

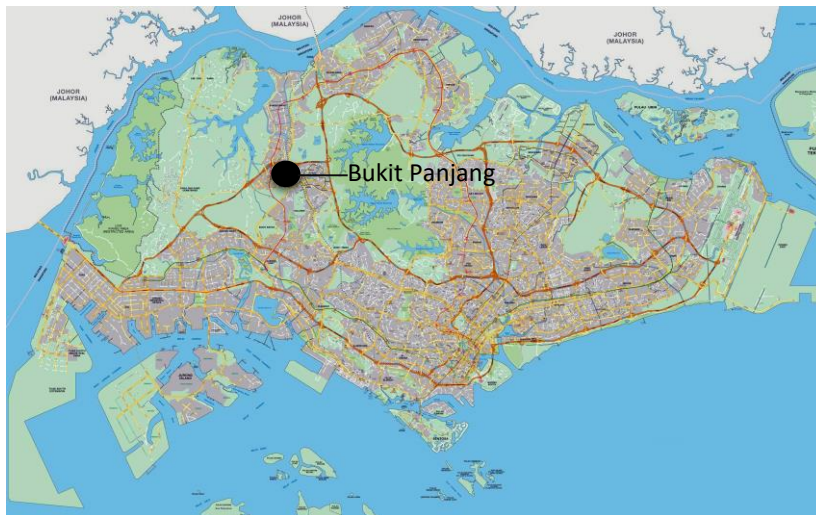


Trenchless Tunnel Construction of Bukit Panjang Underpass

Ed Züblin AG - Singapore Branch
Member of the STRABAG Group
Singapore



Located in the western region of Singapore, the Land Transport Authority (LTA) Contract 9057 Bukit Panjang Underpass Project was awarded to Ed Züblin AG – Singapore Branch in 2014. The scope of works included the Architectural works, the design, construction and completion of an additional underground Entrance and a linkway tunnel connecting the new Entrance to the existing Entrance of the Bukit Panjang Mass Rapid Transit (MRT) Station.





ITA TUNNELLING
AWARDS 2018



- **Project Owner :**

Name : Mr. Chiang Chee Cheong
Company : LTA (Land Transport Authority of Singapore)
Position : Senior Project Manager (SPM)
Email : CHIANG_Chee_Cheong@lta.gov.sg

- **Project Owner's Consultant:**

Name : Mr. Ngan Ping Leung
Company : PB (Parsons Brinckerhoff)
Position : Deputy General Manager
Email : ngan.matthew@pbworld.com



**ITA TUNNELLING
AWARDS 2018**



- **Structural Designer :**

Name : Dr. Oskar SIGL
Company : Geoconsult Asia Singapore Pte Ltd
Position : Partner, Professional Engineer
Email : oskar.sigl@geoconsult.com.sg

- **Architectural Designer :**

Name : Lim Choon Keang
Company : CKLI:ET Architects
Position : Managing Principal
Email : ck@cklietarchitects.com

- **M&E Designer :**

Name : Edward Woo Ewe Wee
Company : Gims & Associates Pte Ltd.
Position : Professional Engineer
Email : ck@cklietarchitects.com



ITA TUNNELLING AWARDS 2018



- **Jet Grouting :**

Name : Benny Oh

Company : Sonic Foundation

Position : Director

Email : sonicfoundation@yahoo.com.sg/benny.oh@sonicfoundation

- **Structural Steel Works:**

Name : Soe Tin

Company : Asia Metal

Position : Director

Email : soetin@asiametal.com.sg

- **Reinforced Concrete Works:**

Name : Liu Jiang

Company : China Railway 11

Position : Executive Manager

Email : LiuJiang@chinarailway11.com.sg

STRABAG
SOCIETAS EUROPAEA

ZÜBLIN

**Operational
Major Brands**

ZÜBLIN

K
BLEES
KÖLLING
BAU

POHNER
EP

JR

WG

STRABAG

Central Staff Units

AUDIT

PROCUREMENT

CORPORATE
COMMUNICATIONS

CONTROLLING

Central Service Companies

BRVZ

BMTI

CML

TPA

ZENTRALE
TECHNIK

- Ed. Zublin AG was founded in 1898 by Eduard Züblin
- It has 14,000 Employees and 3.8 billion Euro turnover (2017)
- Is Part of the STRABAG Group
- Is operating in Singapore for the past 21 years

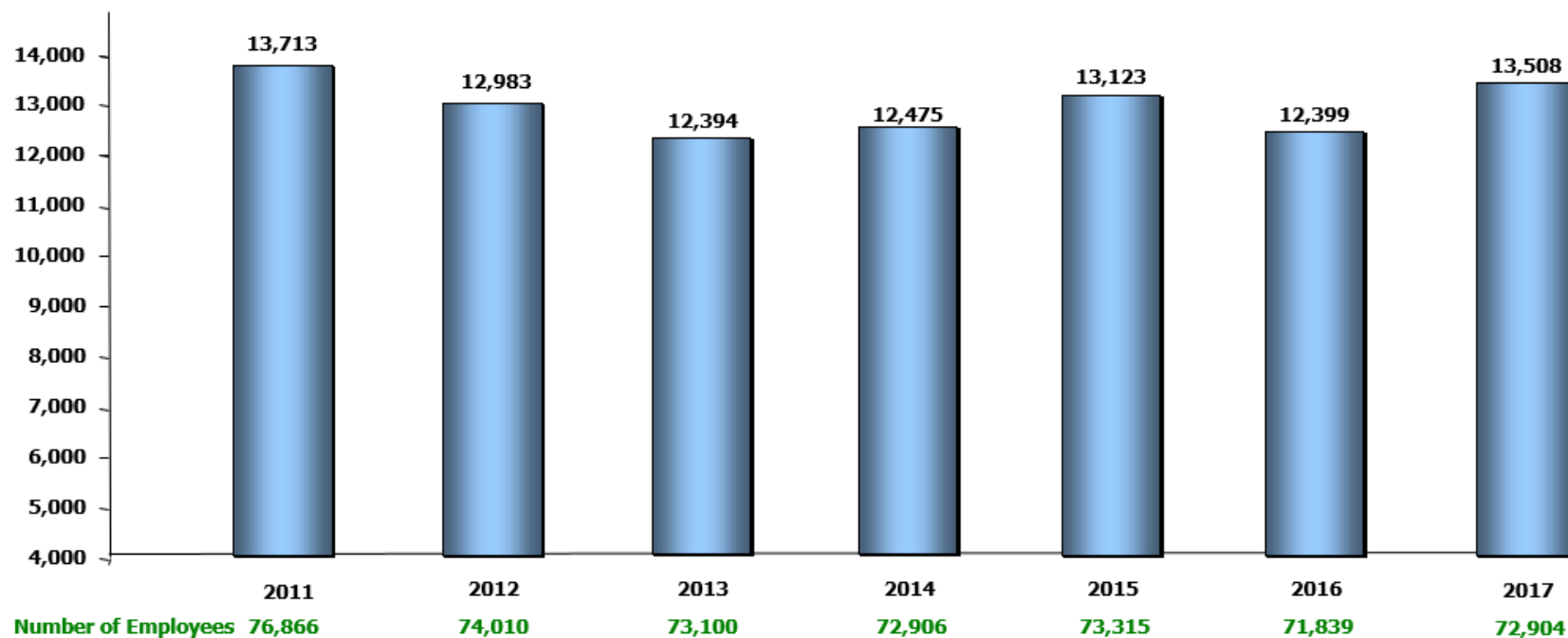


**ITA TUNNELLING
AWARDS 2018**



[Mio. €]

STRABAG SE: Development of Turnover



TUNNELING AND PIPE JACKING EXPERIENCES

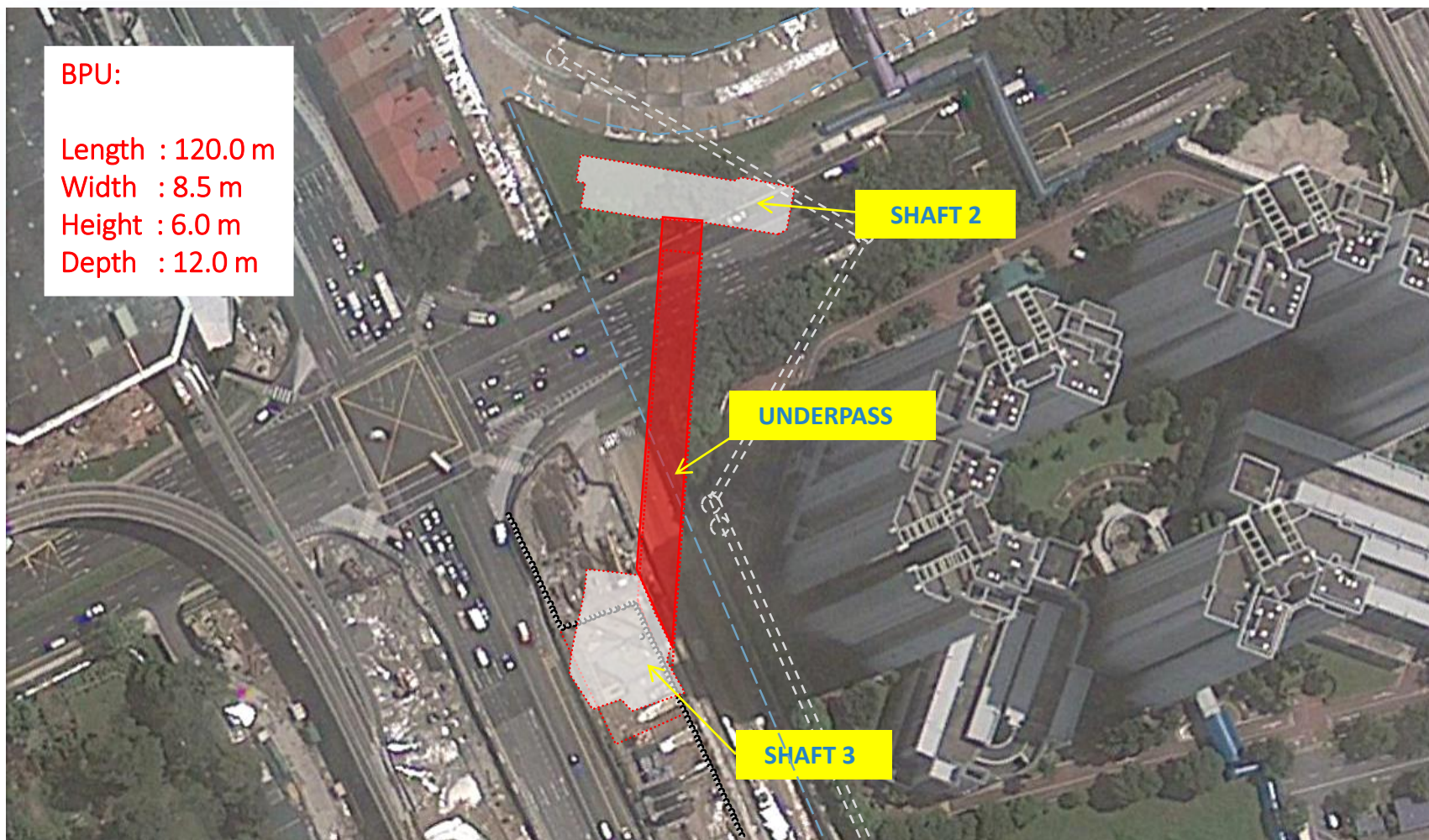
Tunneling Experiences	1,174.0 km
Pipe Jacking Experiences	417.0 km



ITA TUNNELLING
AWARDS 2018



LAYOUT PLAN

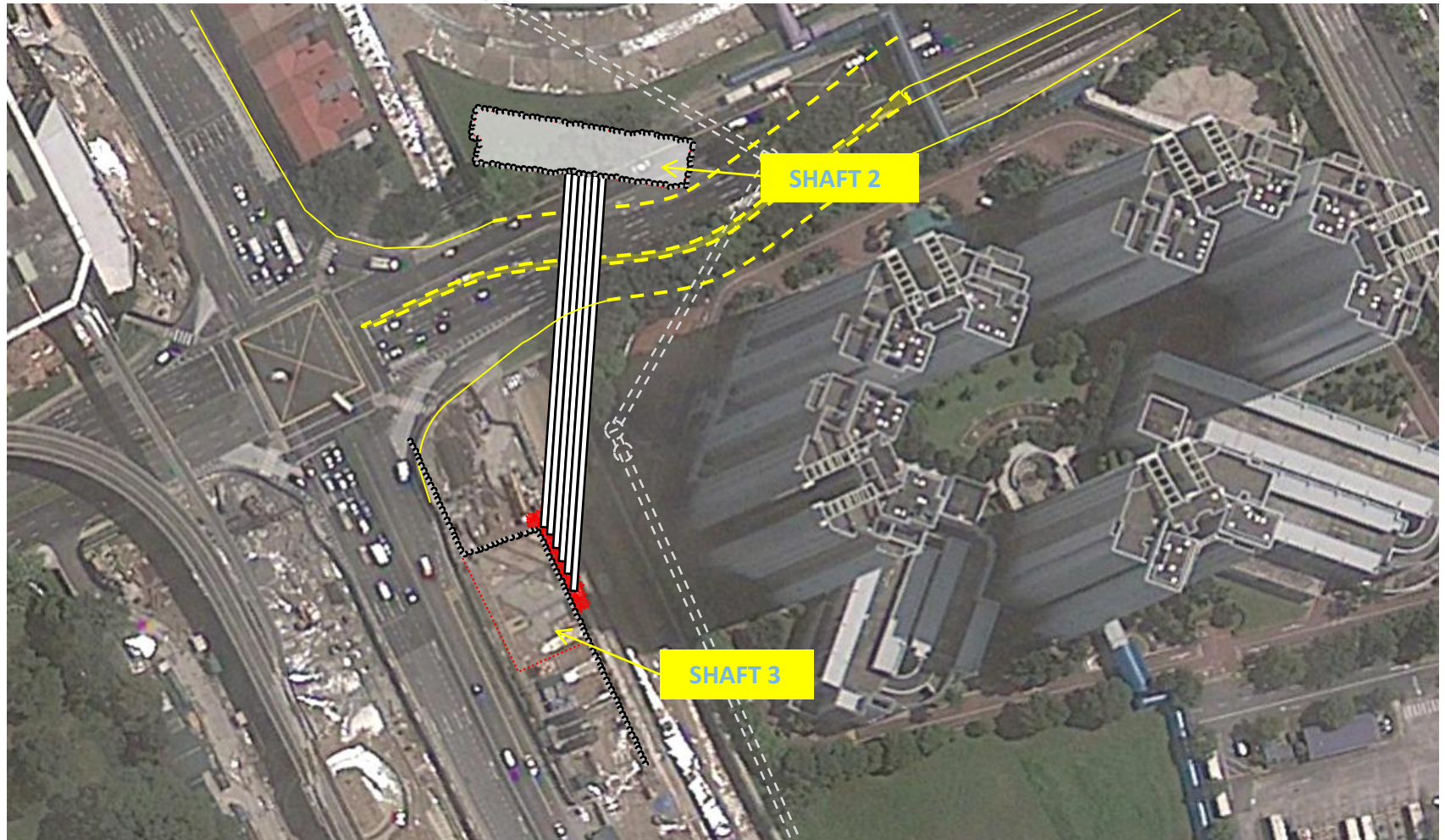




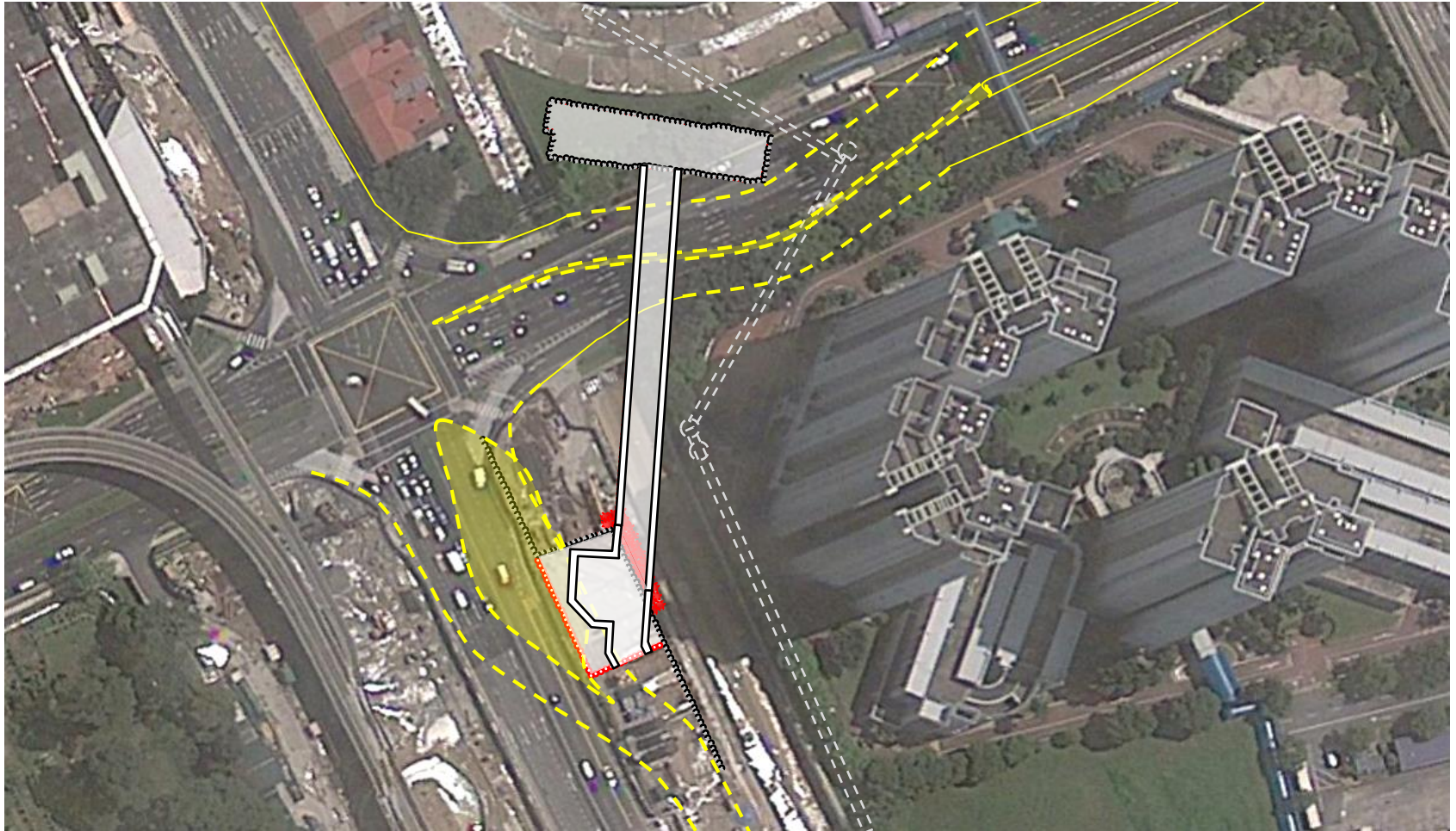
**ITA TUNNELLING
AWARDS 2018**



PIPE JACKING FROM SHAFT 2 TO SHAFT 3



CONNECTION SHAFT





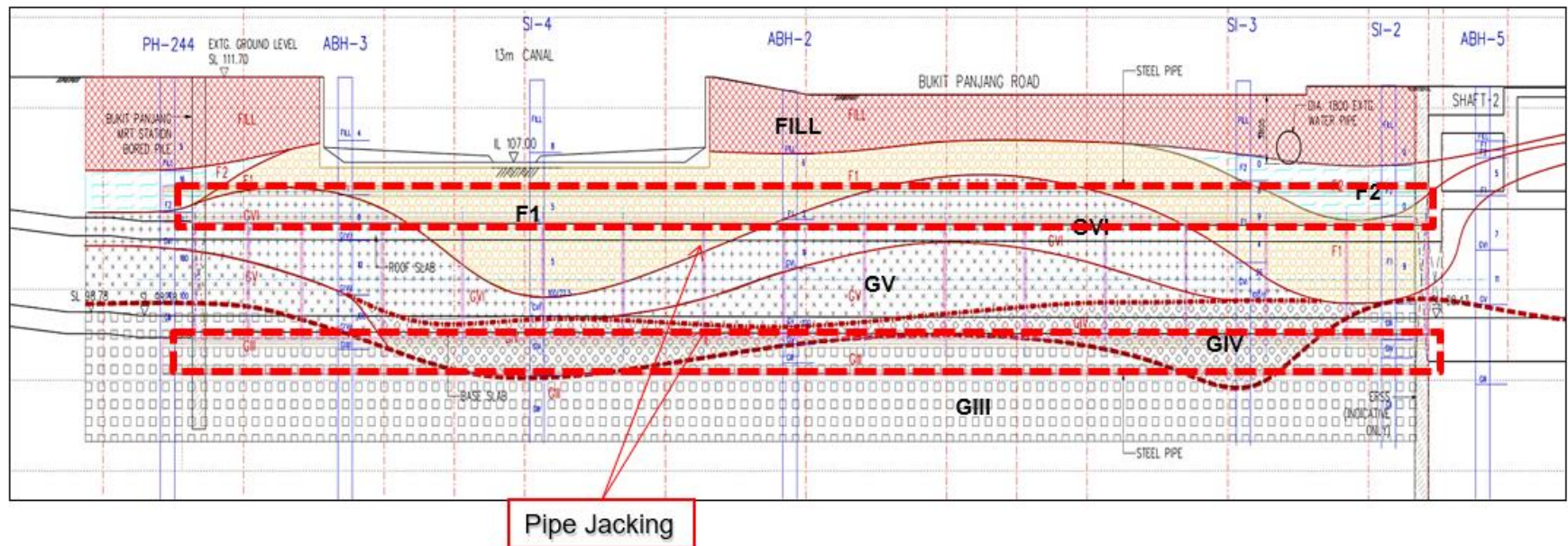
ITA TUNNELLING
AWARDS 2018



GEOTECHNICAL PROFILE

SHAFT 3

SHAFT 2



FILL

F1

F2

GVI

GV

GIV

GIII

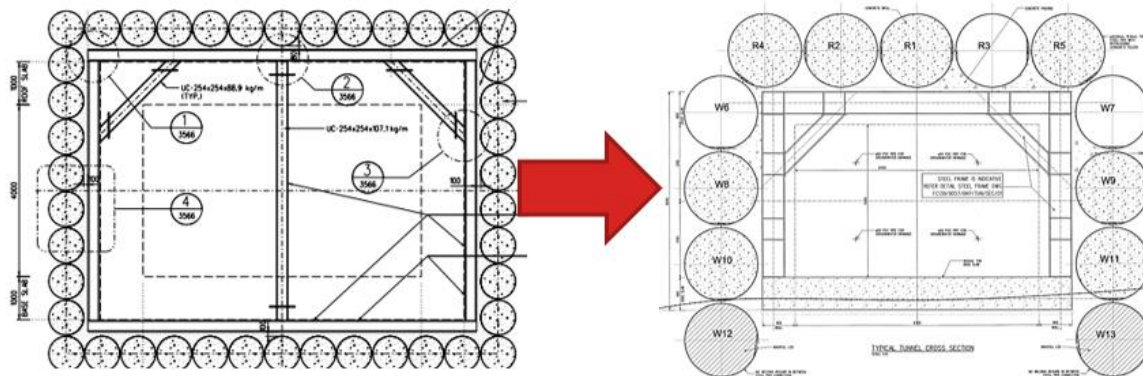


**ITA TUNNELLING
AWARDS 2018**



ADVANTAGES OF LARGE DIAMETER PIPES

Reduce number of pipe jacking drives



Ground improvement carried out from inside of the tunnel pipes

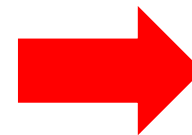
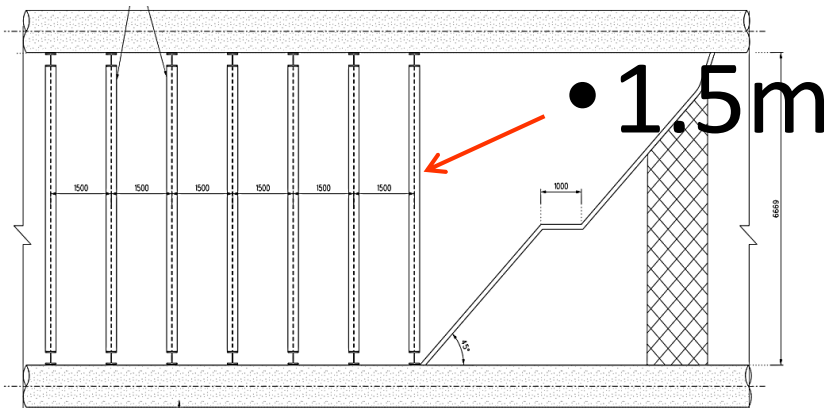




**ITA TUNNELLING
AWARDS 2018**

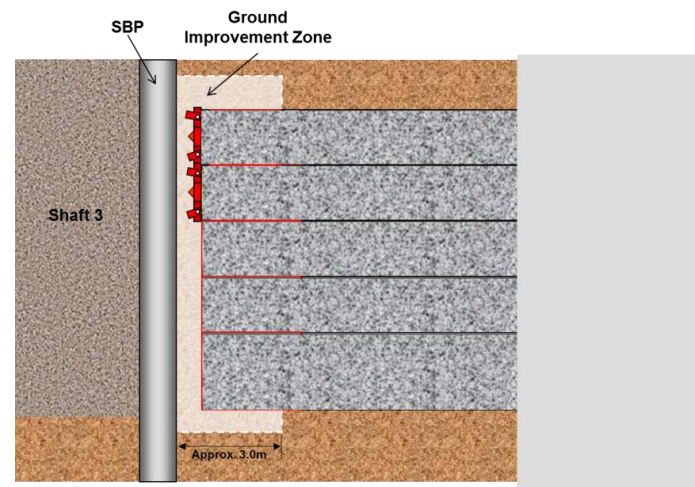
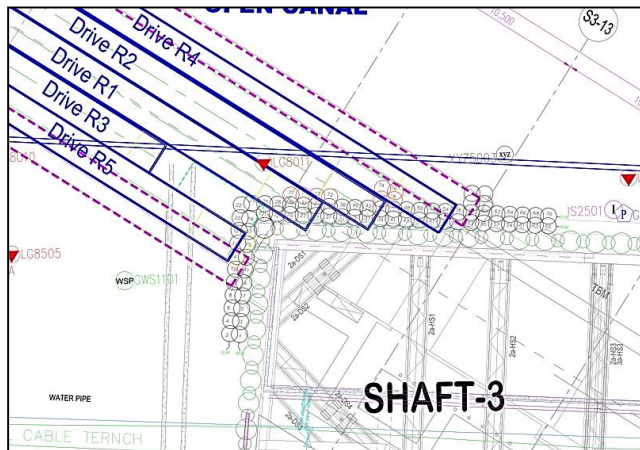


-Applying the JET GROUTING technique, the support beam's spacing can be increased

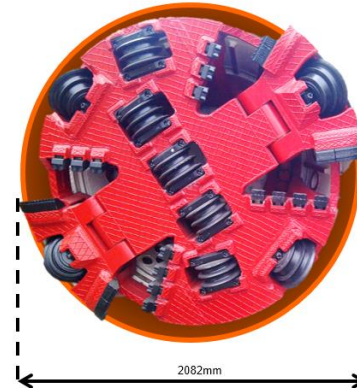


• 6.0m Span

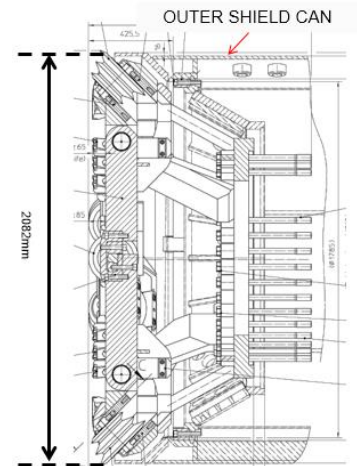
-Using a retrievable TBM the pipe roof system can be constructed timely independent from the construction of Access Shafts



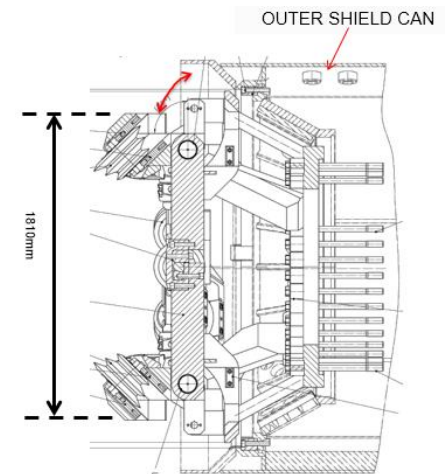
PIPE JACKING MACHINE



DIMENSION OF CUTTER HEAD IN JACKING MODE



DIMENSION OF CUTTER HEAD IN RETRIVAL MODE



AVN 1500TB – Herrenknecht M-1896M

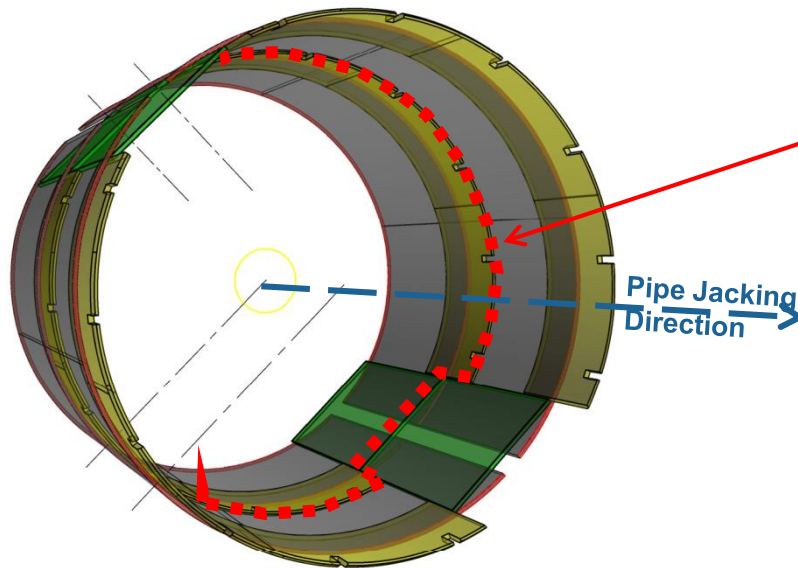
Max. Torque	454 kNm
Max. Drive Length	500m
Rotation Type	Bi-directional
Excavation Mode	Slurry Mode
Steering	900/550 Kn
Guidance System	Laser & Target System
PJM OD	1810/2056mm
Cutting Head Type	Rock Cutting Head



ITA TUNNELLING
AWARDS 2018



PIPE TO PIPE JOINING METHOD



Welding to be carried out after
completing the entire drive



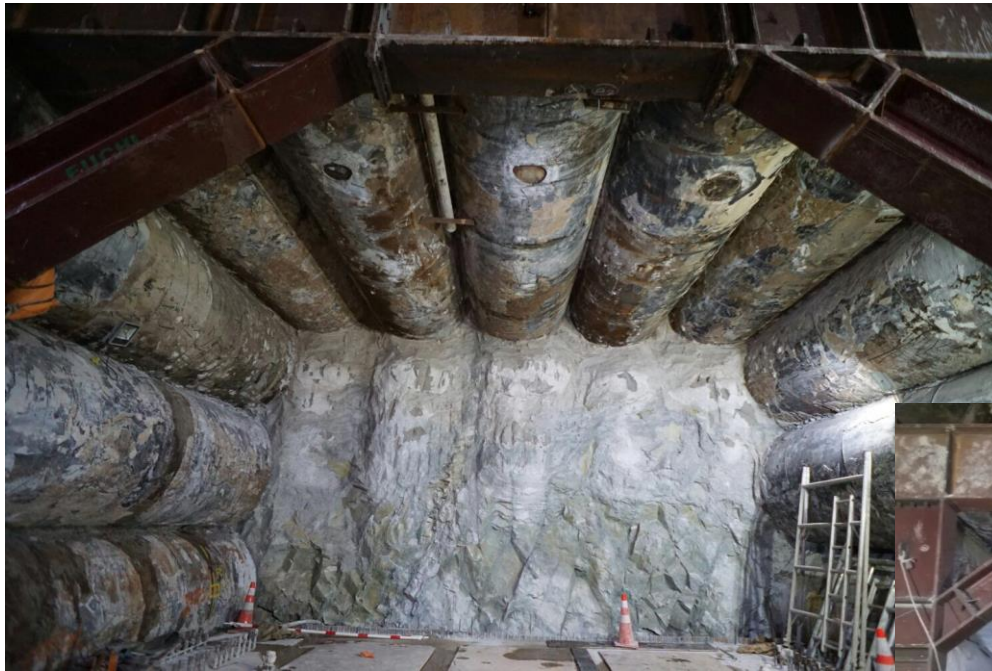


**ITA TUNNELLING
AWARDS 2018**

**PROJECT
OF THE YEAR INCL.
RENOVATION**
- UP TO €50 M -



INSTALLATION OF JET GROUTING PILES AT EVERY EXCAVATION SPAN





**ITA TUNNELLING
AWARDS 2018**

**PROJECT
OF THE YEAR INCL.
RENOVATION
- UP TO €50 M -**

CASTING PERMANENT BASE SLAB UPON EXCAVATION

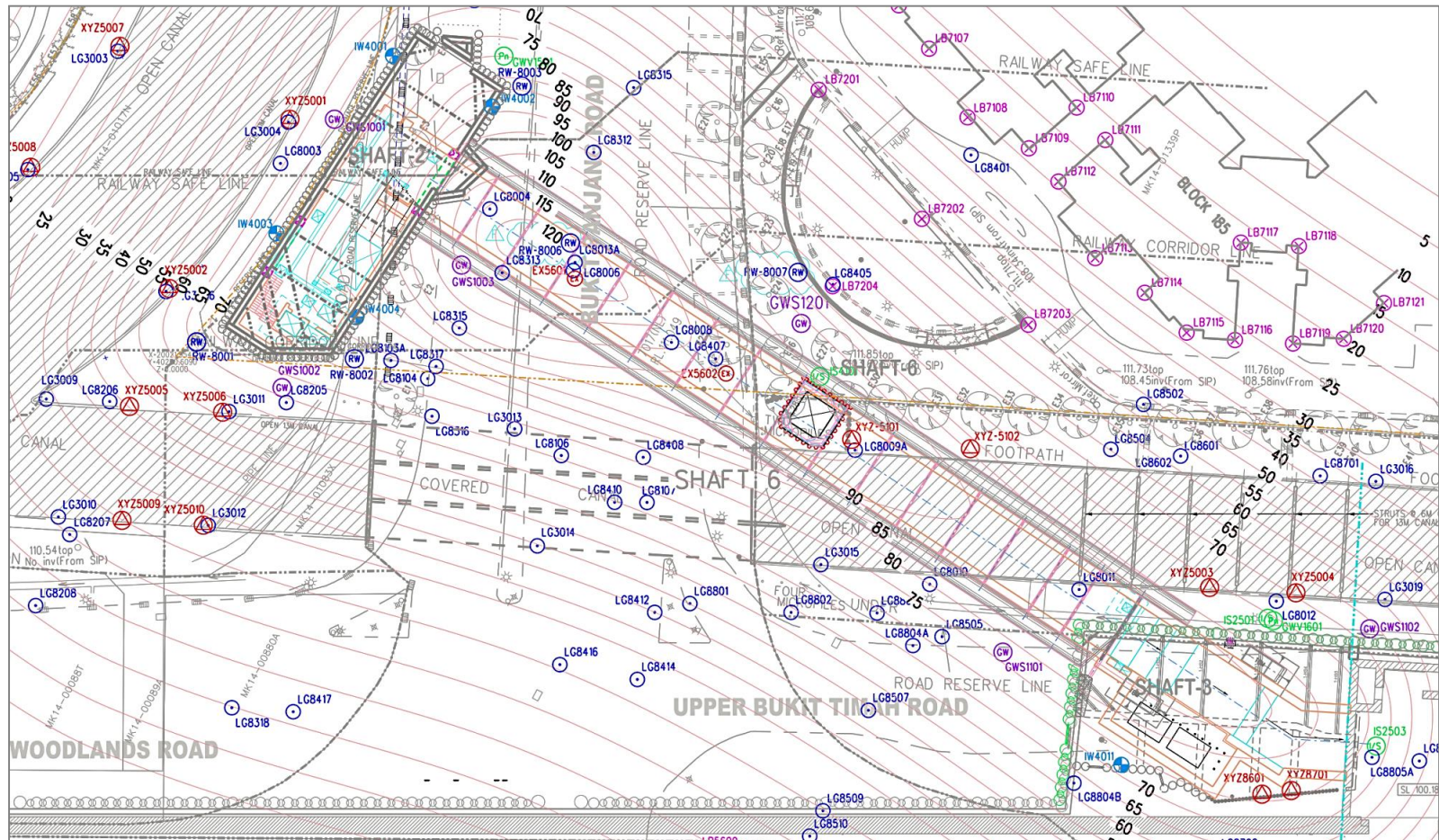


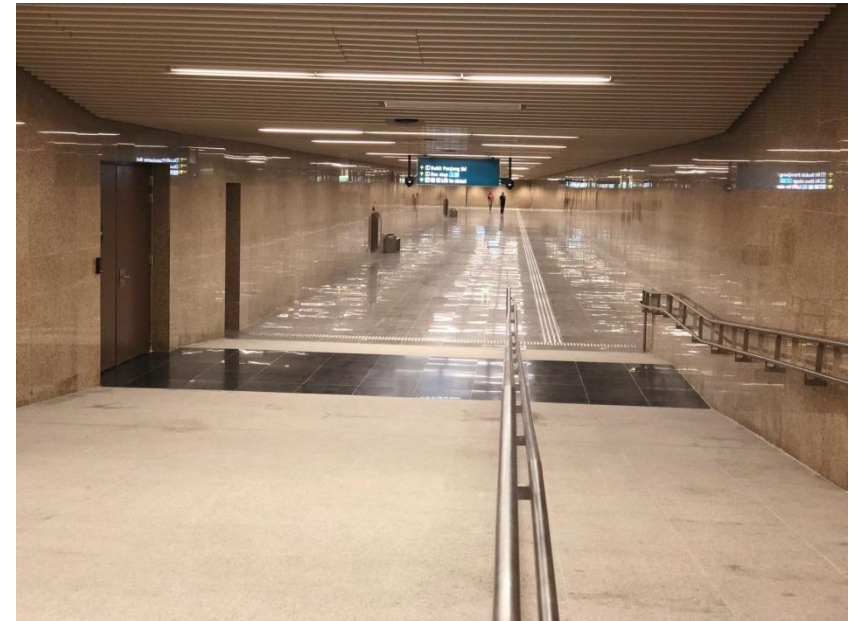


ITA TUNNELLING
AWARDS 2018



INSTRUMENTATION PLAN





Project Summary:

Using an innovative and flexible Engineering Concept, the following Achievements have been realized;

- A robust and safe pipe roofing system has been created.
- The productivity of tunnel excavation has been increased.
- Ground treatment of cohesive soils within the tunnel area could be performed from inside of the pipe roofing system.
- By using a retractable Tunnel Boring Machine works could be performed in parallel so that the overall construction time could be shortened.
- The Tunnel Boring Machine could cope with the mixed soil conditions.
- Ground settlements during shaft and tunnel construction was maintained within the designed limits.
- Environmental Aspects have been addressed and appreciated.
- Safety (see next slides)



From the commencement of the project in 2014 until completion in February 2018, Zueblin had achieved a total of approximately **1.4 million-man hours**, all of which was lost time injury (LTI) free.

The project achieved a zero in Accident Frequency Rate (AFR) and Accident Severity Rate (ASR) for the past four years, an effort and achievement which was subsequently recognized by the Singapore **Ministry of Manpower (MOM)** and **Workplace Safety and Health Council (WSHC)** in 2016 and 2017.

The Zueblin Team has been awarded the **Safety and Health Award Recognition for Projects (SHARP)** for 2018.



ITA TUNNELLING
AWARDS 2018



THANK YOU.