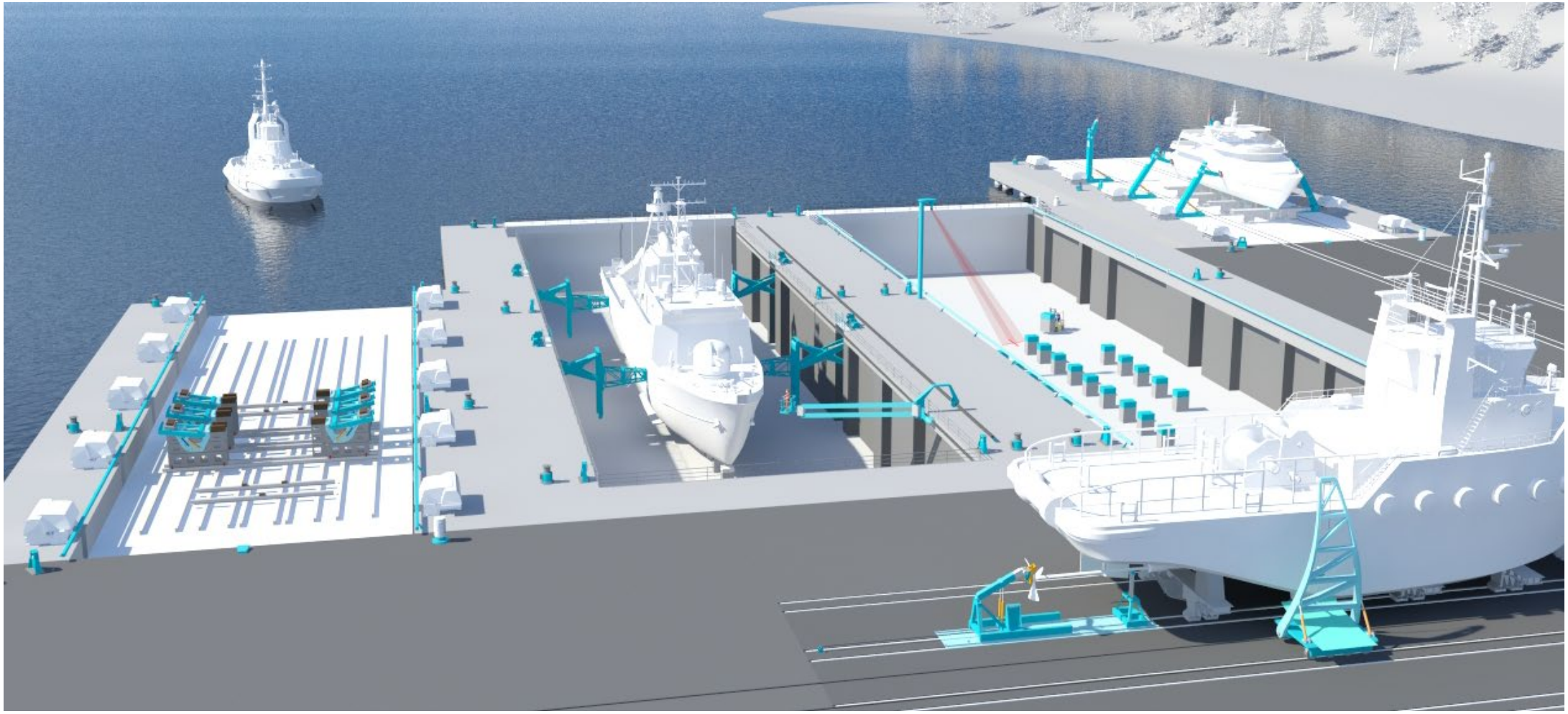
# NSRP Panel Project
# Fast Docking System Study

DM Consulting

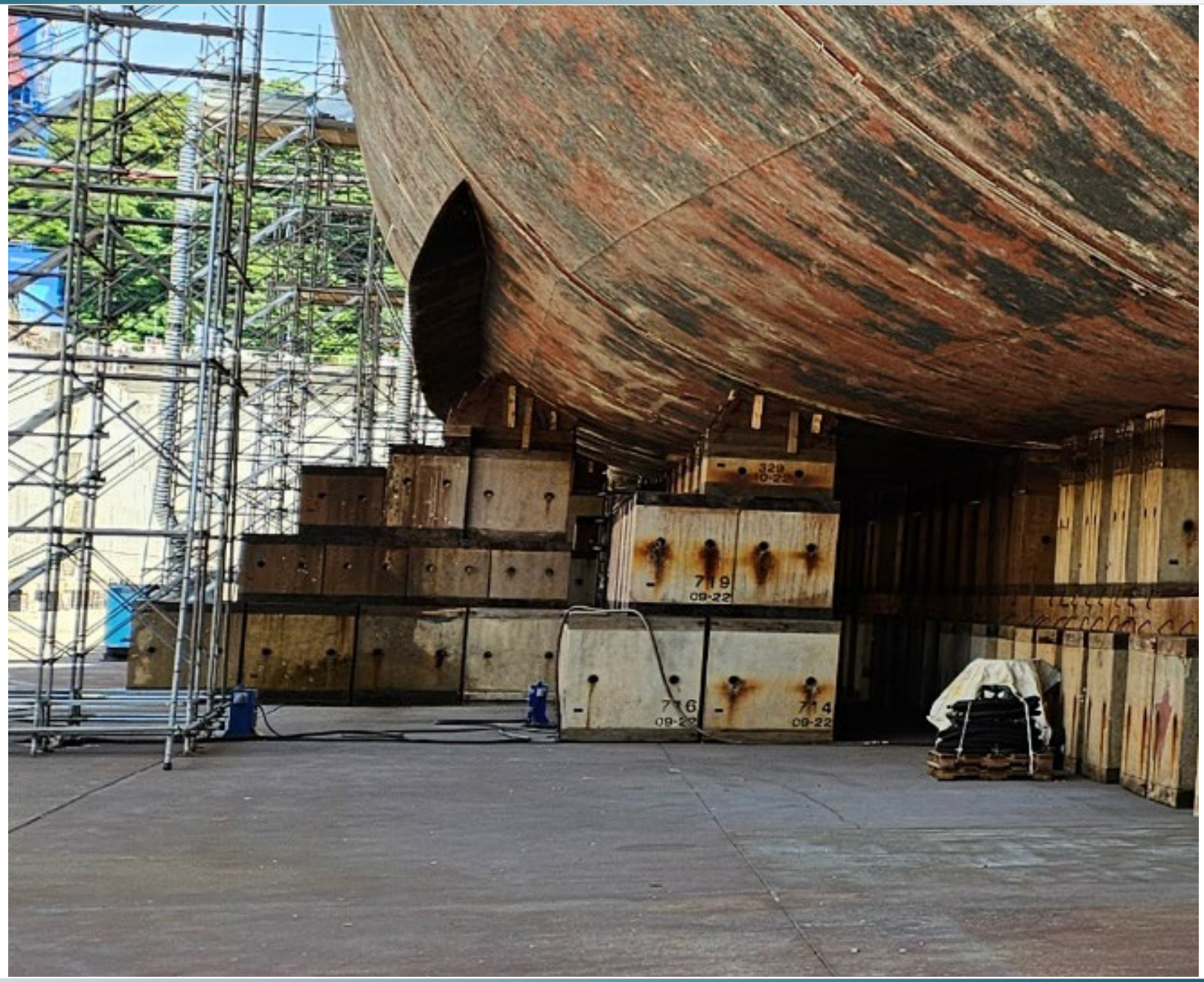

NSRP
NATIONAL SHIPBUILDING RESEARCH PROGRAM™
Taking Shipbuilding and Repair to the Next Level

# Fast Docking Systems by Syncrolift

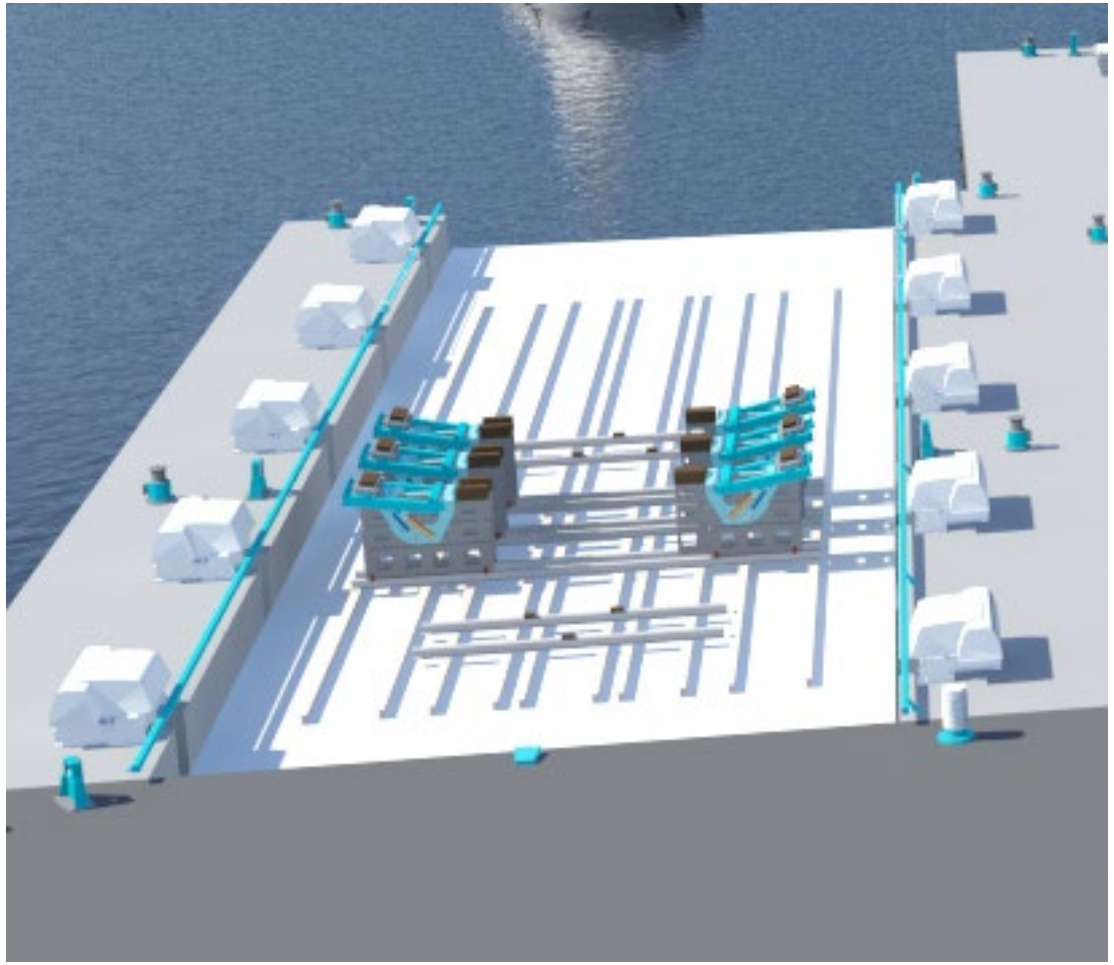
## Innovative hydraulic side block support systems



# Side Blocks



# Bilge Support Arms



# Bilge Support Arms

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# Side Support Arms

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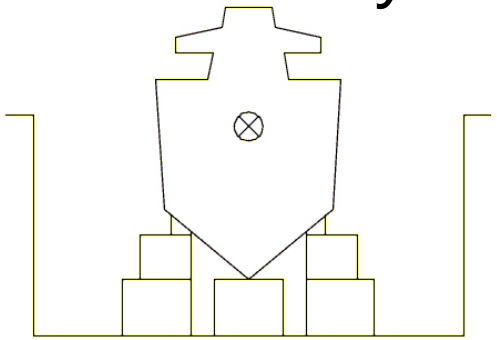
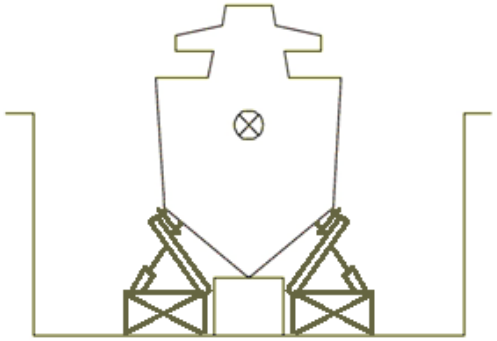
# System Comparisons

On site analysis results



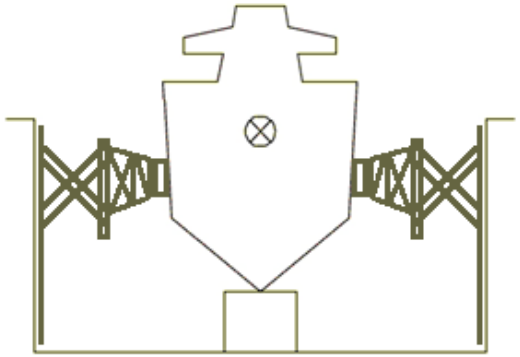
## Standard side bocks

- High preparation time
- Material waste
- Low clearance



## Bilge support arms

- Minimal preparation time
- Low material waste
- Increased vertical clearance
- Increased maintenance, but easy access



## Side support arms

- Minimal preparation time
- Low material waste
- Increased vertical clearance
- Increased hull access
- More difficult maintenance, although systems aren’t fully submerged

# System Validation

## Industry Standard Calculations

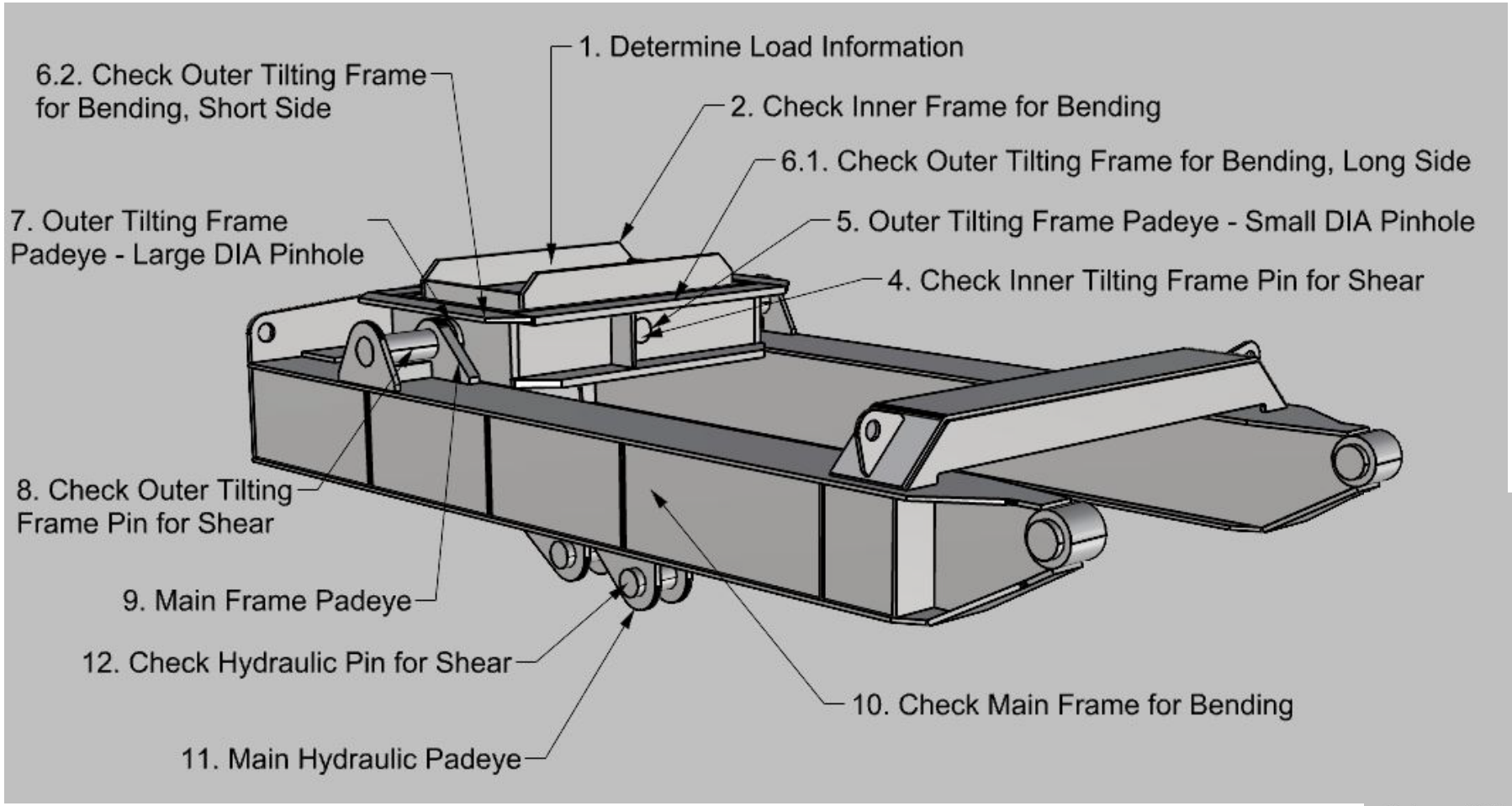
- Worst-case scenario loading situations for side supports in dry dock
- US Coast Guard SFLC Standard Specification 8634
- Equivalent analysis as US Navy NSTM 997 (US restricted)
- Altered for shores

## Steel Construction Manual (AISC 325) Confirmation

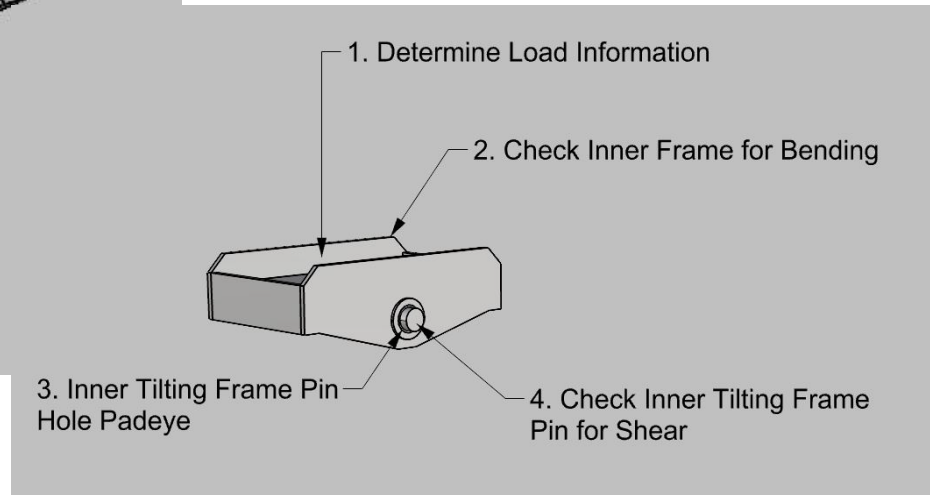
- Validate the structural design IAW Steel Construction Manual
- Steel Construction Manual is referenced in MIL-STD 1625 (USN standard)
- Engineering calculations for shear, bearing, bending, and axial stress checks
- FEA to verify calculated stresses

# Steel Construction Manual Validation

## Bilge Support Arms

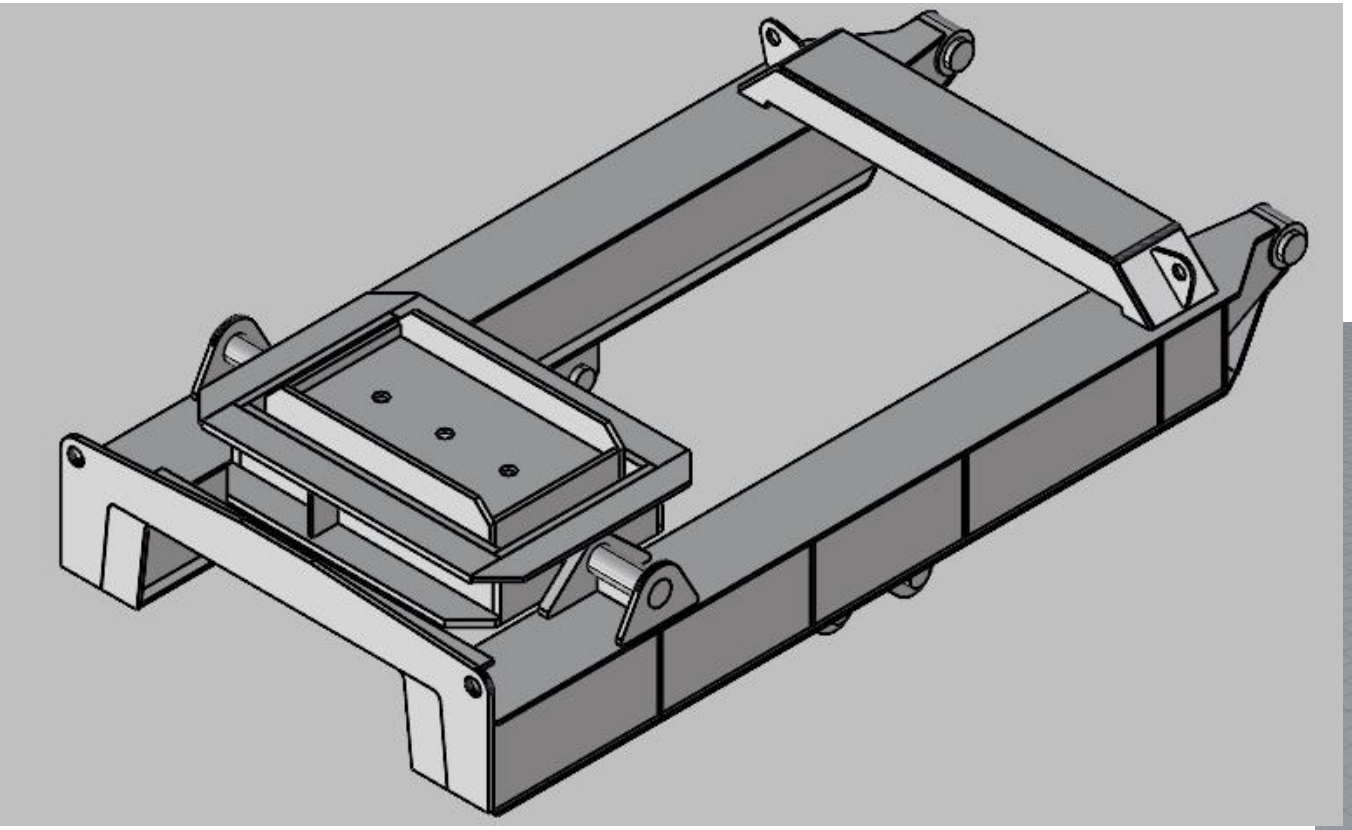


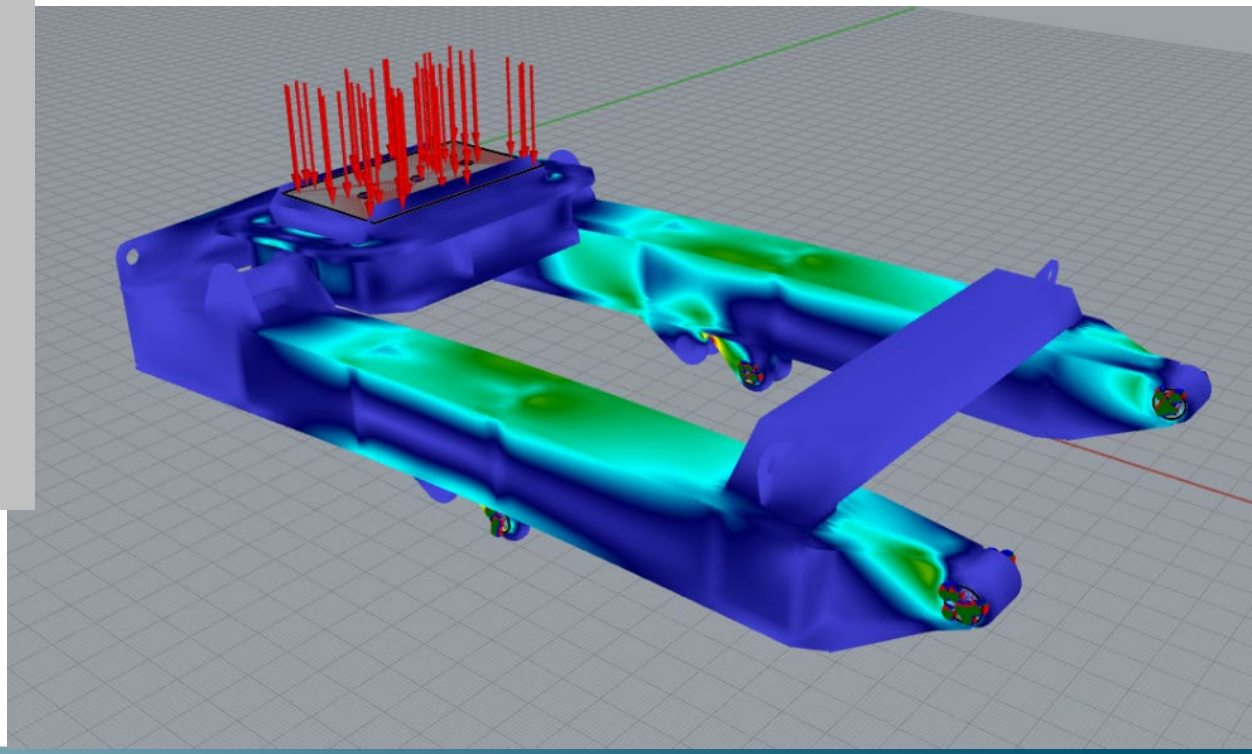

Checking the load path



# Steel Construction Manual Validation

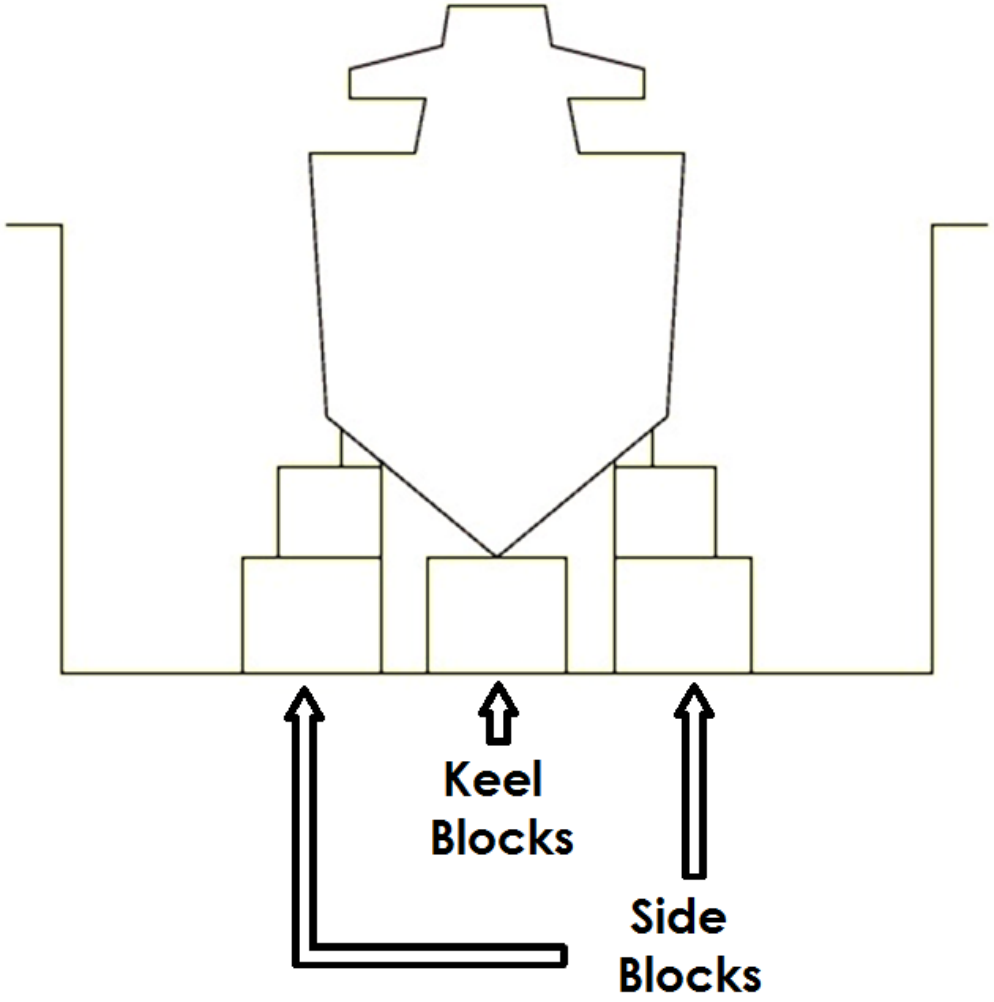
## Bilge Support Arms - FEA

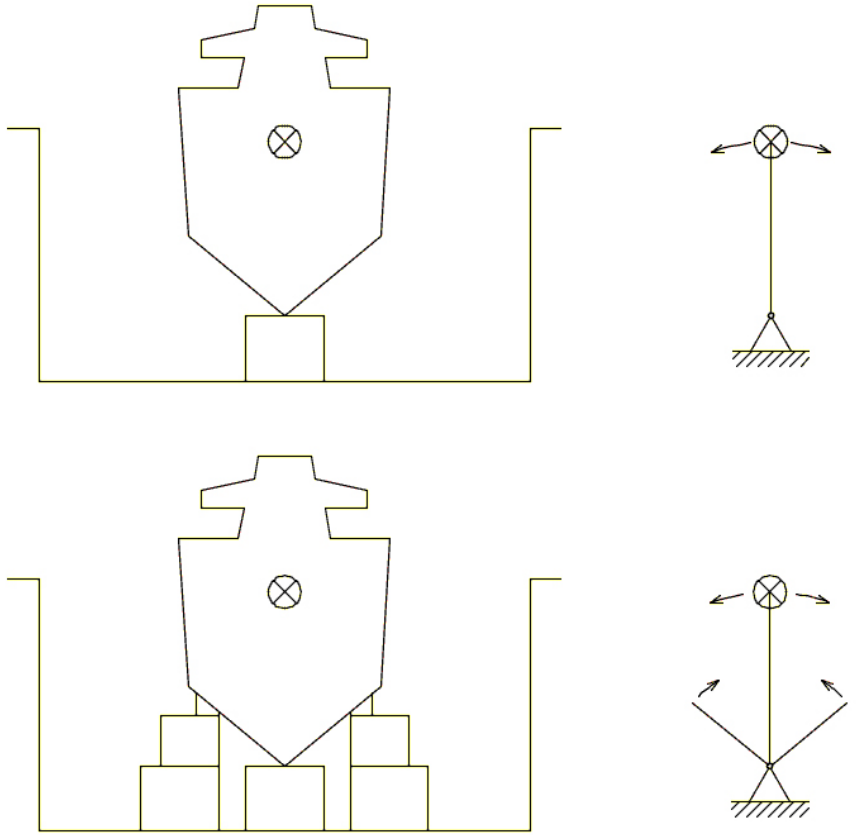




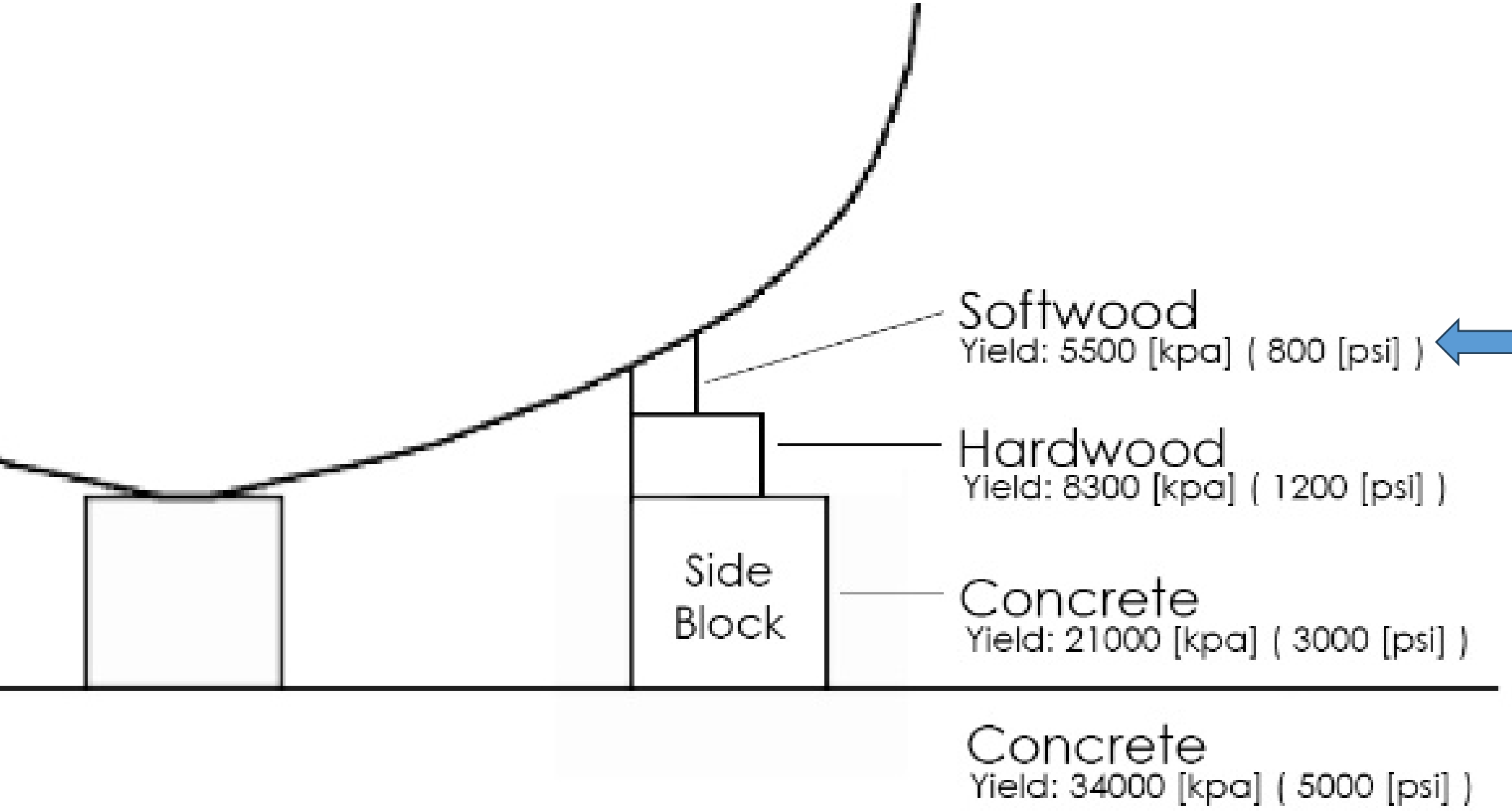
# Industry Standard Calculations

## Current System



# Industry Standard Calculations




Assumption: First point of failure

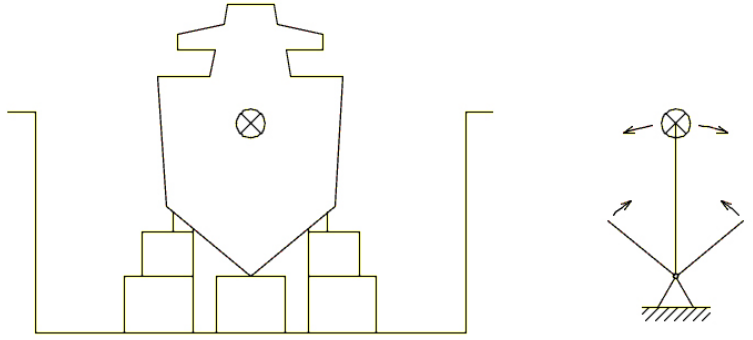
# Industry Standard Calculations

Differences with Hydraulics vs Side Blocks

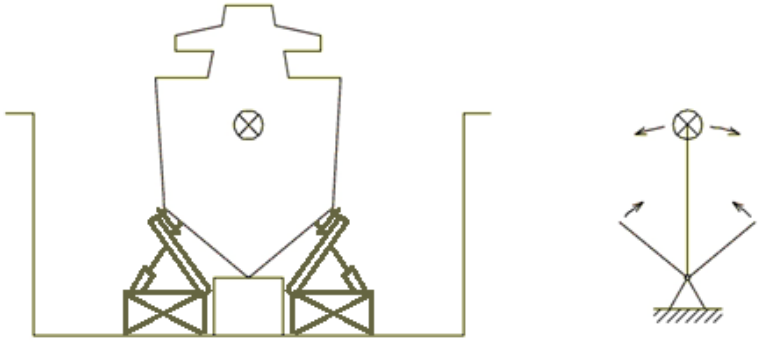
- Analysis using softwood for consistency
  - Rubber could be used, less required crush tolerance with hydraulics
- Analysis using same cap size for consistency
- Bilge support arm has 2 axis-hinged cap rotation
  - Convenient, but not necessary for US Navy with accurate SB offsets

# Industry Standard Calculations

## System Comparisons

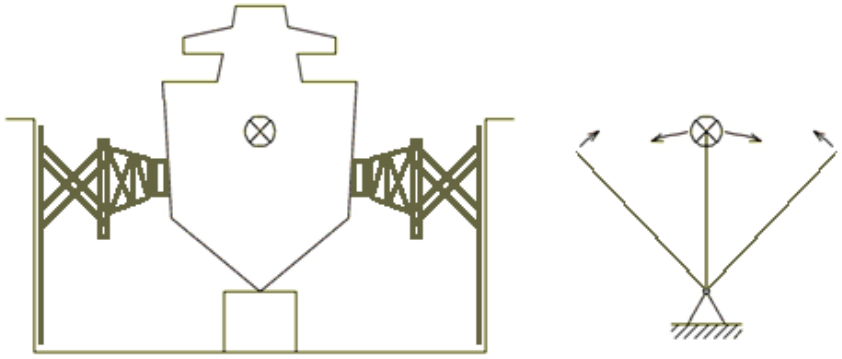


### Standard side bocks



### Bilge support arms

- Same or longer lever arm than SBs



### Side support arms

- Longer level arm = less loads (only limited by dock depth)

# Industry Standard Calculations

Differences with Hydraulics vs Side Blocks

- Analysis using softwood for consistency
  - Rubber could be used, less required crush tolerance with hydraulics
- Analysis using same cap size for consistency
- Additional 2 axis-hinged cap rotation
  - Not necessary for US Navy with accurate SB offsets

# Cost Analysis (Results)

- Baseline Case (up to 30 kts wind)
  - Very Cost Effective
- Emergency Readiness Case (up to 150 kts wind & 0.2 g earthquake)
  - Marginally Cost Effective
- Secondary benefits
  - High-tempo docking
  - Hull-Access
  - Real-Time Load Feedback

# Adoption Challenges

- Current standards restrict side supports based on soft cap pressure
  = many supports required

- Requires adjustment of current standards for shores

NAVSEA approval

- This study is a stepping stone towards approval

# Thank you