



MANAGING RISK

Common Structural Rules (CSR) for Oil Tankers



An Introduction



CSR Oil Tankers

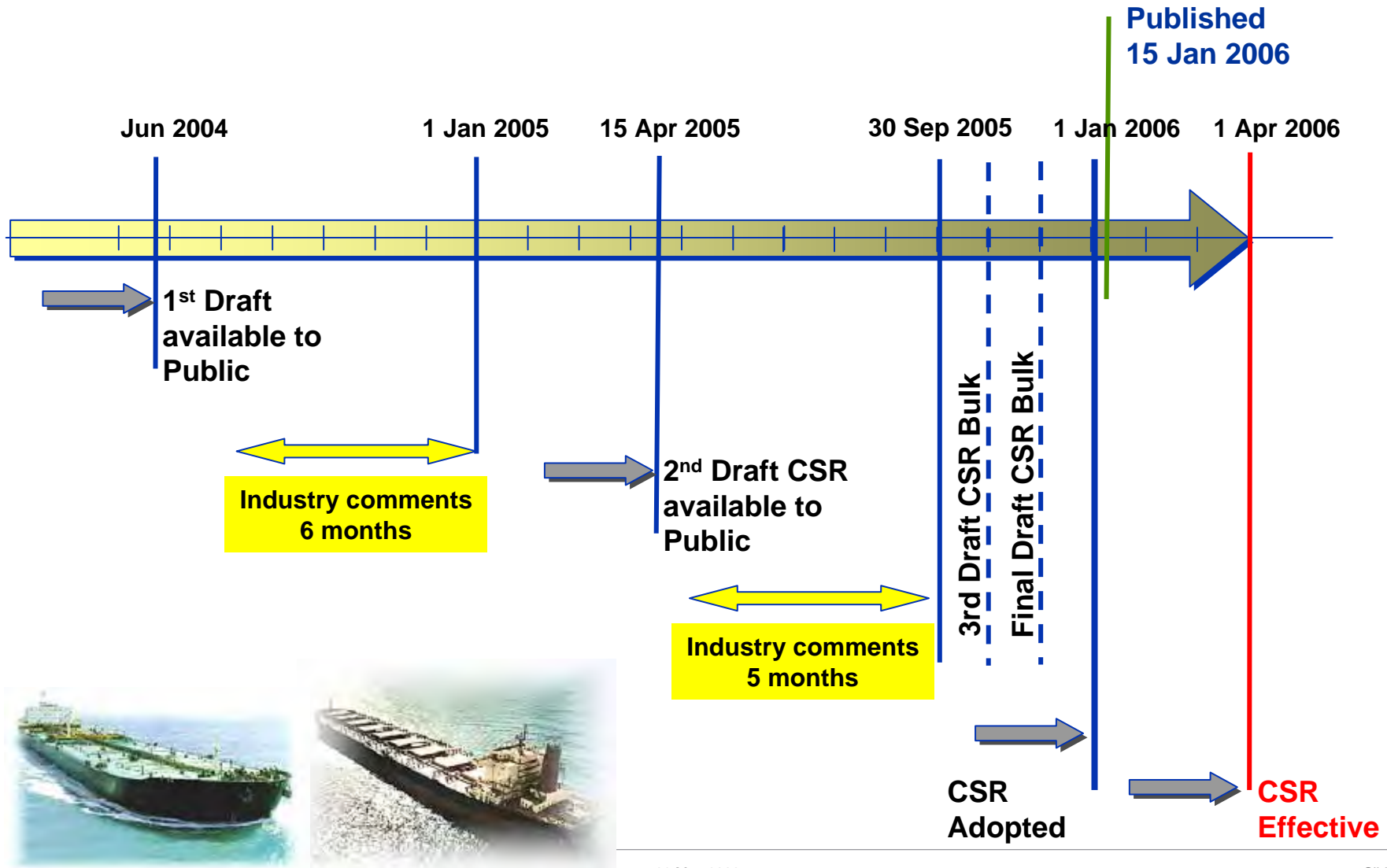
- Complete Set of Structural Rules for Double Hull Oil Tankers
- Length greater than or equal to 150m



CSR Bulker Carriers

- Complete set of Structural Rules for SSS and DSS Bulk Carriers
- Length greater than or equal to 90m

Summary of CSRs



CSR for Oil tankers

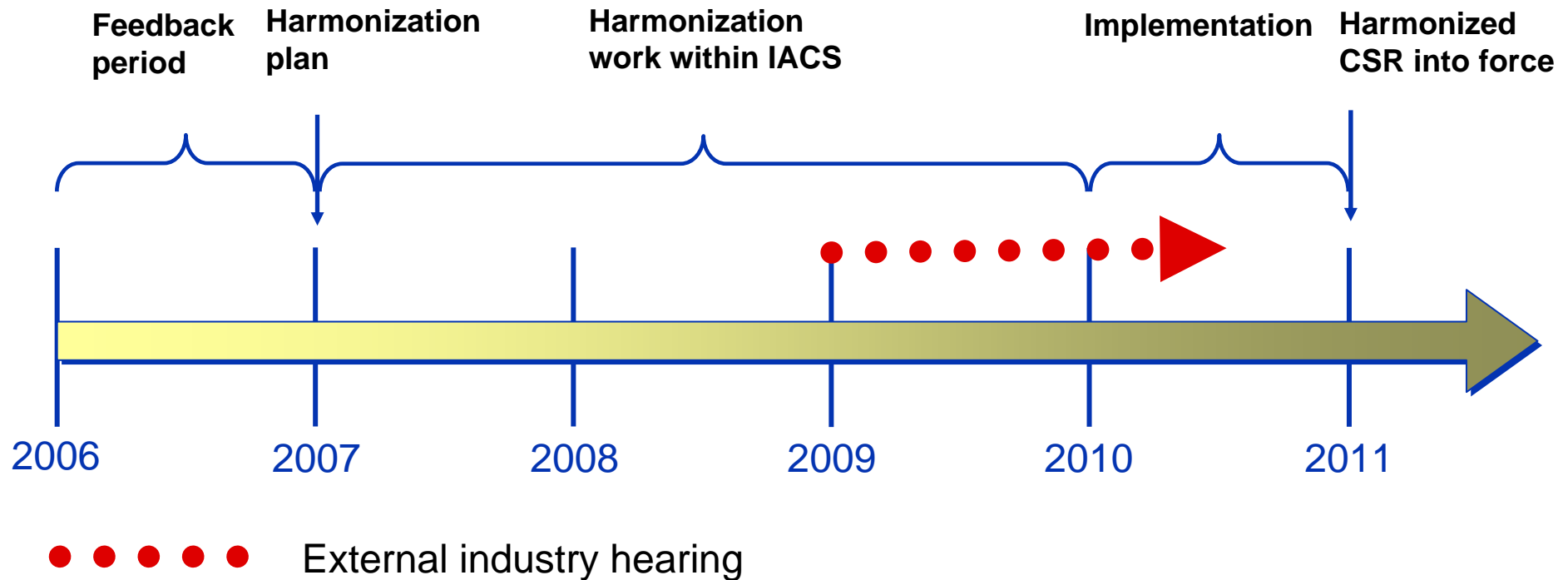
- 1st hearing (Jun ~ Dec 2004)
 - 2834 comments received during hearing period
 - 988 (35%) of which resulted in either editorial or rule change
 - 197 of which are noted for future development

- 2nd hearing (Apr ~ Sep 2005)
 - 228 comments received during hearing period
 - 76 (33%) of which will result in either editorial or rule change
 - 12 of which are noted for future development

- 2005 feedback from industry meetings with designers, shipyards and shipowner groups
 - Japan (3 visits in 2005)
 - Korea (2 visits in 2005)
 - China (1 visit in 2005)
 - Shipowner groups (2 visits in 2005)

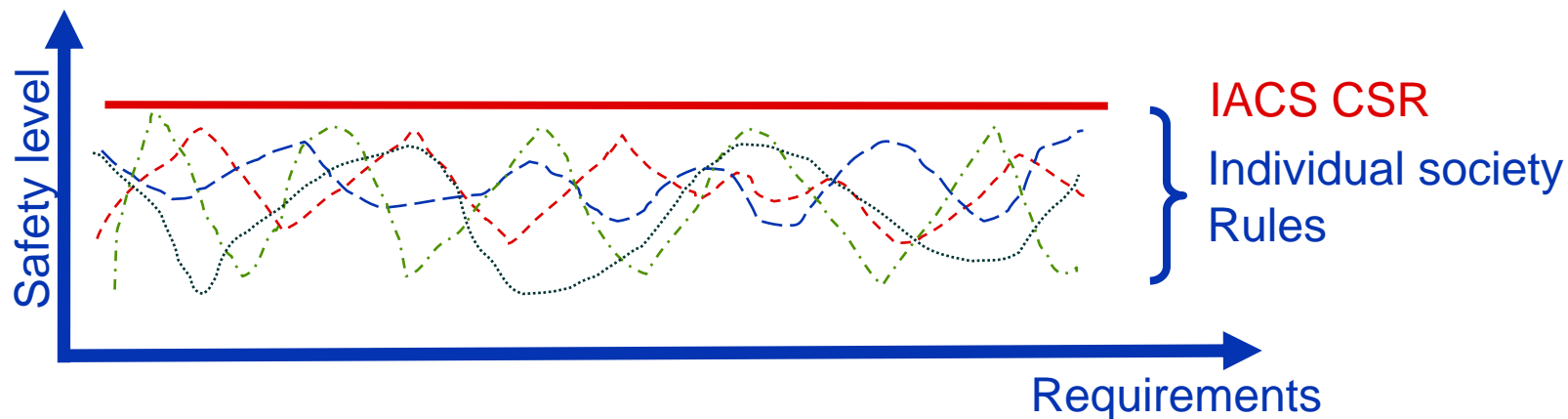
CSR – Expected way forward for IACS Common Structural Rules

■ Long term harmonization

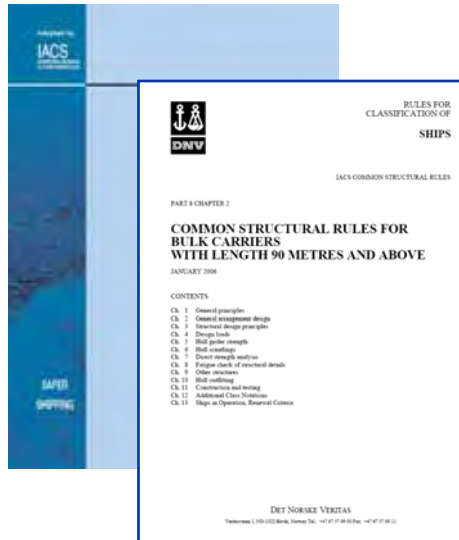


What is CSR?

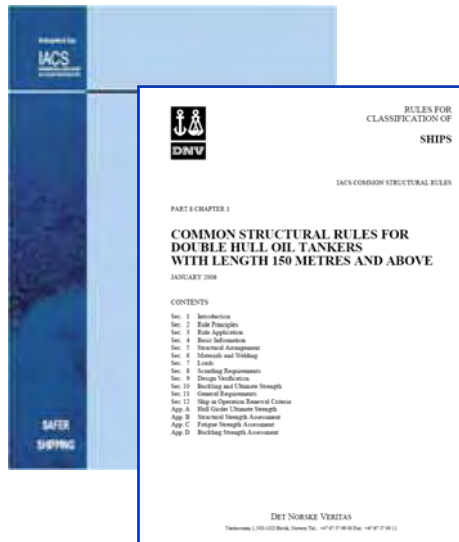
- Rules covering structural requirement for Bulk Carriers and Tankers
- A Rule set utilising state of the art computational methods for more extensive direct calculations
- Vessels built to CSR shall have overall safety of the hull structure equivalent to or better than that currently achieved by present rules
- Safety level exceeding any IACS members existing Rules.



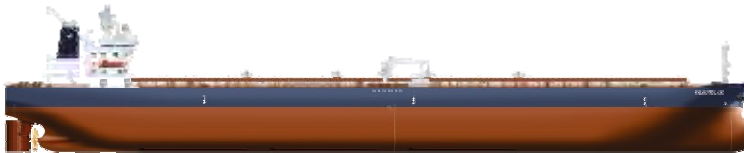
The IACS – Common Structural Rules covers



IACS Common Structural Rules for Bulk Carriers $L \geq 90\text{m}$ and above

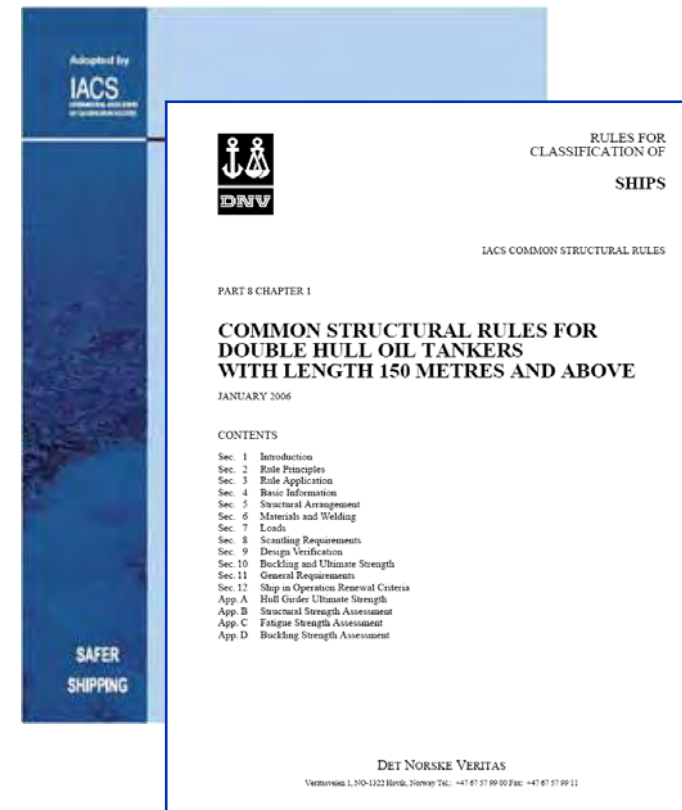


IACS Common Structural Rules for Double Hull Oil Tankers $L \geq 150\text{m}$ and above



Why CSR?

- To obtain control over the minimum safety level during the operation phase
- To eliminate competition between class societies with respect to structural requirements and standards
- To employ the combined experience and recourses of all IACS societies to develop a single standard, or set of Rules
- To ensure that a vessel meeting this new standard will be recognised by the industry as being at least as safe and robust as would have been required by any of the existing Rules



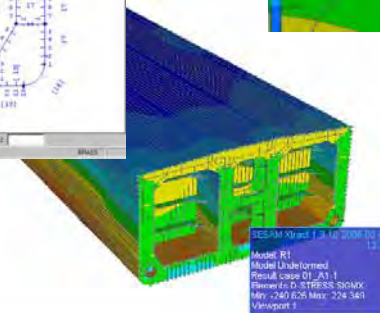
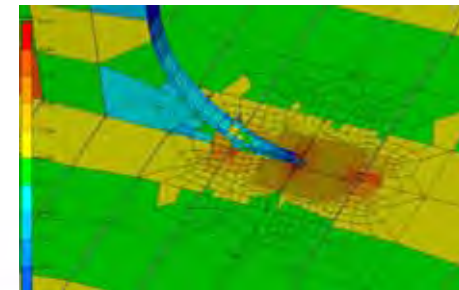
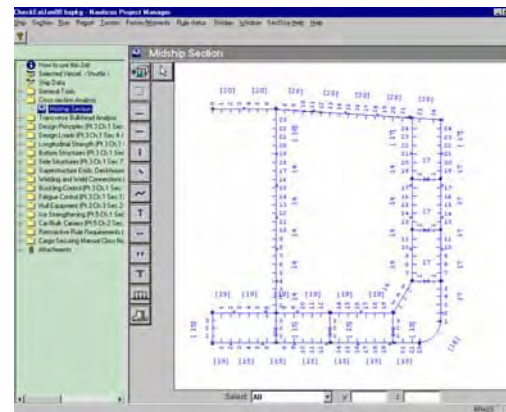
DNV's commitment to support the industry



- DNV's well established Nauticus Hull program has undergone a major upgrade to provide efficient support for the new Rules.
- An extensive training program has been implemented for all approval units enabling our staff to be well prepared to provide efficient and local support
- Offer training programs to designers and yards
- Offer assistance and design reviews for the purpose of upgrading existing designs to comply with CSR
- Offer pre contract service in general

Why software support for the new Rules is so critical

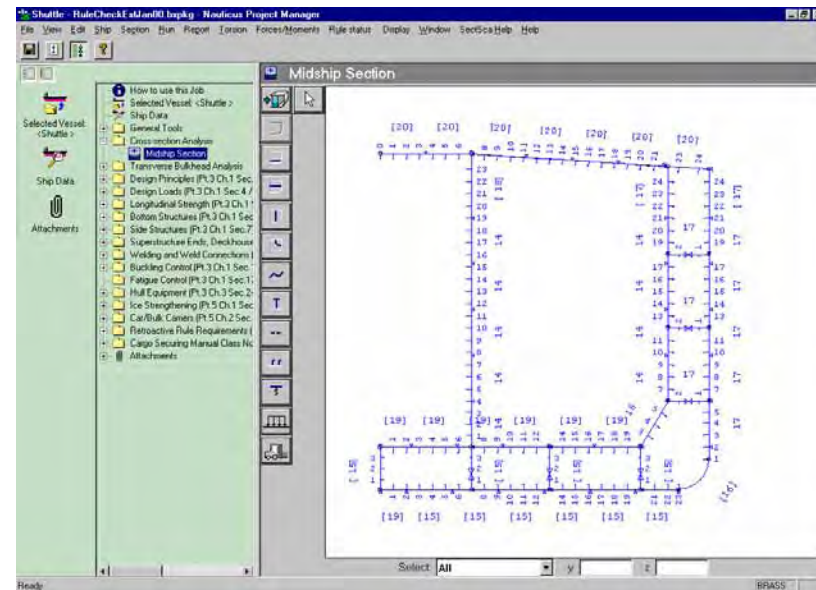
- The new rule requirements, introduce a radical shift towards more computerisation of the rule formulations and structural assessment.
- Hence, good software support is critical for any Class to provide timely and rational support to ship-owners as well as designers and shipbuilders. Efficient software contributes to ensure safe design while shortening the design time..
- In January 2006, DNV was the first Classification Society to launch complete software support for CSR for Oil tankers. During April 2006, DNV again made a new release of its Nautilus Hull software available to the industry, this time with an even wider coverage of the latest Rules updates and clarifications.



Nauticus Hull for CSR Tank – Prescriptive Rules, Rule Check

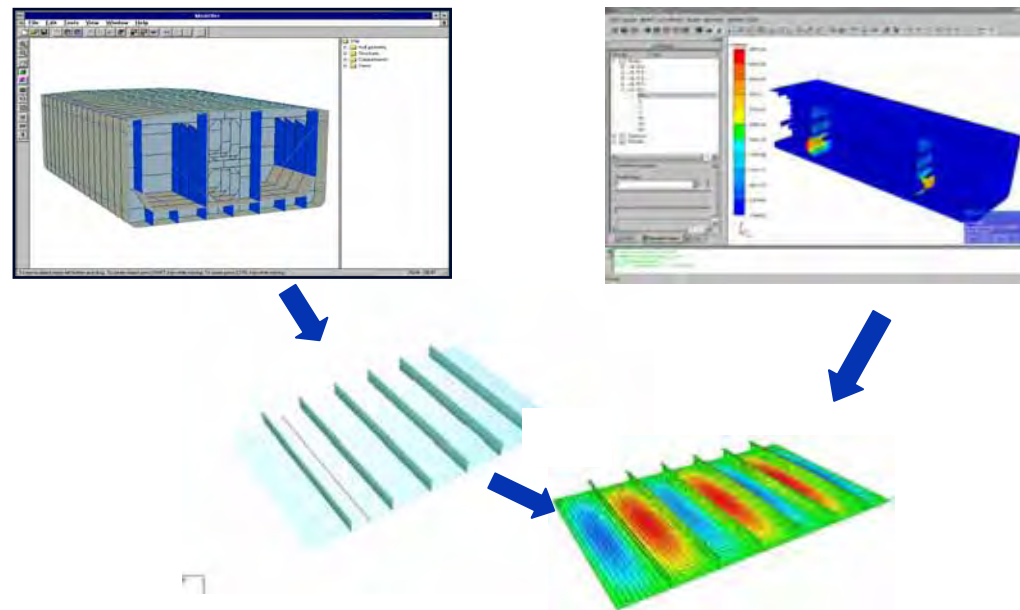


- Market-leader software Section Scantlings has been upgraded to cover CSR for Oil tankers:
 - Hull girder requirements
 - H-ULS (hull girder ultimate capacity)
 - single step
 - multistep
 - Yielding
 - Local pressures
 - Buckling
 - DIN Standard
 - Advanced buckling (PULS)
 - Minimum scantlings
 - Fatigue



Nauticus Hull CSR Bulk - Direct Strength Analysis, FEA

- The software has been developed not only focusing on cutting modeling and input time, but rather cutting the total design and approval time.
- New tools have been developed to make FE analysis more efficient through automated post-processing and code-checking, as well as generation of loads, net scantlings and boundary conditions.
- A standardised report format has been developed to ensure easy comparison between Prescriptive Rules and direct strength assessment by FEA.

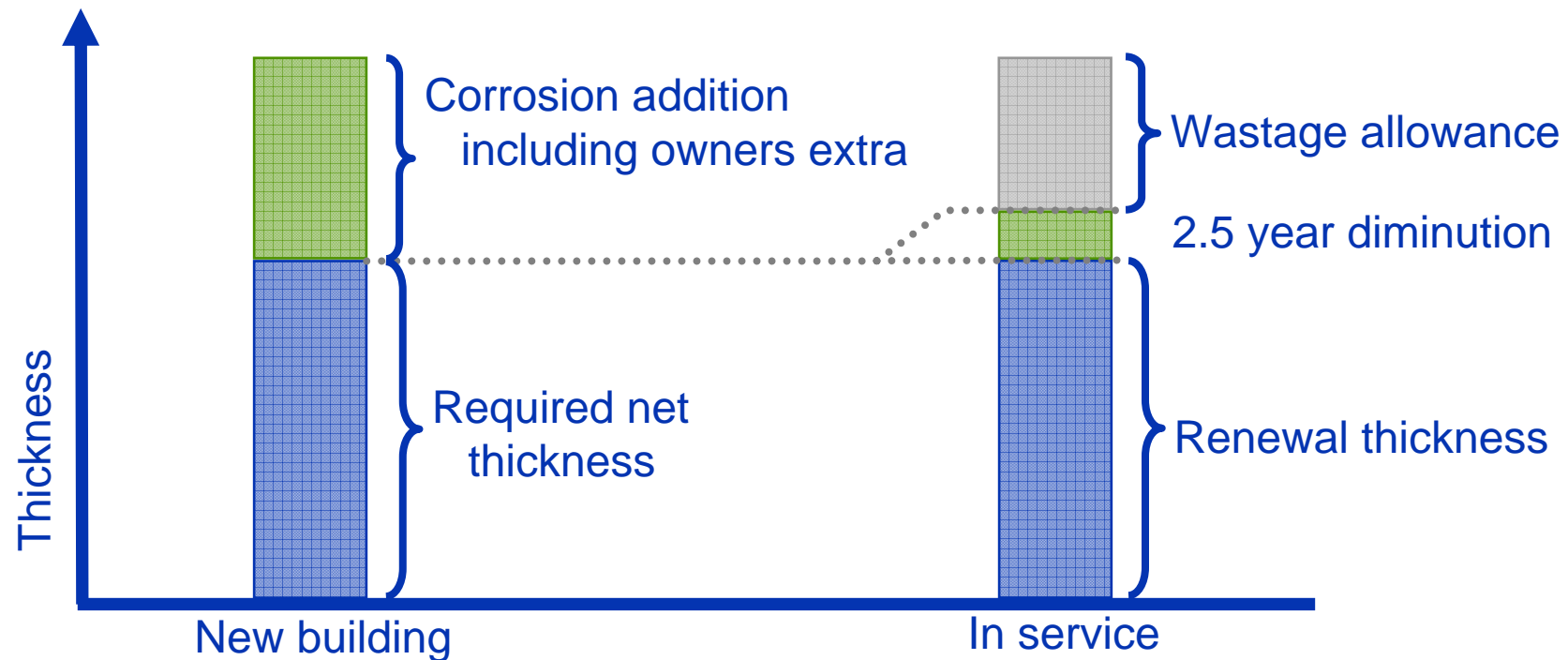


Does CSR provide any benefits to the industry?

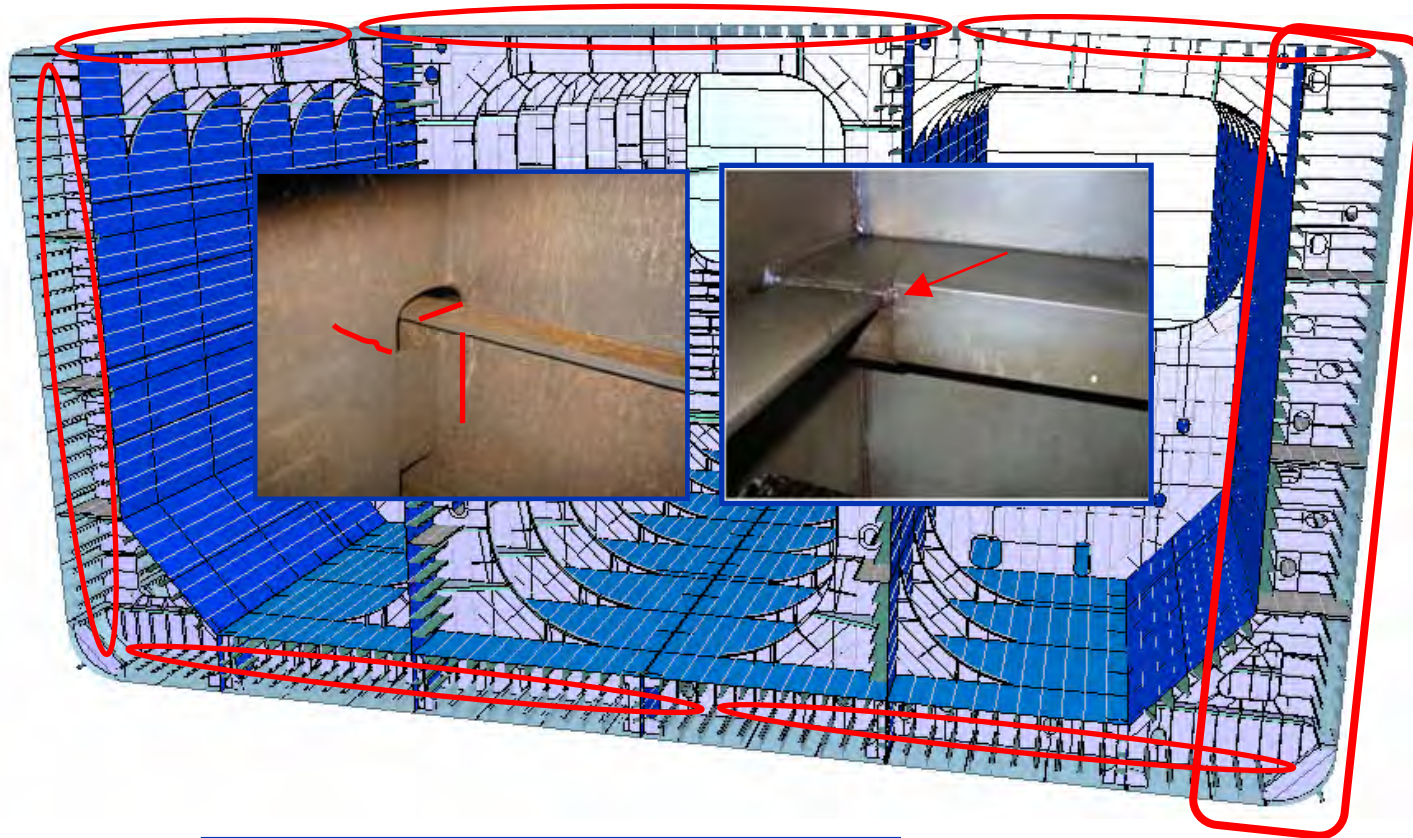
- Greater transparency of the technical background to the Rules
- All IACS societies will cooperate to maintain a single Rule set
- Competition will be focused on service level, i.e. newbuilding and SiO support
- The net scantling principle, i.e. the minimum allowable scantlings during the operational lifetime of the vessel is defined as the net scantlings for the newbuilding design
- Reduced cost for ship yards by relating to one set of structural Rules only
- The intention of the new Rules is to encourage the design and construction of robust tankers and bulk carriers and to eliminate competition on scantlings
- The minimum fatigue design life is set to 25 year North Atlantic environment.
- The corrosion additions that have been established takes into account the location and the environment to which the structural member's surface is subjected
- Stringent and clarified requirements to critical areas

Net scantling approach

- Net scantling to be maintained through the ship life
- Corrosion addition corresponding to the corrosive environment added on top of the net thickness
- Renewal thickness to be identified on drawings at newbuilding stage

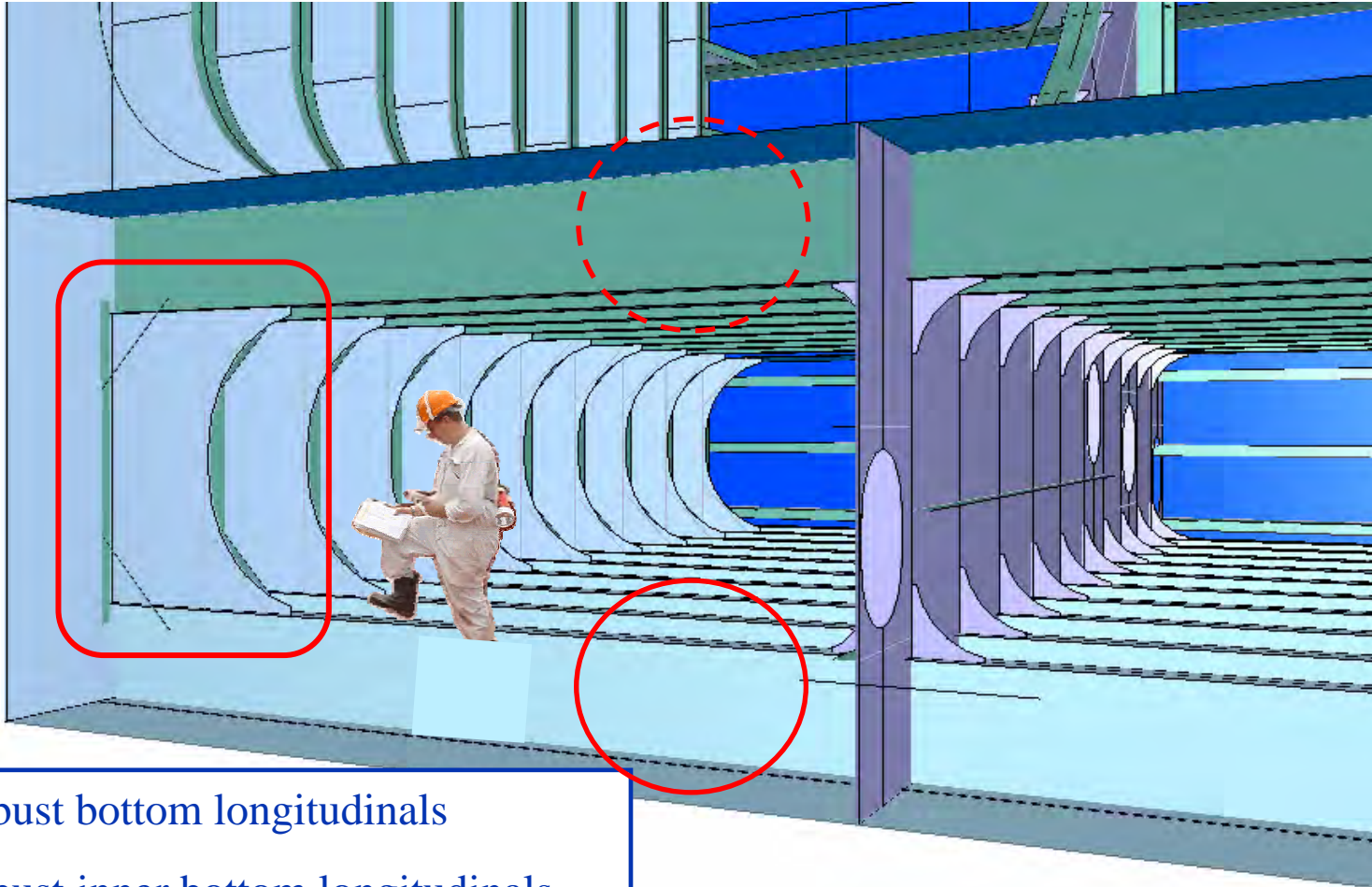


Critical areas – Stringent and clarified requirements



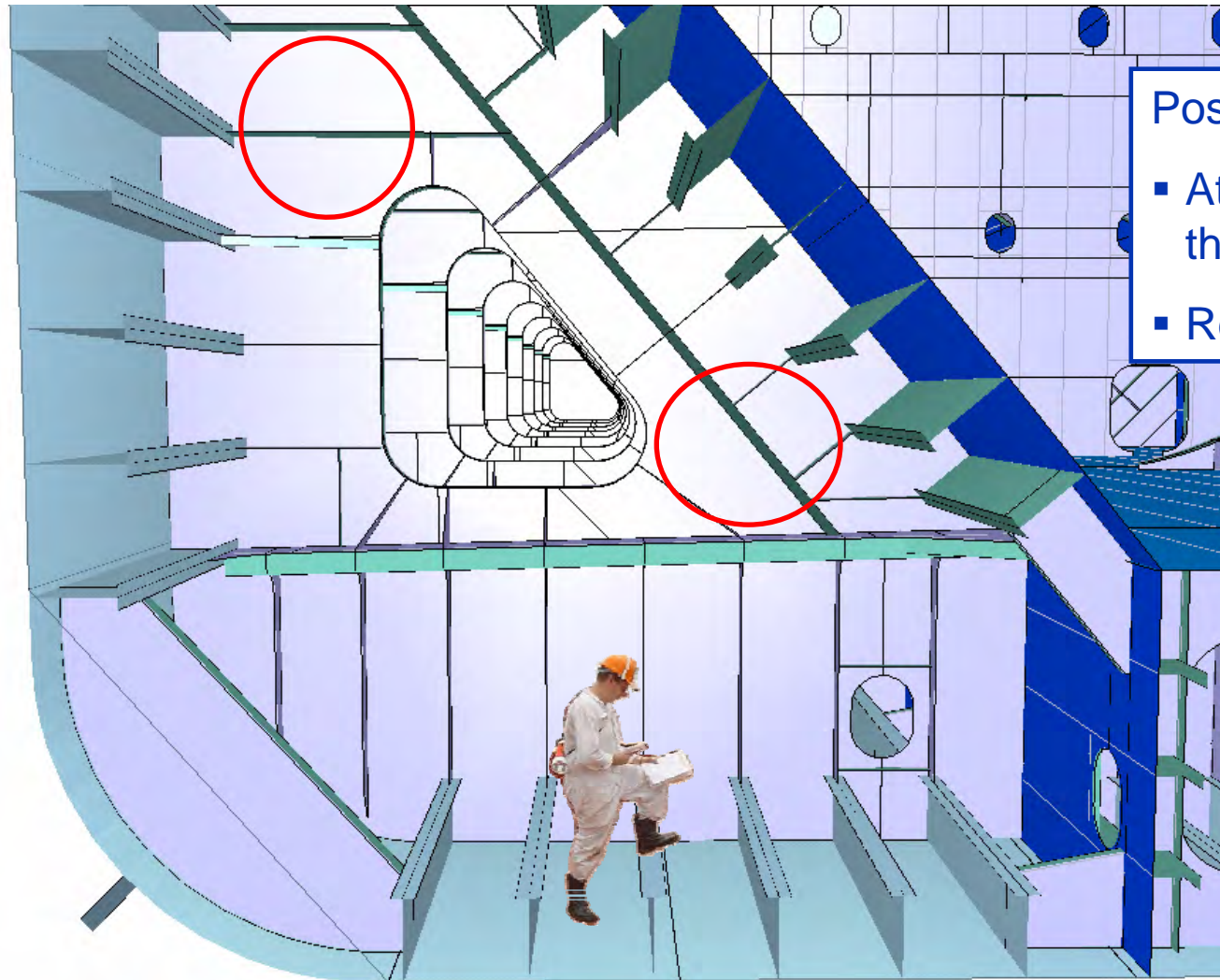
- Robust web frames
- Robust longitudinals
- Specific requirements to end connection areas

Critical areas – Stringent and clarified requirements



- Robust bottom longitudinals
- Robust inner bottom longitudinals
- Brackets at transverse bhds.

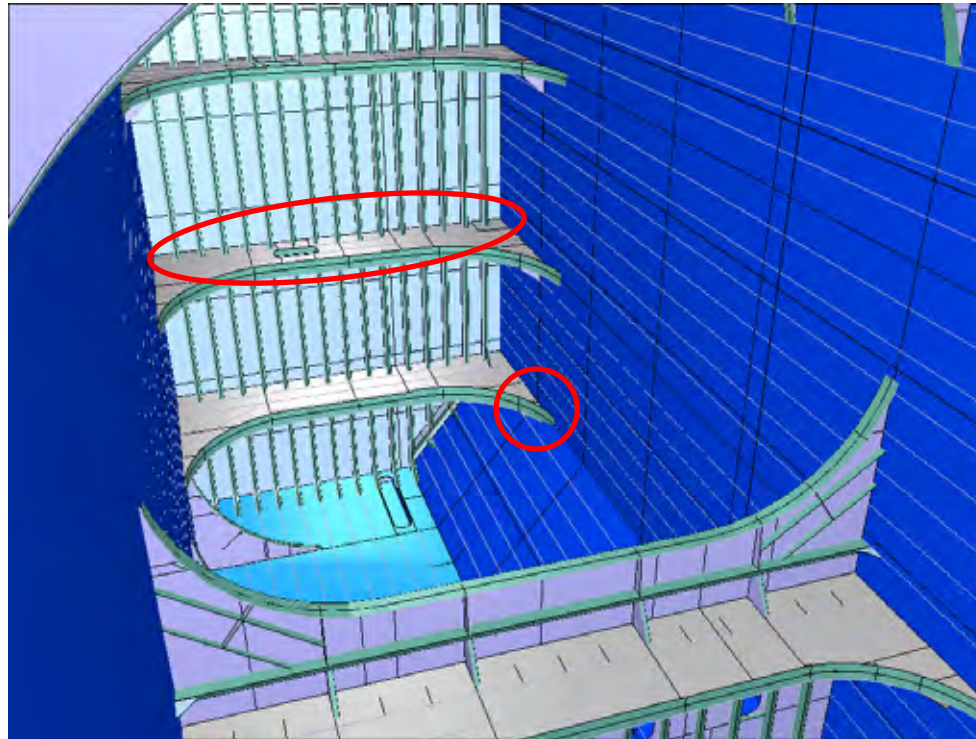
Critical areas – Stringent and clarified requirements



Possible

- Attention to web thickness
- Re-arranged stiffening

Critical areas – Stringent and clarified requirements

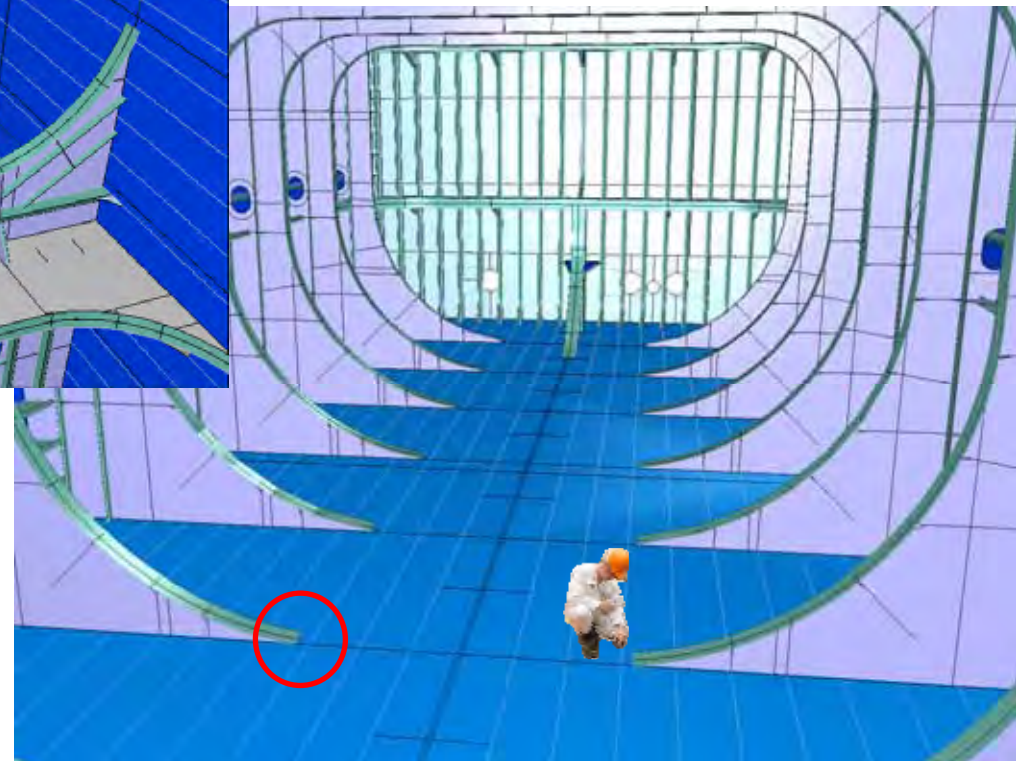


Flange terminations

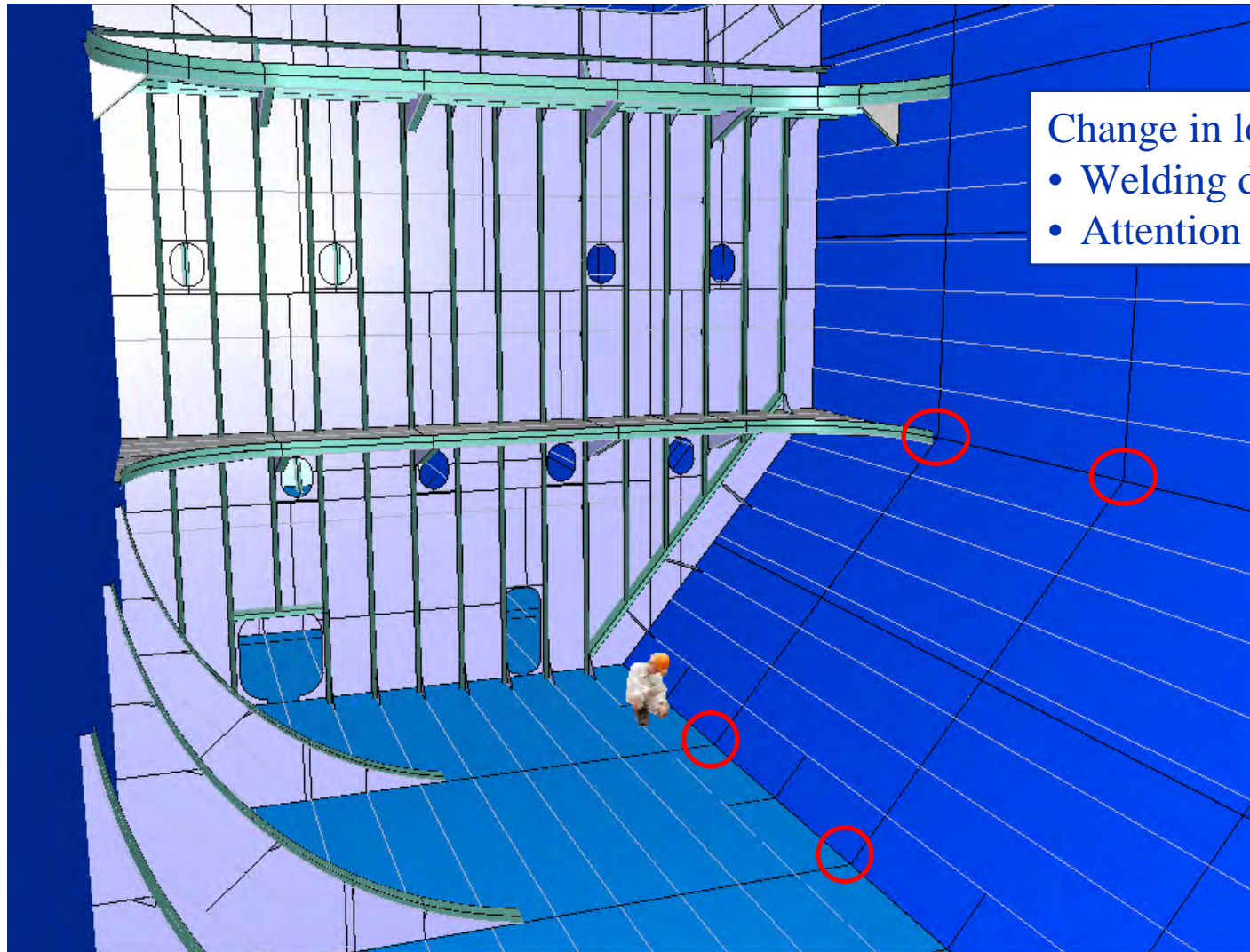
- Nice tapering and not too steep angle
- Stringer toe most critical

Stringer heel

- Normally require back brackets



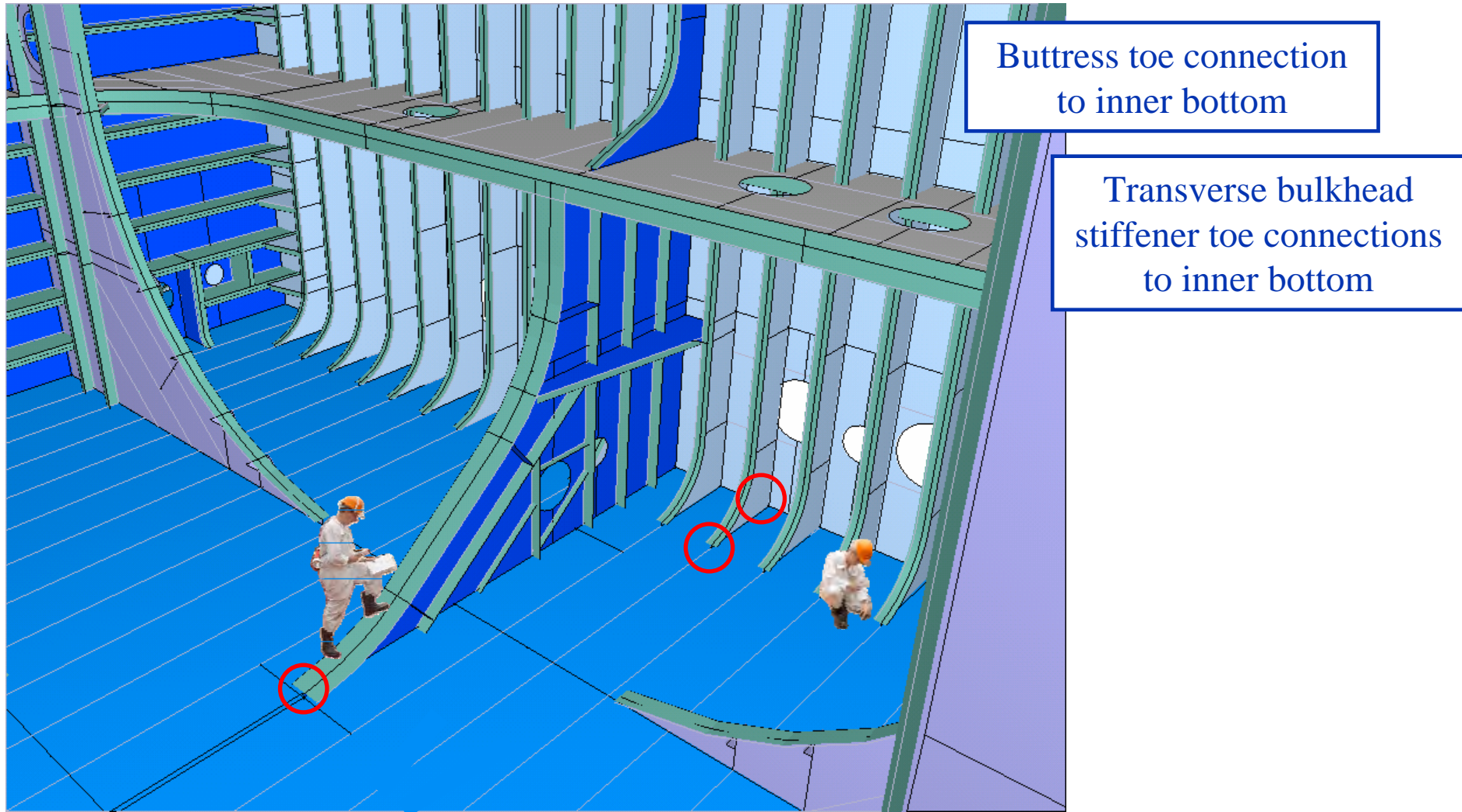
Critical areas – Stringent and clarified requirements



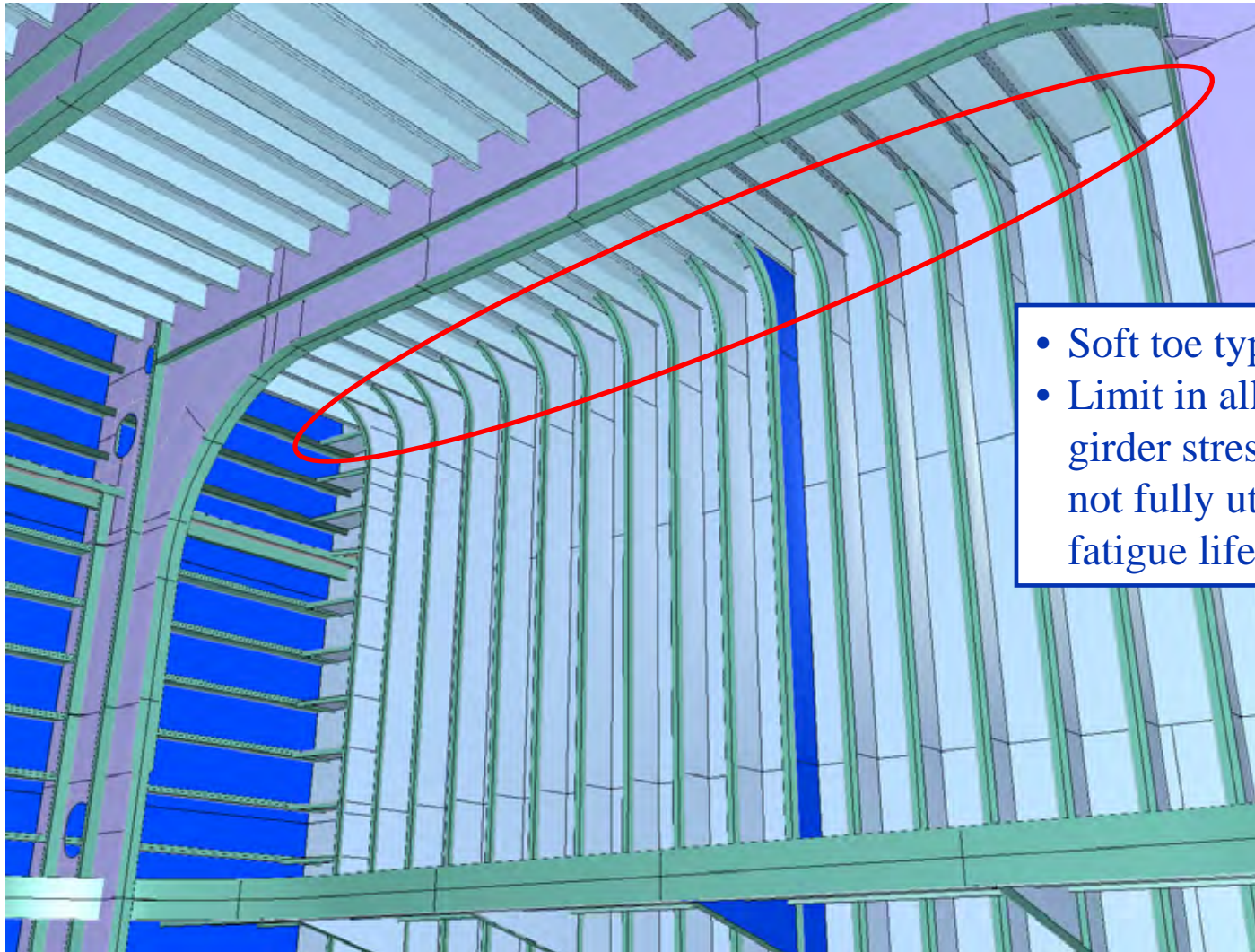
Change in local design

- Welding details and size
- Attention to plating thickness

Critical areas – Stringent and clarified requirements

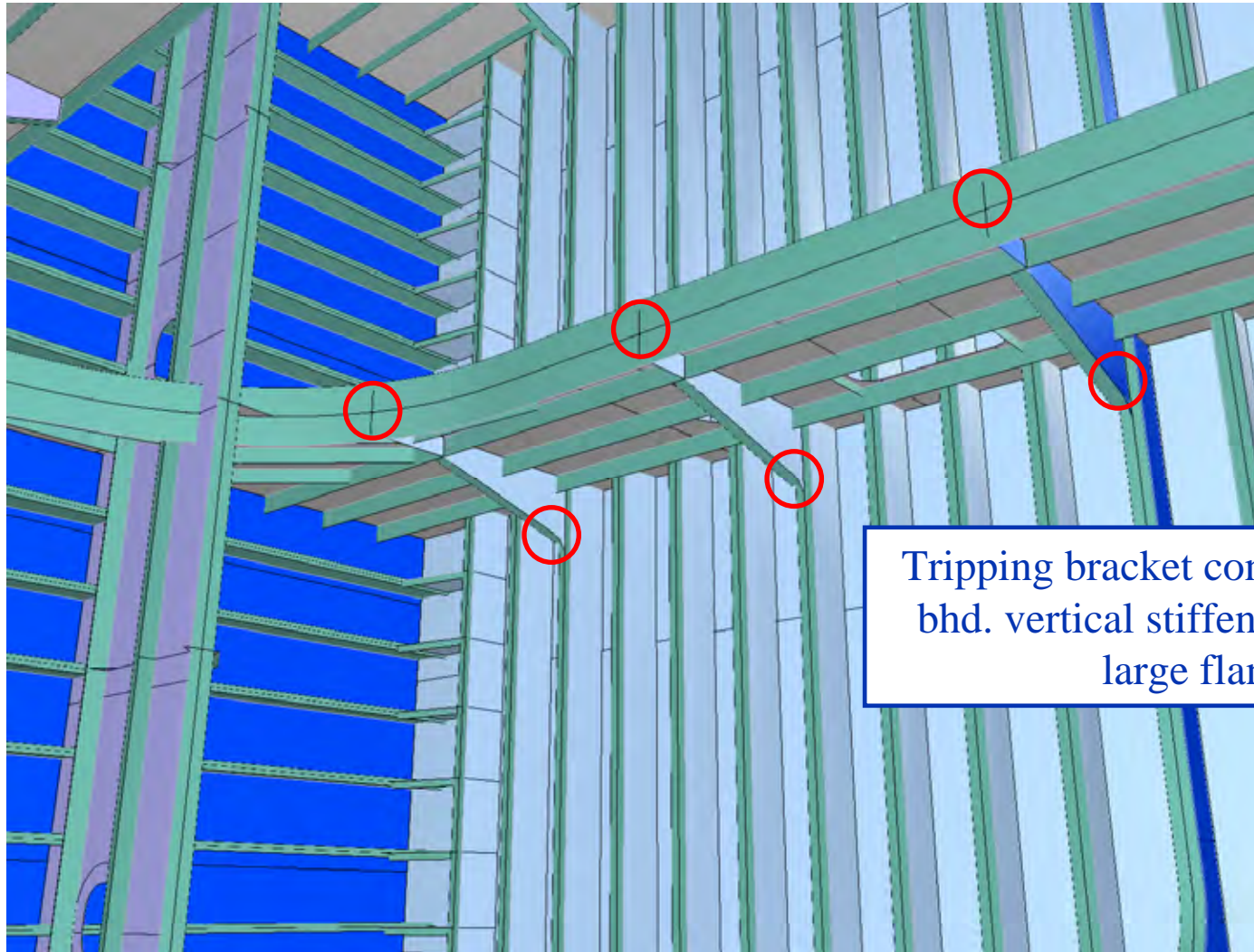


Critical areas – Stringent and clarified requirements



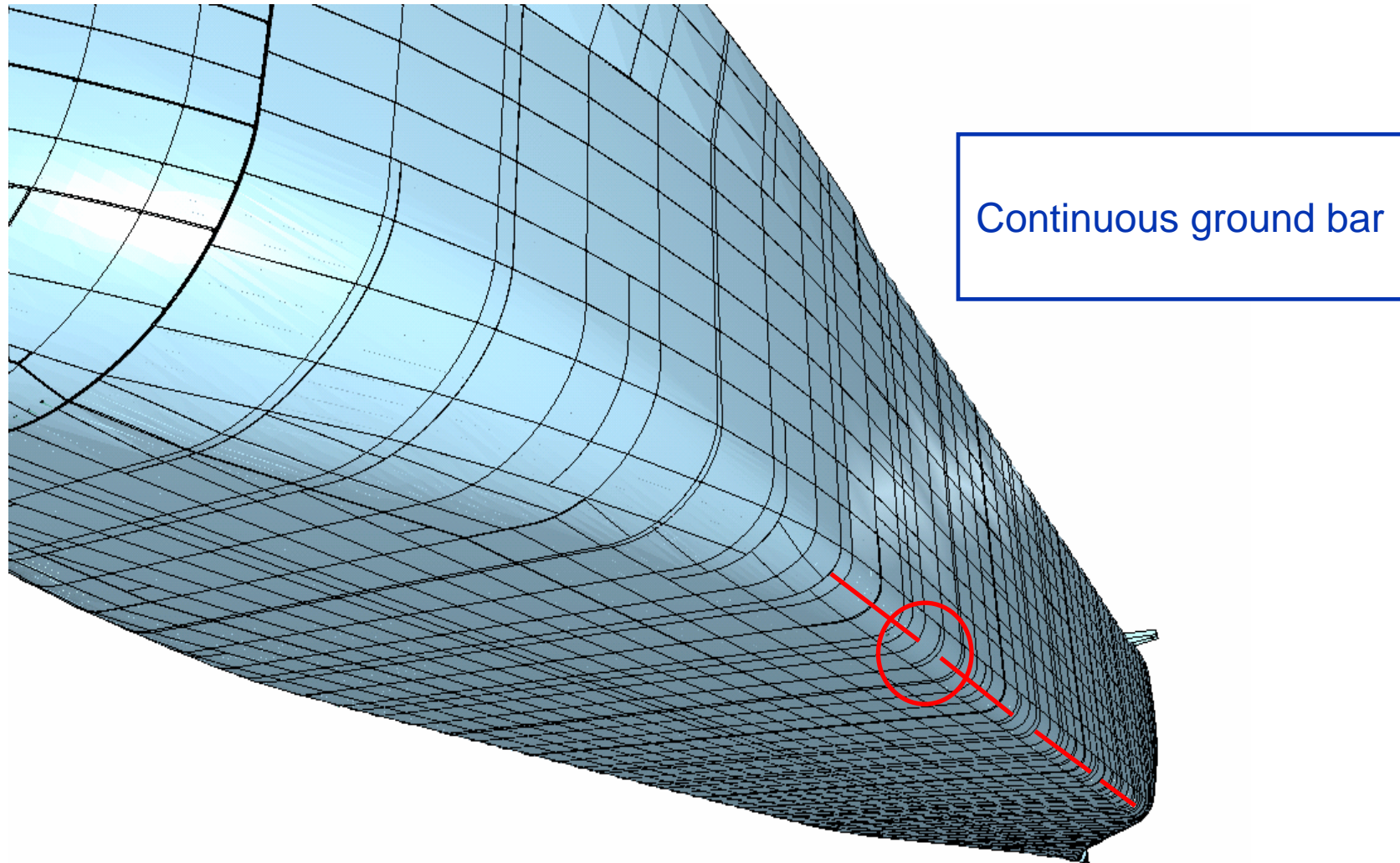
- Soft toe type
- Limit in allowable hull girder stress - i.e. AH36 not fully utilized due to fatigue life.

Critical areas – Stringent and clarified requirements

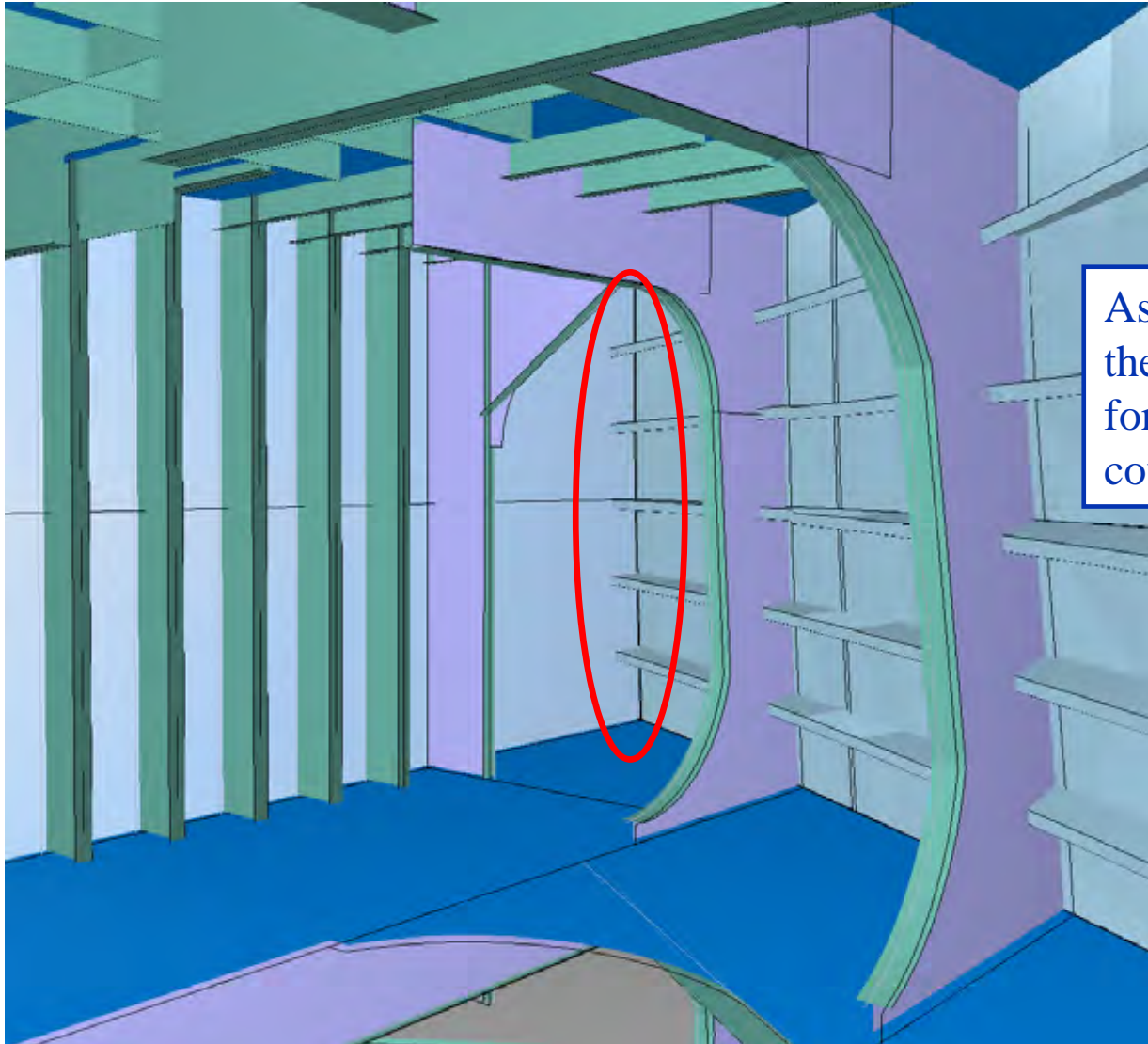


Tripping bracket connections to trv.
bhd. vertical stiffeners and curved
large flanges

Critical areas – Stringent and clarified requirements

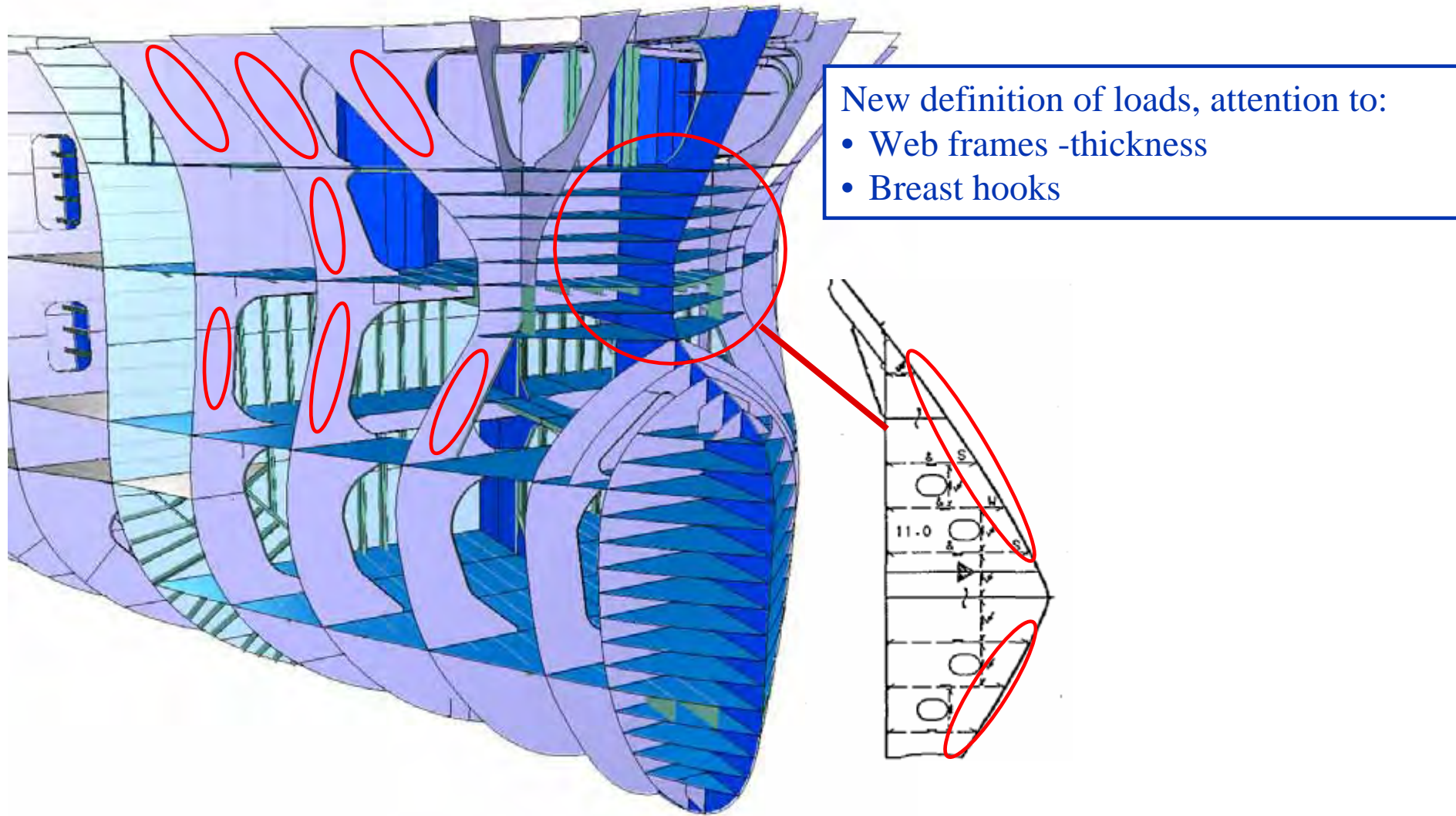


Critical areas – Stringent and clarified requirements



Assessment for fatigue aft of the collision bulkhead, but forward of bulkhead is not covered.

Critical areas – Stringent and clarified requirements



CSR Tank - Application

- DNV Rules issued January 2006 and into force April 2006
- New Part 8, Chapter 1
- The additional class notation CSR will be mandatory
- Nauticus(Newbuilding) will not be given

Oil Tankers

- Tanker for Oil ESP
- Tanker for Oil Product ESP
- Tanker for Chemicals also intended for carrying oil
- Above 150 m



Design Basis

- Design Life – 25 years
- External Environment
 - North Atlantic wave environment
 - Air temperature : -15 degree C
 - Sea temperature: 0 degree C
- Internal Environment
 - Specified gravity cargo: Min 1025 kg/m³ (900)
 - Specified gravity ballast: 1025 kg/m³
 - Max cargo temperature: 80 degree C
 - Min cargo temperature: 0 degree C
 - Corrosion margins based on 25 years design life



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