



SSAB Steel pile day

Drilled piles in Norwegian fjords

18.01.24
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Helsinki

Who are we ?

GEO F&B

HB + KYF

An **Veidekke ASA** subsidiary

- Norway's largest foundation contractor
- 150 employees
- Around 85 Mil € revenue (2022)
- Tree locations: Trondheim, Ål og Fredrikstad
- Established 2021
- Roots back to 1947



Background for the projects

Action plan for green shipping

- The Norwegian government launched a plan to reduce Co2 emissions from Shipping
- Distributed NOK 20 million for competence-enhancing measures for county councils that wanted to set environmental requirements in the procurement of ferries and fast boats. (2016)
- Granted NOK 100 million in income to the county and municipalities to strengthen the boat and ferry sector in 2019, the funds will be continued and are distributed it between the county and municipalities according to the sub-cost key for fast boat and ferries.
- Norway has a target that $> 1/3$ of the 200 ferries will be electric ferries or electric hybrid ferries by 2021.



Electrification of ferries in Norway

Why new quays?

With the electrification of the ferry fleet in Norway, the contracts have also included larger and greater transport capacity.

This has led to that the **ferry** has become **larger and heavier**. Shipowner has now also **strict requirements for energy saving** and must stay within the **set energy consumption**. If they are out of this set consumption, the total payment will be reduced. If they are more efficient, they will get a bonus.

Therefore, almost all ferries have become long and slender, and have a hull that is optimized for the speed required for the lowest energy consumption possible for that specific connection.



Electrification of ferries in Norway



Requirements for the quay

When the ferry docks, the vessel should not protrude behind the pier by more than $\frac{1}{3}$ or preferably $\frac{1}{4}$ of the length. Therefore, the quay must be extended.

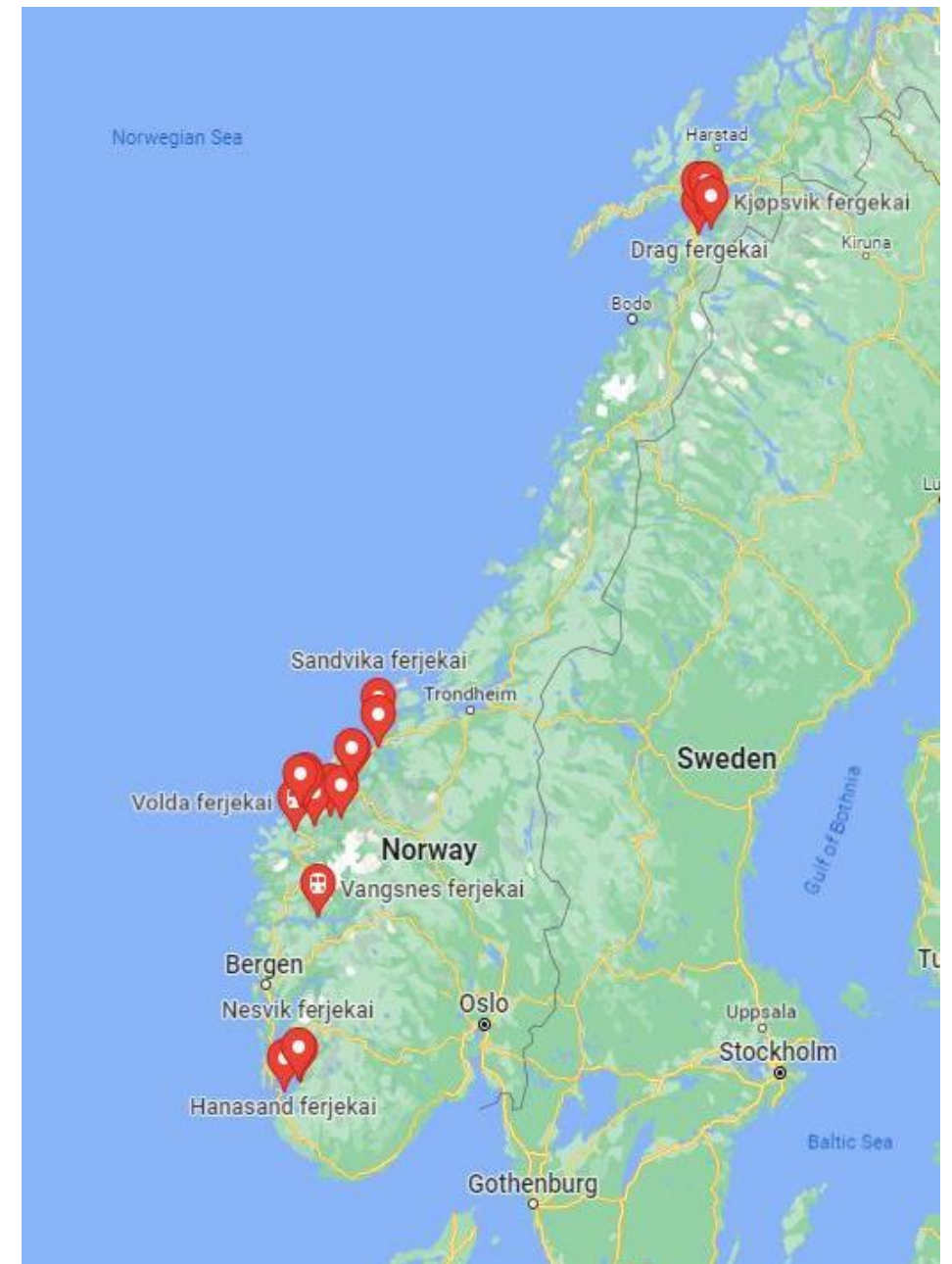
The weight of the ferries is also significantly greater and requires stronger construction, with the right elasticity in relation to impact forces.

On quays with automatic mooring there are suction cups used to pull 400 tons and mostly there are two suction cups per machine. This means that if the ferry "tears itself free from the machine" it would apply a horizontal load of 800 tons.

And this must be considered in the quay construction.

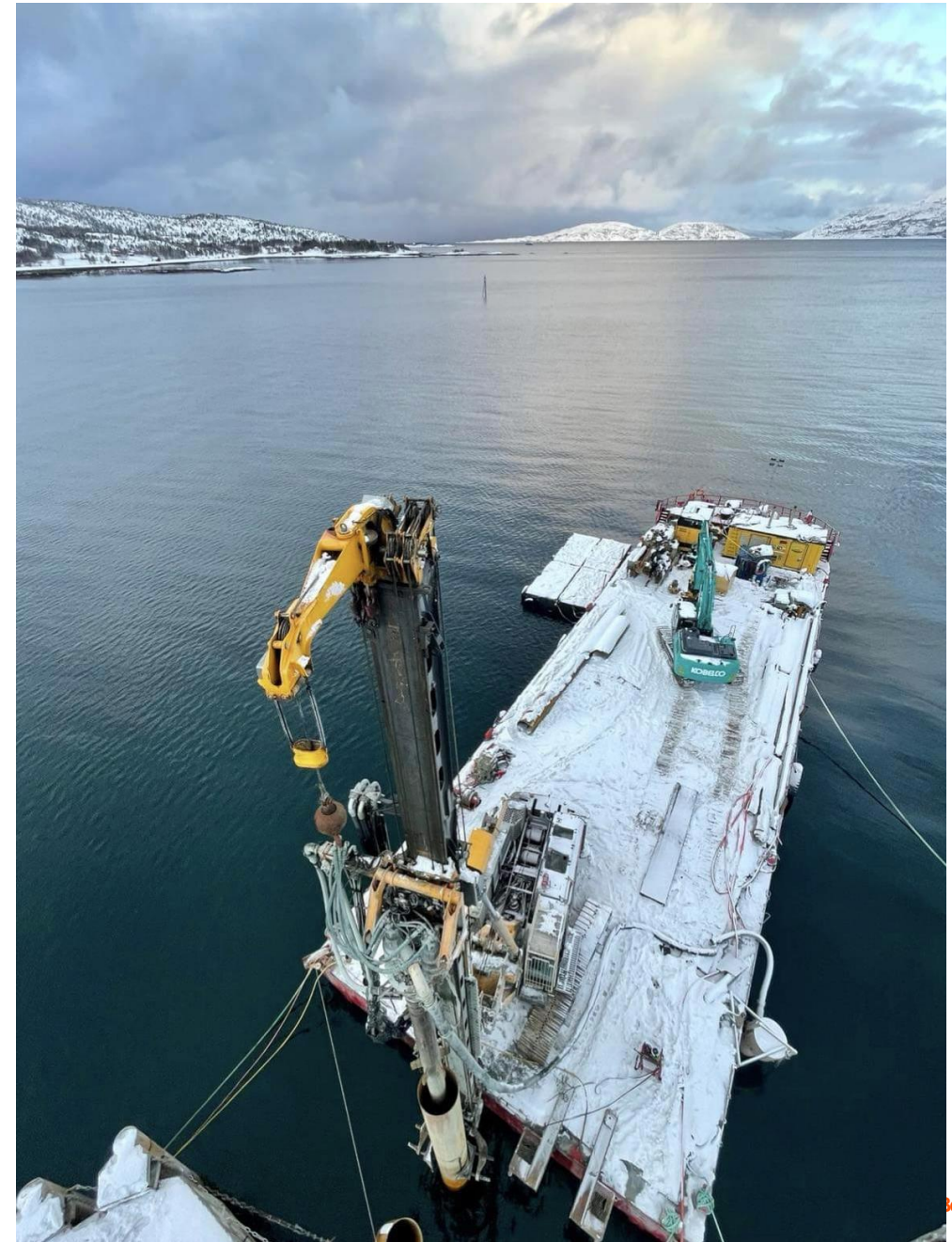
Locations of projects

- Stranda (2015) - New quay-FV 60
- Hanasand (2017) - New quay -FV 519
- Sulesund (2018) - New quay -FV 61
- Volda (2018) - New quay - FV 651
- Sandvika (2019) – Quay extension- FV 669
- Vangsnes (2019) - New quay - RV 13
- Kanestraum ferjekai(2019-2020) - Quay extension- –E39
- Hjelmeland og Nesvik (2019-2020) - New quay - RV13
- Solavågen og Festøya (2021) - New quay and quay extension- E39
- Drag, Skarberget, Bognes og Kjøpsvik (2021-2022) New quay and Quay extension- E6 og Rv 827
- Åfarnes og Sølnes (2022) – Quay extension-FV 64
- Linge (2022-2023) - Quay extension-FV 63
- Igerøy (2023) New quay
- Sandesambandet (2023-24) New quay and quay extension-

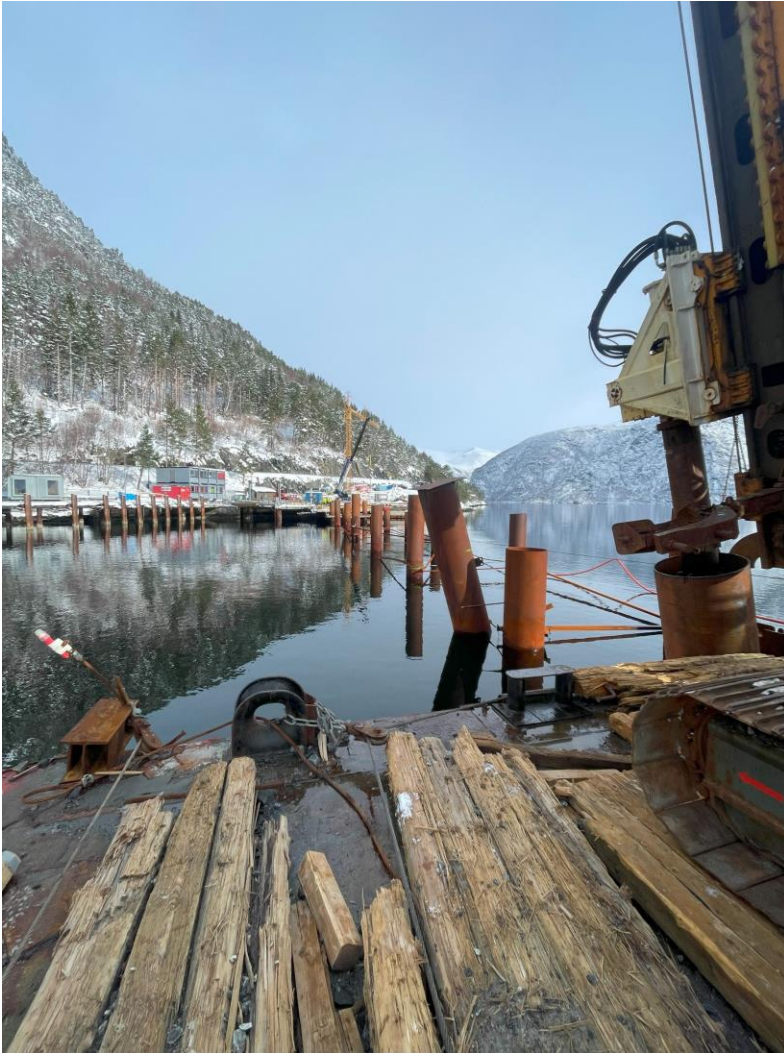


Quantity of drilled piles

- In total, we have delivered 12,000 meters of steel pipe piles, approx. 661 Drilled piles(DTH) on 14 quays.
- All work according to Hb-R762 Process code-2 2018/2015



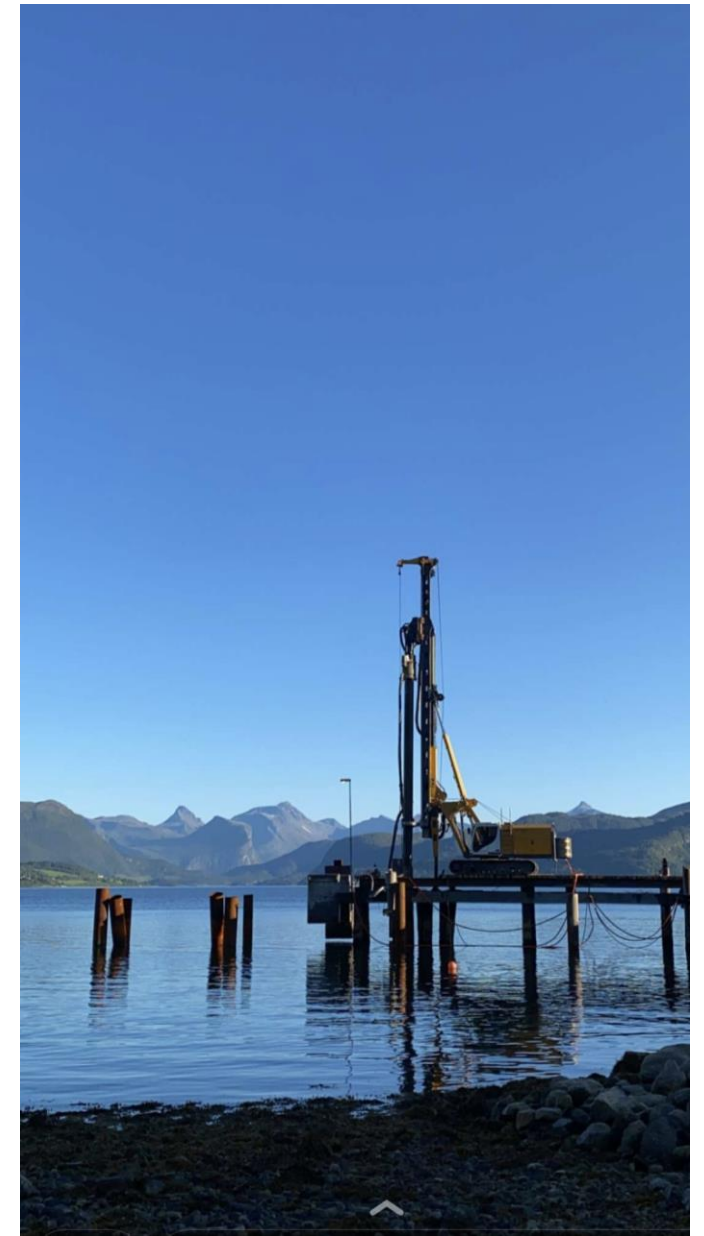
Some numbers



* Approx 2 800 tons of steel



*Large distances from nord to south 650 NM



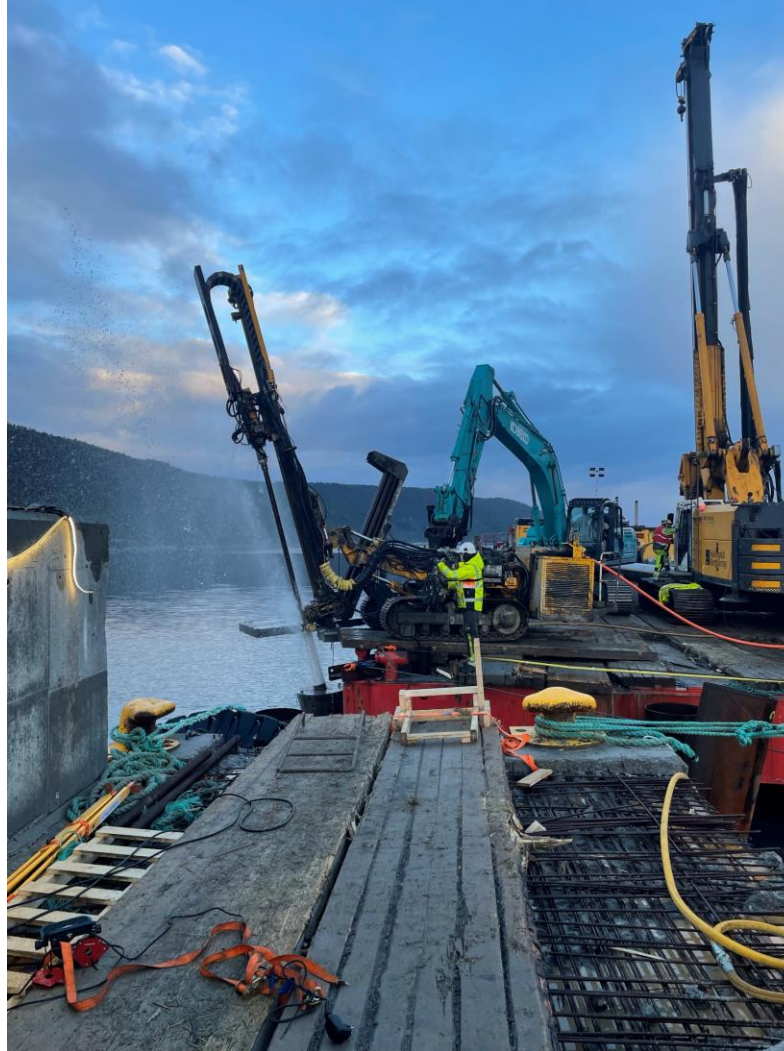
*Great depths in the fjord of anchoring

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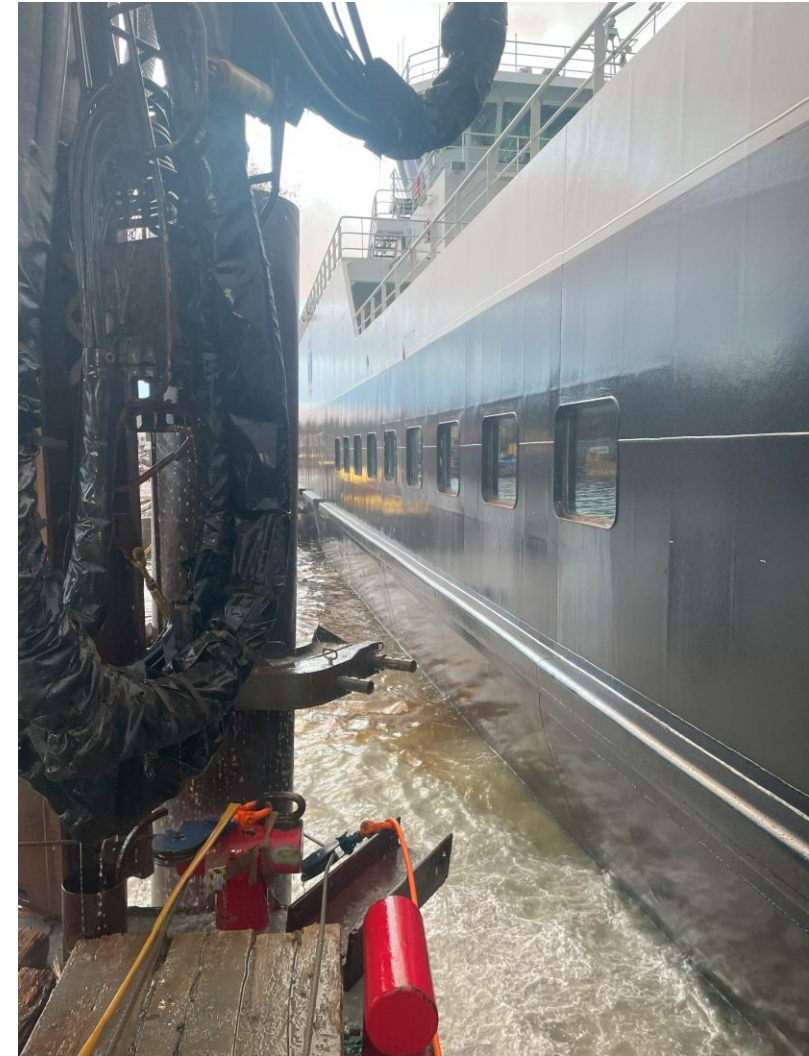
Solutions



*Drilled casing up to 10 meters in rock (813)



* Anchoring and steel cores



* Working while the ferry service is in normal operation

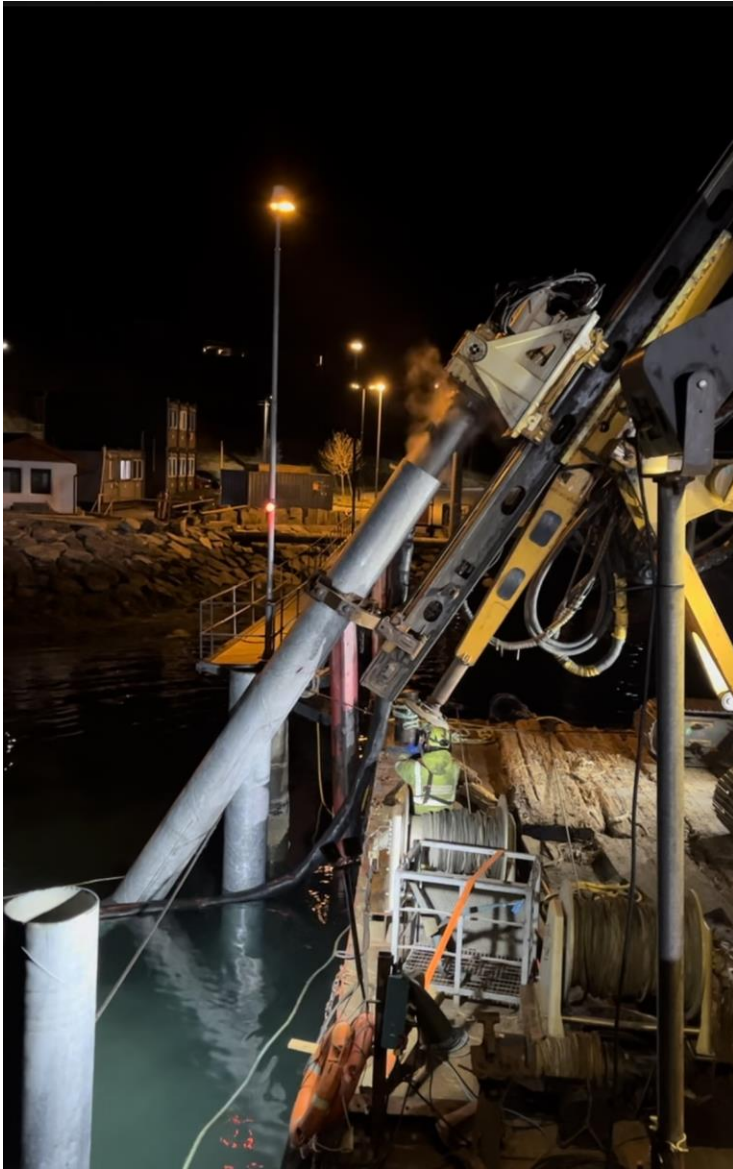
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Solutions

Inclined piles

Drilled 1016 to 50 m
with a slope of 4:1

Usual incline is 4:1 and 3:1



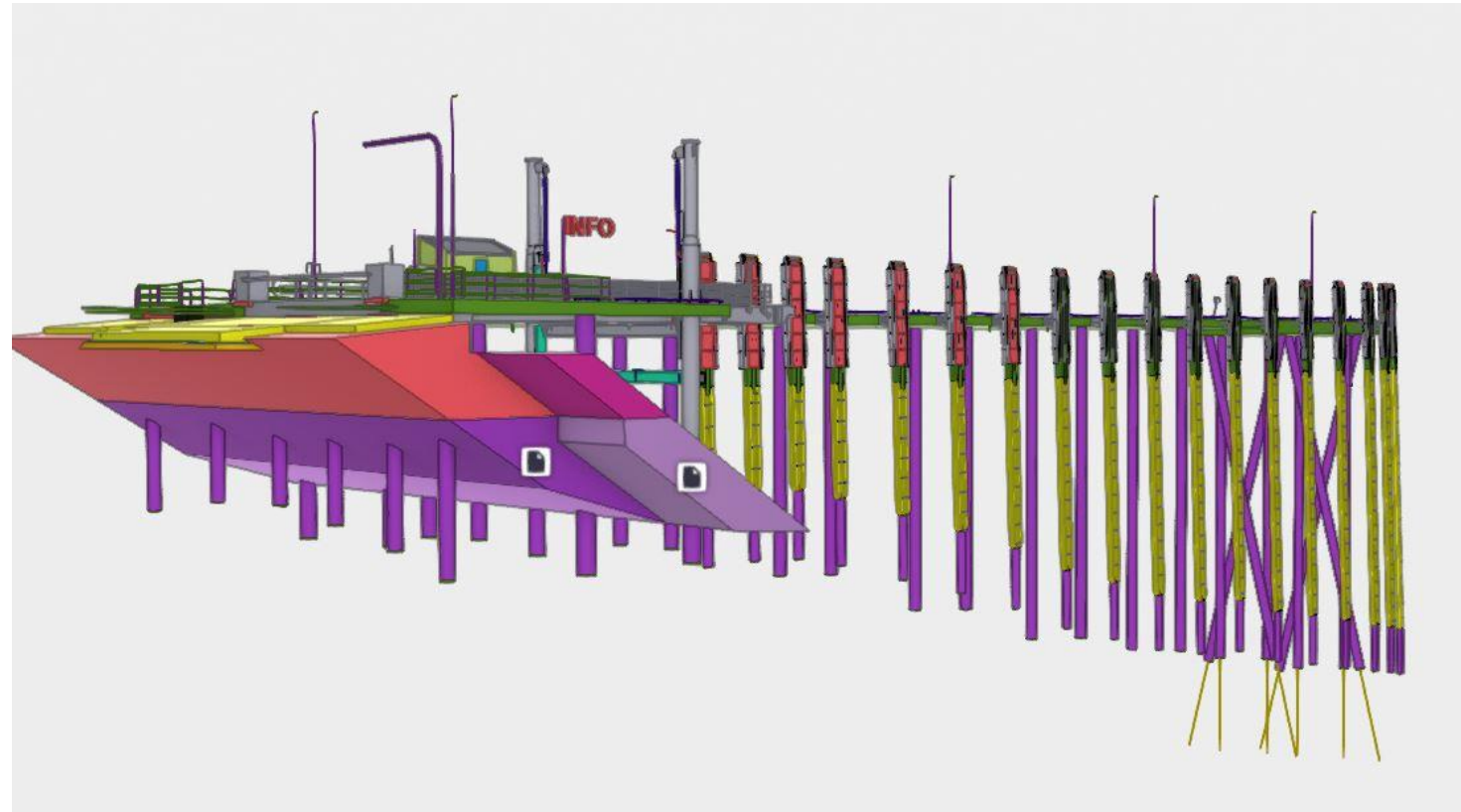
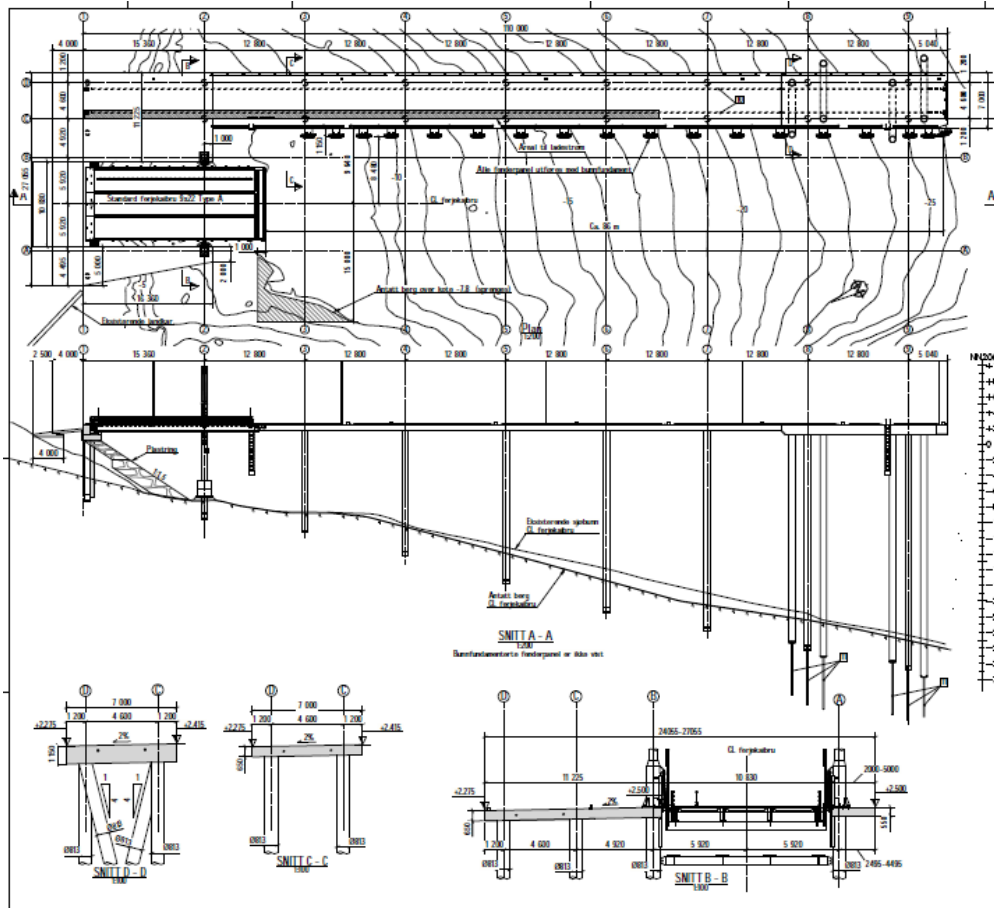
Drilled 610 with slope 30 °.



48 m down to set
point for the piles
straight into rock.

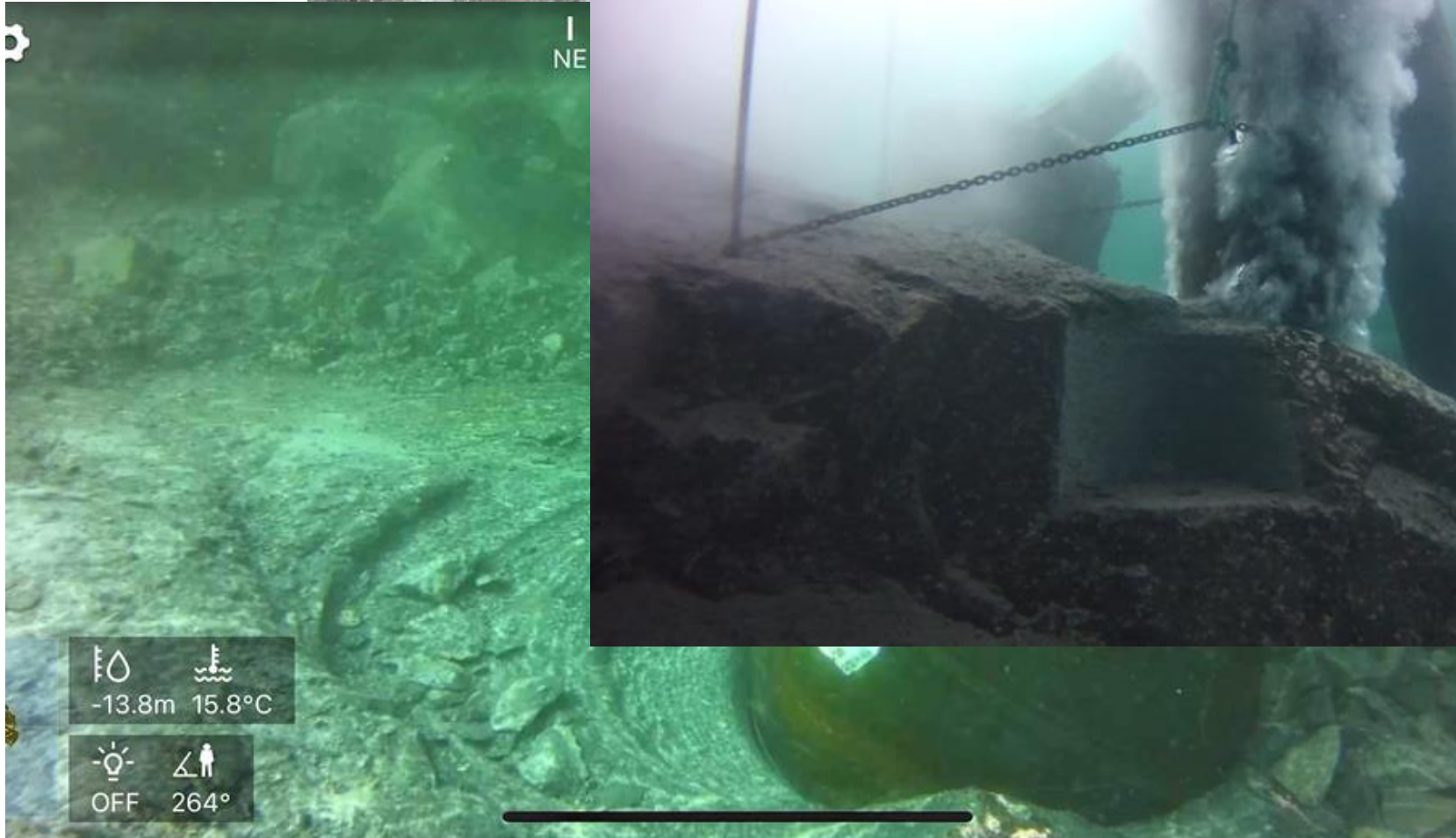
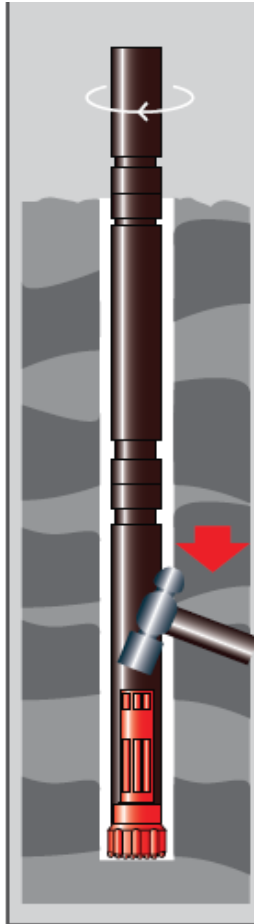
Example of design Kjøpsvik Quey

10 axles, approx. 100 meters long, 31 piles and 18 bumper piles



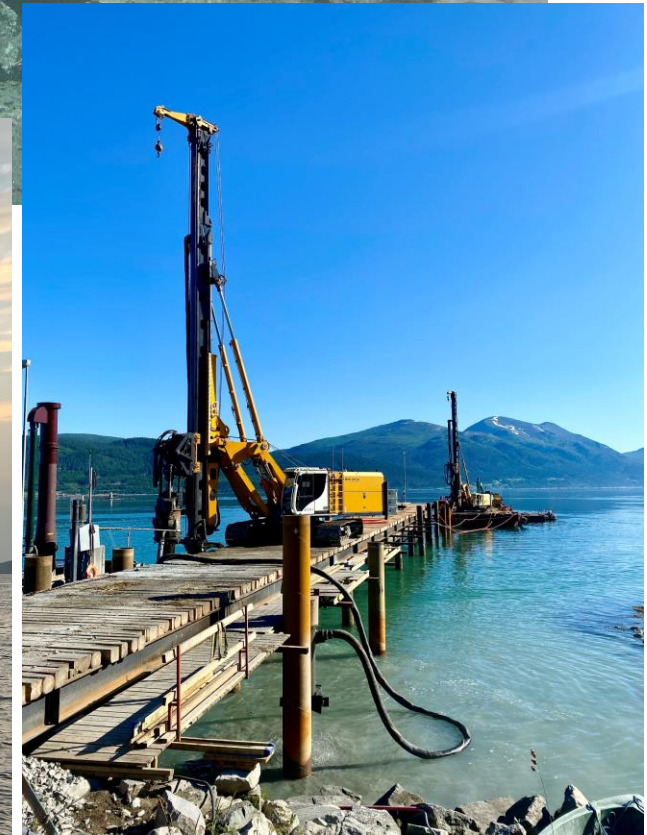
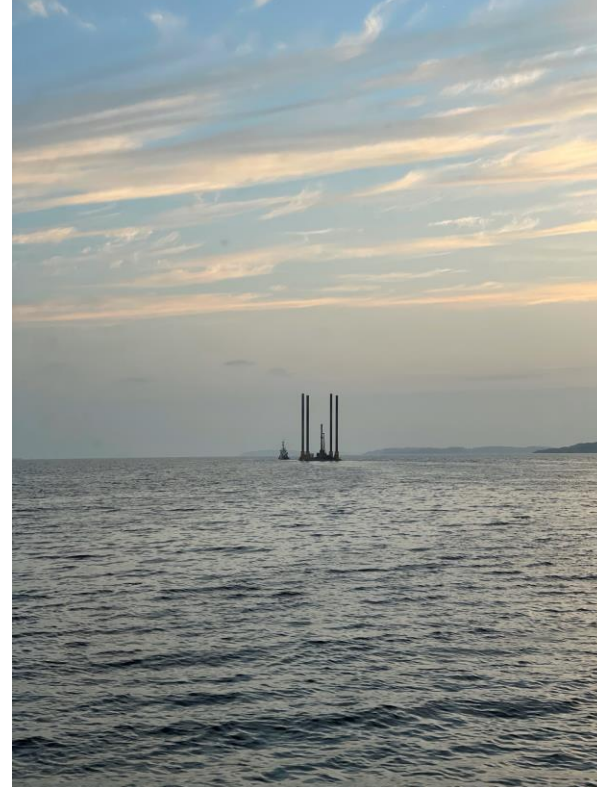
Challenge

Set point directly
into rock



When drilled steel piles are the best option (DTH)

- When the ground conditions make driven piles difficult or uncertain (no or little sediment).
- There are challenges with noise in the surroundings of the driven piles.
- Where higher precision of piles are important.
- Secure transfer of large loads to rock
- Both compressive and tensile forces
- Of the 661 piles - no wrecked piles



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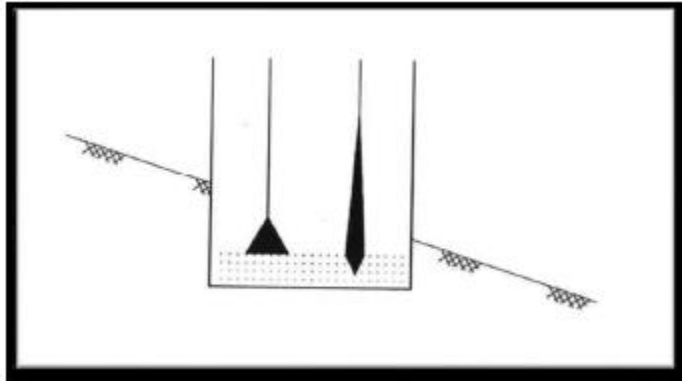
Testing and control

According process code-2 by NRP

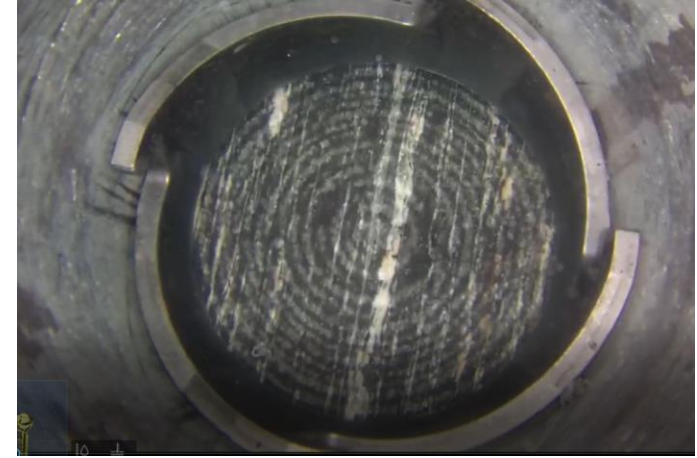
83.347 Cleaning of pile foot



The pile foot can be checked with a digging bar and a flat weight

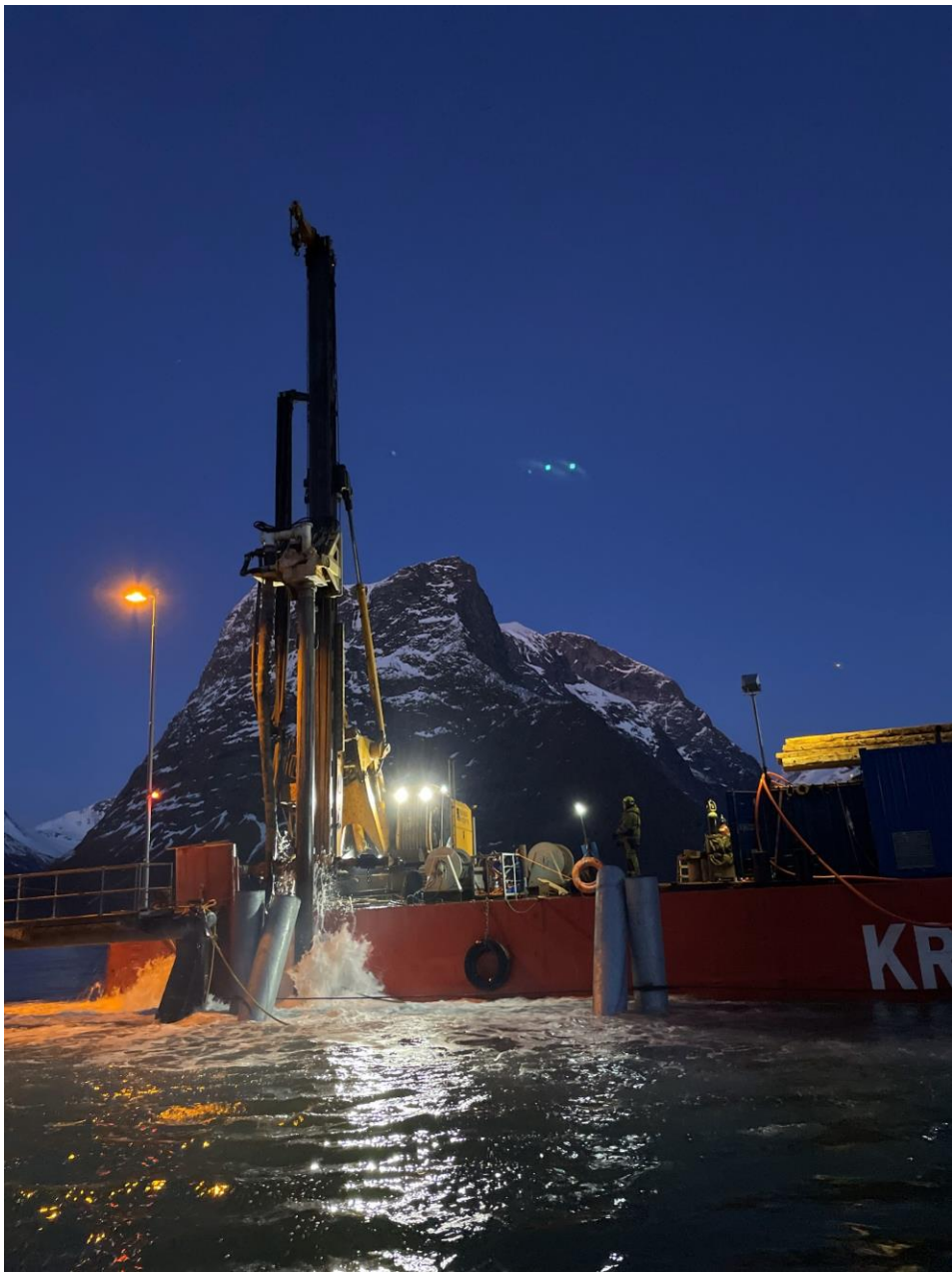


83.355 Video inspection of a pile foot



83.352 Water Loss test





somewhere under the rainbow



Is always a piling rig



Questions ?