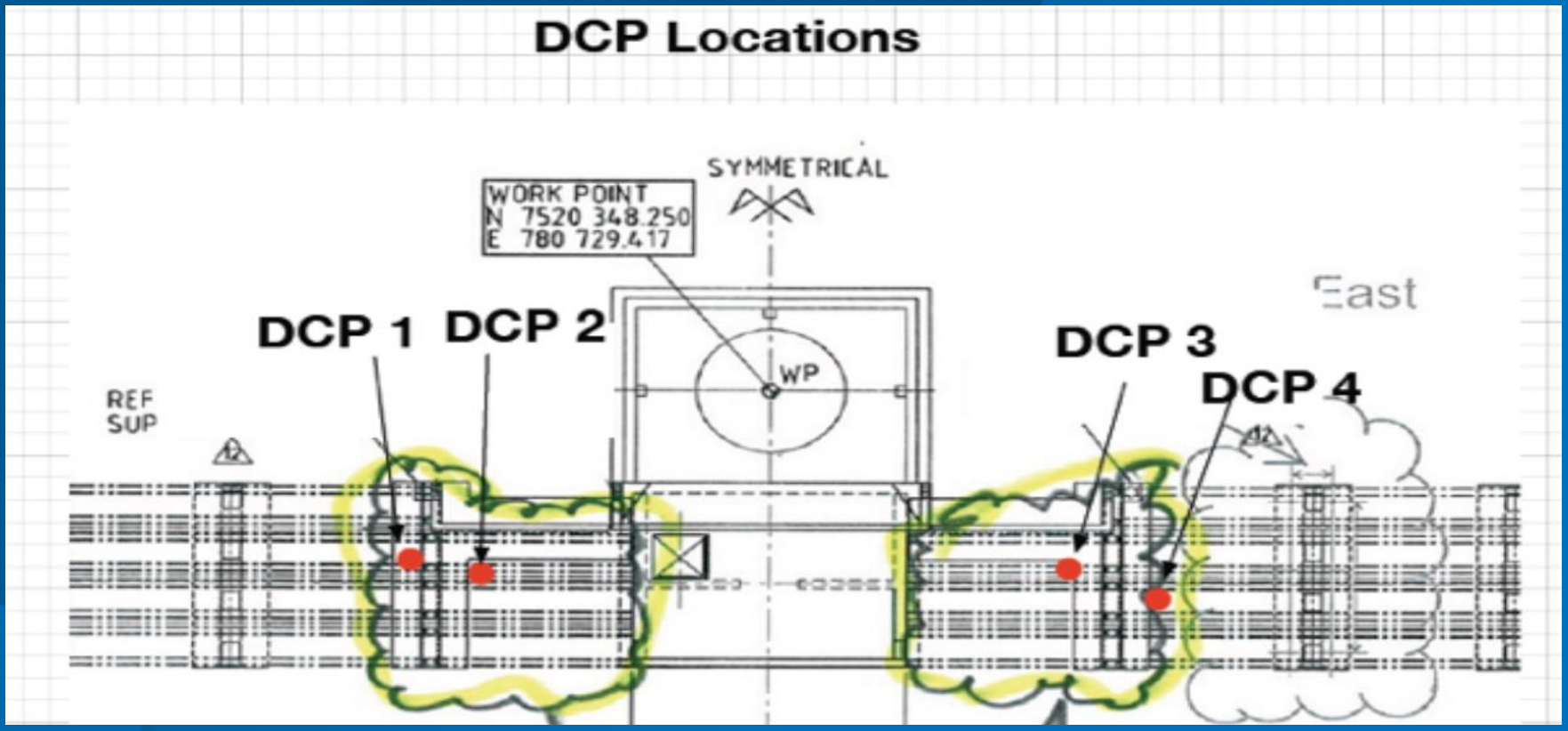
DCP Locations



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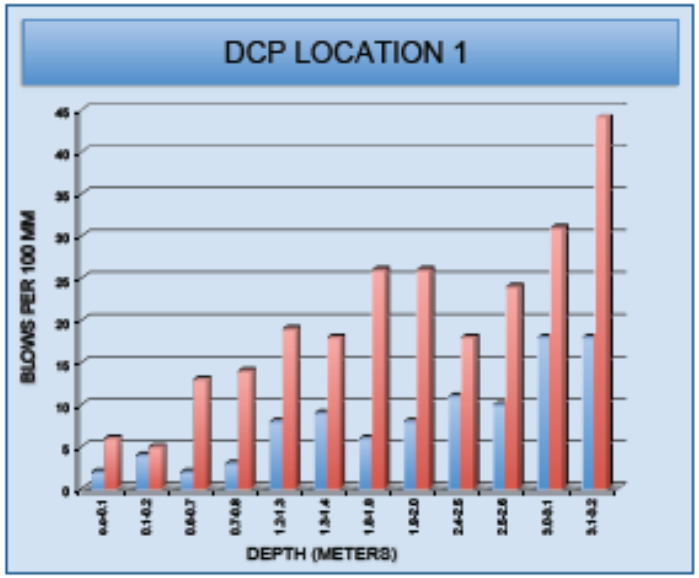

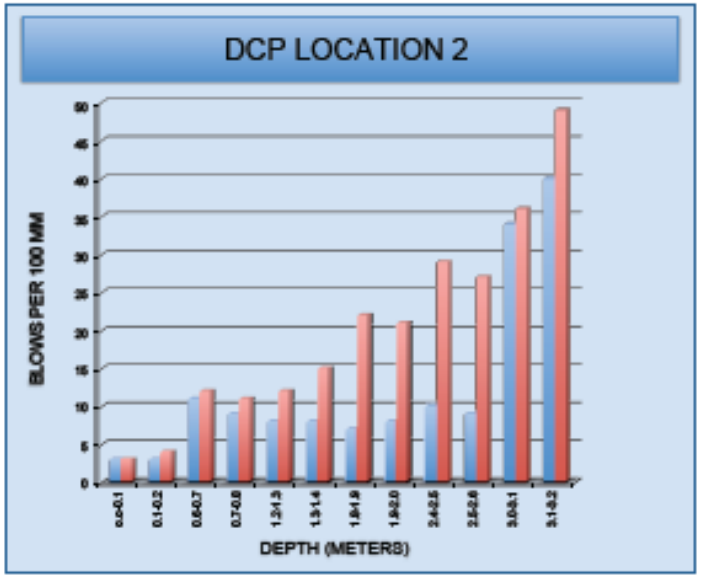

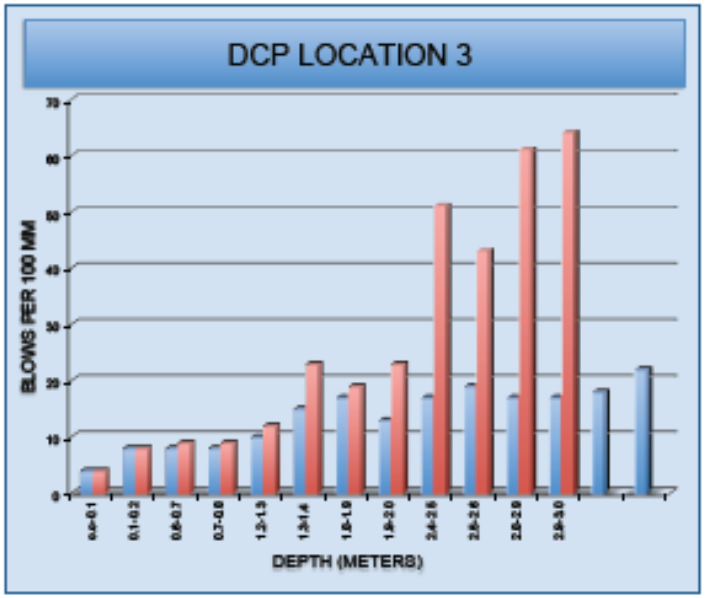

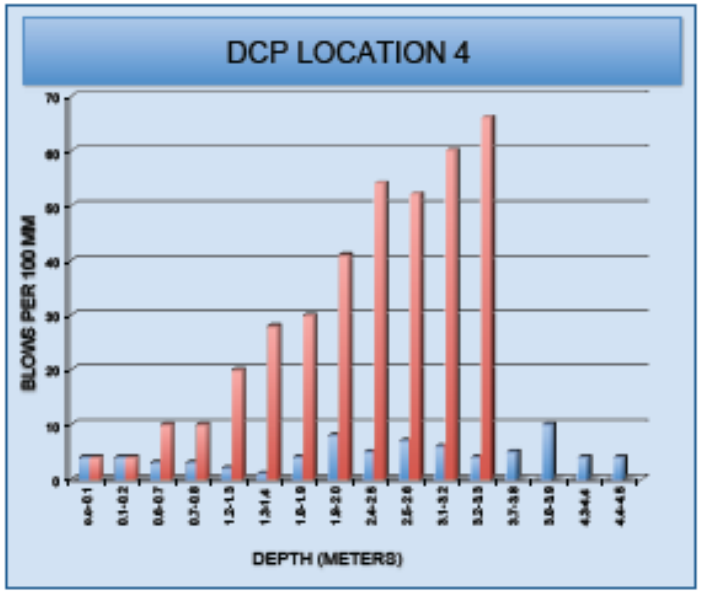

PENETROMETER RECORDS - BEFORE INJECTION

PENETROMETER RECORDS - AFTER INJECTION

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Summary

- 12 injection days
- 30 tonnes of Uretek Material
- Over 350 cubic metres
- (60 concrete trucks)
- Job completed on time
- Within budget
- No incidents
- Zero business interruption
- Cost saving to mine.

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Table 6.1: Particle Size Grading for General and Select Fill

GRADING	General Fill	Select Fill
AS Sieve Size (mm)	Percent Passing (Dry Weight)	Percent Passing (Dry Weight)
150	100	
75	90–100	100
37.5	-	-
26.5	60–100	95-100
19.0	50–100	85-100
9.5	30–100	60-80
4.75	20–100	40-65
2.36	15-80	30-60
0.425	10-70	15-30
0.075	0-15	5-15

Note:

Unless otherwise specified, "Select Fill" shall comply with the grading listed as Select Fill 1.

TABLE 6.2: PLASTICITY AND CALIFORNIA BEARING RATIO (CBR) LIMITS FOR GENERAL AND SELECT FILL

PLASTICITY	Australian Standard	General Fill	Select Fill
Liquid Limit	AS1289.3.1.1	≤ 30%	≤ 30%
Plasticity Index	AS1289.3.3.1	≤ 15%	≤ 12%
Linear Shrinkage	AS1289.3.4.1	-	Between 2% & 6%
CBR	AS1289.6.1.1	≥ 8 at 92% MMDD	≥ 12 at 95% MMDD

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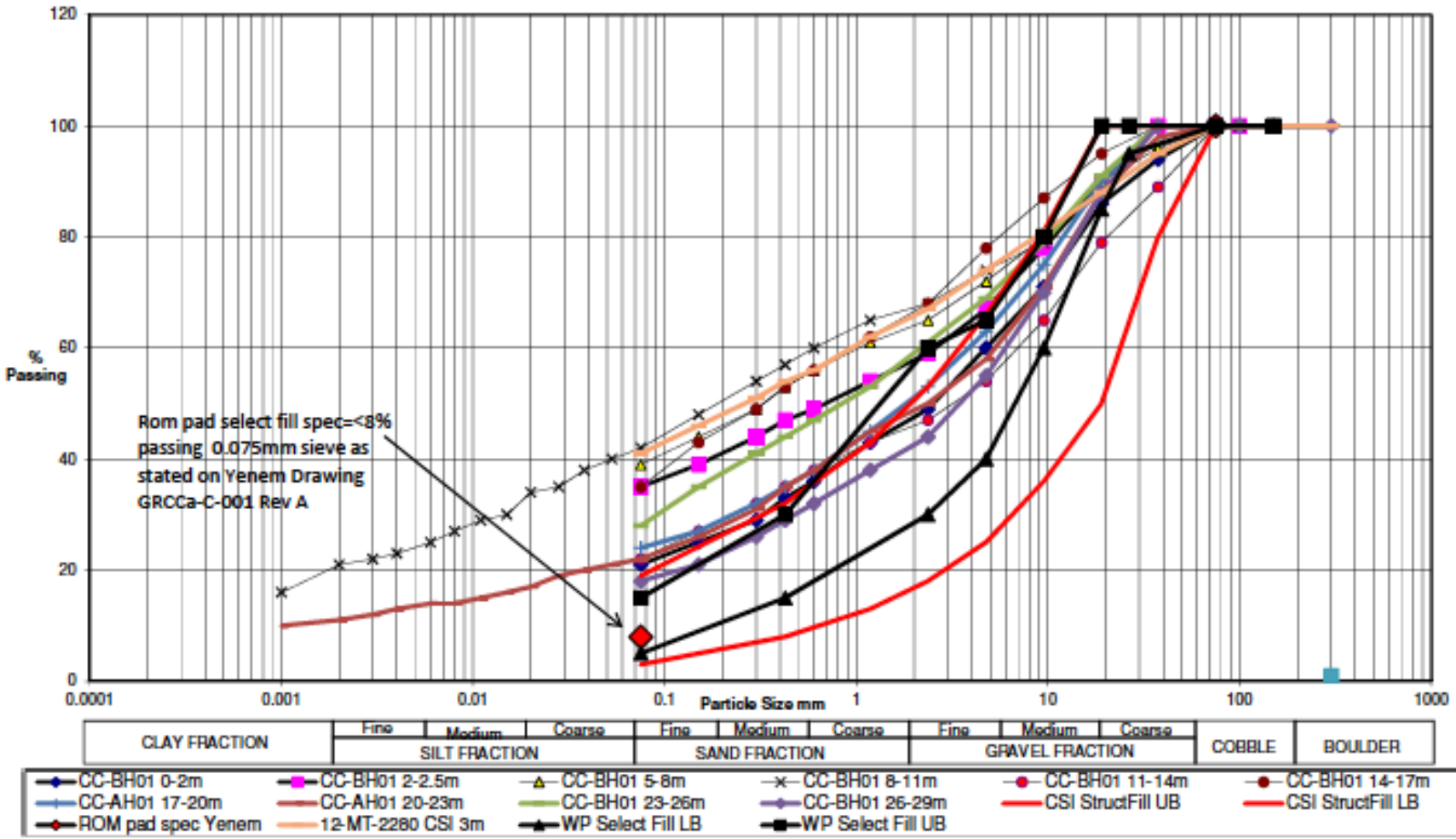
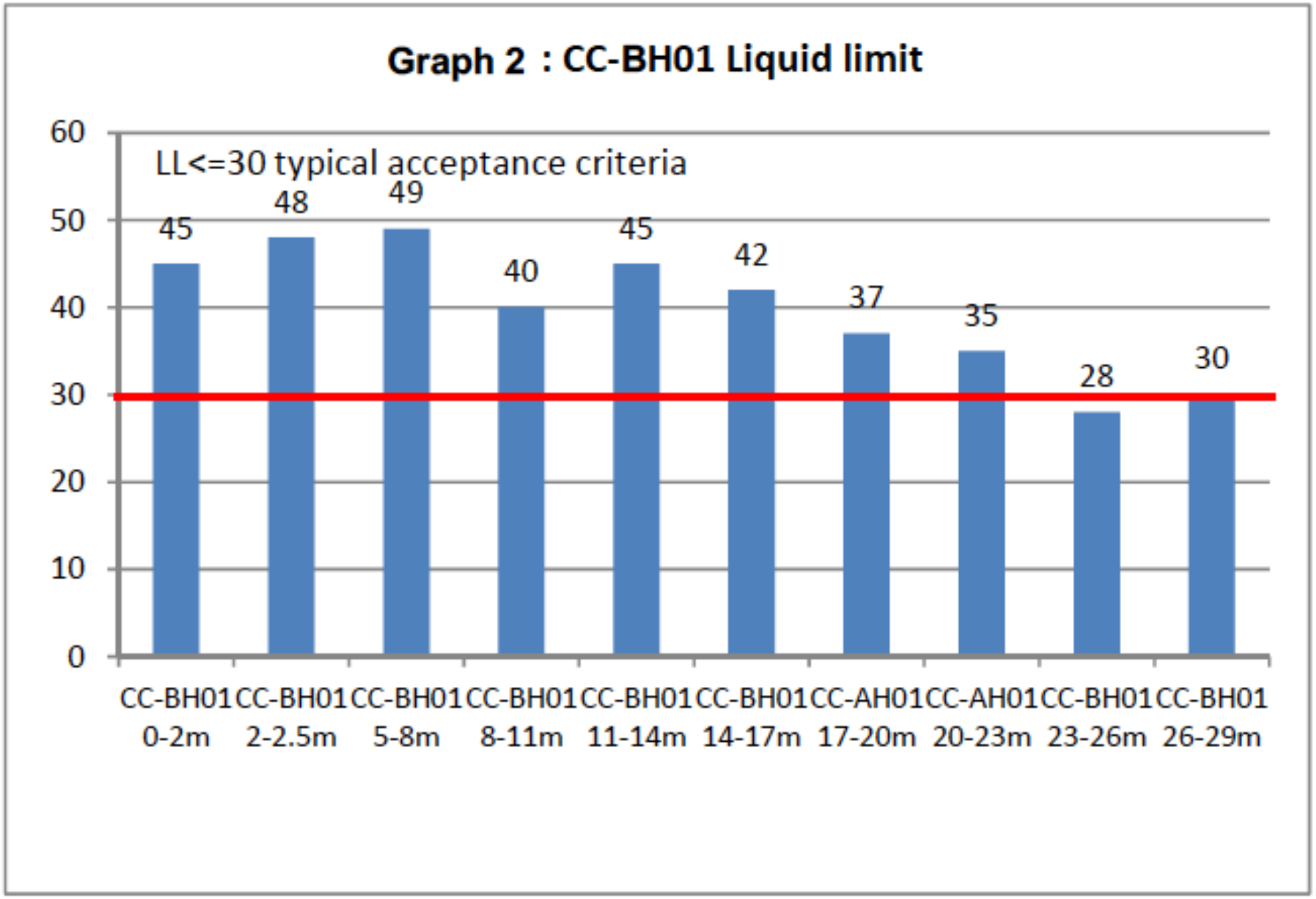
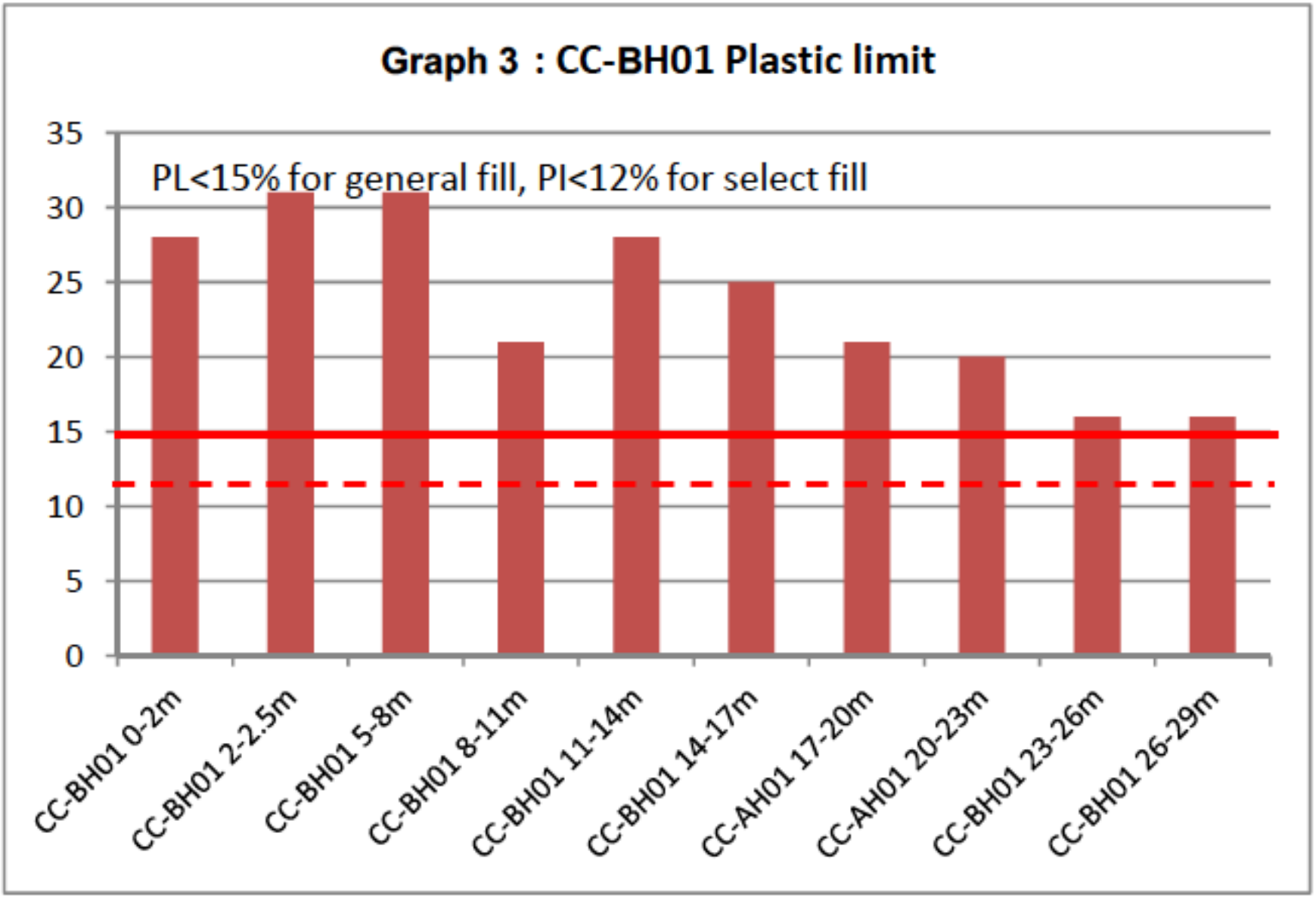
Graph 1 : Particle Size Distribution-at ROM Pad CC-BH01 FMG-Christmas Creek




Graph 2 : CC-BH01 Liquid limit
LL<=30 typical acceptance criteria
60
50
40
30
20
10
0
45
48
49
40
45
42
37
35
28
30
CC-BH01 0-2m
CC-BH01 2-2.5m
CC-BH01 5-8m
CC-BH01 8-11m
CC-BH01 11-14m
CC-BH01 14-17m
CC-AH01 17-20m
CC-AH01 20-23m
CC-BH01 23-26m
CC-BH01 26-29m


Graph 3 : CC-BH01 Plastic limit
PL<15% for general fill, PI<12% for select fill
35
30
25
20
15
10
5
0
CC-BH01 0-2m
CC-BH01 2-2.5m
CC-BH01 5-8m
CC-BH01 8-11m
CC-BH01 11-14m
CC-BH01 14-17m
CC-AH01 17-20m
CC-AH01 20-23m
CC-BH01 23-26m
CC-BH01 26-29m

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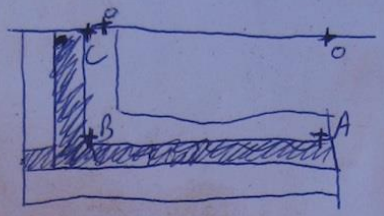

DAY	A	B	C
FRI - PM	0	0	0
SAT - AM	0	0	0
SAT - PM	+102	+82	-8
SUN - AM	+80	+65	-8
SUN - PM	+70	+80	+41
MON - AM	+69	+78	+37
MON - PM	+105	+162	+84
WED - AM	+100	+157	+79
WED - PM	+175	+270	+192

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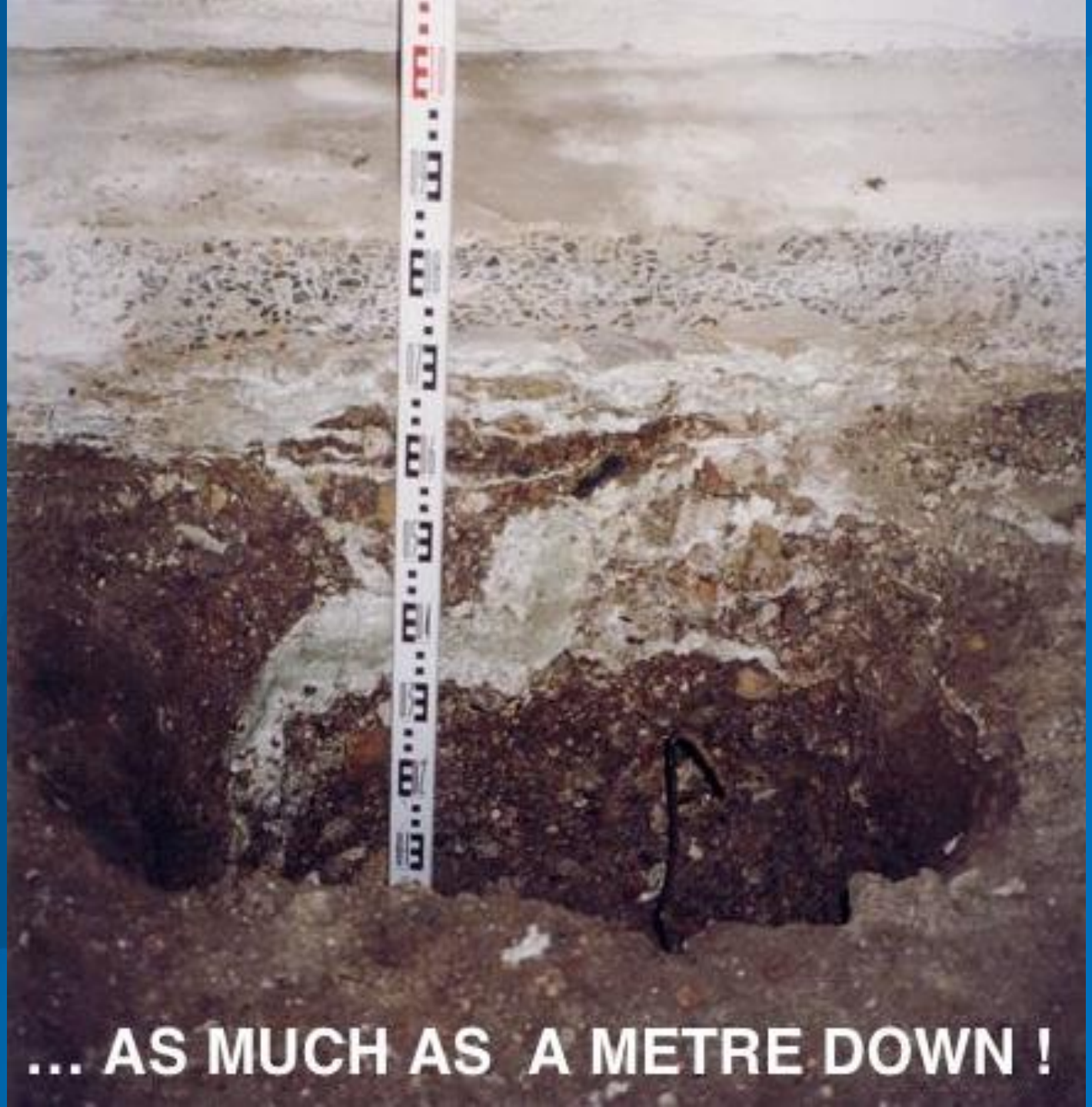

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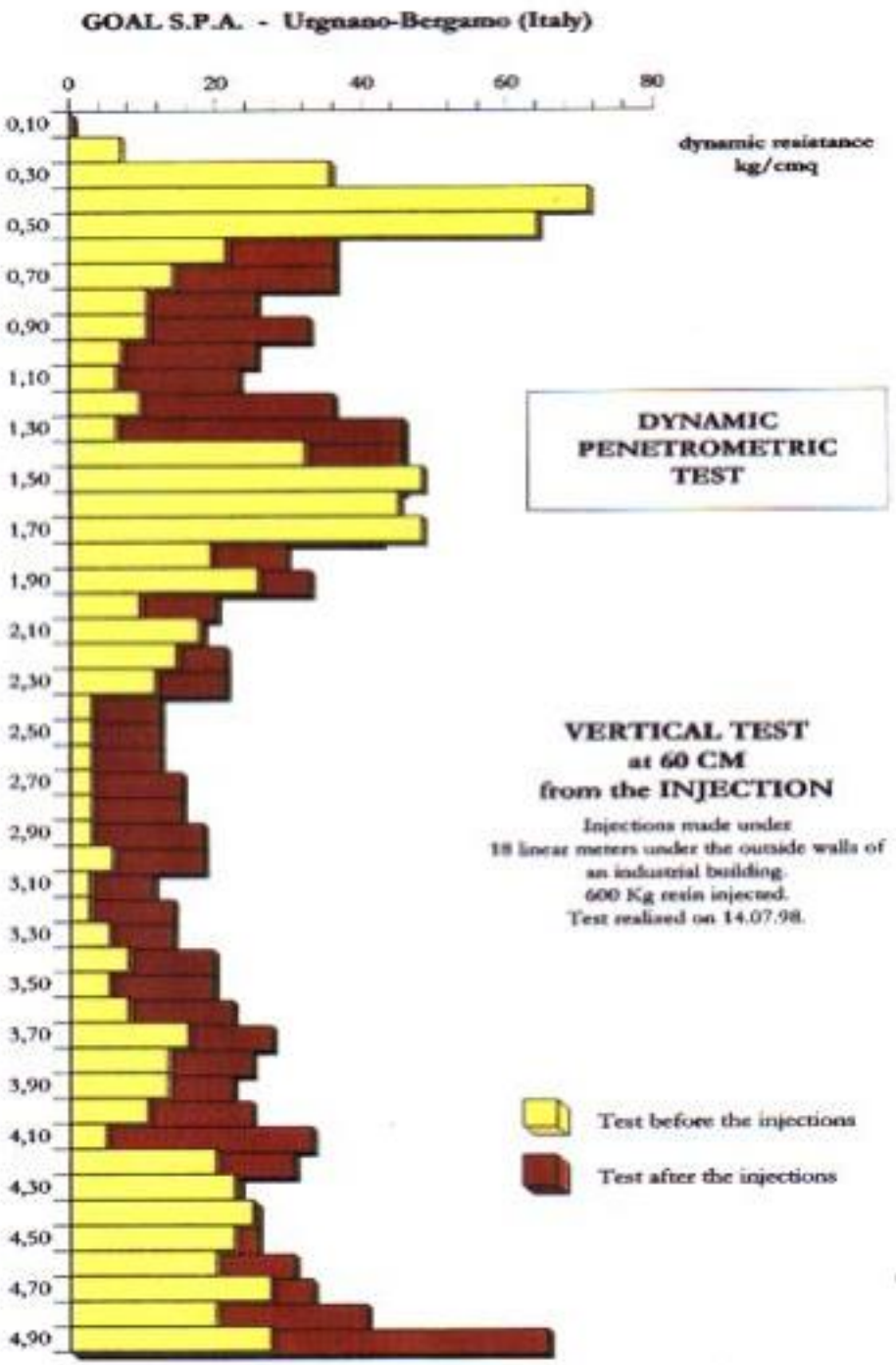
GOAL S.P.A. - Urgnano-Bergamo (Italy)
0
20
40
60
80
0,10
0,30
0,50
0,70
0,90
1,10
1,30
1,50
1,70
1,90
2,10
2,30
2,50
2,70
2,90
3,10
3,30
3,50
3,70
3,90
4,10
4,30
4,50
4,70
4,90
dynamic resistance
kg/cmq
DYNAMIC
PENETROMETRIC
TEST
VERTICAL TEST
at 60 CM
from the INJECTION
Injections made under
18 linear meters under the outside walls of
an industrial building.
600 Kg resin injected.
Test realised on 14.07.98.
Test befoee the injections
Test after the injections

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URETEK
PENETROMETER
TESTING
RENTAL

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URETEK
Deep-Injection
8 metres down!

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URETEK PowerPiles

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Clean, neat, computer controlled installation; to depths up to 6m even under quite low headroom

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This shows a PowerPile that has been expanded to 350mm in a laboratory demonstration and the 30mm element before inserted.

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In use PowerPiles are usually irregular, the shape being effected by the varying strength of ground resistance at the different depths.

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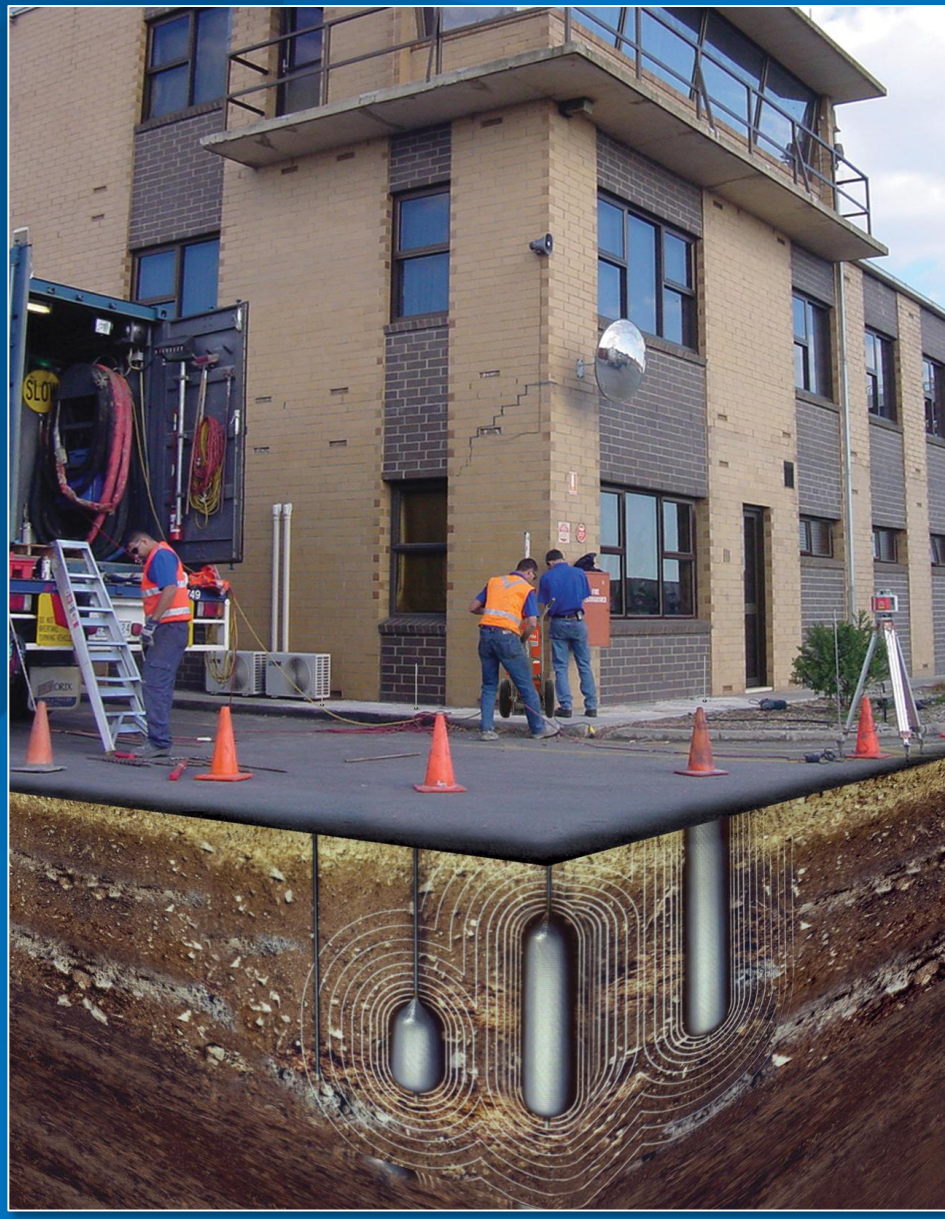
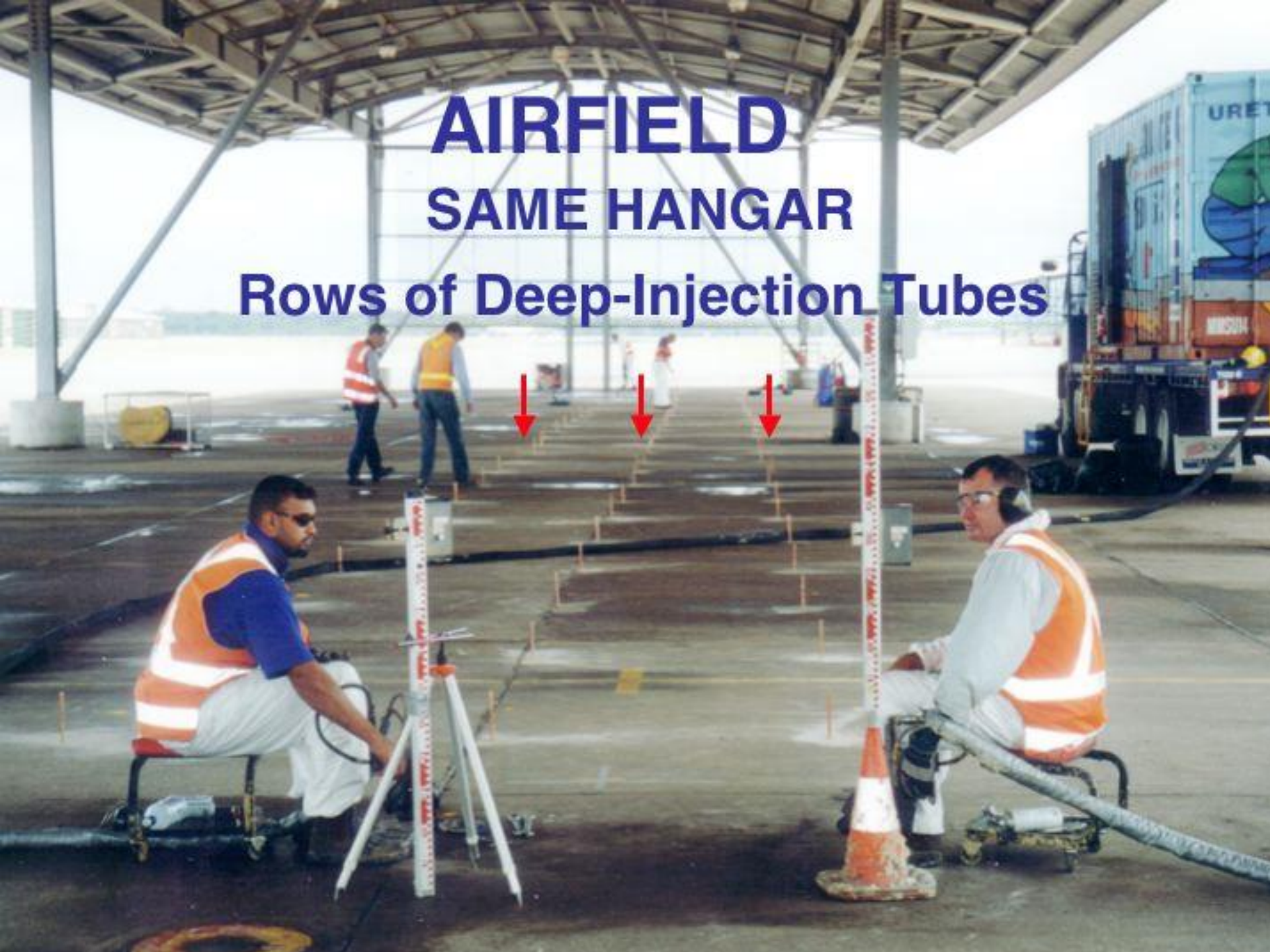


AIRFIELD


AIRFIELD
SAME HANGAR
Rows of Deep-Injection Tubes

BRITISH AIRWAYS

QANTAS JET BASE, SYDNEY

The overburden weight of the 129-tonne-locomotive enabled maximum compaction of the substrate beneath the bridge piers

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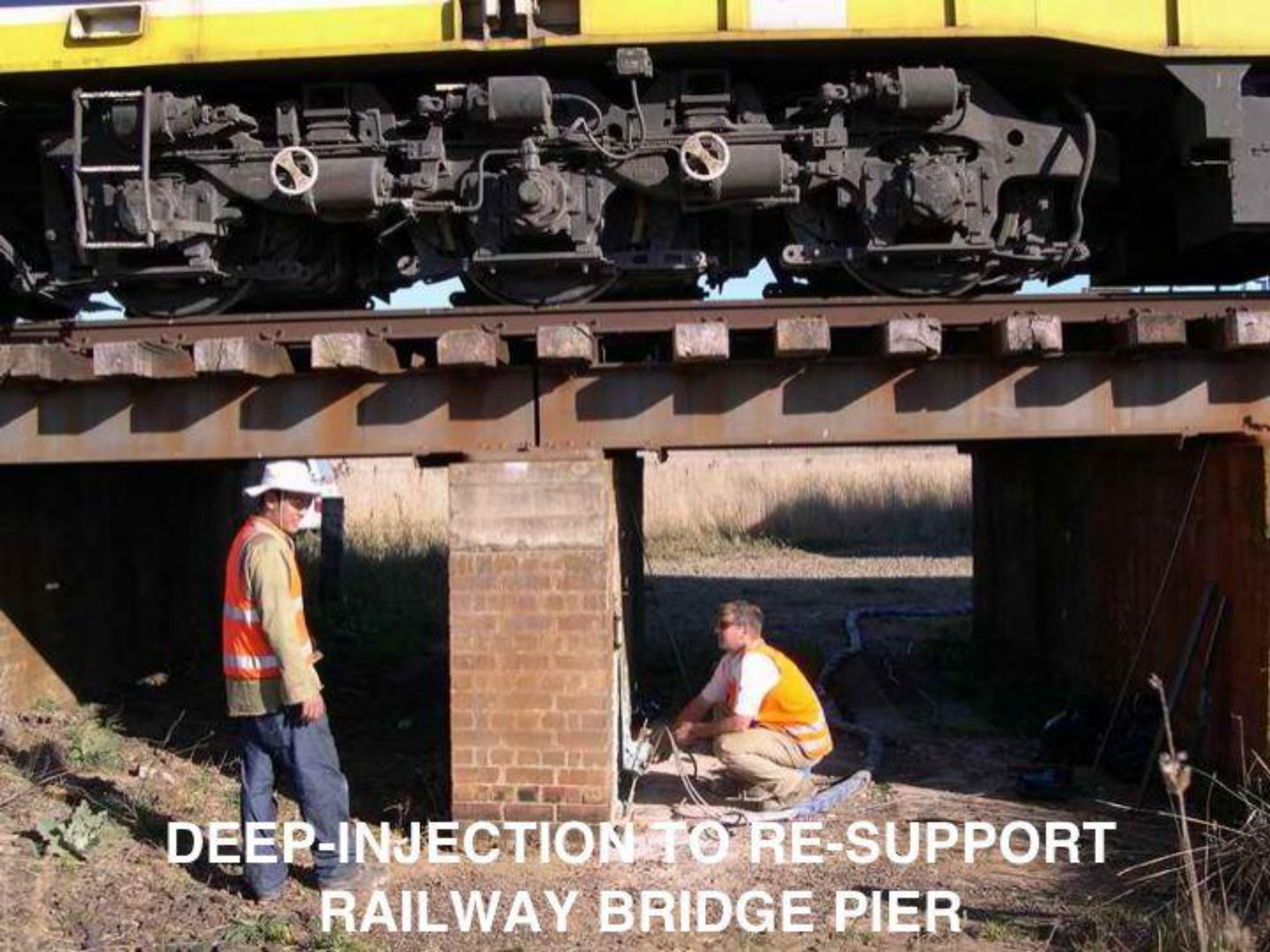

DEEP-INJECTION TO RE-SUPPORT RAILWAY BRIDGE PIER

Typical Bridge Abutment

THANK YOU

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