

# Asset Management of Quay Structures in the Port of Oslo

From a Material Scientist's Perspective



Oslo

NTNU Coastal Engineering Day, 10 April 2025  
Eirik Bugten Hamnes



# Who am I?

## Position

### **Project Manager / Quay Asset Manager (Kaiforvalter)**

*Specialist in materials science, corrosion, surface protection and condition assesment of steel and concrete structures*

## Background

**2014 – 2017** NTNU Kalvskinnet BSc in Materials Science,

**2017 – 2019** NTNU Gløshaugen MSc in Materials Science – Metallurgy

**2016 – 2018** Statnett Summer Internt Mechanical Engineering Design

**2019 – 2024** Multiconsult Consulting Engineer Materials Science

**2024 – now** Port of Oslo Project Manager / Quay Asset Manager

## Vision

To extend the life of marine infrastructure through smart use of materials and preventive strategies. By combining deep knowledge of corrosion, degradation and protection systems with practical experience, I focus on choosing the right materials for each environment and developing innovative strategies for preventive maintenance. **The goal is to avoid costly repairs, reduce environmental impact, and create long-lasting, sustainable structures**



# Agenda

- Introduction
- The Port of Oslo – and our Vision and Social Responsibility
- Quay Area and Structures
- Structural and Material Challenges
- Our Approach to the Challenges
- Projects

# Port of Oslo



Norway's largest container port



Grain and salt storage



Import terminal for fuel



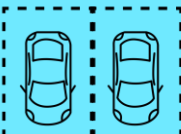
Building materials / concrete



Cement Import



Container transshipment terminal



Car Import



Intermediate storage for future CO2 plant



Oslo



# Our Vision and Social Responsibility

## Social responsibility

Enable efficient, low-emission sea transport to and from Oslo at the lowest societal cost

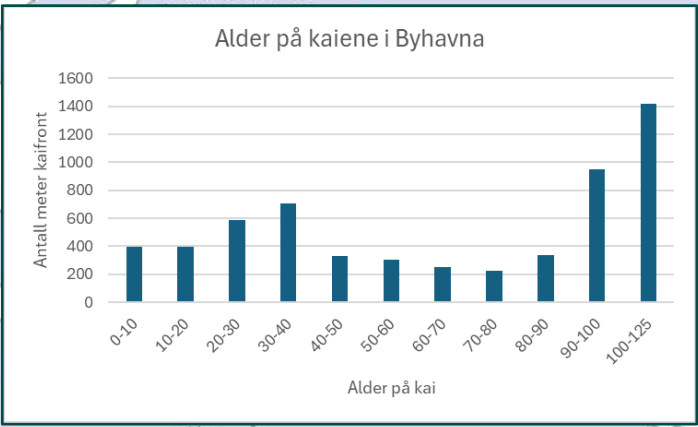
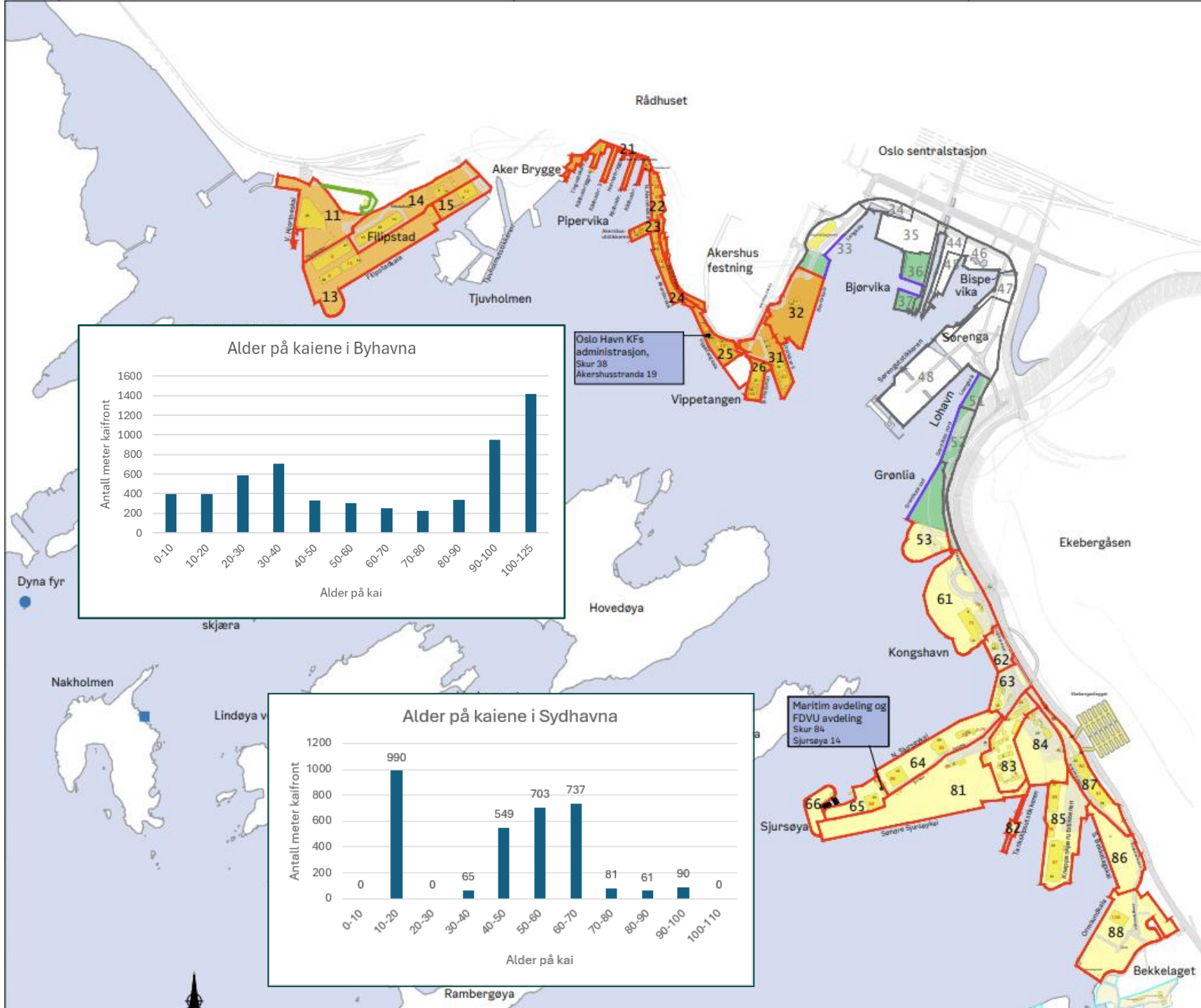
## Vision

To be the world's most area-efficient and environmentally friendly urban port

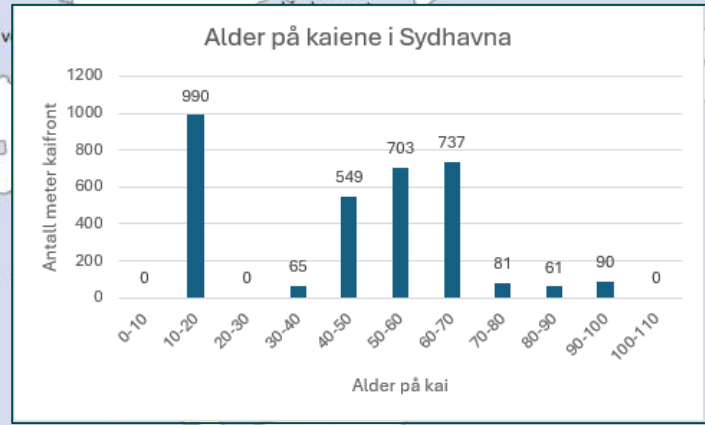
→ Every property decision should support long-term sustainability and high-quality, durable infrastructure

Oslo is a global leader in the green and digital transformation of the maritime industry





Oslo Havn KFs administrasjon, Skur 38 Akershusstranda 19



Maritim avdeling og FDVU avdeling Skur 84 Sjørsøya 14

Byhavna	Sydhavna
11 Hjortnes	61 Kongshavn
13 Filipstad vest	62 Nordre Kongshavnkai
14 Filipstad-bakre område	63 Søndre Kongshavnkai
15 Filipstad øst	64 Nordre Sjørsøykai
21 Rådhusbryggene	65 Verkstedområdet
22 Nordre Akershuskai	66 Sjørsøymoloen
23 Akershusutstikkeren	81 Søndre Sjørsøykai
24 Søndre Akershuskai	82 Tankskiputstikkeren
25 Vippetangaia	83 Østre Sjørsøykai
26 Utstikker III	84 Nordre Bekkelagskai
31 Utstikker II	85 Kneppeskjærutstikkeren
32 Revierkaia	86 Søndre Bekkelagskai
33 Langkaia	87 Bekkelagsstranda, området øst for Kongshavnveien
34 Palékaia	88 Ormsundkaia
35 Krankaia	
36 Bjørvikutstikkeren	
37 Vestre Akerselvkai	
44 Østre Akerselvkai	
45 Paulsenkaia	
46 Bispekaia	
47 Sørengaia	
48 Søregutstikkeren	
51 Loengkaia	
52 Grønlikaia nord	
53 Grønlikaia syd	

### Øybrygger og fyr

11 Bygdøynes brygge
91 Bleikøya brygge
91 Lindøya øst
91 Lindøya vest
91 Nakholmen
91 Kavringen
91 Heggholmen fyr
91 Dyna fyr

Skurnummer i rødt  
Vegadresse i svart

- Eiendommer utenfor havneområdet som eies og forvaltes av Oslo Havn KF.
- Eiendommer som eies av HAV E.
- Eiendommer Oslo Havn KF leier eller fester og forvalter.
- Kaifront Oslo Havn KF leier og forvalter.

Oslo

<b>Kontaktinformasjon:</b> <input type="radio"/> ARK <input type="radio"/> RIB <input type="radio"/> RIE <input type="radio"/> RIV		<b>Konsulent:</b>  Konsulentens prosjektnr.:	
Utførende: LH Eiendomsinfo	Kontrollert: EB	Godkjent: AB GM	Opprettet dato: 21.01.2025

# Quay Structures in the Port of Oslo

## 1. Block wall quays (Blokkmur)

Traditional granite-faced solid structures with low load capacity

## 2. Timber crib quays (Tømmerkiste)

Historic timber chambers filled with stone

## 3. Platform quays

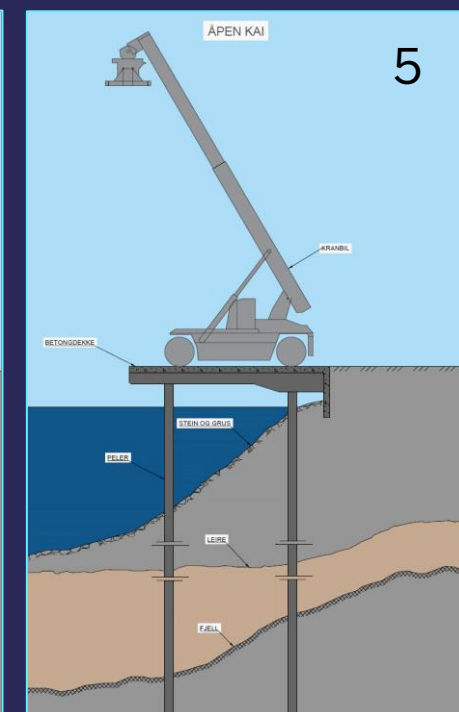
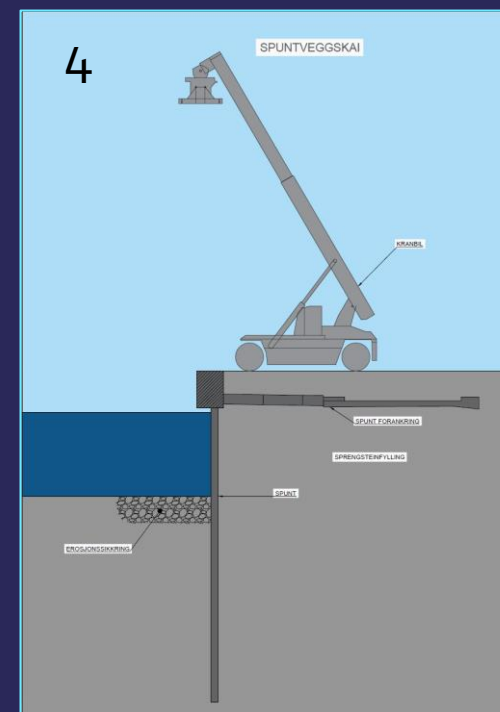
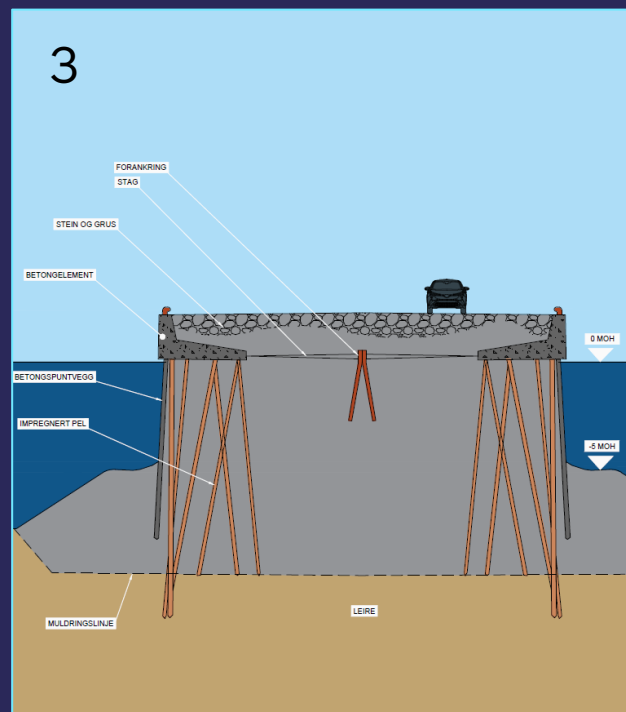
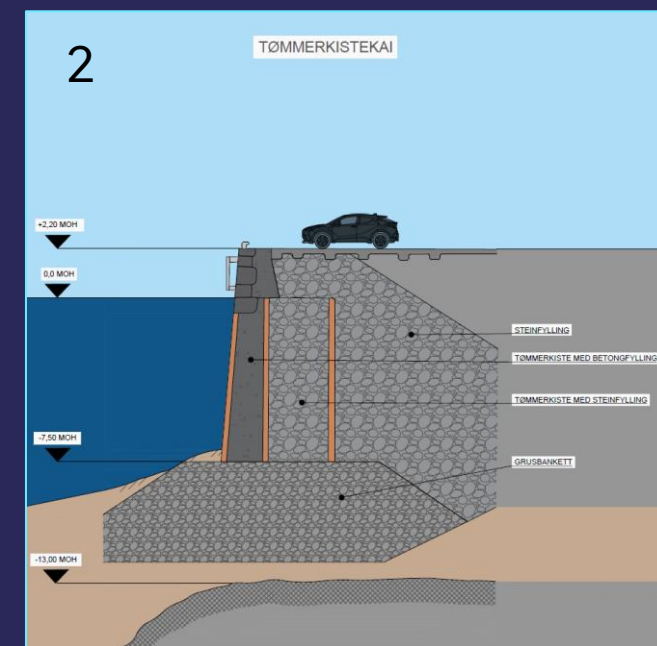
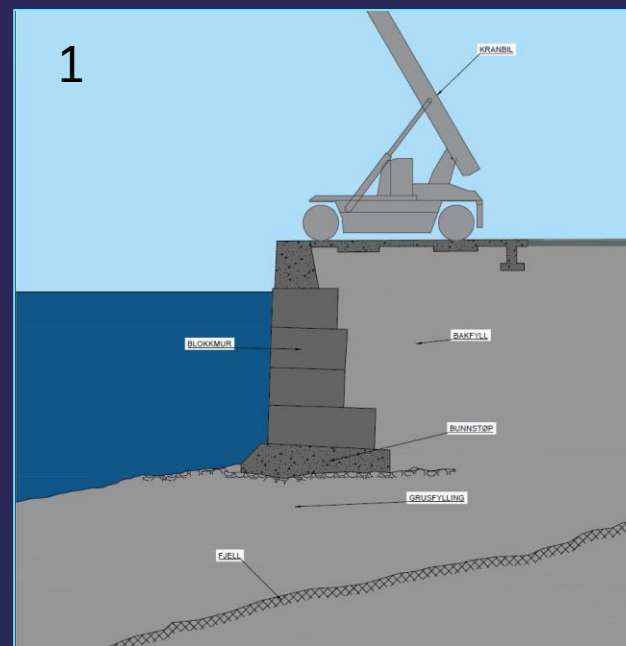
Concrete platform on timber piles with anchor ties

## 4. Sheet pile wall quays

Steel sheet piles driven into seabed

## 5. Pile-supported quays

Concrete decks on piles to bedrock

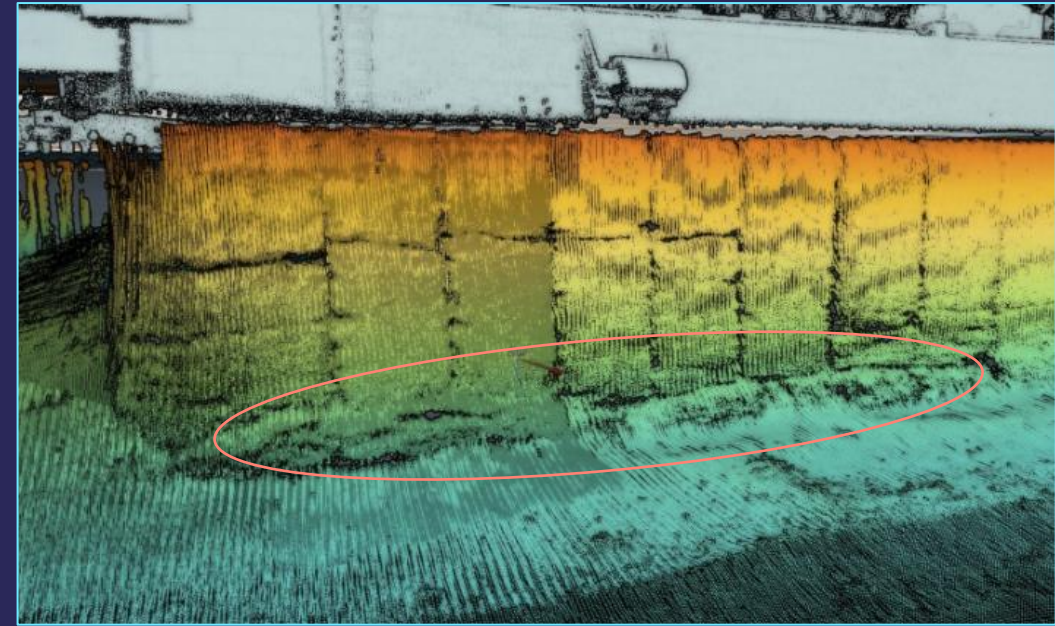


# Typical Challenges

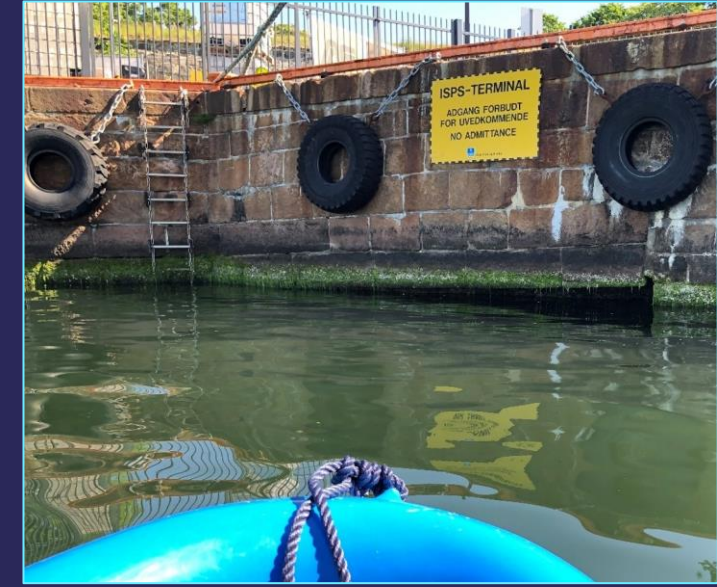
Material-specific and zone-dependent degradation mechanisms



# Block Revetment Structures

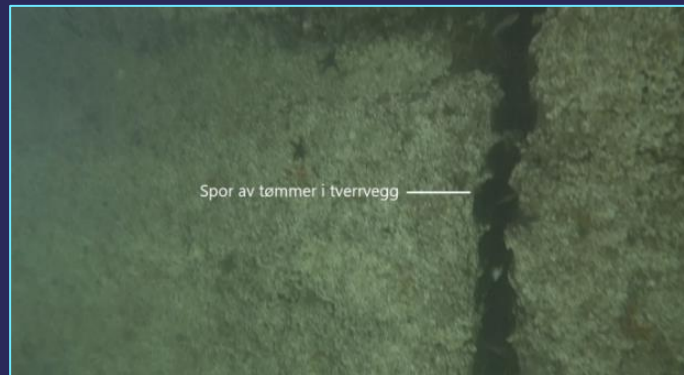
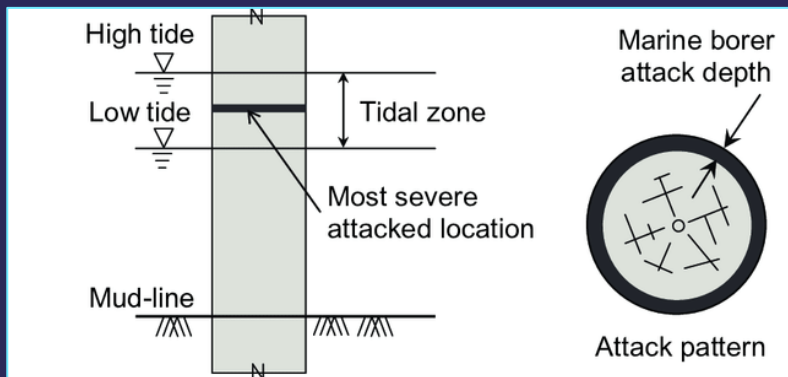
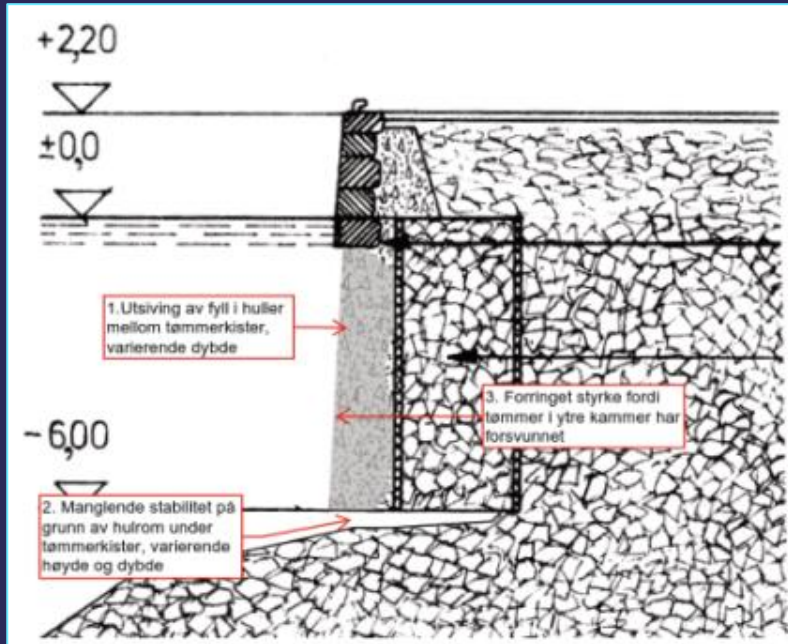


- Toe scour and undermining – most critical
- Joint degradation and block displacement
- Ice action
- Biological growth and weathering



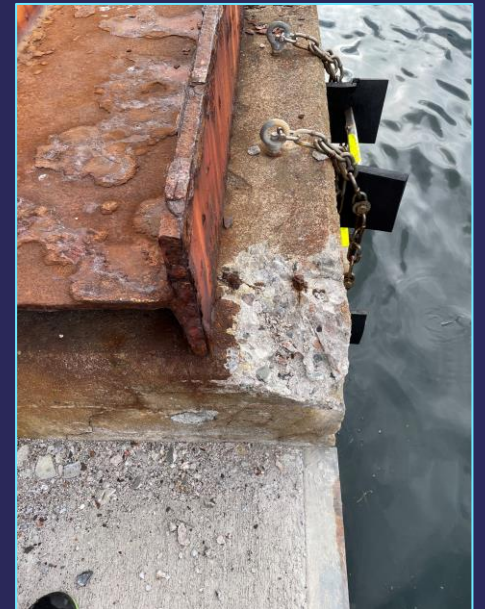
# Timber Crib Quays and Piles

- Severe damage from marine borers (e.g. shipworms) in submerged timber, and rot
  - Loss of fill through internal gaps
  - Loss of structural integrity, increasing the risk of collapse
- Undermining and erosion – from current and propeller wash
  - Reducing stability



# Reinforced Concrete Structures

- Chloride ingress → rebar corrosion, cracking & spalling
- Carbonation → reduced pH, passive layer breakdown, rebar corrosion
- Freeze-thaw cycles → cracking, accelerated chloride penetration



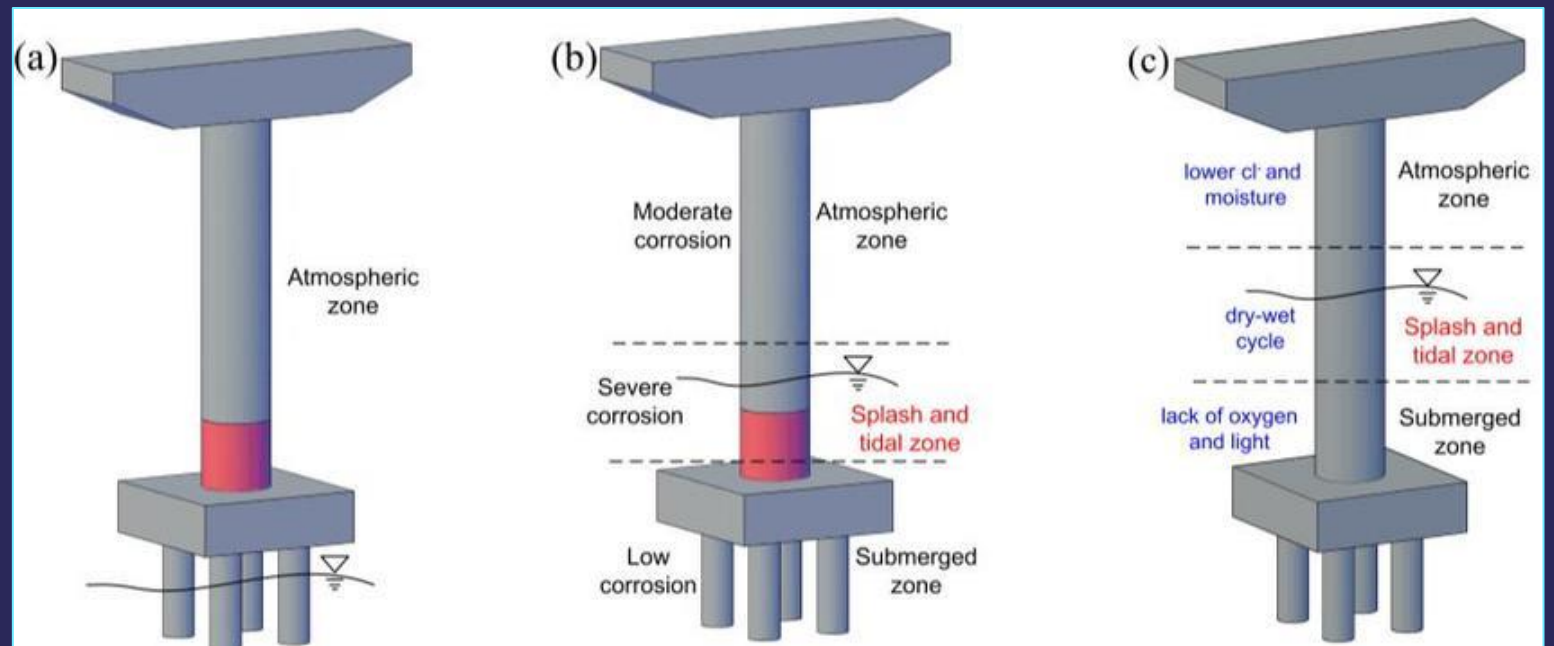
# Steel Structures and Surface Protection



- General corrosion, pitting and accelerated low water corrosion (ALWC) are most critical.
- ALWC causes rapid section loss near low tide ( $\geq 0.5$  mm/year). Concrete-filled piles are highly vulnerable
- Coating systems often fail due to mechanical impact, salts and ice.

# Splash and Tidal Zone

- Most aggressive zones for corrosion and degradation
- Protection systems often fail – coatings, CP, materials
- Difficult to find an ideal long-term solution
- Clear need for further testing and smarter strategies

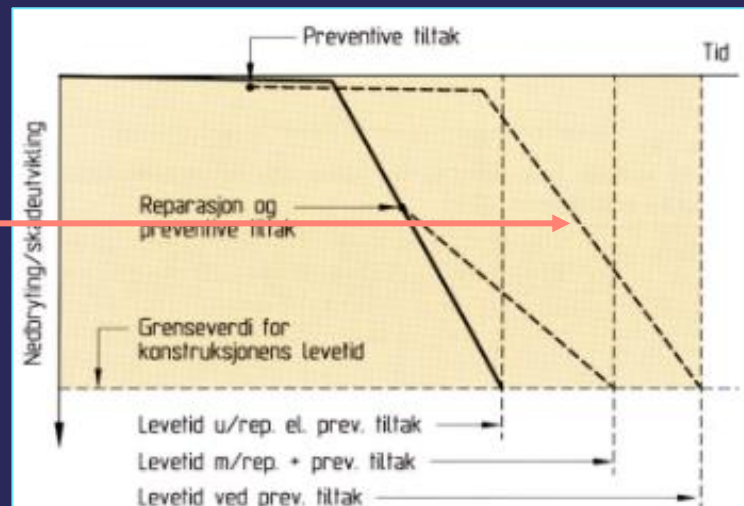
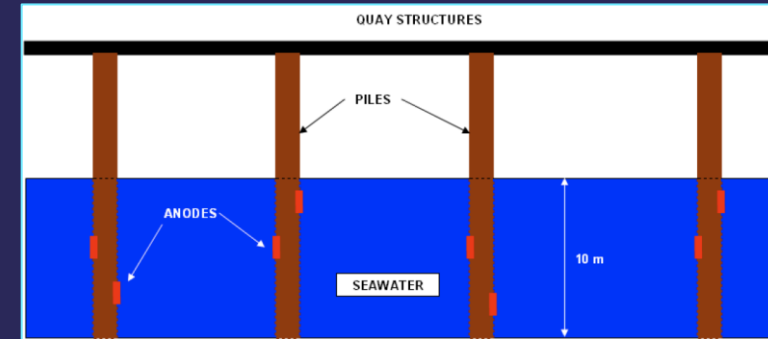


# Protection Strategies

- Cathodic Protection
- Protective coatings
- Durable material selection
- Physical barriers
- Concrete surface sealers

But most importantly:

- **Predictive maintenance**



# Projects

## Summer Interns – Condition Assessment

- Based on NS 3424 – Level 1
- Helps identify visible damage on quay structures
- Important part of our preventive maintenance strategy
- But – difficult to monitor damage progression over time






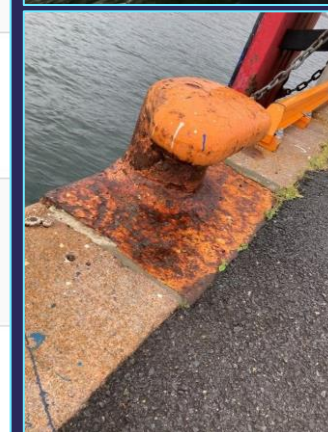
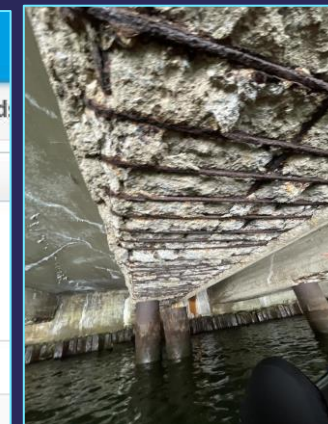
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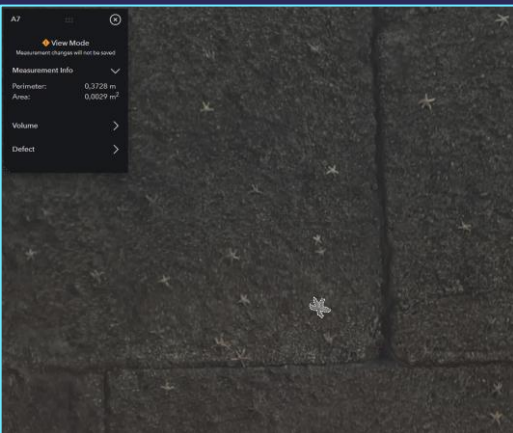
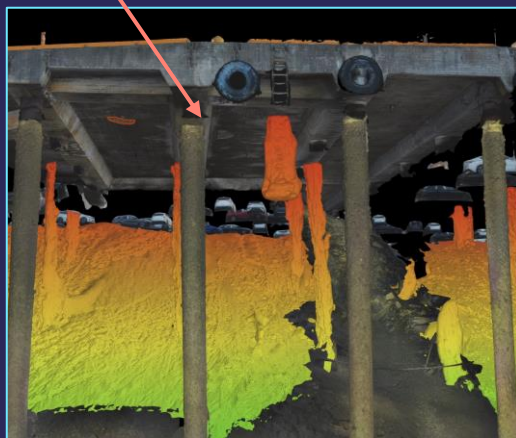
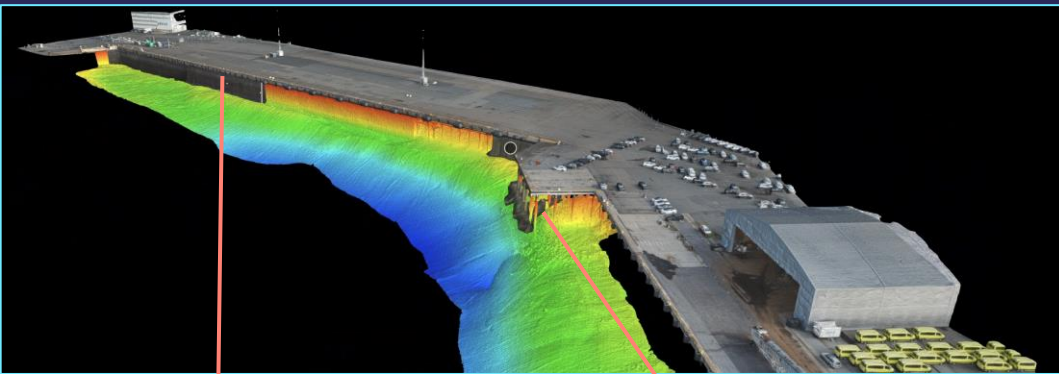
Kaier Område 88 Ormsund - Ormsundkaia (pelekai) > Tilstandsanalyse > Tilstand

Ubehandlet 25 Under behandling 0 Lukket 0 Tilstandsbeskrivelse Dokumenter 1

+ Ny tilstand Skriv ut Behandle valgte

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<input type="checkbox"/>		Dårlig fuge	Ved pullert 13
<input type="checkbox"/>		Åpen vannluke	Mellom pullert 8 og 9
<input type="checkbox"/>		Riss	Akse 5-12, 14-27, 29-56





# Projects

## Scanning Project – Marine Digital Condition Assessment

- Combines photogrammetry, ROV, multibeam echosounders and lidar to create a 3D-model
- Tracks cracks, deformation, corrosion etc. over time
- Reduces need for diving – improves safety and data quality, lower costs over time
- Aims to support smarter, digital and more proactive maintenance planning



Oslo Havn

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hjemmesider →  
Om oss →  
Ledige stillinger



**OSLO HAVN**

**VI TRENGER DEG**

**SOMMERJOPP:**

- Tilstandskontroll på arealer iht. NS 3424
- Vedlikeholdsplanlegging
- Planlegge, delta og rapportere funn fra inspeksjoner

Port of Oslo

Søknadsfrist  
21. April

Oslo Havn

Thank you!