United Nation World Geospatial Information Congress
The Geospatial Way To A Better World
Spatially Enabled Future Cities

- **DGNSS**-Assisted Piling System

PANG CHOON CHEW
DGNSS-ASSISTED PILING SYSTEM

- Motivation
- PILING PROCESS
- CONVENTINAL SURVEY FOR PILING
- THE TRANSFORMATION
- NOW
The McKinsey report indicated that the Construction industry has huge potential for digitalization, productivity and growth.
The Piling Process

Engineer Prepares Piling Plan (Position, Type, Size)

Surveyor Surveys and marks position of pile

Piling Contractor Piles at points marked by surveyor

Surveyor Measures and documents difference between actual and design position of pile

Surveyor Measures and documents result of remedy work

Piling Contractor Piling for remedy work

Surveyor Surveys and marks out position for remedy work e.g. additional piles

Engineer Reviews any discrepancy between design and actual pile position and orders remedy work
Conventional Surveying and Setting Out

Two-man Team

Daily Setup (15 mins per site)

Assistant finds pile position

Labels Piling Peg (Marker)

Hammers in Peg

Found design position
CURRENT PILING METHOD

- Pile positions set using total station.
- Riggers place reference points.
- Piling rig moves in and pile is installed.
- Move to next pile point.
Surveying in the Piling Process

Survey and find Pile Position

Full-time surveyor needed if have to check peg just prior to piling.
➢ The peg move when the piling machine move in
➢ Pile displacement due to pressure from the neighboring pile
➢ Excavations
➢ Poor supervision
➢ Human error
BACKGROUND – PILE POSITIONING PROBLEMS

• The piling pegs get displaced from their original positions
  • due to soil movement caused by piling.
  • due to maneuvering of heavy machines.

• No independent method is used to verify peg positions

• Pile eccentricity (error in position) is recorded too late
  • towards end of piling process, at cut-off-level
  • when piling machines have already been deployed to other sites
Transformation begin:
- Set pile using conventional method.
- Check by GNSS to confirm the reliability.
- Mount the receiver on the pile.
Problem:
- When Jet-in pilling machine moves in, peg point will be displaced
- Worker have to go below the heavy machinery to align the peg point
• SiReNT is the national Differential GNSS infrastructure supporting a wide range of positioning applications;

• SiReNT is the realisation of Singapore’s reference frame (SVY21) ensuring data integrity and interoperability; &

• SiReNT Differential GNSS provides sub-metre & centimetres positioning accuracy in real-time.
SiReNT GNSS Reference Stations

- 8 GNSS (GPS/GLONASS/QZSS/COMPASS & GALILEO) reference stations
- 1 Integrity monitoring reference station
Jet-in Machine
Installed on bored pile machine
Solutions:
• Two antennae will be installed on the machine
• Operator will be guided to the design location from the tablet in the control cabin.
• Reduced safety risk
• Saves remedy cost
• Improved productivity
Setting Piling Pegs Using GNSS
Bidadari C4 Project

- 2 machines using conventional setting out method.
- 2 machines using dual antenna solution
THANK YOU
谢谢