



CHKSTT Conference on Trenchless Technologies

Keynote Speech

Applications of Trenchless Technology in Drainage and Sewerage Projects

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Contents

Introduction

Why trenchless

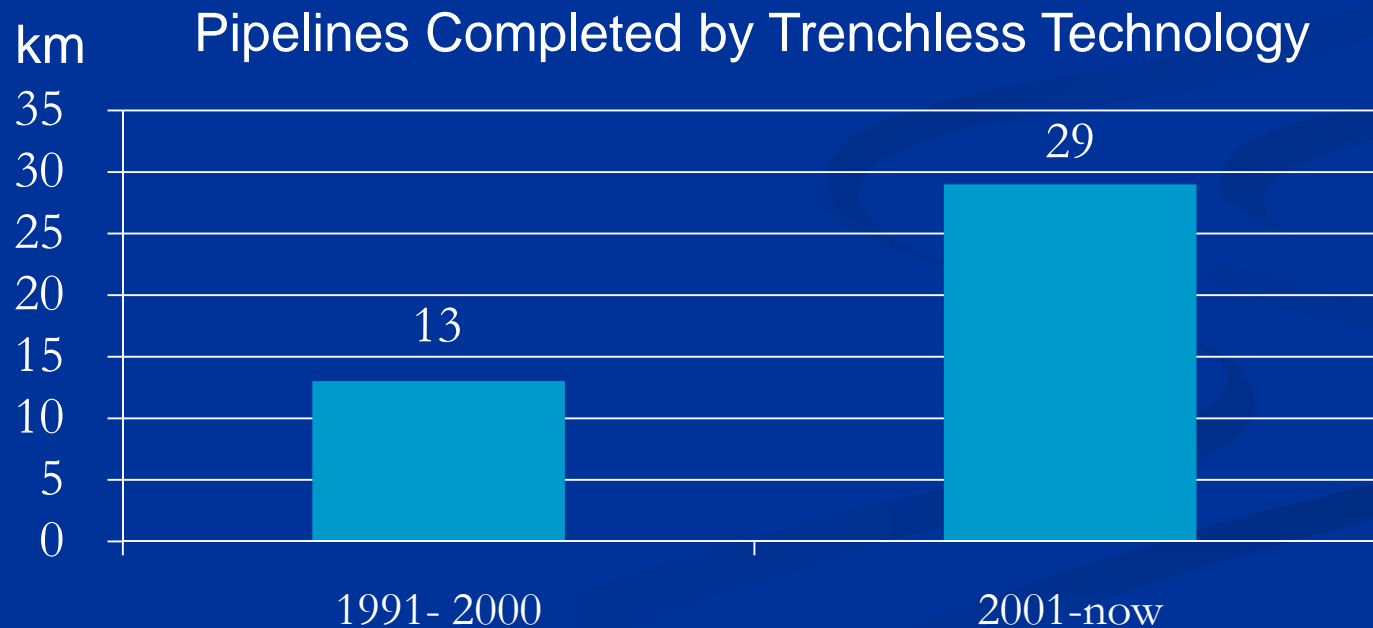
What common problems

How to better prepare



Introduction

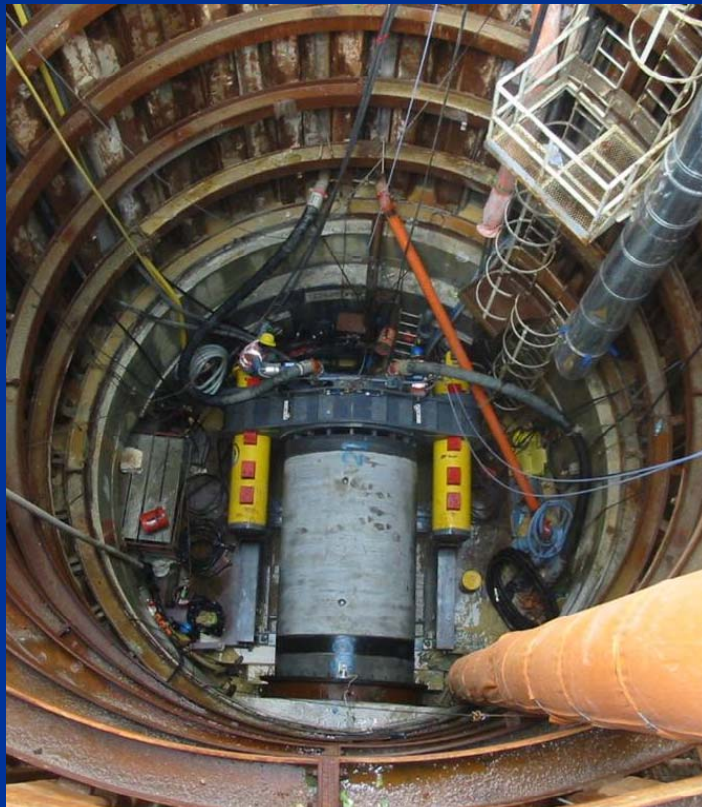
- Earliest record in 1991
- Completed over 42km pipelines within 21 years





Introduction

Pipejacking Method



By TBM



By Hand Shield



Introduction

Heading Construction



Supported by
Steel Portals



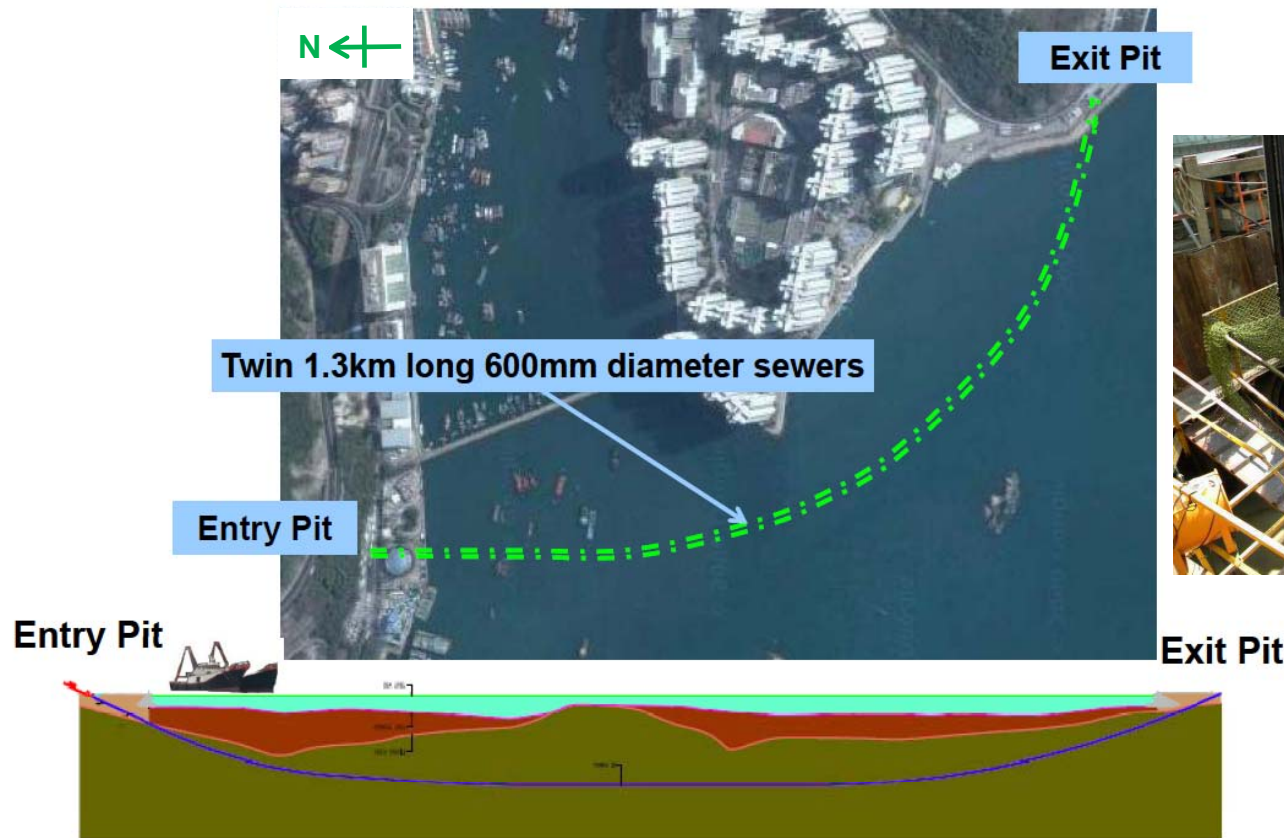
Supported by
Prefabricated Segments



Introduction

Horizontal Directional Drilling (HDD)

Layout Plan and Profile





Introduction

Pipeline Rehabilitation



CIPP (Cured-in-Place Pipe)



Renovation using liner



Pipe-in-pipe



Why trenchless?

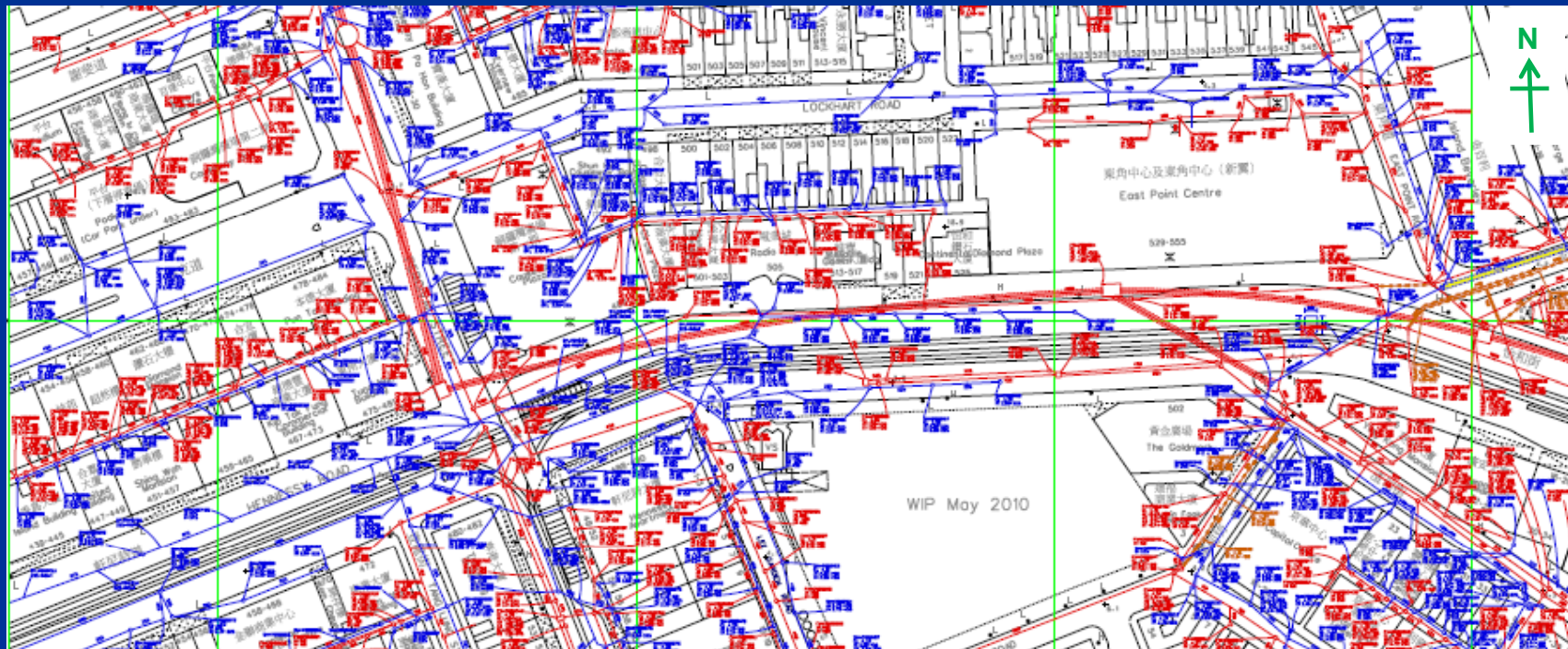
Our Vision:

To provide world-class wastewater and stormwater drainage services enabling the sustainable development of Hong Kong



Why trenchless?

Networks of sewers and drains in Hong Kong





Why trenchless?

Busy Traffic



The use of trenchless technology minimizes surface opening.....



Why trenchless?

Congested Utilities





Why trenchless?

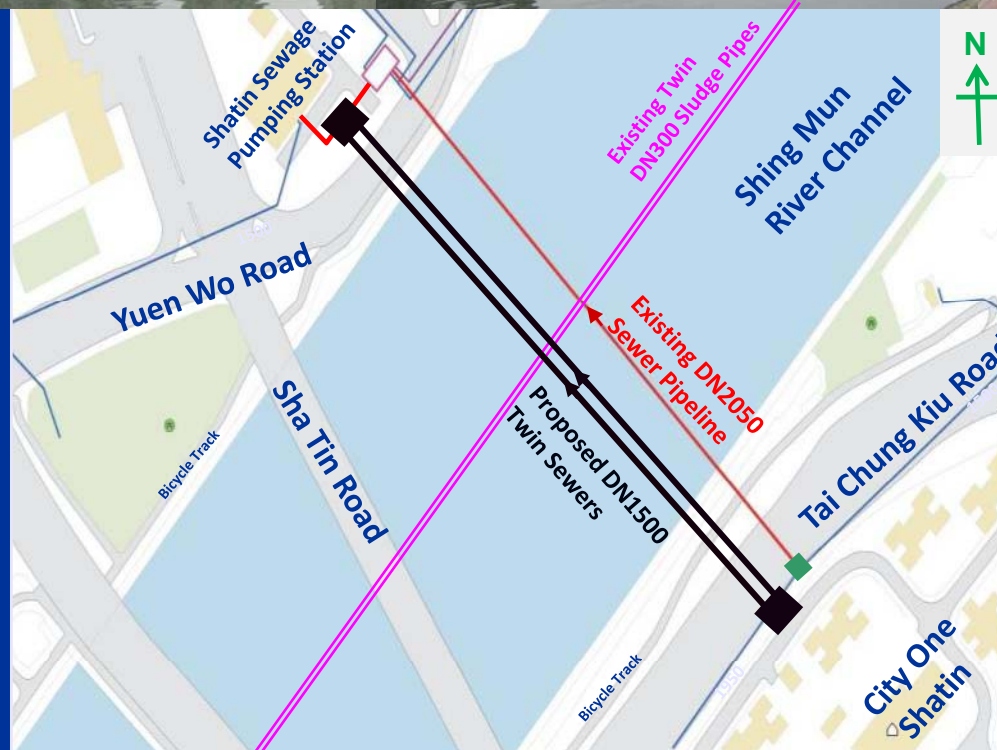
Noise and Dust Nuisance





Why trenchless?

River crossing





Why trenchless?

Faster construction

Could be a few times faster

Factors including:

- Congestion of utilities
- Ground condition
- Pipe depth and length



What common problems?

Settlement



Crack &
Stepping



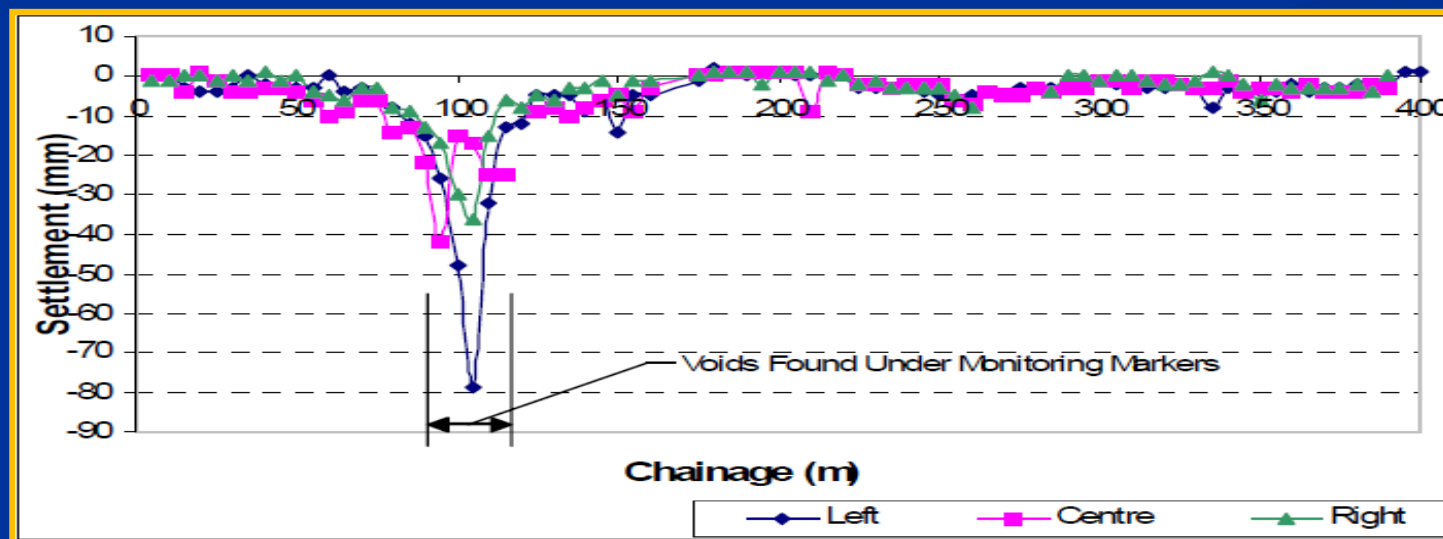
Road
Subsidence



What common problems?

Settlement

- Generally controlled within 20-30mm
- Can be less than 15mm for pipejacking with TBM
- Settlement monitoring to pick up early warning





What common problems?

Settlement

Based on a project in Wan Chai and North Point:

- Filling the annulus by grouting
- About 25% of settlement occurred after completion of pipejacking works
- Settlement usually stopped after
3-4 weeks for shallow drives with sandy materials
8-10 months for deep drives with clayey materials



What common problems?

Excessive deviation in line and level

- Most pipelines are controlled within 75mm for line and 50mm for level
- Hydraulic checks on out-of-tolerance sections
- Make good depressed/damaged sections



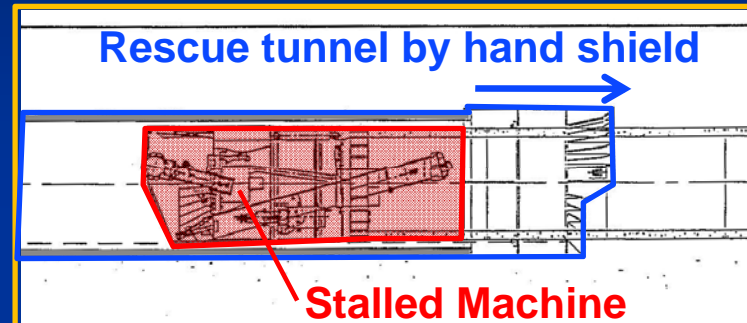


What common problems?

Stalling of TBM



Rescue Shaft



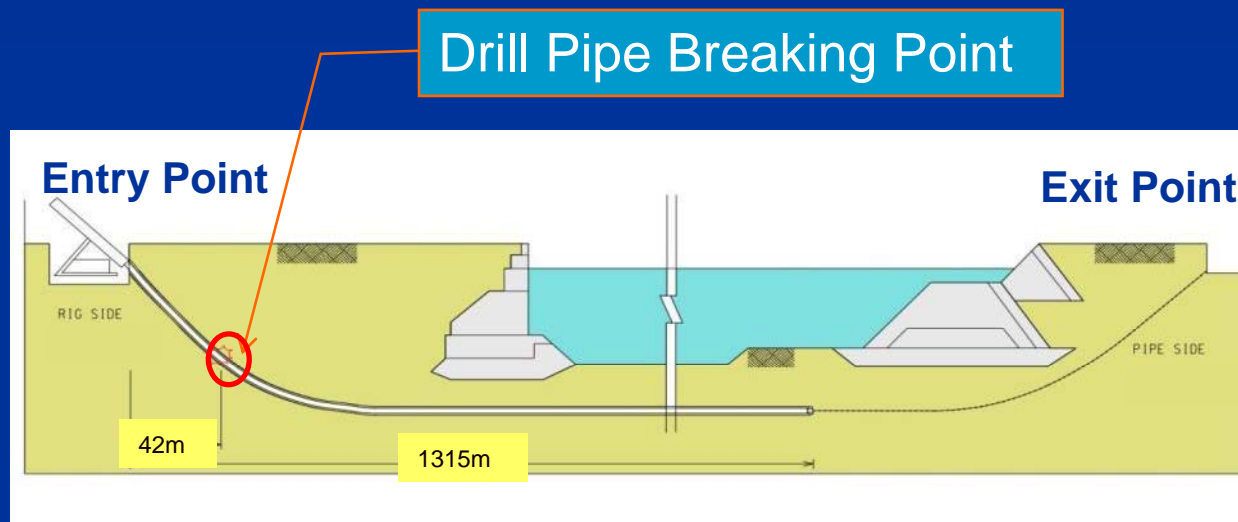
Rescue Tunnel

Rescue operation – High impacts on time and cost



What common problems?

Breaking of Drill Pipe of HDD



Broken Drill Pipe



What common problems?

Some limitations

- Minimum cover – usually 2 x diameter
- Excavation of “over-sized” temporary tunnel by heading construction





What common problems?

Cost

- It is more expensive
- Previous study: 1.4 to 7 times
- Factors:
length, depth, ground condition, method etc
- Social cost not counted



How to better prepare?

More problems!

Careful planning and design

Revise construction method

Some examples



How to better prepare?

- Problem – Relocation of jacking/receiving shafts due to congested utilities and heavy traffic.
- Advance contracts for projects in busy urban areas.



Trial TTMS at Hennessy Road in 2001 with inspection pit

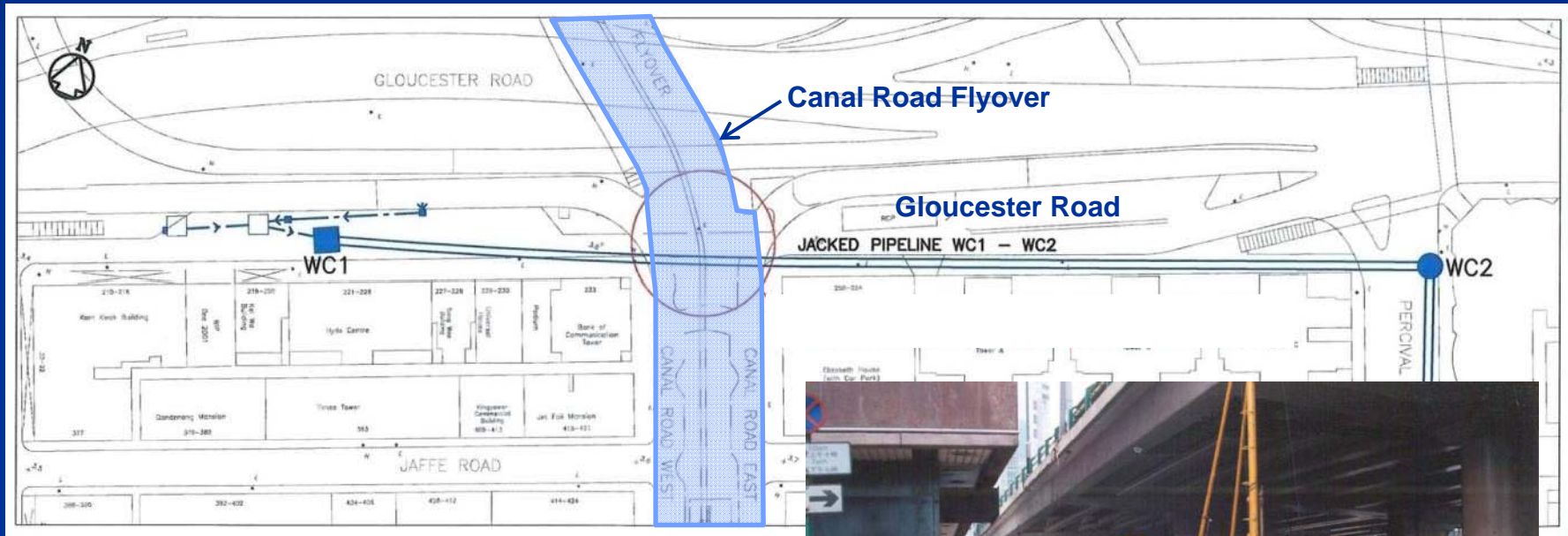


Actual TTMS at Hennessy Road in 2003



How to better prepare?

Problem – Accuracy of old record on raking piles?

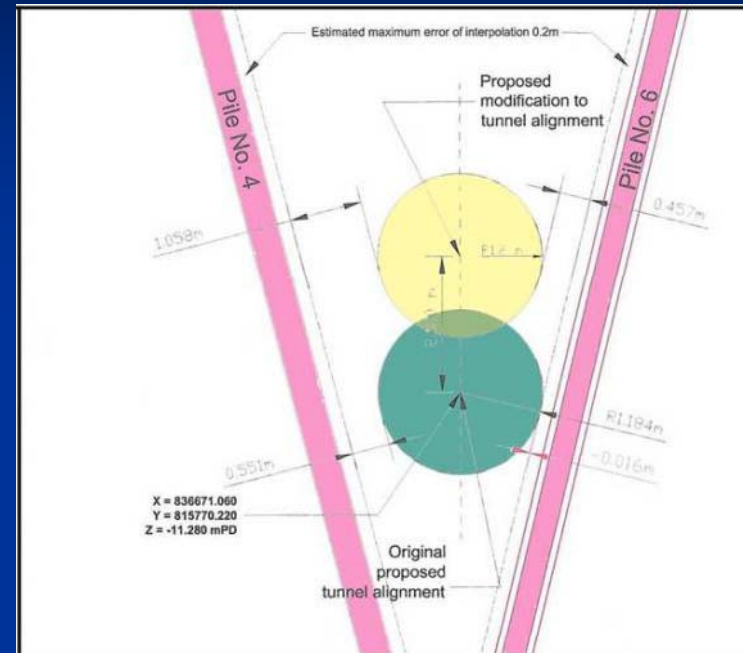
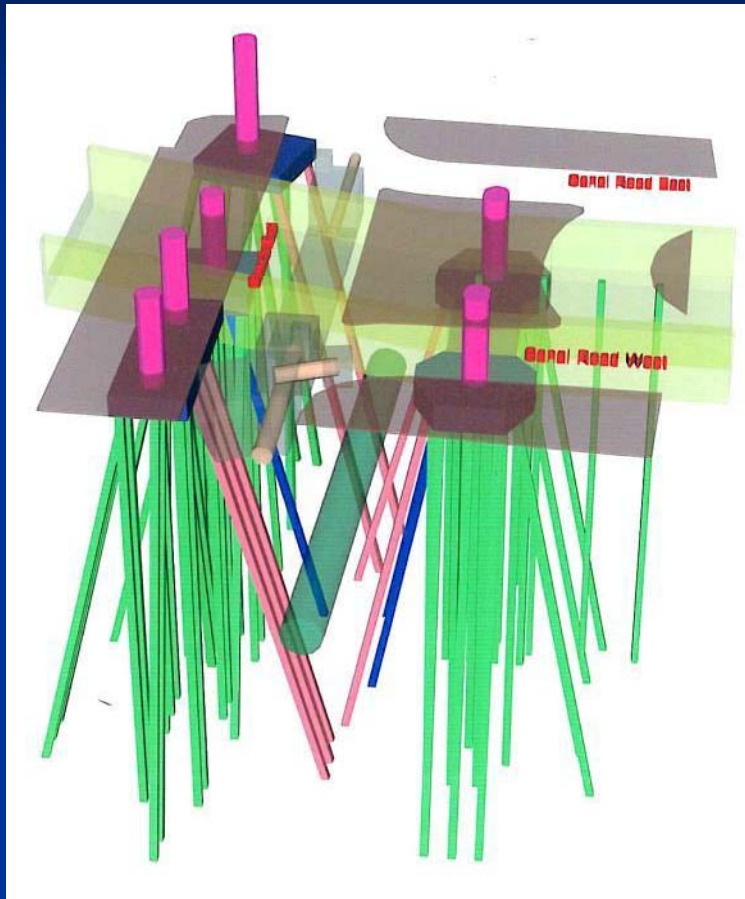


- Geophysical survey to determine the true as-built geometry





How to better prepare?



To elevate the sewer by 2m
to avoid potential conflict

Geophysical Survey on Raking Piles of Canal Road Flyover



How to better prepare?



20m 1050mm dia drain
Tin Hau Temple Road



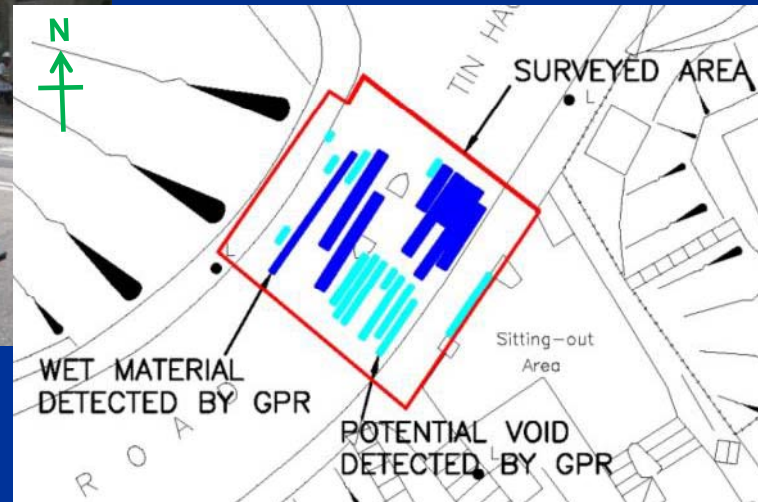
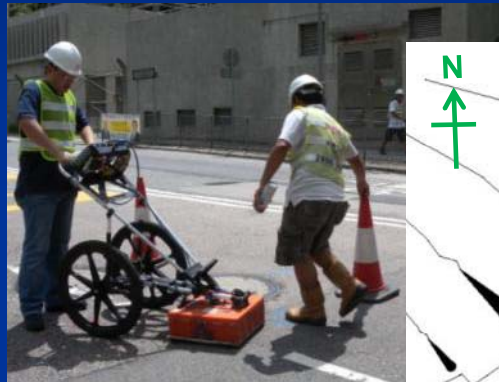
Repeated road subsidence
in the vicinity

Problem – Area with very high risk of settlement/subsidence



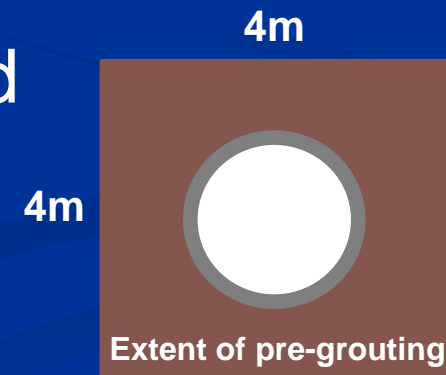
How to better prepare?

- Conduct Ground Penetrating Radar Survey



- voids
- wet materials

- Pre-excavation grouting is required
- Extent of grouting: 4m x 4m





How to better prepare?



Pre-excitation Grouting



Excavation



Completed Tunnel

Completed in 3 months

Maximum Settlement = 9mm

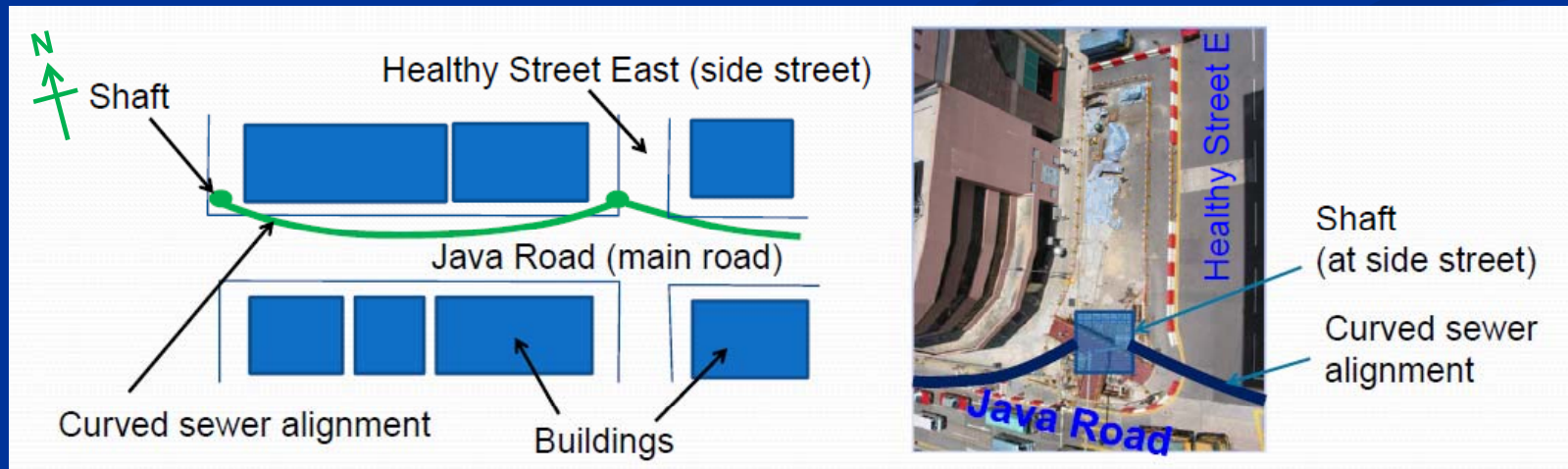


How to better prepare?

Problem – Locating jacking/receiving shafts in busy area



Curved pipejacking alignment

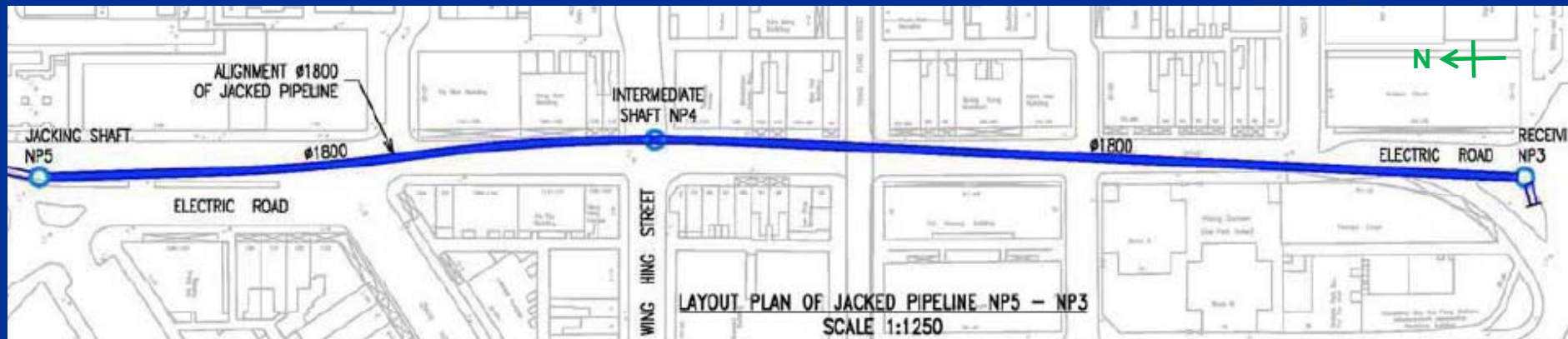




How to better prepare?

Problem – Limited construction duration at shaft sites

Jacking through intermediate shafts

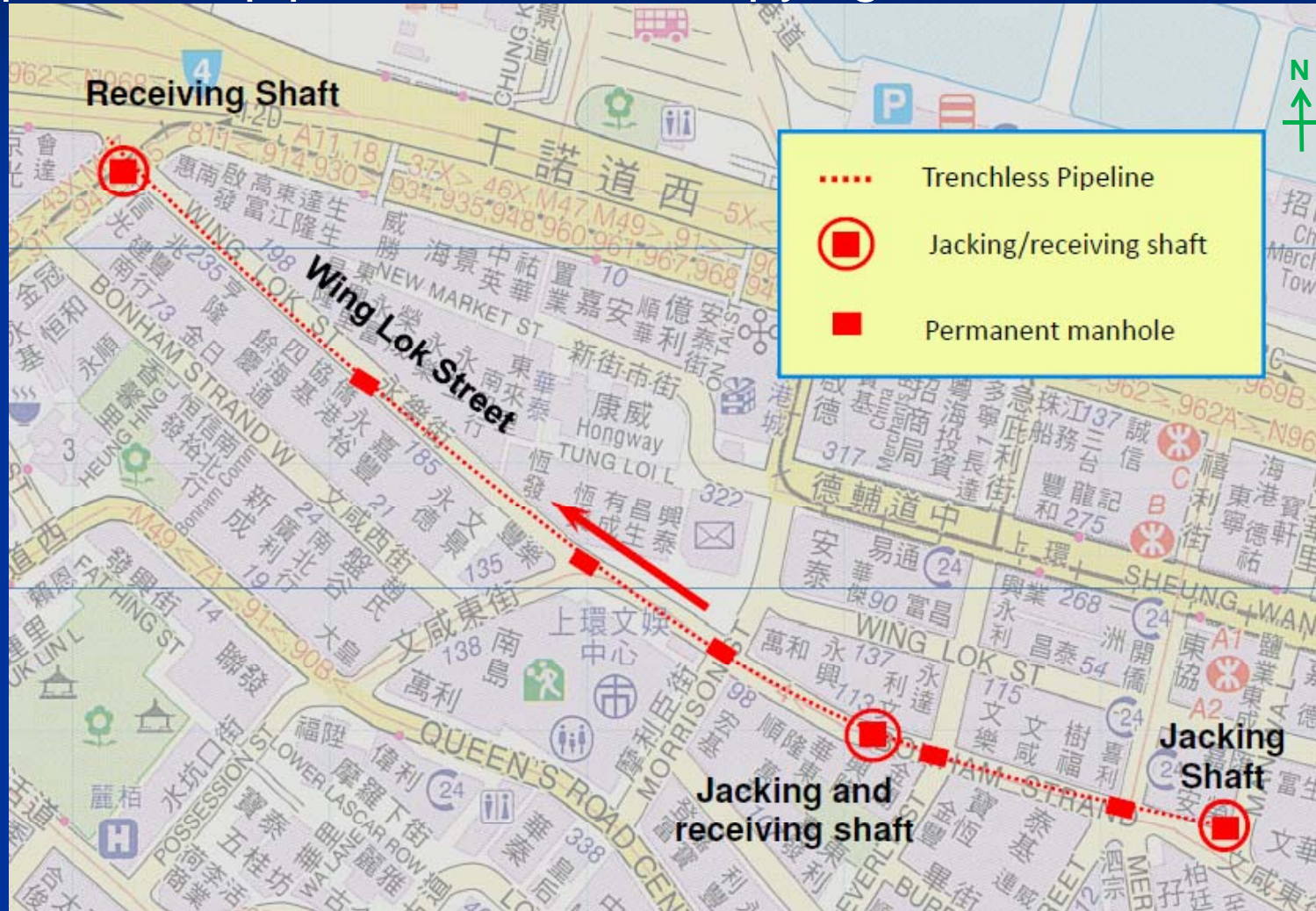


- Public concerns on construction duration at Jacking Shaft NP4
- Combine two drives into one through completed Manhole NP4 (intermediate shaft) in a 404m long S-shape alignment
- Shaft site NP4 was reinstated about 10 months earlier



How to better prepare?

Completion of pipeline before occupying intermediate shaft sites





How to better prepare?

Adoption of new method/technology

How about jacking a box section?





How to better prepare?

We need good planning, good design and good contractors.

Contractor's execution is important

- right methods
- right people
- right actions against technical problems
- right PR approach



Closing Remarks

More experience gained and shared among the industry

Better performance and wider applications of trenchless technology are expected

Trenchless technology will continue to play an important role in DSD projects



Thank You