Improving Small Diameter Drill Rig Front End Safety - A Discussion

Daniel R. MacLean, P.Eng.

Broadbeach, QLD – ISM 2019

August 22, 2019

THINK SAFE

Safety Moment – Texting and Walking

Before our Discussion

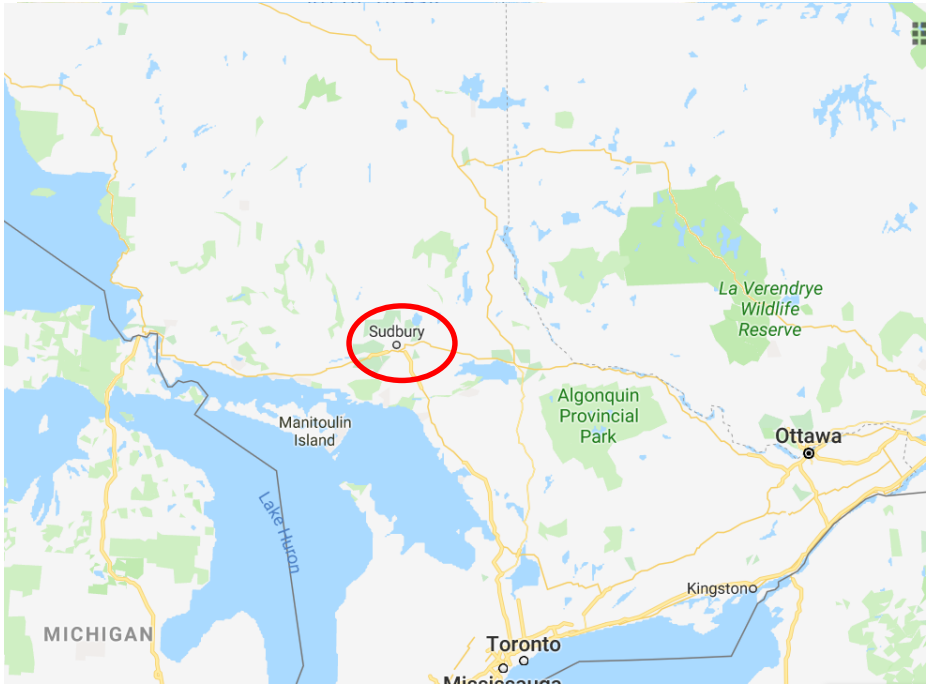
- Give a brief overview of a couple of projects, similar but separated by a year
- Show the safety improvements from year 1 to 2

Keller's role at Falconbridge – Year one (2017)

- 234 Micro-piles located in the courtyard of the Falconbridge smelter operations
- 10,000 working man hours for Keller employees
- A maximum of 14 Keller workers on site at one time, three drill rigs
- Mine safety regulated site
- Highly observed site

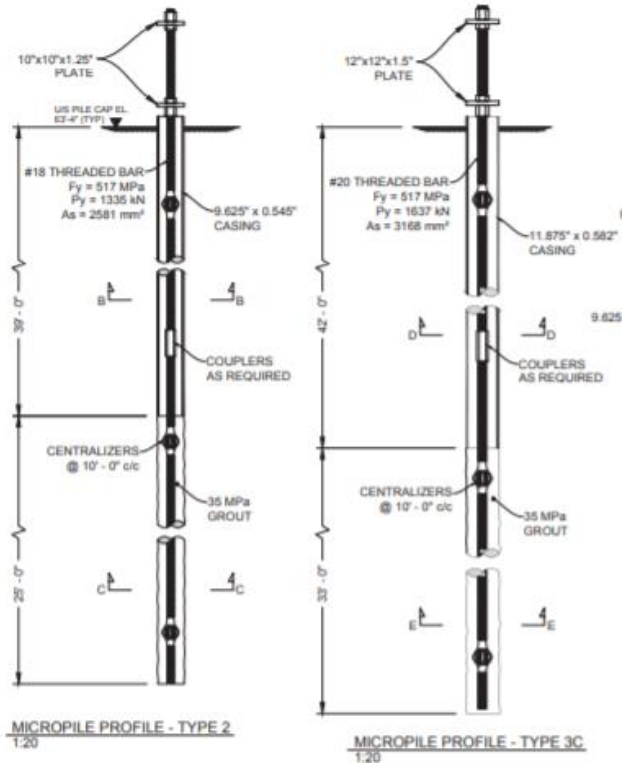
Subsurface Conditions

- Site located at the boundary of Sudbury Basin in Ontario Canada
- Thick Layers of consolidated slag at shallow depths – Highly Corrosive
- Overburden of the Sudbury Basin, native dense silty sands to gravely sands
- No ground water present



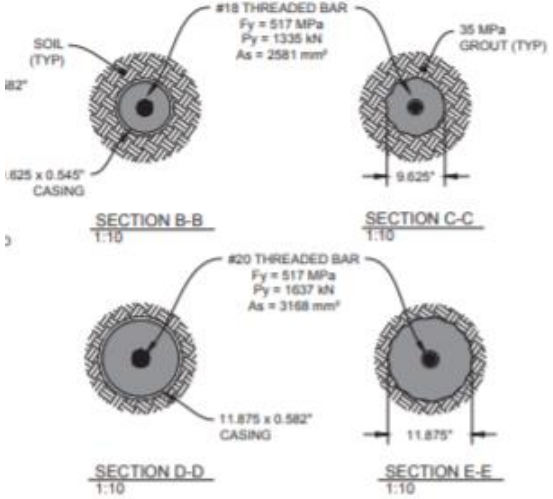
Design

- High Dynamic Loads
- Up to 1300 kN Compression
- Up to 890 kN Tension
- Vertical to 30 degress from Vertical
- Fully Cased Free Zone through the slag with a soil bond zone.



Design

- Diameters ranged from 194 to 301 mm
- Bonds zone from 3 m to 13.4 m
- Corrosion Protection
  - Permanent casing through the slag, no load contribution
  - Full load on center bar, 4 mm of sacrificial steel
  - High sulphate resistant cement



Testing

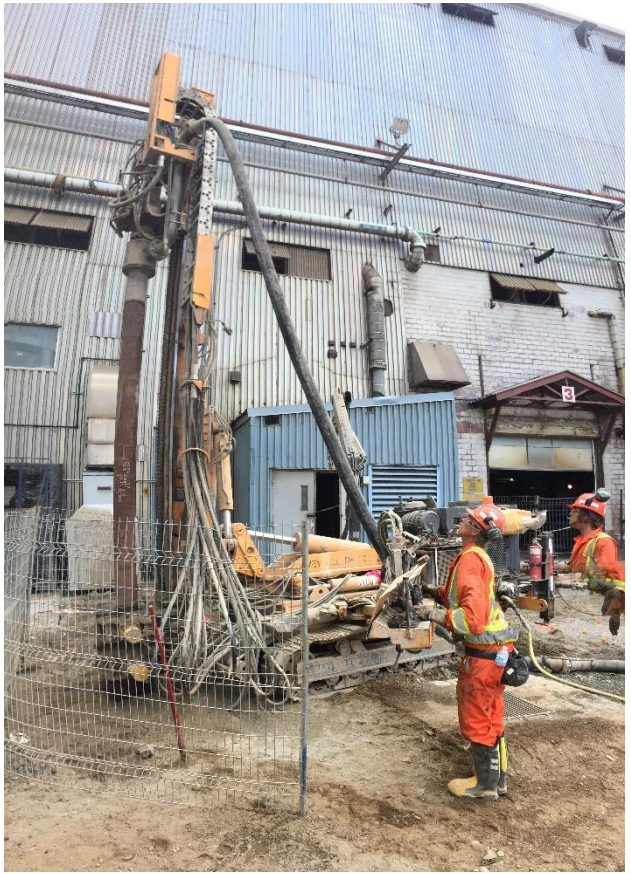
- 3 sacrificial test micro-piles
- 11 post-production proof tests
- Utilize General's excavator to maneuver the large beams safely into position.
- All test passed successfully

Year One Issues

- Did not come to site with a plan in regards to rotating parts
  - Not prepared for requirements of mining site compared to civil site
- Had to come up with something quickly to get job going
- Looks unprofessional, caused mine officials to watch closely
- Time to setup and safety hazard when collapse happened
- Workers would sometime forget to place fencing before drilling

Year One Site Safety Stats

- Total reported incidents: 4
- Total near misses: 3
- Total property damage: 2



Keller's Role at Falconbridge – Year two (2018)

- 139 micro piles
- Same subsurface conditions as 2017
- Same Design as 2017
- Maximum of nine Keller workers on site at one time, two drill rigs
- Mine safety regulated site
- Highly observed site
- Finished ahead of schedule

Safety Improvements From Year 1 to 2

Year Two Site Safety Stats

- Total reported incidents: 2
- Total near misses: 0
- Total property damage: 1

Year Two Issues

- Initial cost
- Production slightly slower due to the fact nothing can work until cage is closed
- Client requested we put a shield at the bottom of the cage as it did not extend to the ground
- Difficult to load rods around cage

Year Two Improvements

- More efficient setup at each hole compared to construction fencing
- Looked professional which caused fewer stoppages by mining officials
- No construction fencing blowing over
- Overall better production rates compared to year one and no injuries on the project.

Results of Planning

Hiu,

Just a quick note to say good working with your team, and congratulations on getting through the 139 piles incident free ahead of schedule. That's a good outcome, and for our project a good win.
Best of luck and look forward to working with your team again one day

Thanks and Best Regards
Gary

Gary Norvall CP Eng; FIEAust; MBA

HATCH

Acknowledgments to my Co-Authors:

Hiu C. Lee, M.Eng, Project Manager
Josh Dwyer, CRSP, HSEQ Director

Phone: 1-888-846-7858

Email: info@kellerfoundations.ca

Our Discussion

- What is done in other parts of the world for front end safety?
- Do these barriers make the operation safer?
- What should the ISM promote and recommend towards front end safety?