



# Aluminium Hatch Covers

## Increased Stability and Higher Payload

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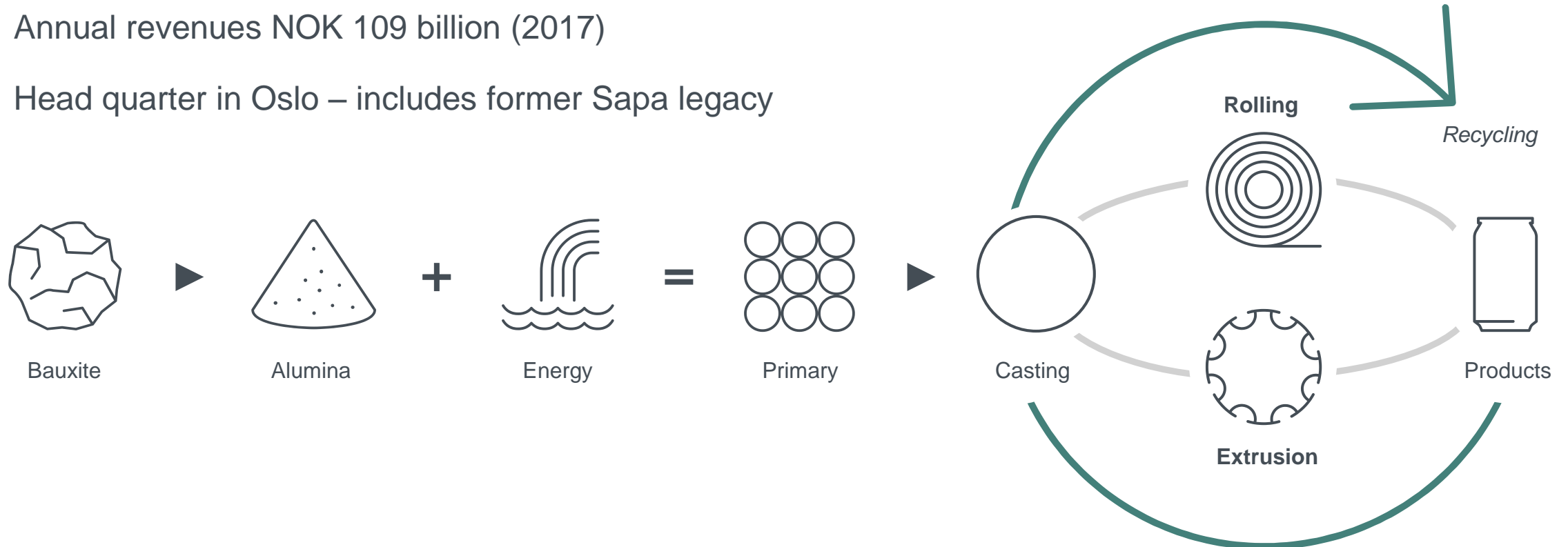
Hoogezand, 22-01-2019

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Hydro in brief

# Engaged in the entire aluminium value chain

- **Global** provider of alumina, aluminium and aluminium products and solutions
- 35,000 employees at 150 locations in 40 countries
- Annual revenues NOK 109 billion (2017)
- Head quarter in Oslo – includes former Sapa legacy



# Hydro Aluminium Solutions



FSW Extruded panels





# Aluminium is the metal for the future

Properties lead to increased market share

## ✓ Lightweight



- 1/3rd density of steel
- high strength-to-weight ratio
- weight savings usually 35% - 55% (structural applications)

## ✓ Cost



- **Material**
- **Integrated Functionalities**
- **Surface Treatment**
- **Assembly**
- **Maintenance**
- **Recycling**
- ...

## ✓ Formability



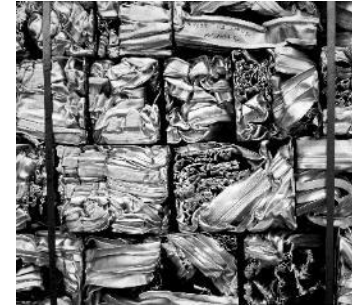
- Design flexibility
- Integration of functionalities

## ✓ Corrosion resistant



- Natural oxide layer
- Protects the metal against corrosion
- Virtually maintenance free

## ✓ Recyclability



- 5% of original energy consumption
- 75% of all aluminium produced still in use

## ✓ Arctic temperatures



- High fracture toughness compared to most steel grades and composites
- Aluminium does not get brittle at lower temperatures as steel and composites do.

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# Hatch Cover projects

Overview

# Hatch covers

2 projects within Hydro



- Great Lakes barges
- Roof - Sliding type
- Load requirements – Sea going



- Sea going coasters
- Pontoon – Lifting type
- Load requirements – Sea going



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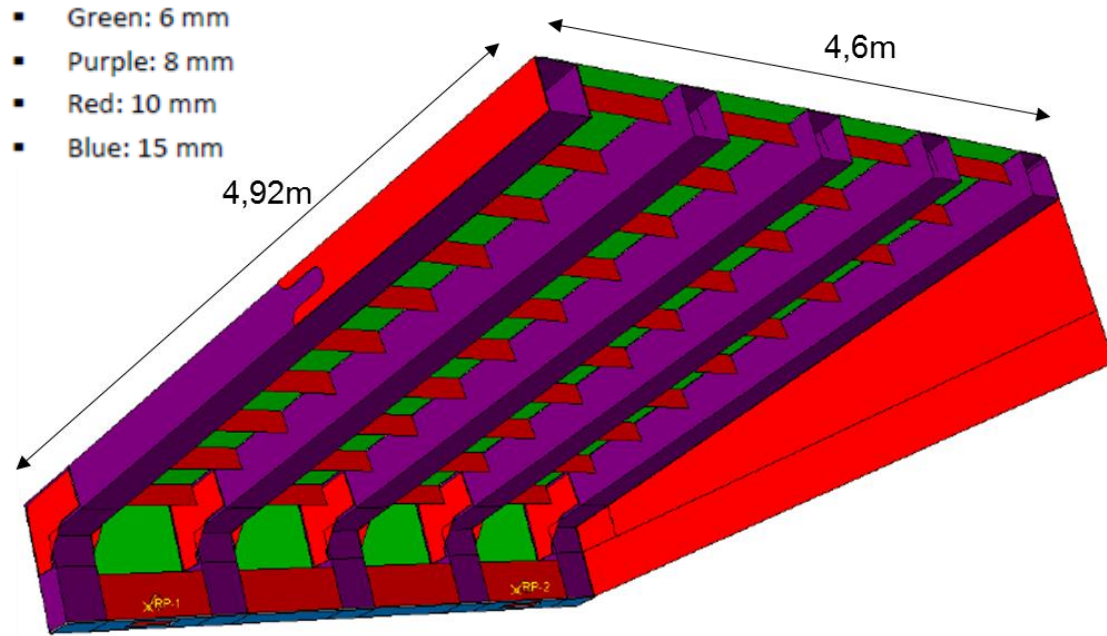
Blommaert

Steel design



# Steel Hatch Cover

Current design, boundary conditions and FEA results



- High hatch cover steel weight: 8855kg
- The steel profiles and plates are all MIG welded together

## Loading on hatch according to report customer

$$P_{\text{hatch}} := 17.16 \cdot \text{kPa}$$

$$A_{\text{hatch}} := 4.920 \cdot \text{m} \cdot 4.6 \cdot \text{m} = 22.632 \text{ m}^2$$

$$F_{\text{hatch}} := P_{\text{hatch}} \cdot A_{\text{hatch}} = 388.365 \text{ kN}$$

- Deflection = 38.7mm
- Von Mises stresses = OK

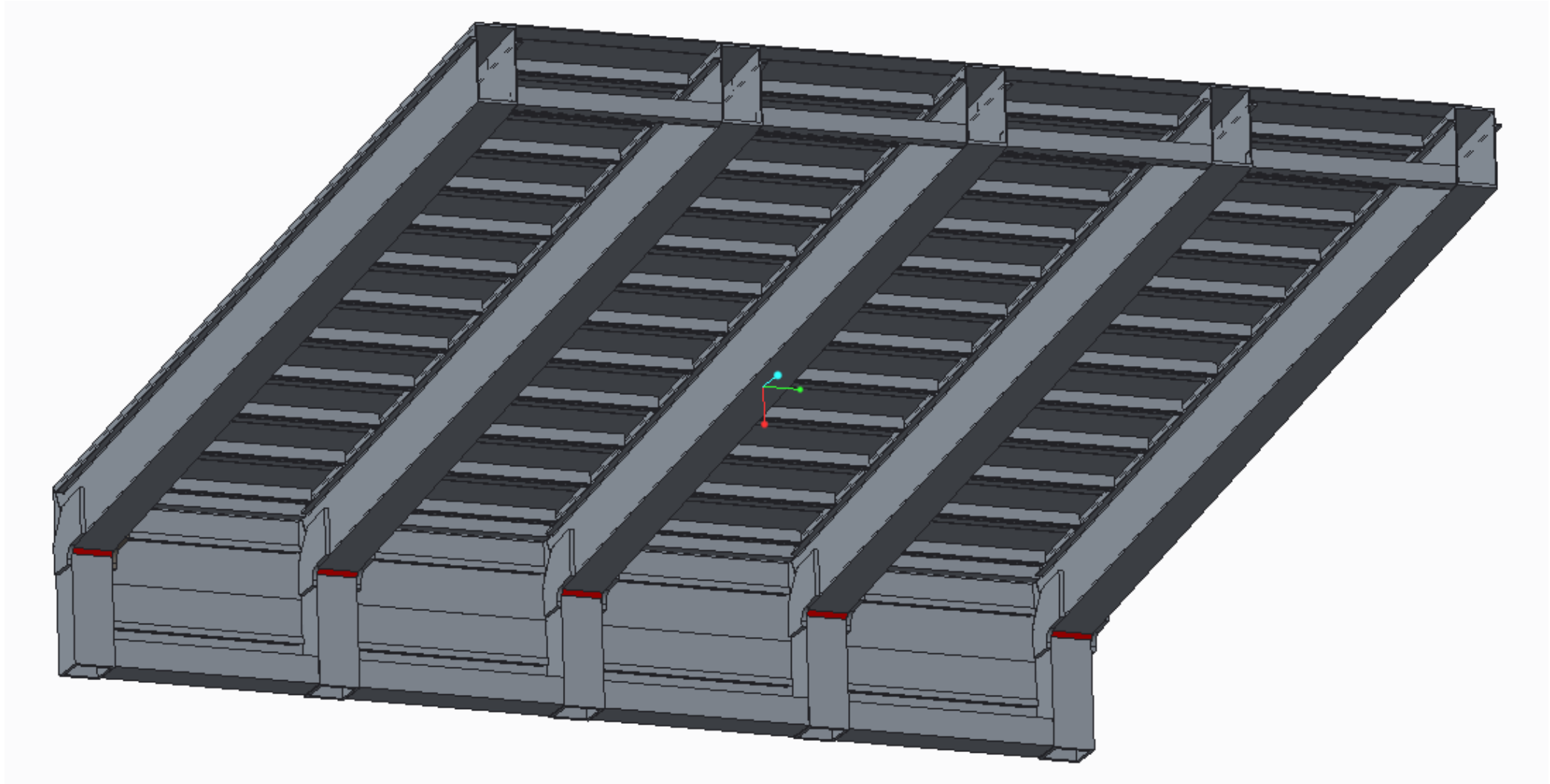
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Blommaert

Aluminium design

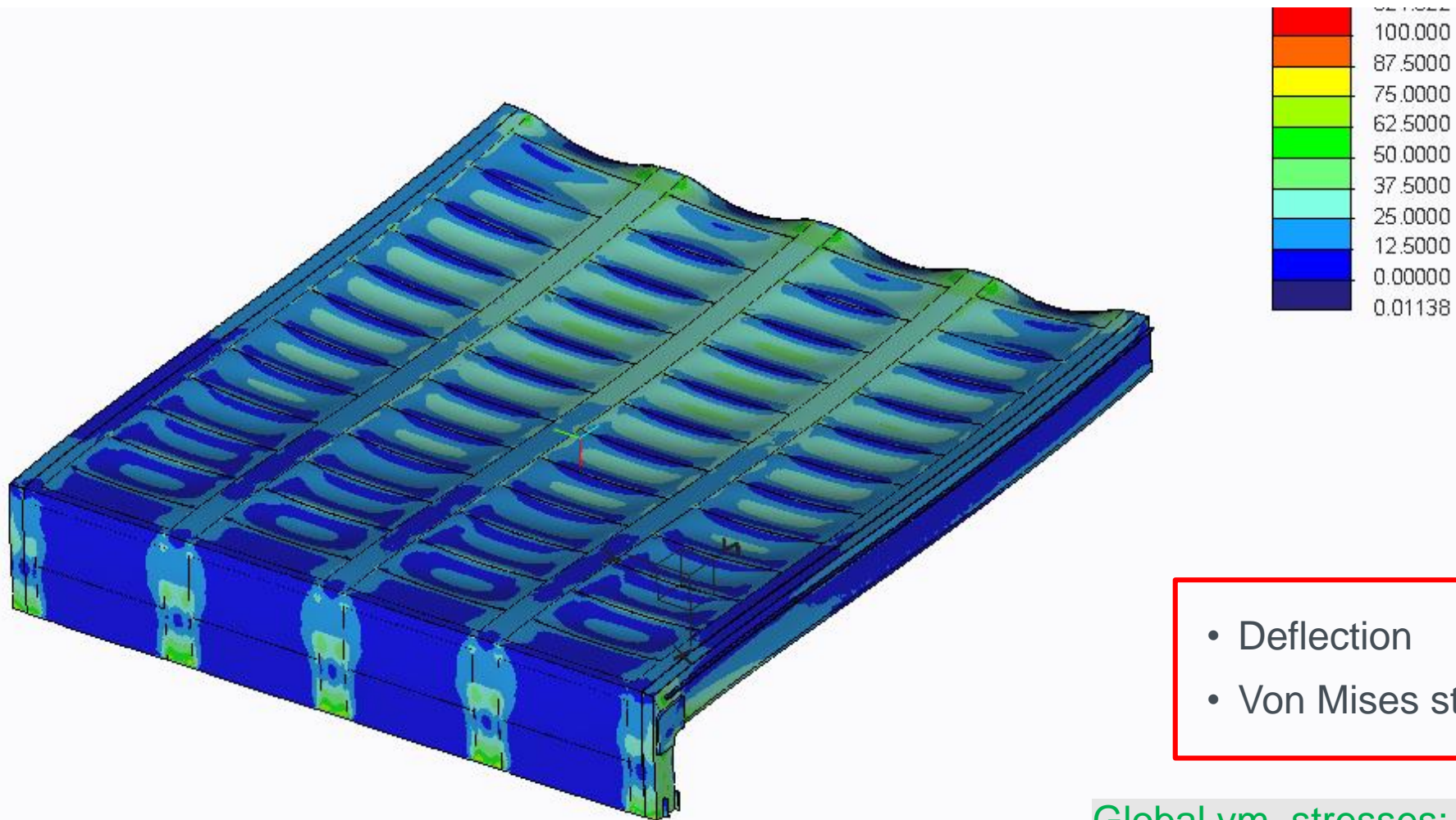
# Aluminium Hatch Cover

Design for 99% based on extrusions



# Aluminium Hatch Cover

## FEA results



- Deflection = 18 mm
- Von Mises stresses = OK

Global vm\_stresses: +-70MPa < 260MPa OK!



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# Conoship

Steel design

# Steel Hatch Cover

## Current design, loads

- 10 hatch covers of app. 7m (length) \* 11.5m (width) \* 0.6m (height)
- Light weight steel design, total weight app. **150tons**
- Loads: the **vertical weather design load** is leading with **39.4 kN/m<sup>2</sup>** for (at least) the forward hatches
- Deflection: the max. allowed deflection for 11.5m span is **51mm**

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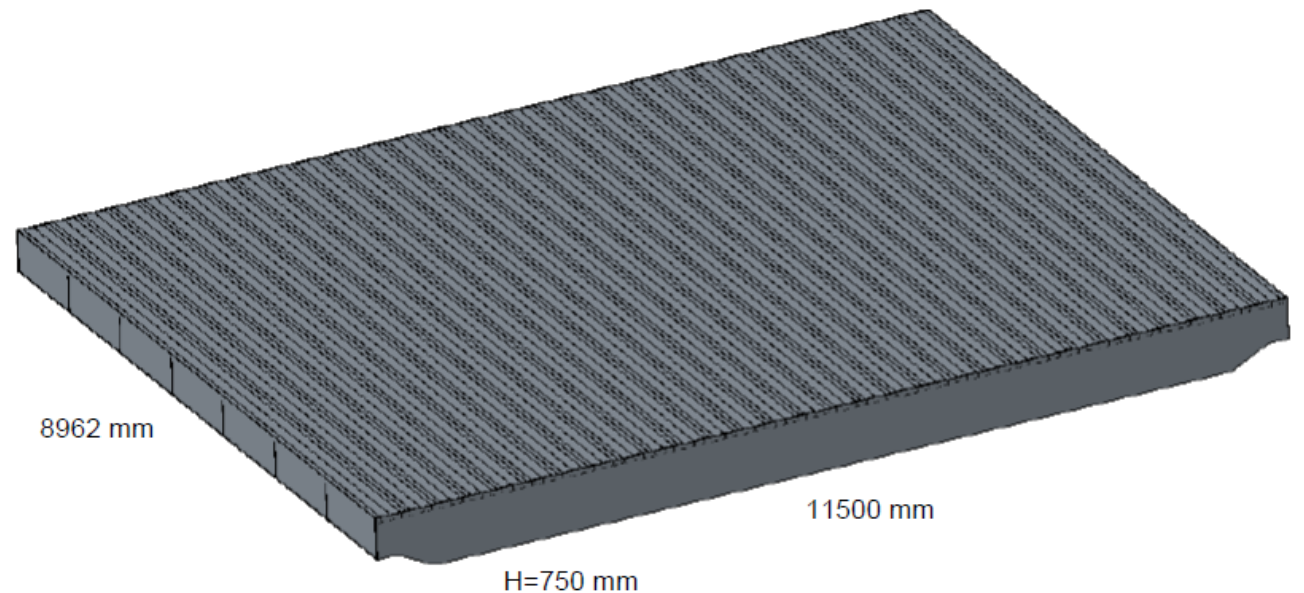
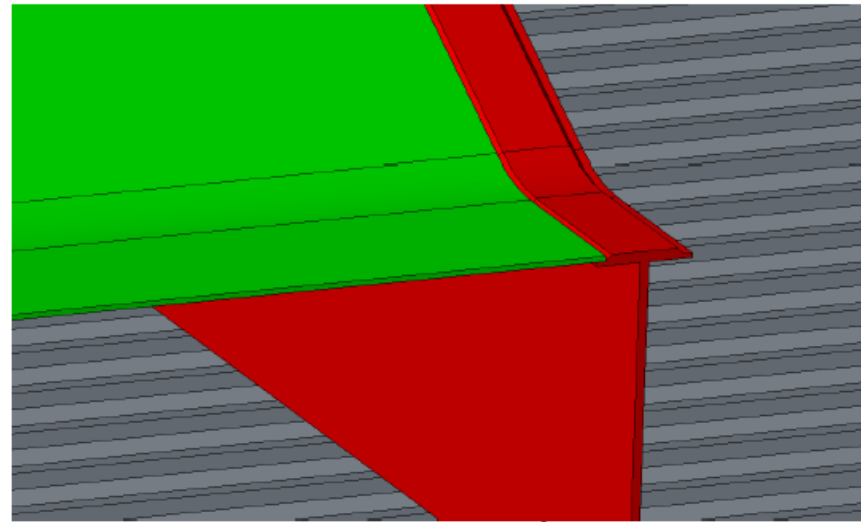
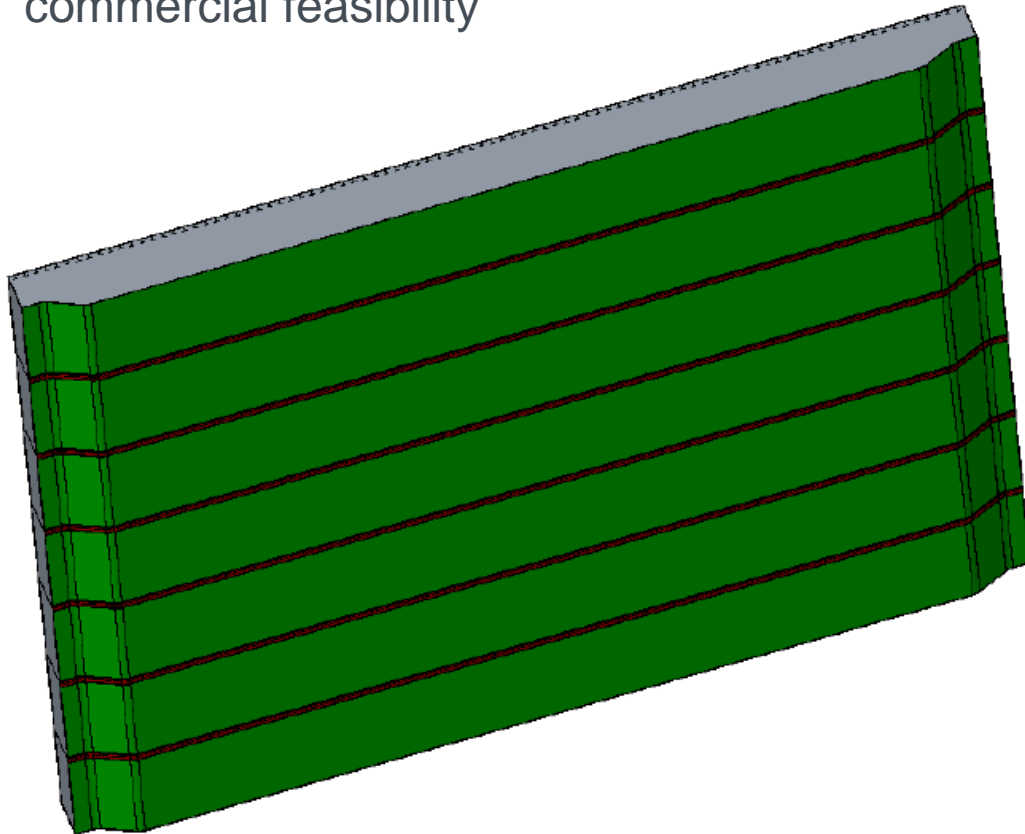
# Conoship

Aluminium design

# Aluminium Hatch Cover

Design app. 50%-50% extrusions - plate

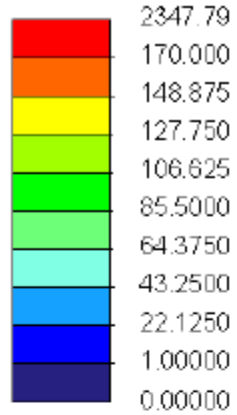
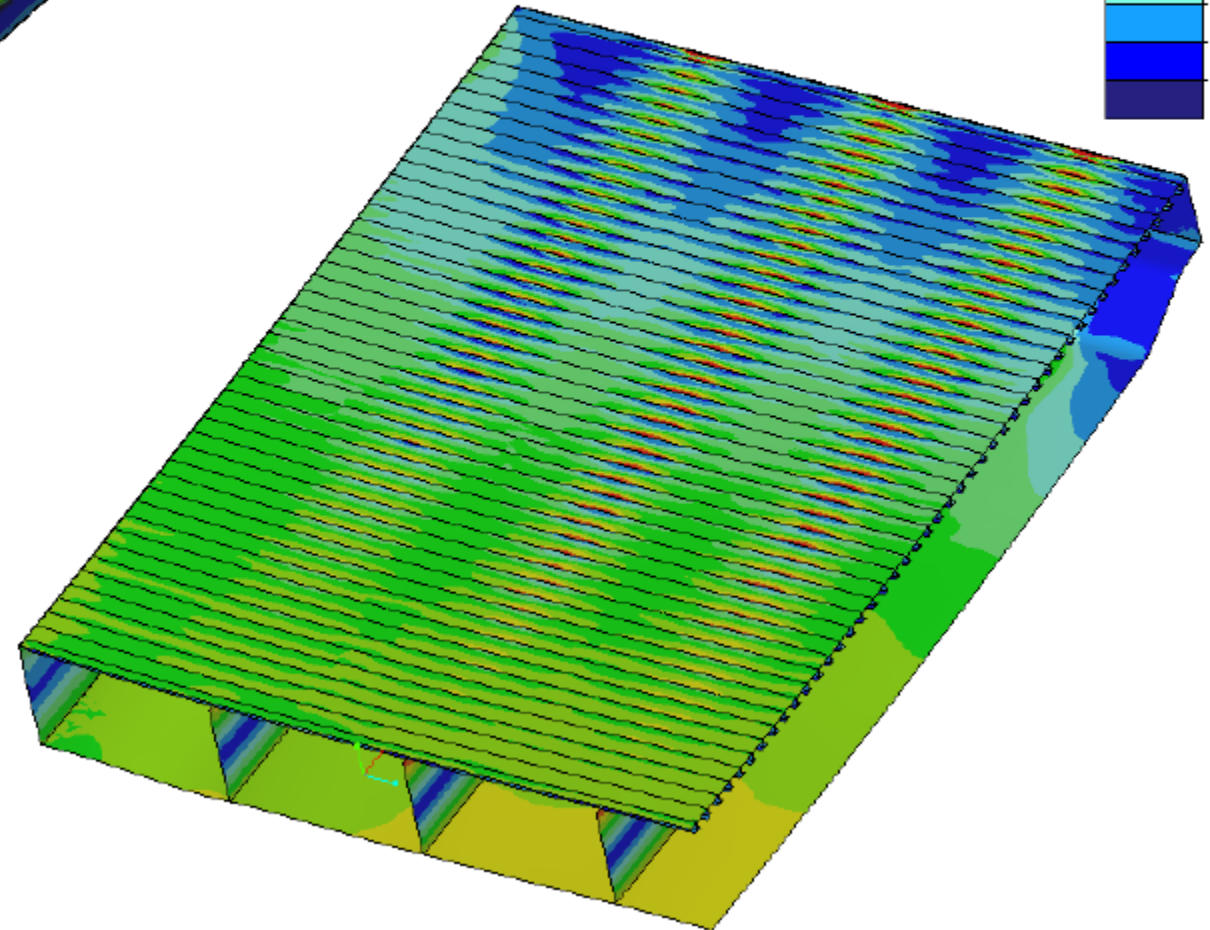
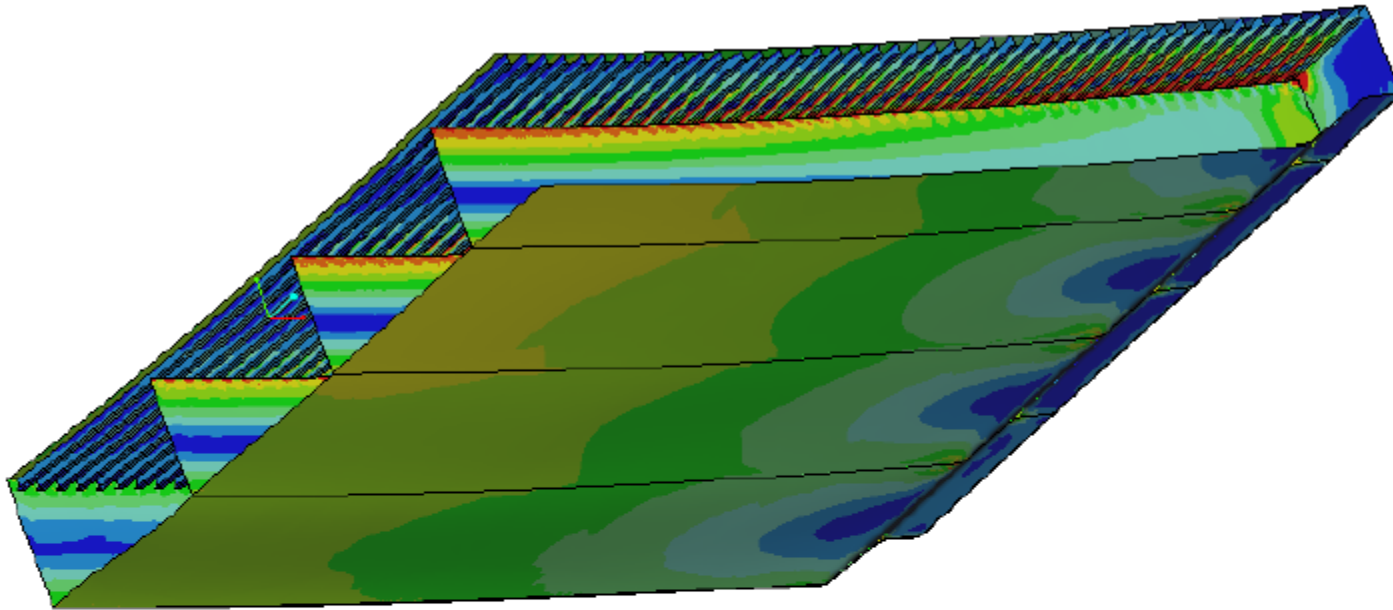
- Global design to prove technical and commercial feasibility





# Aluminium Hatch Cover

FEA results



- Deflection = **104 mm**
  - Apply slight pre-curvature
- Von Mises stresses = OK

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# Conclusions

...

# Aluminium Hatch Covers



## Benefits

	Blommaert roof-sliding type	Conoship pontoon-lifting type
Weight saving	≈ 70%	≈ 63 – 55%
	Smaller hatch cover crane Better stability (hatch covers + crane) Higher payload Lower cost global design	
Cost saving	Lower - max. equal to steel	± 10% cost of (normal) steel
Maintenance	Virtually none (= additional cost saving)	
Recycling	100% recyclable Relatively high scrap value compared to other materials	
Assembly	Riveting & Welding	Welding
Logistics	Containerized kits	Ship-deck

# Aluminium Hatch Covers

## Conclusion

- Apply pre-curvature to compensate for increased deflection
- Highly interesting in terms of weight saving
- Cost competitive alternative to steel – both CAPEX & OPEX

Thanks for your attention !





# Hydro

*We are aluminium*

