
DTSS Kim Chuan Link Tunnel Sewers – Contract 1

7 July 2004

By Neil Smith

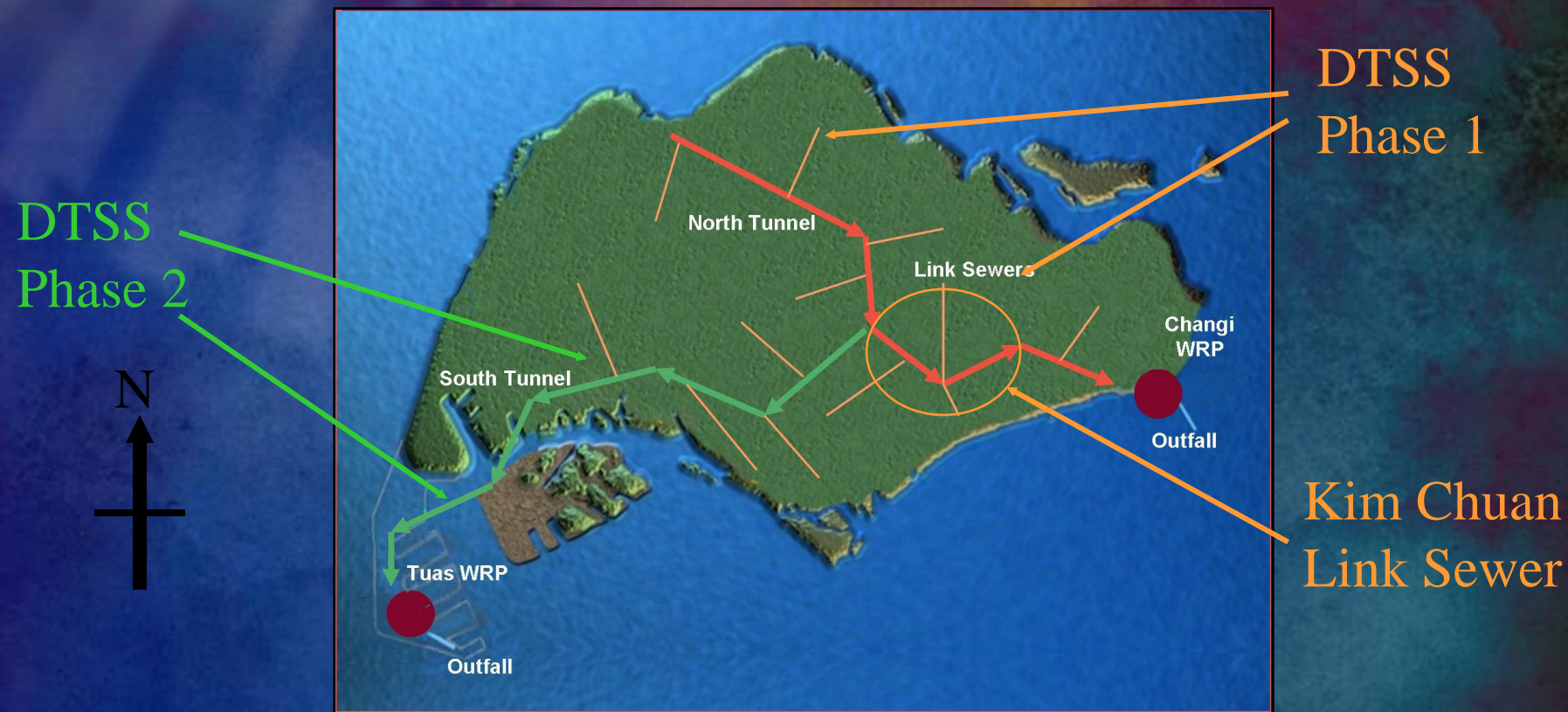


- Kim Chuan Link Sewers – Contract 1
 - ❖ Introduction
 - ❖ Tunneling Using An EPBM
 - ❖ Intermediate Manholes
 - ❖ NATM
 - ❖ Secondary Lining
 - ❖ Questions

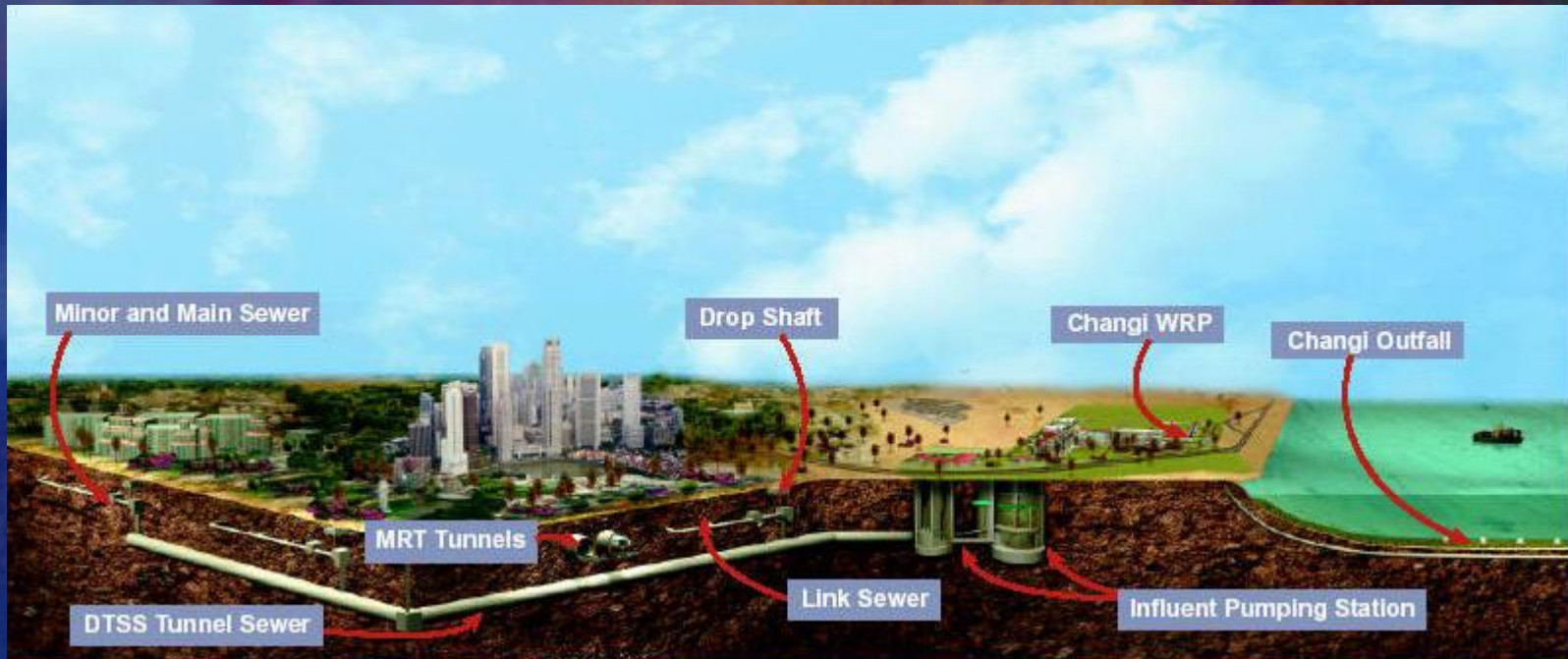
➤ Introduction

- ❖ Client: Public Utility Board (PUB – SD)
- ❖ Consultant: CPG Consultants Pte Ltd
- ❖ Contractor: Tiong Seng - Dong A Consortium
- ❖ Engineers Design
- ❖ 5.2km 2.8m Diameter Tunnel
- ❖ 20 No. shafts 18 – 24 m deep
- ❖ Ground Conditions – Predominantly Marine Clay
- ❖ Project Cost: S\$44M
- ❖ Project Commenced May 2002
- ❖ Project Completion June 2005

Location Plan Of Deep Tunnel Sewer System (DTSS) in Singapore

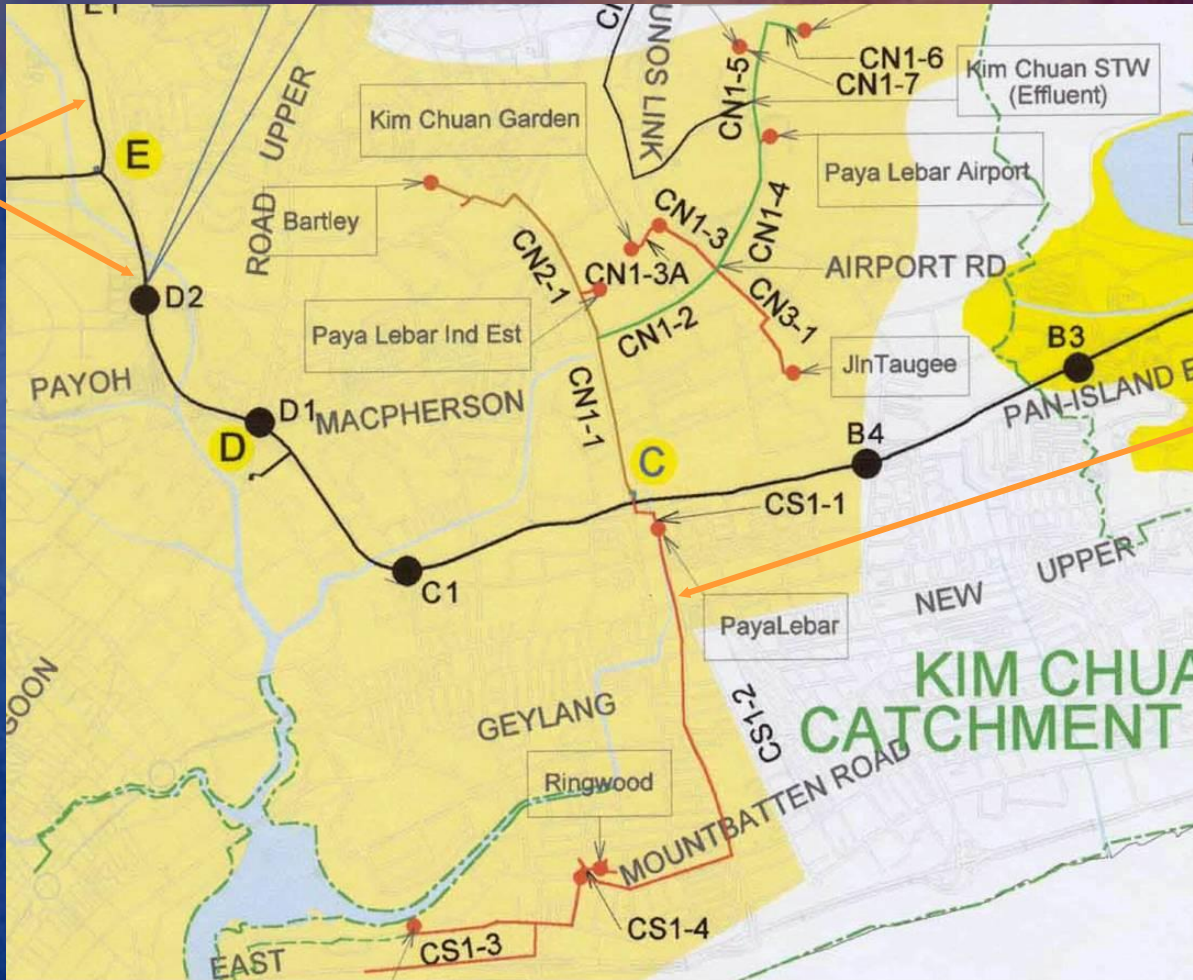


Long Section Plan Of DTSS in Singapore



Location Plan of DTSS System

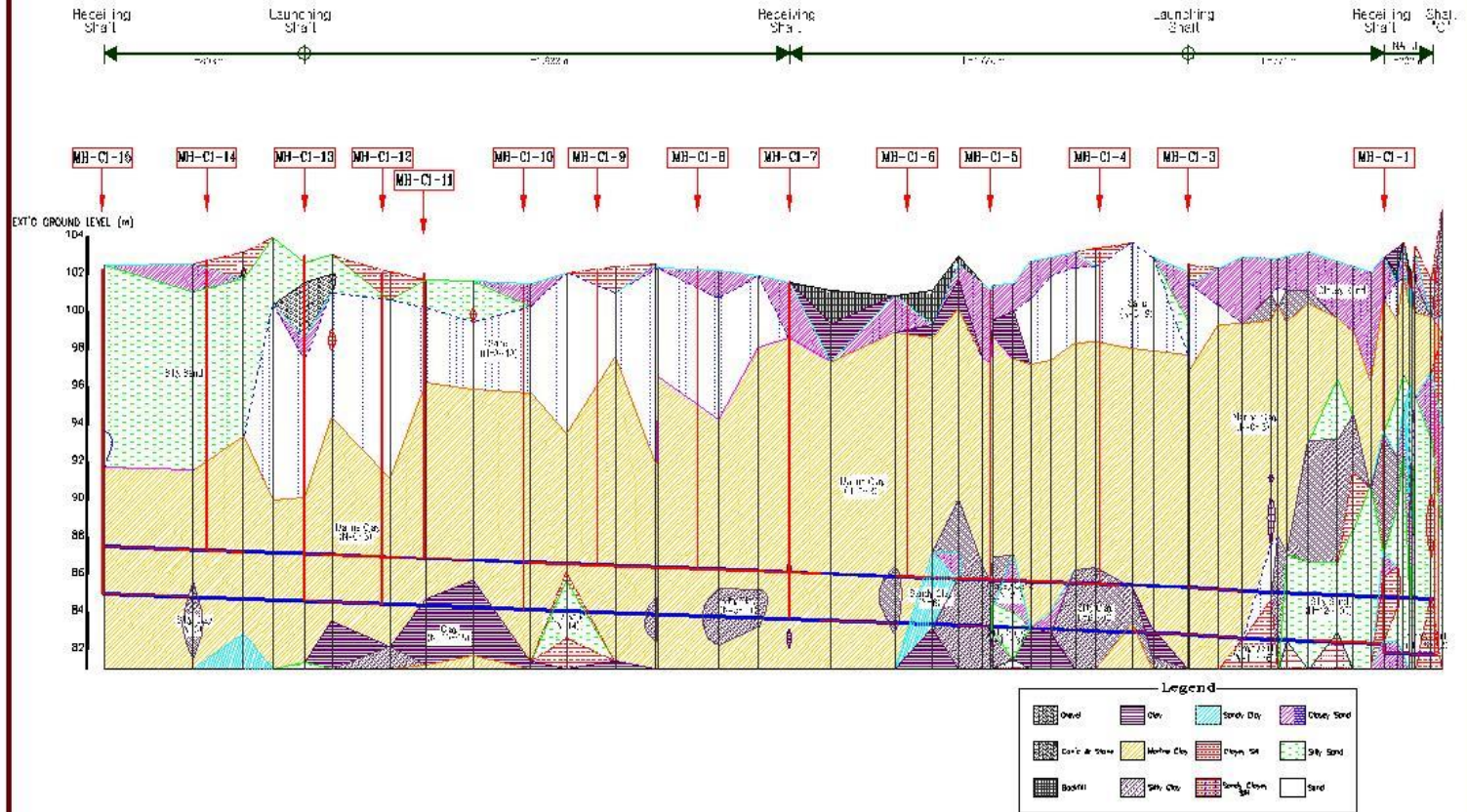
DTSS
Tunnel
Sewer



Kim Chuan
Link Sewer

PUB Construction Seminar

Geological section for Kim Chuan Link Sewers Contract 1



➤ Tunneling with an EPBM

- ❖ Lovat TBM
- ❖ Cut: 3.3m
- ❖ TBM Length: 7.5m
- ❖ Total Length: 60m



Site Office and Main Tunnel Launch Shaft



Launch Shaft

Main Tunnel Launch Shaft



Formation of Tunnel Eye



Jet Grouted Piles

➤ TBM Launch Shaft



➤ Initial Excavation



➤ Initial Setup of the TBM



➤ The Backup



- Tunnel Segments
- Outside Diameter: 3.2m
- Inside Diameter: 2.9m
- Thickness: 150mm
- 5 Segments + Key
- Min Curvature 90m
- Elastomeric Gasket
- Conventional Design



➤ Segment Delivery



➤ Ring Building



➤ Marine Clay Discharging to Muck Wagon



➤ Marine Clay on Conveyor



➤ Muck Wagon Arriving at Shaft



➤ Removal of Clay to Surface



➤ Muck Being Tipped into Loading Bay



➤ **First Break Through**



➤ Secondary Grouting



➤ Completed Section of Primary Lining



➤ Tunnel Ventilation



Tunnel Alignment From The Surface

Paya Lebar
MRT Station



Tunnel Alignment

PUB Construction Seminar



Tunnel Alignment

Intermediate Manhole



PUB Construction Seminar



Tunnel Alignment

Vortex Drop Shaft



➤ Intermediate Manhole Construction

- ❖ 9 No. Intermediate Manholes Required
- ❖ Up to 18m deep, 1800mm diameter
- ❖ Manhole to be FRP Lined
- ❖ Ground Conditions Predominantly Marine Clay

Temporary Works - 2.4m ID Steel Casing



Vibration of Caisson to 0.5m Above Tunnel Crown



Guide Wall

Excavation of Intermediate Manhole

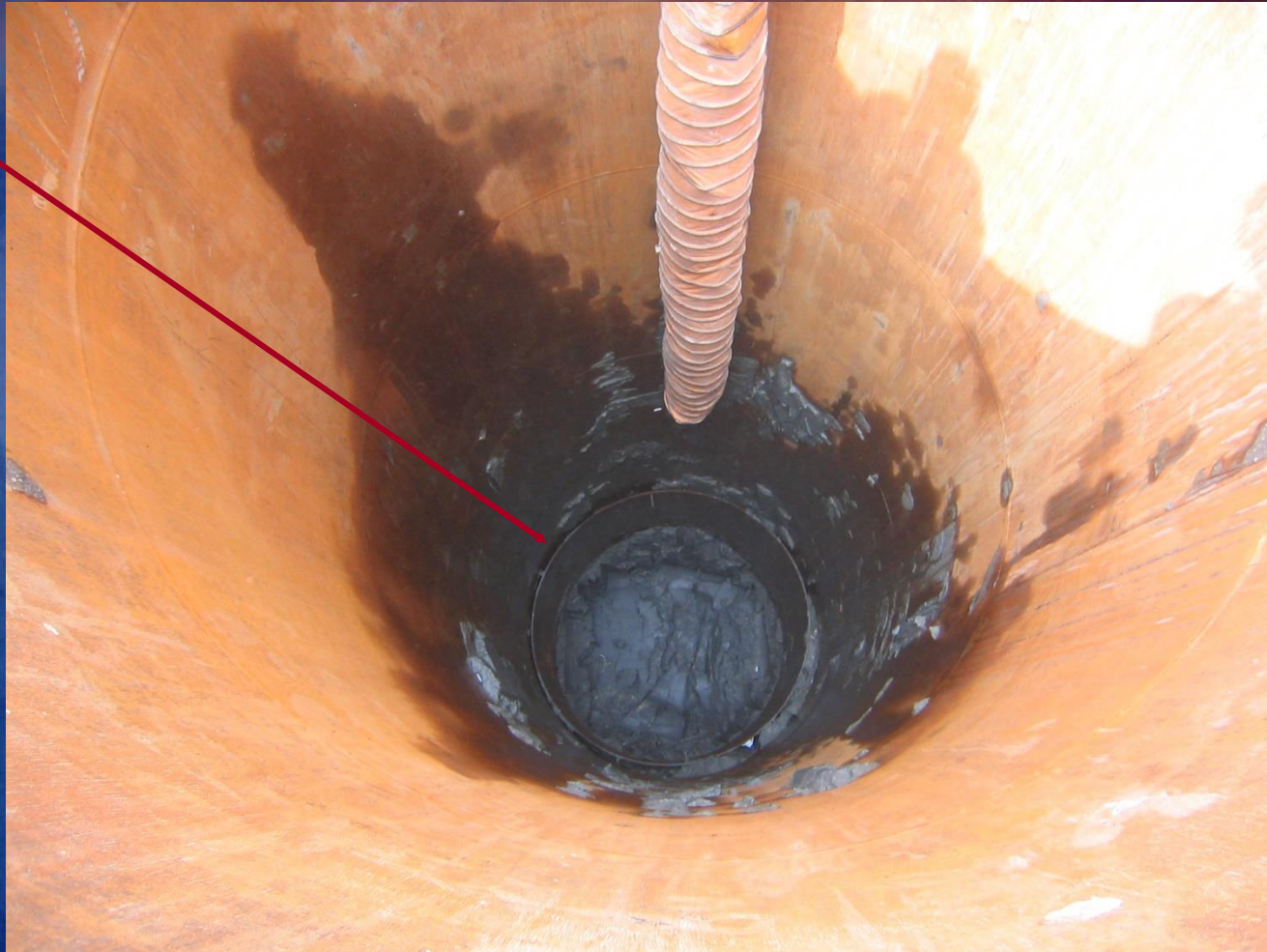


Installation of Secondary Caisson

Profile of
Caisson to
Match Tunnel
Crown



Installation of Secondary Caisson



Completion of the Installation of the Temporary Caisson



Delivery of FRP Manhole Liner



Installation of the FRP Liner



FRP Liner Installed Ready for Concreting



➤ NATM Excavation

- ❖ 203m
- ❖ Under PIE
- ❖ 20m deep
- ❖ Old Aluvium



Alignment

Excavation of TBM Receiving Shaft/NATM Drive Shaft

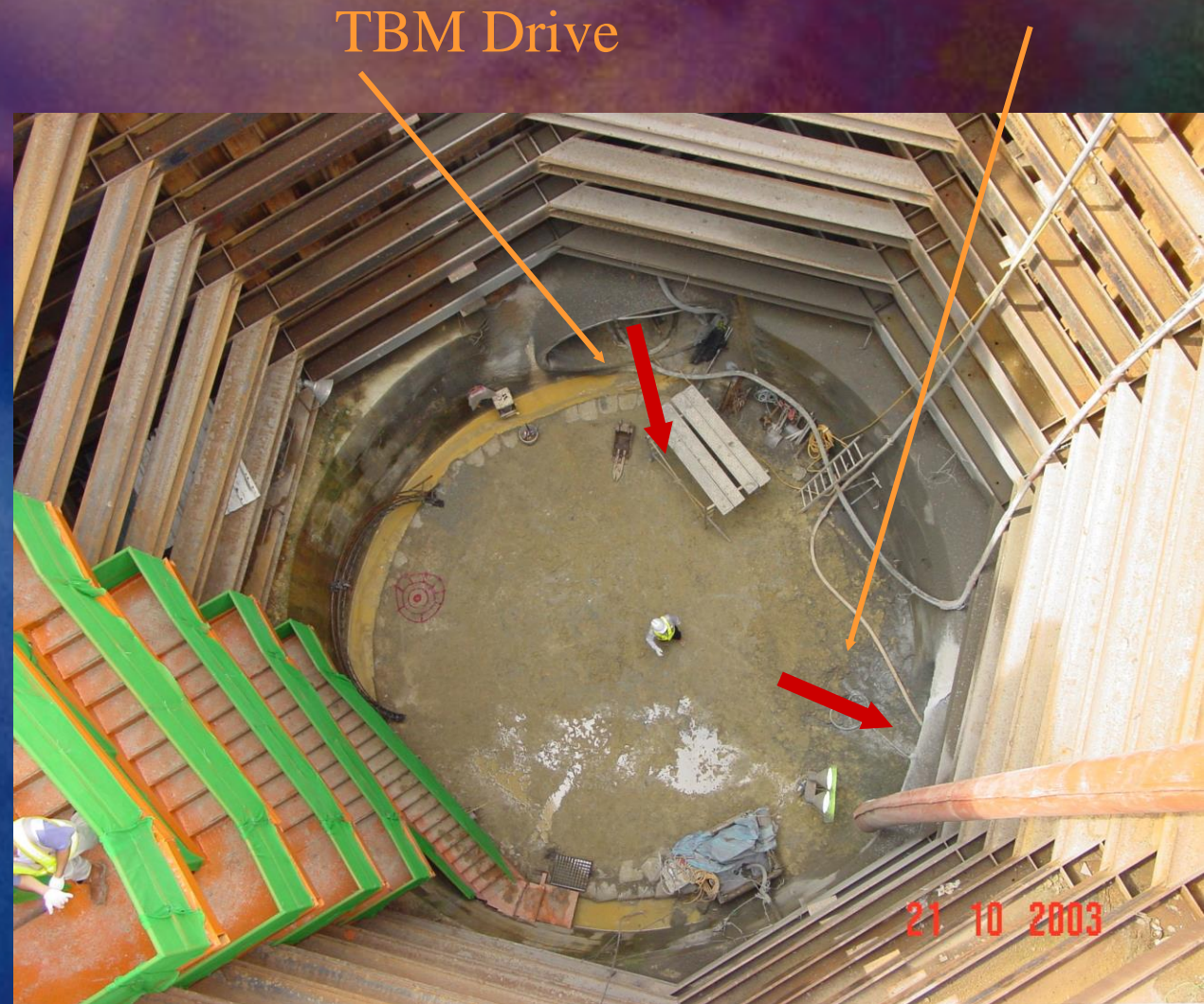


Excavation of Marine Clay from Shaft



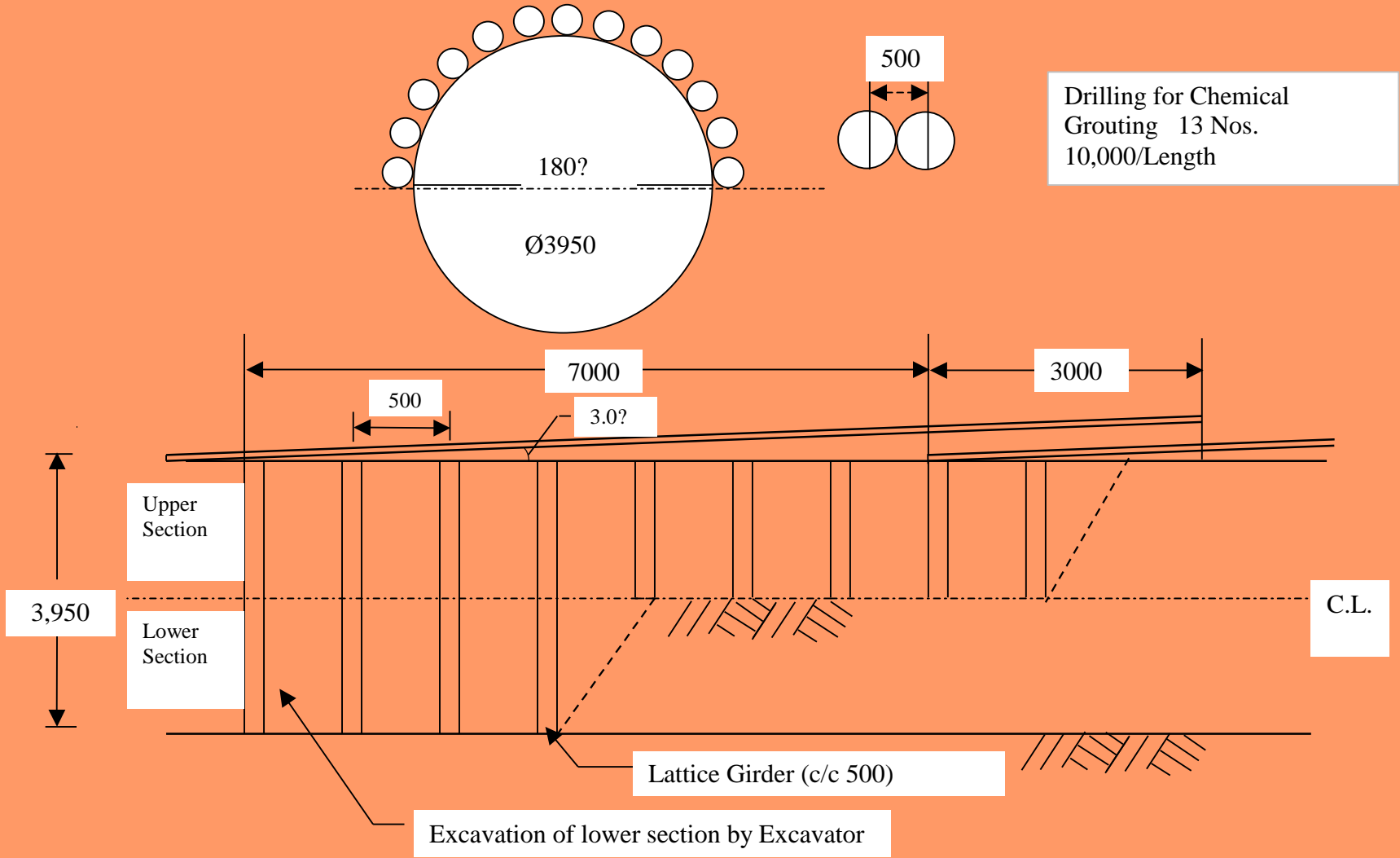
NATM Tunnel

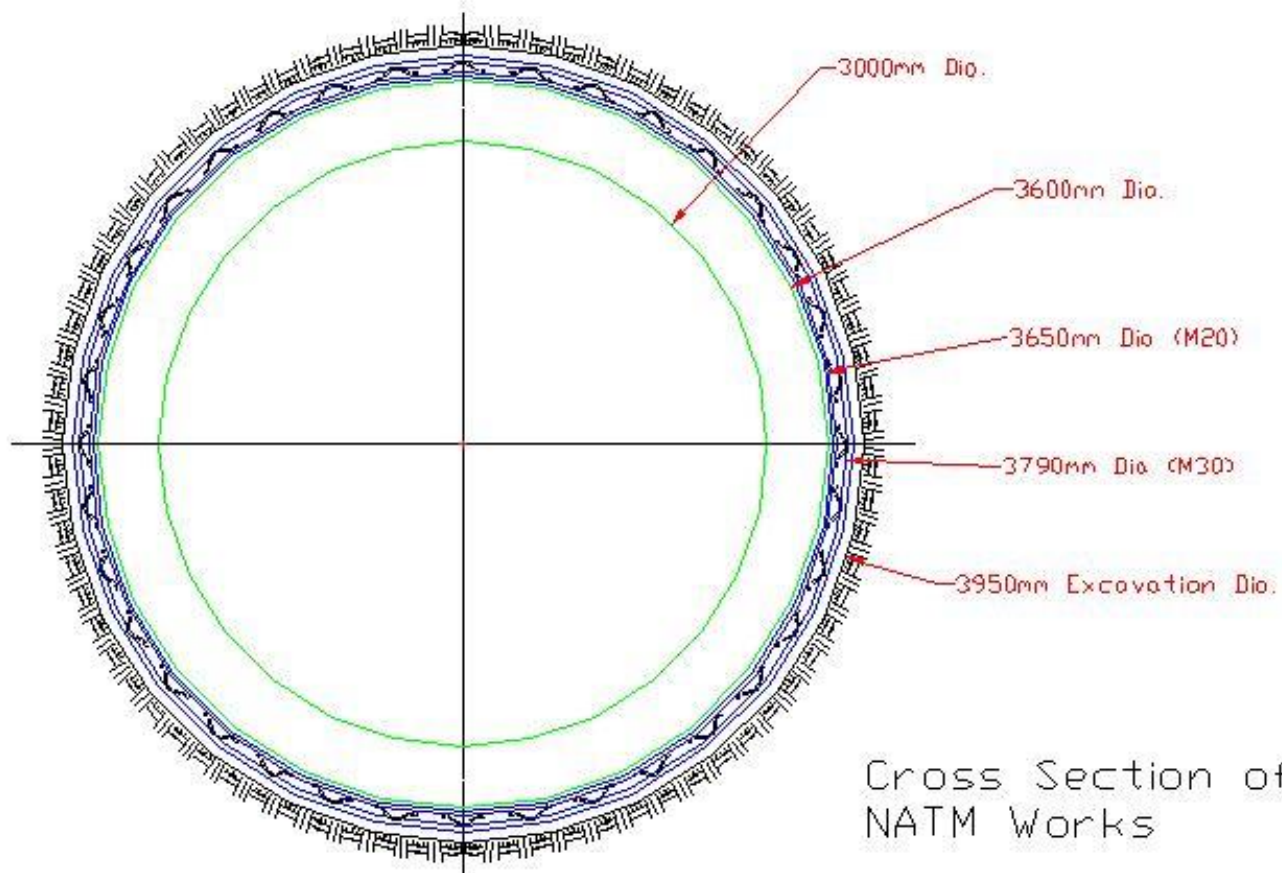
- **NATM Shaft**
- ❖ 23m Deep
- ❖ Sheet Pile
- ❖ Caisson Ring
- ❖ Stiff Clay



NATM Sequence of Excavation

Pattern II





Cross Section of
NATM Works

- Temporary Support
- ❖ Lattice Girder
- ❖ 750mm centers
- ❖ Shotcrete 200m



➤ Dry Shotcrete Batching Plant



➤ NATM Portal Preparation



➤ Shotcreting NATM Portal



➤ Shotcreting NATM Portal



➤ NATM Work Face



➤ NATM Work Face



➤ Heading Shotcrete & Lattice Arch Support



➤ Bench Shotcrete & Lattice Arch Support



➤ Shotcrete Portal



➤ NATM Secondary Lining



HDPE
Liner

17/01/2004

➤ NATM Grouting to Secondary Lining



➤ NATM HDPE Welding



➤ NATM HDPE Testing



➤ NATM Connection to T02 at Drop Shaft C





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