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Short-Segment Jacking of Water Main for Realignment under Limited Space in Urban Area

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TAIWAN

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- Short segment pipe jacking
- Water main realignment project
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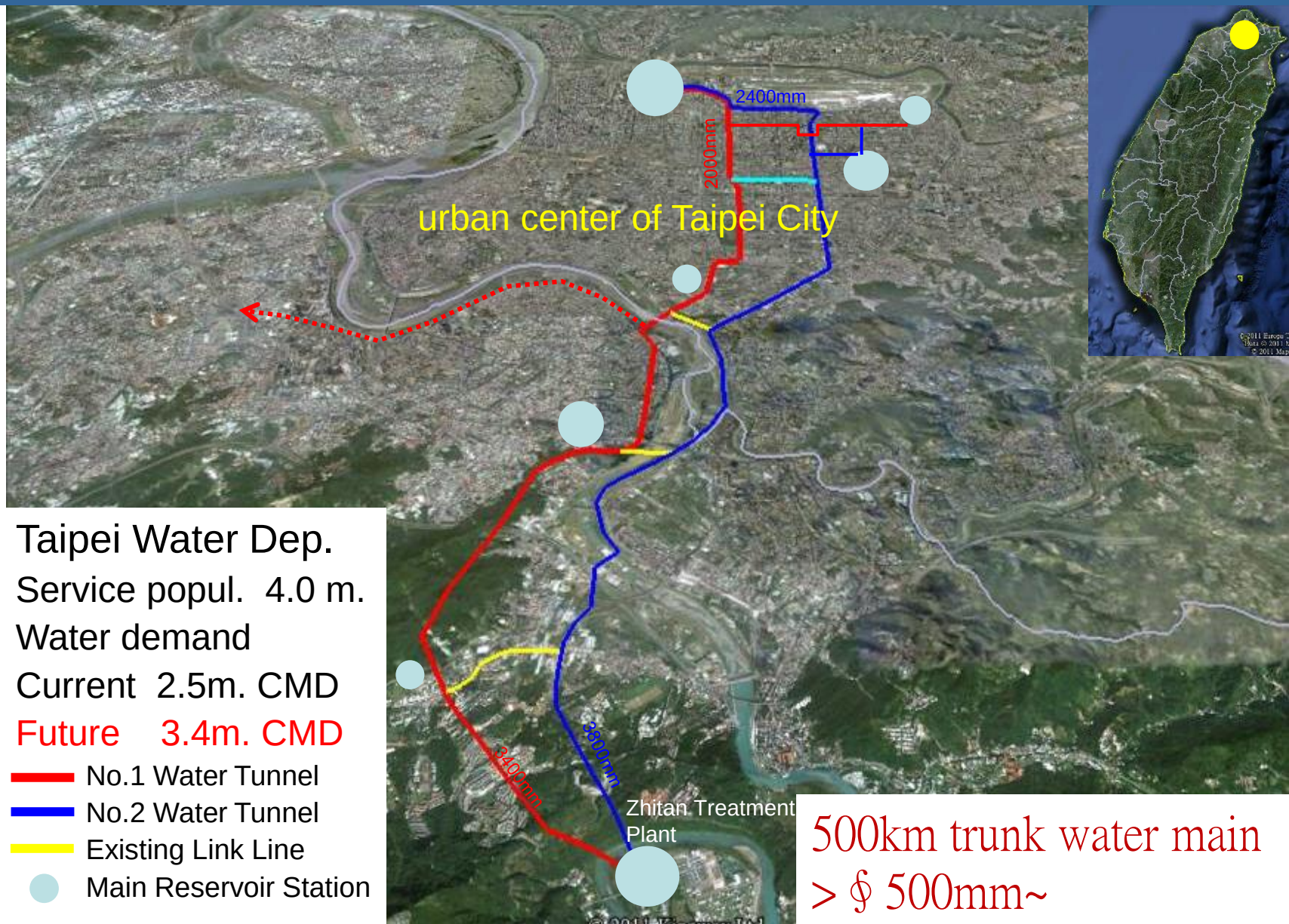
臺北自來水事業處
Taipei Water Department

Prologue



Taipei Water Dep.

Service popul. 4.0 m.

Water demand

Current 2.5m. CMD

Future 3.4m. CMD

- No.1 Water Tunnel
- No.2 Water Tunnel
- Existing Link Line
- Main Reservoir Station

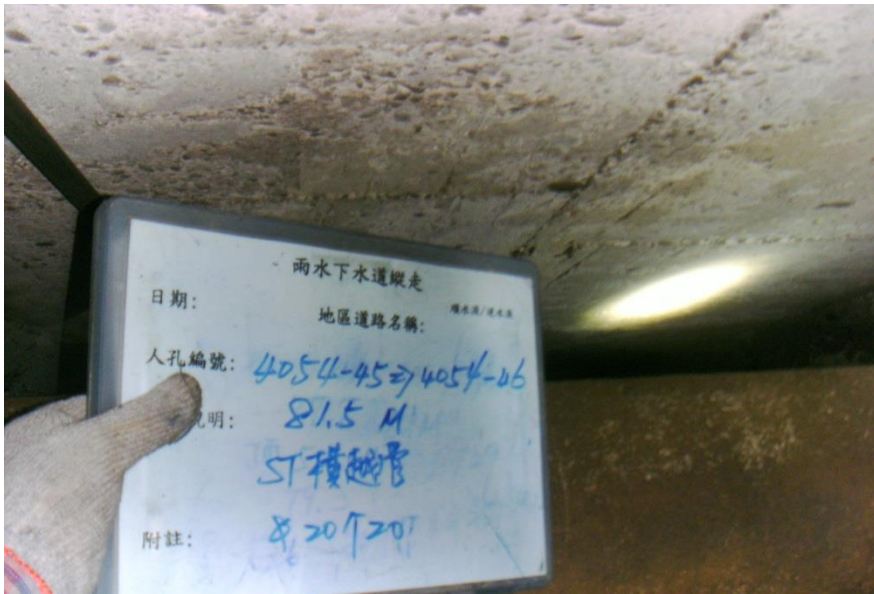
500km trunk water main

> ϕ 500mm~

Prologue

- Underground
  - Orderless underneath circumst-ance
  - Pipelines & structures crossing each other
  - Widespread drain systems are main obstructions
  - Trunk water main through drain structures cause public hazard
  - Water main removal policy implemented

Prologue

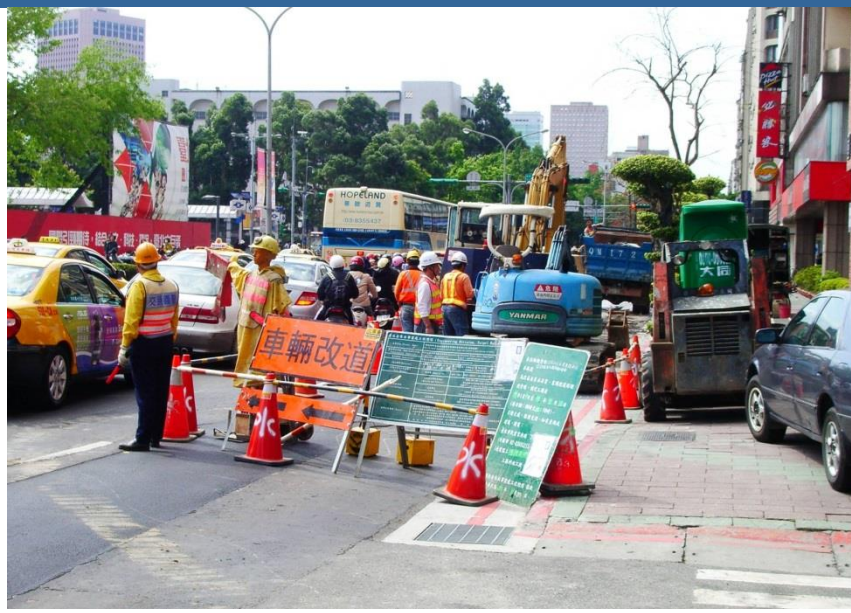


Prologue

Difficulties of realignment

Open-Cut

- Lengthy procedure for permi-ssion of transportation detour & road excavation
- Pollutions & disturbances along the construction site
- Frequent complaints from nearby which were affected
- Extremely limited undergrou-nd space of urban area
- Numerous and unexpected obstacles underground



Difficulties of realignment

Difficulties of realignment

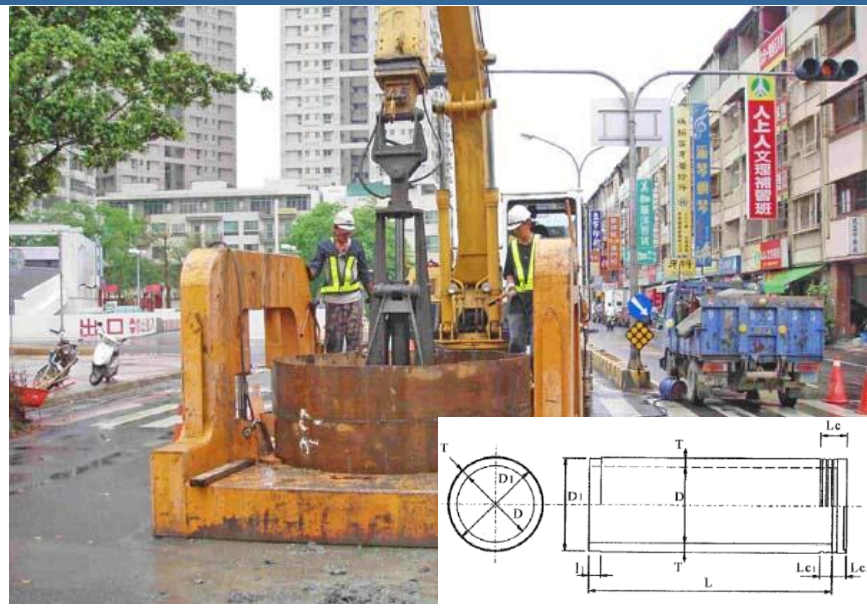
Trenchless

- Long DIP jacking pipe(@6M) as existed specification
- Large shaft(min. 4X8M) digged necessary
- Start shaft compound (min. 6X15M) setting
- Limited urban area with congested road way
- Sharply decrease for water pipe jacking works
- Dilemma for water main realignment projects

Short segment pipe jacking

Reference-Sewer

- Short Reinforced Concrete Pi-pe (RCP@1M) jacking for sewer construction
- Smaller shaft(avg.∮2.6M) by steel cylinder sinking
- Start shaft compound (avg. 3X8M) setting more feasible
- Limited disturbance & lessen complaints
- Proper model for water pipes jacking innovation

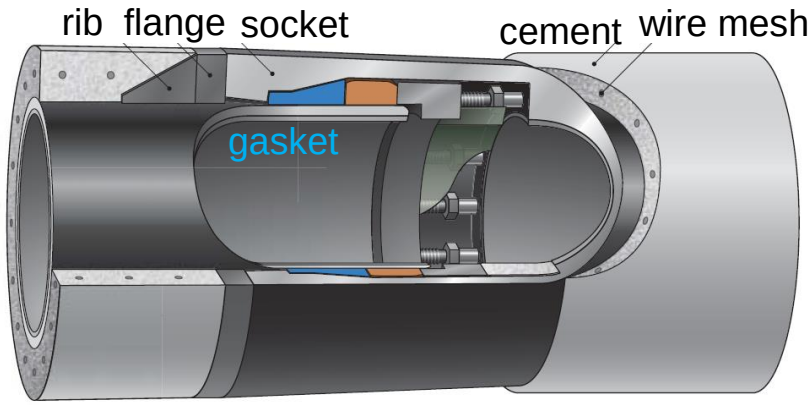


Short segment pipe jacking

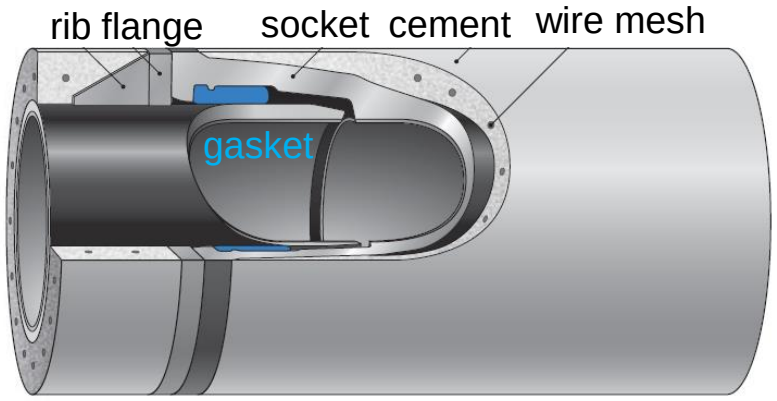
Material/joint

- Jacking Water Pipe Spec.
  - DIP with U/T type joint
    - U type for ≧ ϕ800mm
    - T type for ≦ ϕ700mm
  - sustain high water pressure
  - standard length 6M

U type ≧ ϕ800mm



T type≦ ϕ700mm

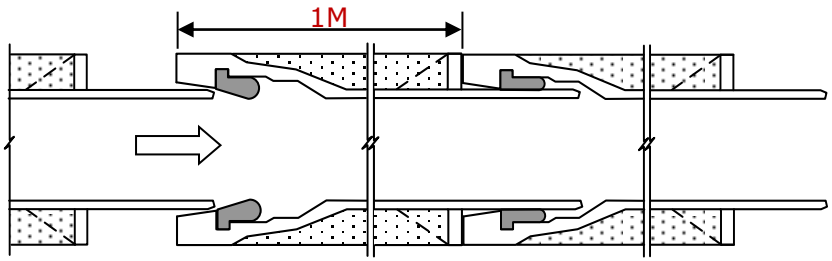


Short segment pipe jacking

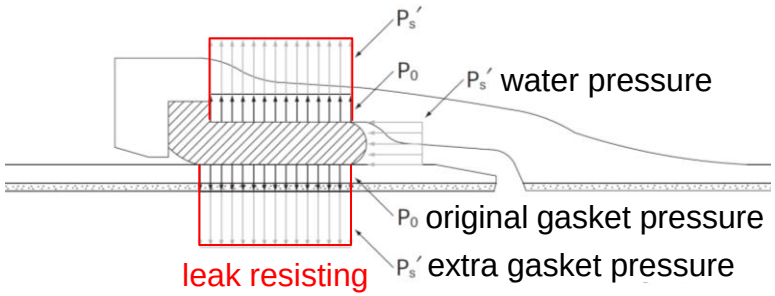
Pipe length innovation

- spec. amendment
  - DIP with T type joint
    T type for ≦ ϕ700mm
  - pipes fit for ϕ2.6M shaft
  - standard length 6M→1M
- joints & leakage risk increase by 6 times
- self-sealing mechanism
- water pressure rating 2.5Mpa

jacking pipes assembly



self-sealing mechanism



Short segment pipe jacking

- Pipe length innovation

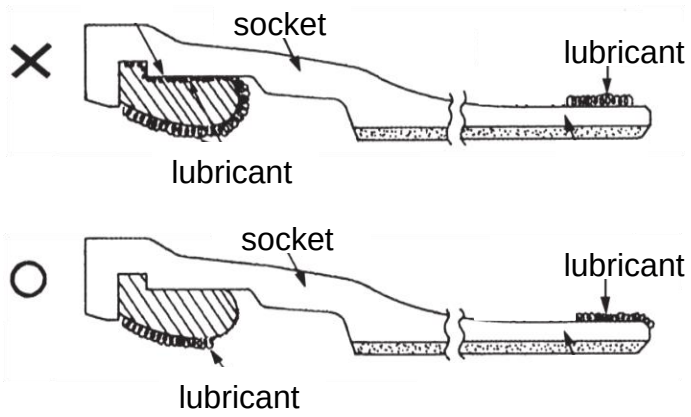
Short segment pipe jacking

Joint sealing guarantee

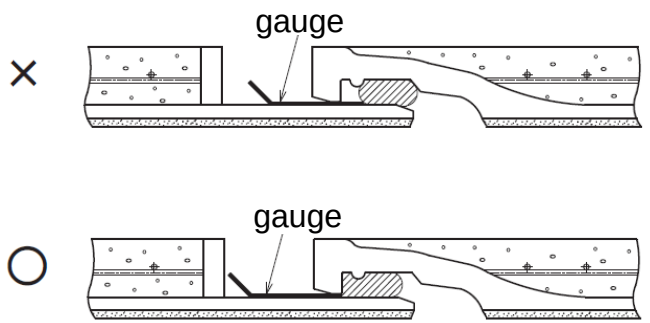
Gasket dislodged prevention

- Pre-assemble
  - gasket surface
  - cleaned & lubricated
- Mid-assemble
  - smooth inserting
  - gasket dislodged inspec-tion
- Post-assemble
  - view inspection inside
  - water pressure test

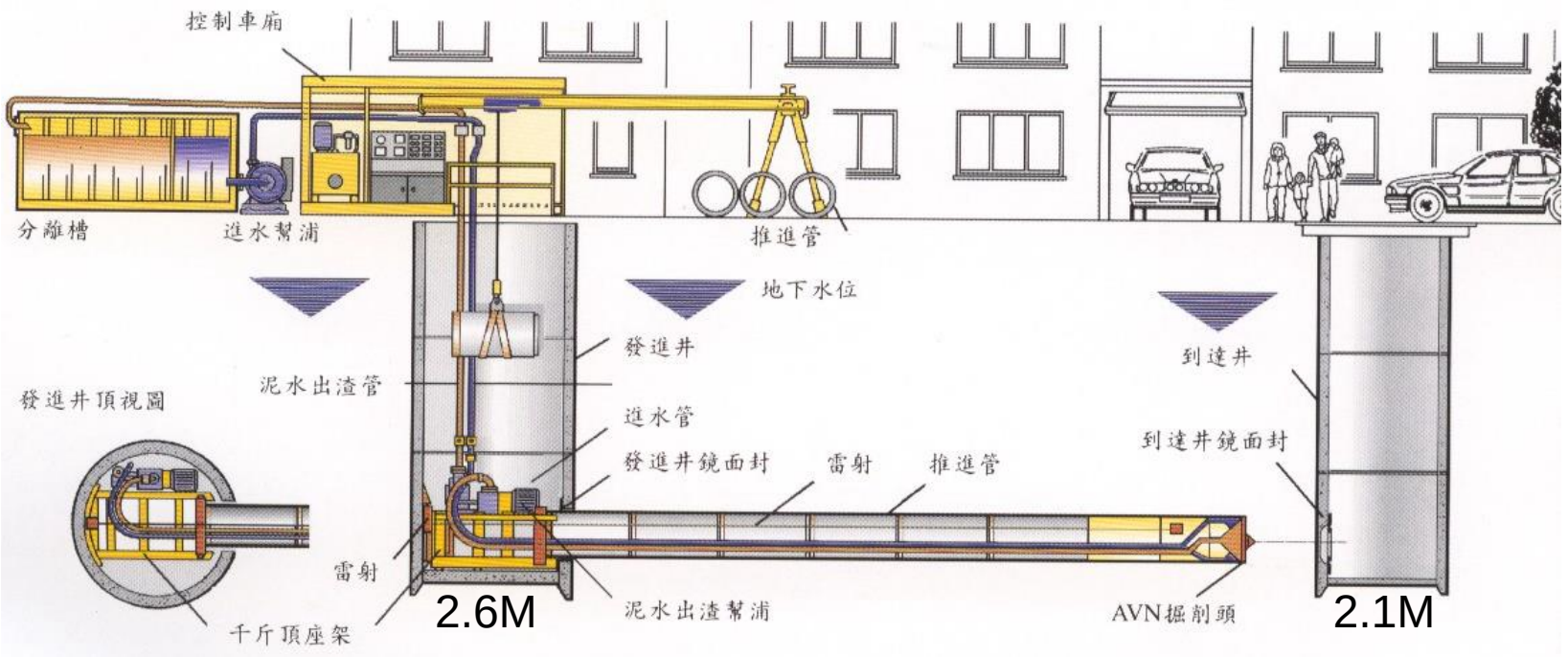
Pre-assemble

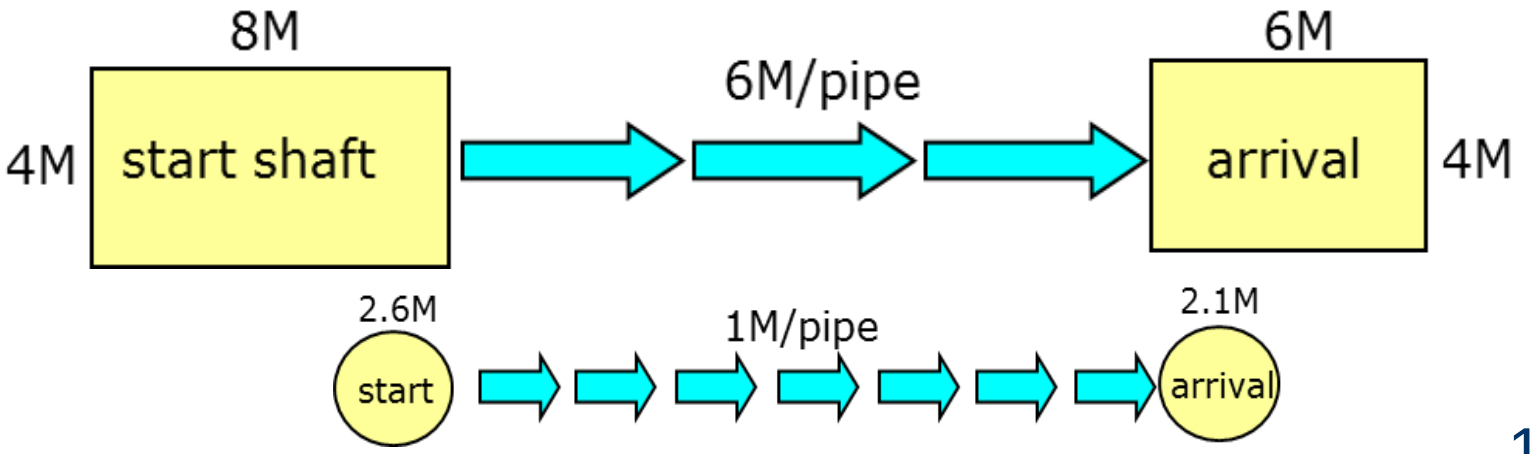


Mid-assemble



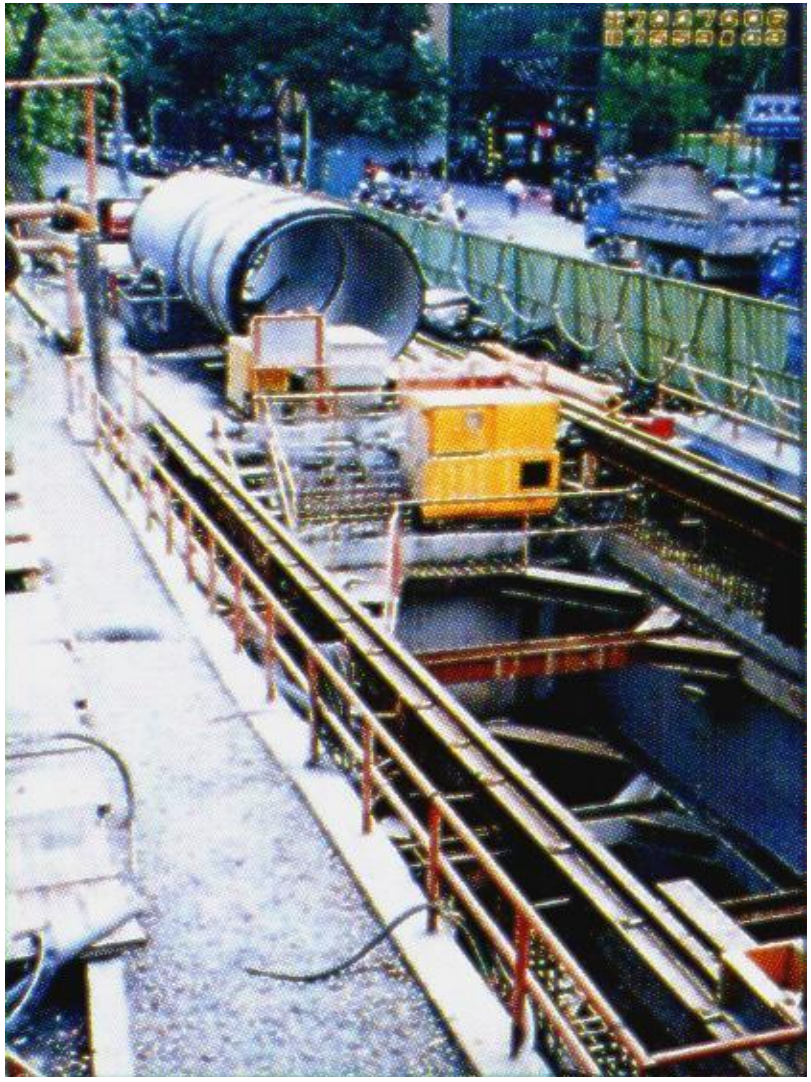
Short segment pipe jacking





Short segment pipe jacking

- Jacking compound layout



Short segment pipe jacking

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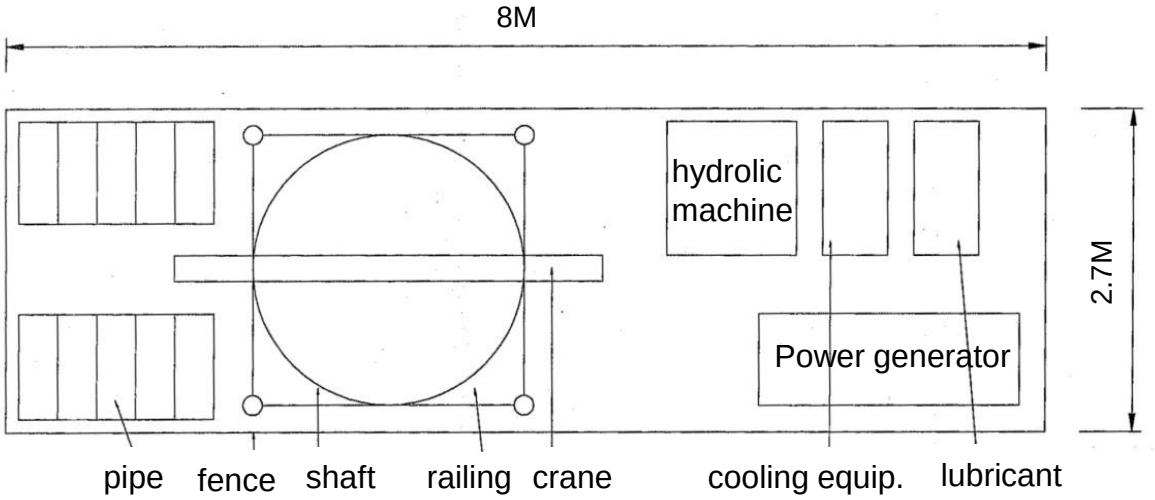
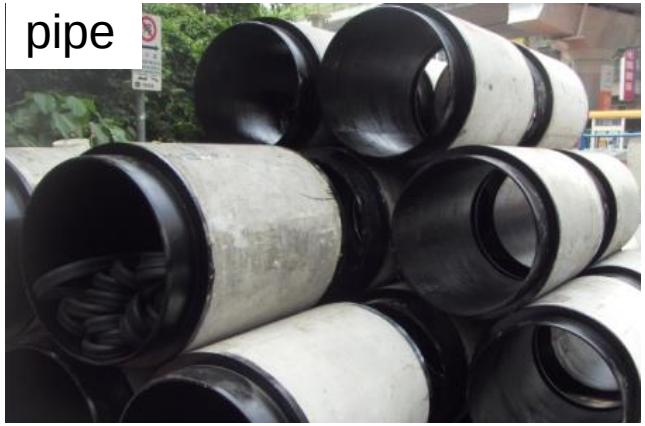


pipe



controller

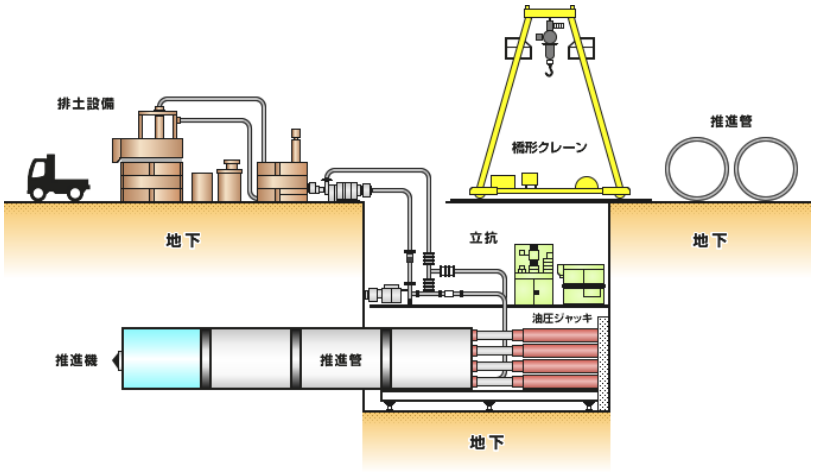
auger

auger conveyor

Short segment pipe jacking

Feature

- Minimum compound space needed
- Thrust wall un-necessary
- Cost effective & minor distur-bance
- Easy for traffic maintenance
- Minor impact for environment
- Vibration-free during shaft setting
- Public safety enhancement
- Feasible approach for urban area trenchless



Water main realignment project

Case study

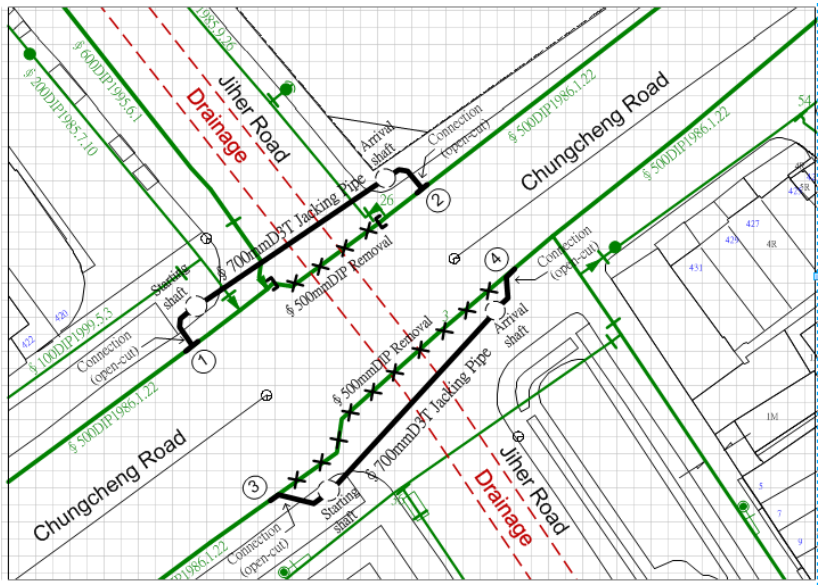
- Chungcheng-Jiher Road DN500 mm water main realignment project
- Content :

  2-start shafts, 2- arrival shafts

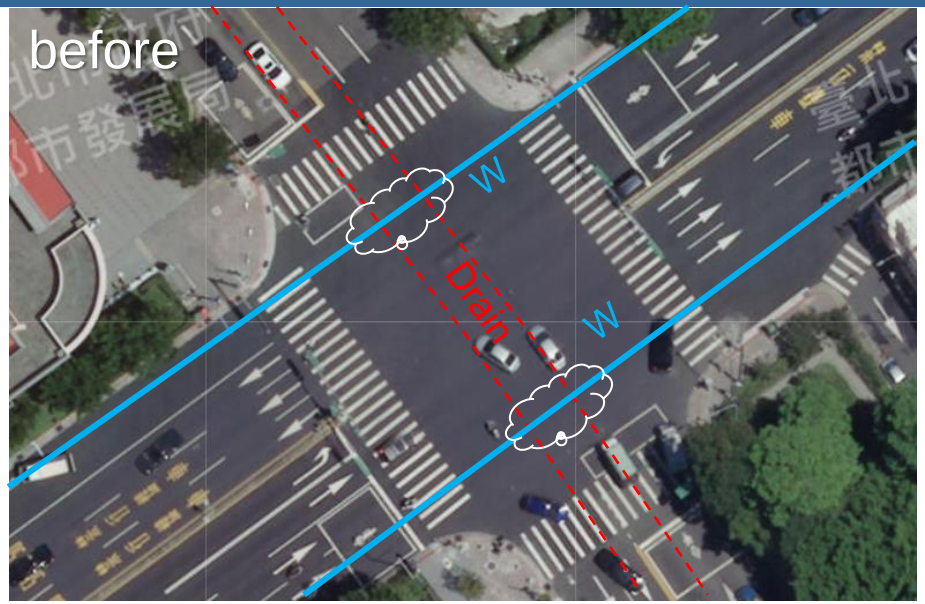
  2-DN700mm DIP jacking pipe

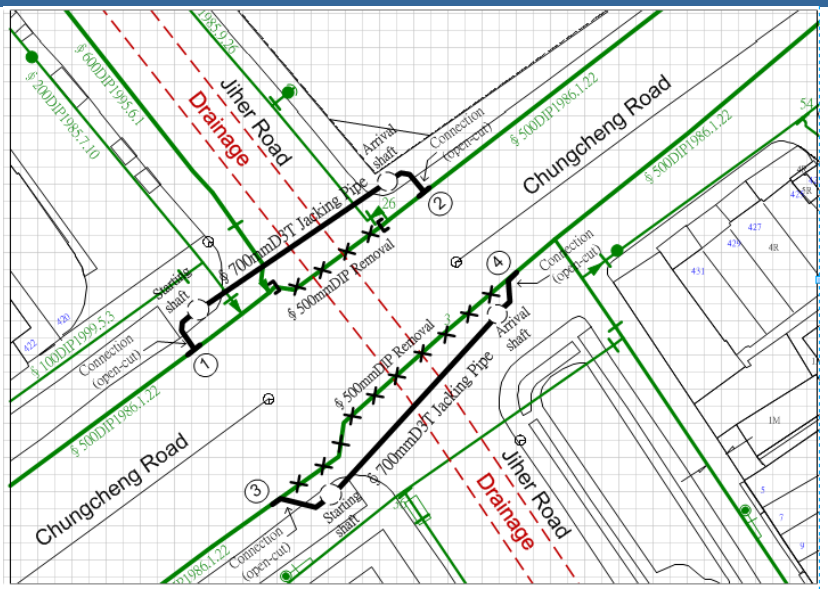
  (T joint, 1M/unit)-30M
- Cost : US 300,000

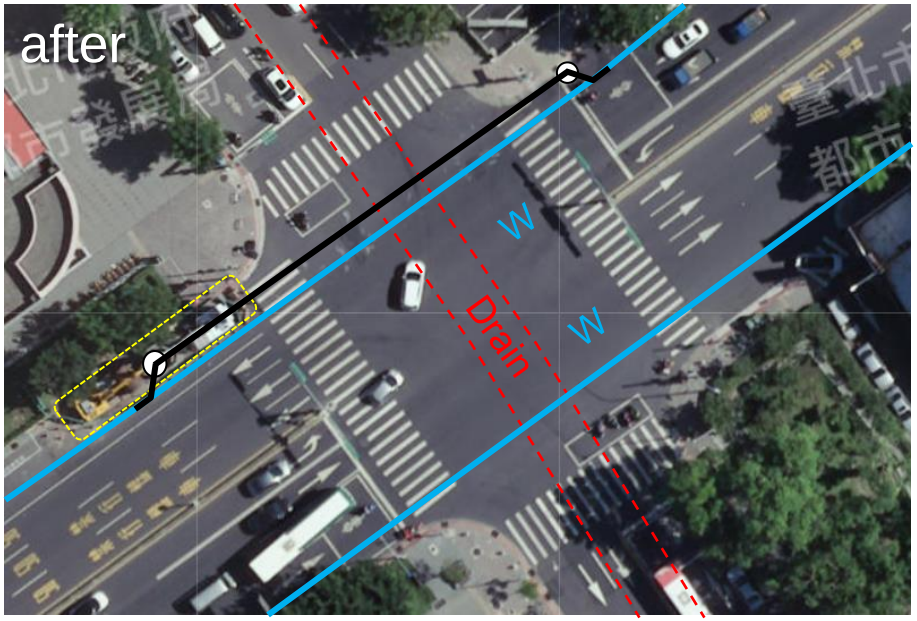
  (EU260,000)
- Duration : 120 days

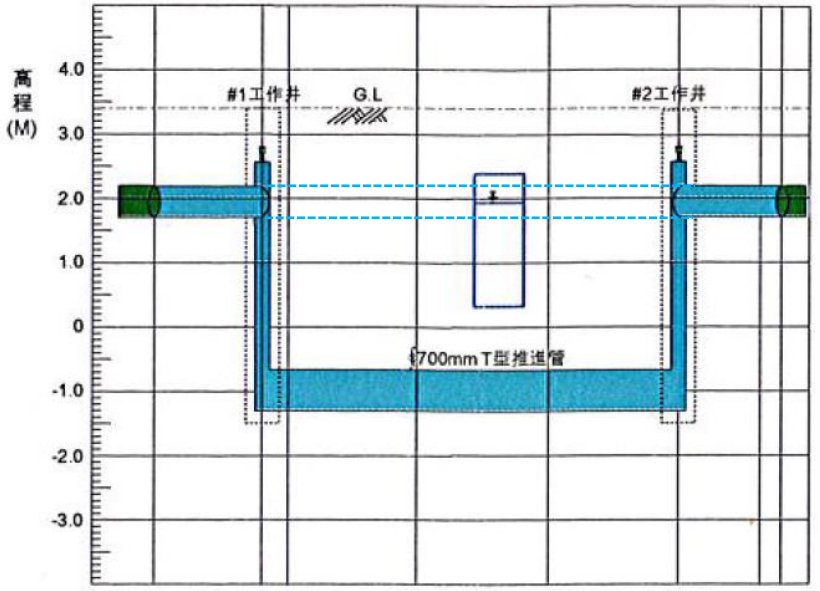


Water main realignment project









Water main realignment project

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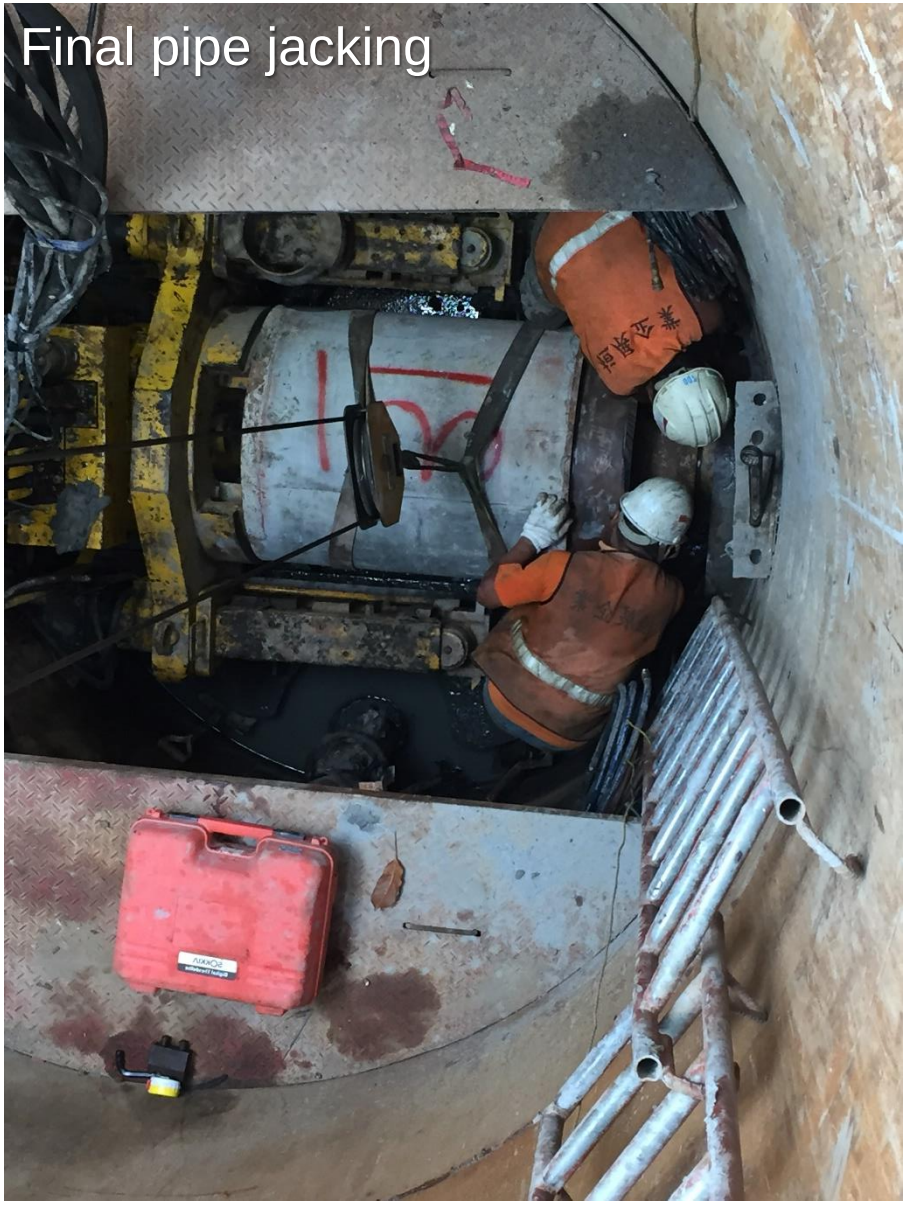

Water main realignment project

Conclusion

- Open-cut method for water main gradually rare in urban areas of Taipei city
- Conventional trenchless method(pipe jack) encounter various difficulties
- Ordinary pipe jacking failure experiences lead to innovation and adjustment loop
- Innovated short-segment pipe jacking perform effectively throughout urban circumstance
- Ductile iron pipe(DIP)/T joint is credible for pressure water main
- Further improvement for short-segment pipe jacking technique are vital

Thanks for attention

Q&A