

MARITIME SAFETY COMMITTEE  
102nd session  
Agenda item 7

MSC 102/INF.20  
10 March 2020  
ENGLISH ONLY  
Pre-session public release:

## GOAL-BASED NEW SHIP CONSTRUCTION STANDARDS

### Status report addressing GBS audit observations common to IACS members

Submitted by IACS

#### SUMMARY

*Executive summary:* This document provides the updated status report of the work undertaken to address the IACS "common" observations as of 29 February 2020

*Strategic direction, if applicable:* Other work

*Output:* OW 7

*Action to be taken:* Paragraph 4

*Related documents:* MSC 102/INF.15; MSC 101/24, MSC 101/INF.13; MSC 100/20, MSC 100/6/5, MSC 100/6/10; MSC 99/22, MSC 99/INF.19; MSC 98/23, MSC 98/INF.7, MSC 98/INF.12, MSC 98/INF.14; MSC 96/5, MSC 96/5/1, MSC 96/5/1/Add.1 and MSC 96/5/9

#### Background

1 The Maritime Safety Committee (MSC), at its 101st session, having received the information contained in document MSC 101/INF.13, noted that IACS and its member societies would provide an update to MSC 102 on the progress made regarding their GBS audit observations.

#### Updated reports on the status as of 29 February 2020

2 IACS has prepared updated reports on the status of the work to address the "common" observations of both the initial verification and the first maintenance verification. These updated reports are provided in the annex and related to the work in progress. The latest updated status is indicated in "grey shading" to highlight all modifications.

3 The GBS status report in the annex includes only observations that have not been addressed in earlier reports to the Committee, as contained in previous information documents, i.e. MSC 98/INF.12, MSC 99/INF.19 and MSC 101/INF.13.

**Action requested of the Committee**

4 The Committee is invited to note the information provided.

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**ANNEX**

**STATUS REPORT ADDRESSING OBSERVATION**

<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/02</b></p>
<p><b>Corrective Action Plan:</b> Annex 2 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 8 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>Modern data show both an increase in mean significant wave height for the North Atlantic and that more extreme weather is being experienced in recent years, including the existence of rogue waves and the possible effect of climate change. However, IACS Rec. No.34 that is based on old wave statistics was last revised in 2000/2001 and there is no evidence of monitoring since its adoption. While the TB report notes that significant discrepancies are observed between predictions by different databases, no studies have been submitted to show how new data have been assessed to conclude that none of the new databases could be used, nor has any sensitivity study been provided to assess the potential effect of the new data on motions and loads.</p> <p style="text-align: center;">[paragraphs omitted]</p> <p>The audit has not found sufficient justification that the wave data used in the rules properly represent North Atlantic conditions.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"> <li>1. Periodical reviewing the available information on published or commercially available new wave data.</li> <li>2. Updating the mathematical model and Technical Background Report using the information on new wave data when reliable data are available.</li> <li>3. Updating the information contained in Rec. 34 on probabilities of occurrence of the sea states (scatter diagram) in the North Atlantic when reliable and accepted data are available.</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Detailed plan to periodically review available wave data, taking into consideration weather routing as required.  The plan to determine how Rec. 34 can be updated and identification of the source(s) of necessary reliable wave data were completed in January 2018.</li> <li>2) Revised IACS Rec. 34.  A dedicated project team (PT) is working on the subject up to 2021.</li> </ol> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/03</b>
<b>Corrective Action Plan:</b> Annex 3 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 10 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>The expression of "special consideration" is not consistent with the requirement of "providing guidance for assessment" which is requested in the audit standard 2.2.3.</p> <p>[paragraphs omitted]</p> <p>In reply to this observation, IACS has explained: 'The text "special considerations" has existed in the rules of classification societies for a long time to cover cases of innovative design character which otherwise would not be allowed. The proposed design solutions are specially considered by selected experts of the classification society using fundamental, well established, engineering principles and then accepted by the governing/technical bodies of the society.'</p> <p>Even if this answer may well reflect the reality, the audit has not found any auditable common procedures providing guidelines for assessment when design parameters are outside the range or evidence to support IACS self-assessment in this regard.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1. Development of an IACS common procedure that provides:<ol style="list-style-type: none"><li>a) criteria for selection of the experts and accepting technical body within the individual classification society;</li><li>b) recommendations for fundamental engineering principles for direct determination of the life-time ship motions and loads in waves;</li><li>c) criteria for acceptance of the approach to determine the life-time extreme ship motions and loads in waves and the results obtained;</li></ol>when design parameters are outside the range specified by the Rules.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) IACS common procedure providing general principles for determining the life-time extreme ship motions and loads in waves when design parameters are outside of the range specified by the Rules.<p>"Guidelines for the special considerations to be used in developing ship motions and loads when ship size or design life deviates from design basis determined in CSR" was approved and uploaded to the IACS member space of IACS website in April 2018. The approved guidelines are in the process of being implemented by the individual IACS members as per their individual rule processes.</p></li><li>2) Rule Change and/or revised Technical Background document as considered necessary.<p>There will be no IACS Rule Change etc.</p></li></ol> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/04</b>
<b>Corrective Action Plan:</b> Annex 4 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 11 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report– part only)</p> <p>No benchmarking of reference values (values obtained by direct analysis) with experimental or service data has been found, as requested by the GBS audit standard 2.2.4.</p> <p>IACS replied on 6 November 2014 that: "current CSR-OT and CSR-BC have been developed based on experiences from successful operation of ships and have been modified based on feedback from operational experience. This indicates current CSR-OT and CSR-BC already comprise service history data." However, the successful operation and operational experience referred to has not been reported as evidence of benchmarking to the audit.</p> <p style="text-align: center;">[paragraphs omitted]</p> <p>However, upon a direct question at the last meeting with IACS 7 May 2015, IACS could not provide evidence that procedures for a systematic collection of data to benchmark CSR-H are in place.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1. Development of a procedure for collection of experimental and service history data to benchmark CSR requirements.</li><li>2. Validation and benchmarking of a method for determining the life-time ship motions and loads based on available experimental and service history data.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) IACS common procedure for the systematic collection of data to benchmark CSR requirements.</li></ol> <p>IACS decided to hold the discussion on a common procedure for collection of experimental and service history data to benchmark design loads in the CSR until the on-going work related to IACS/2015/FR1-8/OB/02 is completed.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/05</b>
<b>Corrective Action Plan:</b> Annex 5 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 15 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>While the solvers in all FE software are basically identical if linear analyses are considered, this is not the case for pre- and post-processing software as implementation of models and assessment of computed results can be carried out by applying different strategies.</p> <p>In IACS reply to questions raised about consistency of results provided by different software it was explained that "A so-called 'cross check' test was performed. IACS classifications societies independently performed FEA analyses required by CSR-H (for the same ship), using their own computer programs and obtained quite similar results. Models and results generated by different class members were checked and verified by IACS HPT 10. It is ensured that consistent results were obtained (see information in CA- Summary Report).'</p> <p style="text-align: center;">[paragraphs omitted.]</p> <p>However, no formal procedures describing the scope, methodology or acceptance criteria for such regular cross checks have been submitted.</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"><li>1. Updating the TB Report, "Consequence Assessment (CA) – Summary Report" clarifying the methodology for cross checking.<ol style="list-style-type: none"><li>a) Reviewing and assessing the data, summarizing the scope, methodology and acceptance criteria for cross checks by IACS.</li></ol></li><li>2. Prepare a procedure for periodic cross checking.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Updated CA Report.</li><li>2) A procedure for cross checking.<p>"Instruction for carrying out software cross check for Common Structural Rules" was approved in March 2018.</p></li></ol> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

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<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/06</b></p>
<p><b>Corrective Action Plan:</b> Annex 6 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 17 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report - part only)</p> <p>These three criteria have not been supported by explicit justification.</p> <p style="text-align: center;">[paragraphs omitted]</p> <p>The reference to CSR-OT and its background description, together with the very general reference to calibration against existing vessels cannot be considered sufficient justification of the acceptable limits of yielding and buckling. It is therefore not possible to verify that the limits of yielding, buckling and ultimate strength set at levels that will maintain the structural integrity, as required by the audit standard.</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"> <li>1. Individual class societies advise pre-CSR or other history of allowable stresses for global and fine mesh finite element stress analyses.             <ol style="list-style-type: none"> <li>a) Include mesh size vs. allowable stress.</li> <li>b) Document background/justification if available.</li> <li>c) Report on experience of those vessels to which the allowable stresses were applied (include all vessel types)</li> </ol> </li> <li>2. Provide example of analysis results using the allowable stress for an existing vessel and show how that vessel did not experience damage in its service history. (Note, this is an example and not 'absolute proof' of the allowable limits.)</li> <li>3. Reference existing studies, papers, codes or best practices regarding acceptable limits that are greater than yield stress</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Report of the study that addressed issues raised in the audit report. An IACS explanatory paper, including a summary of the pre-CSR rules of IACS members and reference to associated TB report, will be finalized in 2019.</li> <li>2) Updated TB Report and/or Rule Change as considered necessary. There will be no TB Report and/or Rule Change.</li> </ol> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/08</b>
<b>Corrective Action Plan:</b> Annex 8 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 20 of MSC 96/5
<b>Observation</b> (extract from the audit report – part only) Statement of facts CSR-H Pt 1 Ch 10 Sec 2 [3.1.1] requires that "Main engines and thrust bearings are to be effectively secured to the hull structure by foundations of strength that is sufficient to resist the various gravitational, thrust, torque, dynamic, and vibratory forces which may be imposed on them." <p style="text-align: center;">[paragraphs omitted]</p> Neither the rule text nor the justification seem to provide full explanation of how the CSR-H consider the vibration levels that may damage or impair the ship structure, equipment or machinery according to GBS audit standards 3.2.1.11 and 3.3.10. In reply to this finding, IACS has further explained: ' <i>During testing (sea trials) vibration levels will usually be considered and strengthening or other rectification will be required by the surveyor in cases where high vibration levels are identified.</i> ' However, no references have been given to such requirements in the rules and no guidelines for surveyors on acceptable corrective measures have been submitted to the audit. <b>Detailed Action Plan:</b> <ol style="list-style-type: none"><li>1. Consider possible options for more prescriptive guidance or requirements for structure supporting machinery to determine what is effective and practical. Options will need to consider the variation in support requirements for different types of machinery. Further consider the observation holistically, taking into account the recommendations made by the audit teams together with MSC 96/5/9, paragraph 6.</li><li>2. Consider the development of IACS Guidelines for Surveyors on acceptable corrective measures for vibration. Such guidelines will be written in order to address the need as suggested in the audit, and include:<ol style="list-style-type: none"><li>a) Locations to check</li><li>b) Corrective measures (local reinforcement, vibration analysis, dampers, change excitation frequency, etc.)</li></ol></li></ol> <b>Deliverables</b> <ol style="list-style-type: none"><li>1) Report of the study that addressed issues raised in the audit report.</li><li>2) IACS Guidelines, if considered to be necessary.<p>IACS is updating the first draft of "Guidelines for the Identification of Vibration Issues and Recommended Remedial Measures on Ships".</p></li></ol> <b>Timescales</b> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	



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<p><b>Corrective Action Plan:</b> Annex 9 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 23 of MSC 96/5</p>
<p><b>Observation</b> (extract from the audit report – part copy)</p> <p>While the CA methodology is recognized as the traditional way class rules have been developed (sequentially) from service history, it is not fully in line with the provisions of the audit standard and the concept of benchmarking, which means metrics showing how goals are achieved. The CA shows the general outcome of a combined rule application and cannot be considered equally effective in identifying any shortcomings or improvements in rules' performance.</p> <p style="text-align: center;">[paragraphs omitted]</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"> <li>1. Collate service history of pre-CSR vessels.</li> <li>2. Provide examples of stress analysis results for existing vessels and show how that vessel did not experience damage during service.</li> <li>3. Demonstrate that although pre-CSR vessels were not explicitly checked for ultimate strength, in-service experience is satisfactory.             <ol style="list-style-type: none"> <li>a) Show how the hull girder ultimate strength methodology is sufficiently robust for pre-CSR vessels.</li> <li>b) Worked example of the hull girder ultimate strength methodology to a known hull girder ultimate strength failure.</li> <li>c) Document worked example of non-linear FE hull girder ultimate strength analysis against the CSR BC &amp; OT ultimate bending capacity methodology.</li> </ol> </li> <li>4. Service performance will be monitored for any occurrence of hull girder failure and any occurrence will be investigated, giving due consideration to update to the rules, where necessary.</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Report of study that address issues raised in the audit report. IACS completed the study on the issues raised in the audit report and included the report of this study in IACS explanatory paper finalised in 2019.</li> </ol> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

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<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/10</b>
<b>Corrective Action Plan:</b> Annex 10 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 25 of MSC 96/5
<b>Observation</b> (extract from the audit report – part only) <p style="text-align: center;">[paragraphs omitted]</p> <p>Limit standards for fabrication, fairness, alignment, welding, etc. are closely linked with the structural safety level adopted in the rules. Although rules allow alternative standards, no guidance or criteria have been found for keeping the same safety level when accepting alternative standards.</p> <p>In a reply to the teams' early comments on this issue 6 November 2014, IACS replied: '<i>One should assume that other standards force shipbuilders to apply measures of ship construction accuracy not lesser than those defined in IACS Rec.47. Maintenance Team will be asked to reconsider wording of [5.1.2].</i>' In a later reply to the interim report on 14 March 2015 this was changed to: '<i>The acceptance of another standard as an alternative to IACS Rec. 47 is left up to the individual Class Societies with IACS Rec. 47 as a reference document.</i>'</p> <p>However, neither of these interpretations '<i>not lesser than those defined in IACS Rec.47</i>' or '<i>with IACS Rec. 47 as a reference document.</i>' provide enough evidence to support IACS self-assessment about compliance with this audit standard since equivalence criteria have not been established in CSR-H and the consideration of this recommendation by the individual Class Societies cannot be predicted.</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"><li>1. Consider the development of an IACS Guideline for acceptance of other recognized standards<ol style="list-style-type: none"><li>a) Identify accepted recognized standards in order to develop, document and verify equivalency</li><li>b) Develop a procedure for accepting other standards</li><li>c) Develop acceptance criteria for accepting other standards</li></ol></li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Report of the study that addressed issues raised in the audit report.</li><li>2) IACS Guidelines, or updates to Recommendations as considered necessary.</li></ol> <p>IACS completed the study on the issues raised in the audit report and included the report of this study in IACS explanatory paper. In addition, IACS decided to revise UR Z23. The draft of Rev.7 of UR Z23 was completed and is now under review for approval and publication.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

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<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/11</b>
<b>Corrective Action Plan:</b> Annex 11 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 26 of MSC 96/5
<p><b>Observation</b> (extract from the audit report – part only)</p> <p>[paragraphs omitted]</p> <p>Functional requirement 3.3.9 necessitates that the tapering of primary structures, including transitions fore and aft of the cargo block, are defined in sufficient detail in the rules.</p> <p>Unlike pre-CSR rules of major IACS Class Societies, CSR-H's requirements for structural continuity in Pt 1, Ch 3, Sec 6, [2.1] are high level goal-based statements and as such cannot be considered as meeting the criterion of the audit standard 3.3.9.1 while 3.3.9.2 was considered not fulfilled because guidance on how to model transition zones in the direct calculations was found insufficient.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1. Review previous discussions on this topic in the IACS Knowledge Centre as it has been raised previously.</li><li>2. Assemble individual Class Societies pre-CSR Rules, IACS Rec. 76 and Rec. 96 as related to the fore/aft transitions and consider during development of the corrective action.</li><li>3. Develop updates to the TB and/or draft RCP as considered necessary.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Report of the study that address the issues raised in the audit report.</li><li>2) Updated TB Rule Reference or possible rule change, as considered necessary</li></ol> <p>IACS completed the study on the issues raised in the audit report and included the report of this study in IACS explanatory paper finalised in 2019. The explanatory paper includes a table which lists the rule paragraphs in the CSR on structural continuity and the existence of similar provisions in the existing pre-CSR rules of IACS members etc.</p> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/12</b>
<b>Corrective Action Plan:</b> Annex 12 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 27 of MSC 96/5
<b>Observation</b> (extracted from the audit report - part only) <p>The discharge of bulk carriers with class notation BC-A &amp; BC-B invariably necessitates the use of bulldozers, which frequently cause damage to the plating and welds in the vicinity of the bottom of the hold. Still Pt 2, Ch 1 of CSR-H does not provide requirements for full penetration welding between the tank top and the hopper tank sloped plating or the tank top and the transverse lower stool plating.</p> <p>[paragraph omitted]</p> <p>No evidence has been provided to show how renewal criteria and corrosion additions fulfill the criteria 3.3.15 on protective arrangements to avoid damage due to bulldozers.</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"><li>1. Review previous discussions on this topic in the IACS Knowledge Centre.</li><li>2. Investigate service experience related to bulldozer usage to see how frequent damage occurs. Contact Owners for feedback on experience and preventative measures they have taken against bulldozer damage.</li><li>3. Investigate options related to bulldozer protection or monitoring of damage, e.g. enhanced weld inspection, local protection (FRP, half-round bar, abrasive resistant coating, etc.), operational restrictions to bulldozer operations, rubber protection on bulldozer blade, etc.</li><li>4. Document and explain the corrosion additions in way of the grab (and bulldozer) usage in order to provide evidence that adequate protection is fitted, taking into account the recommendations made by the audit teams together with the para 6 of MSC 96/5/9.</li><li>5. Develop updates to the TB and/or draft RCP as considered necessary.</li><li>6. Consider link to audit observation IACS/2015/FR1-8/OB/07.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Report of the study that addresses the issues raised in the audit report. <p>IACS completed the study on the issues raised in the audit report and included the report this study in IACS explanatory paper finalized in 2019. The explanatory paper includes a summary of the increased thickness margins included in the inner-bottom, lower hopper and stools of the transverse bulkheads .</p></li><li>2) Updated TB Rule Reference and/or possible Rule Change, as considered necessary.</li></ol> <p><b>Timescales</b></p> <p>The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

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<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/13</b></p>
<p><b>Corrective Action Plan:</b> Annex 13 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 28 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>It is generally agreed that the evaluation of fatigue life has serious inherent uncertainties. It is therefore important that the evaluation of fatigue life should incorporate factors of safety that are explicit and transparent. When the team asked for clarification on these factors, IACS replied on 6 November 2014 that they, in spite of the TB report statement referenced above, considered the 100% operation in North Atlantic condition as an additional safety margin.</p> <p style="text-align: center;">[paragraphs omitted]</p> <p>Even if adoption of two standard deviations in the number of cycles to failure (S-N Curves) takes into account uncertainty on the capacity side, evidence has not been provided to prove that this margin is enough to take into account all the remaining uncertainties.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"> <li>1. Review relevant documents, taking into account the recommendations made by the audit teams, together with MSC 96/5/9, paragraph 6.             <ol style="list-style-type: none"> <li>a) Rule text and related Technical Background (TB) reports.</li> <li>b) IACS interim replies.</li> </ol> </li> <li>2. Perform a detailed investigation into the uncertainties in fatigue assessment with respect to:             <ol style="list-style-type: none"> <li>a) Loads</li> <li>b) Capacity</li> <li>c) Analysis methodology</li> <li>d) Survey and inspection</li> </ol> </li> <li>3. Update the Technical Background document considering the findings of the investigation in 2 above.</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Report of the findings of the investigation.</li> <li>2) Updated TB-Document and/or Rule Change as considered necessary</li> </ol> <p style="background-color: #e0e0e0;">The TB Report was published in August 2019.</p> <p><b>Timescales</b></p> <p style="background-color: #e0e0e0;">The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

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<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/14</b>
<b>Corrective Action Plan:</b> Annex 14 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 31 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report)</p> <p>GBS audit standard 4.2.1.11 requires an explanation of the effect of uncertainties/assumptions on fatigue life, highlighting any margins used in fatigue calculations, taking into consideration the consequence of failure of the particular structural member.</p> <p>IACS has replied on the teams finding that requirement 4.2.1.11 seems not be fulfilled as follows: <i>'A formal structural reliability fatigue analysis has not been carried out. Nevertheless, it should be highlighted that basic assumptions of fatigue evaluation are conservative: North Atlantic sea conditions considered during all fatigue life; Design S-N curve with 2.3% of failure probability e.g. two standard deviations below the mean S-N curves, etc. Fatigue cracks are to be repaired as soon as possible after identification. Therefore, consequence of failure of structural members was not taken into account for the formulation of requirement.'</i></p> <p>It is thus confirmed that the consequence of failure of the particular member has not been considered for the fatigue calculation margins and the information required has not been provided.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1. Examine the Rule basis for the uniform acceptance criteria for fatigue</li><li>2. Investigate fatigue safety factors considered in other rule/standards</li><li>3. Re-check overall Rule TB consistency</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Reports from the various investigations undertaken</li><li>2) Revised Technical Background document and/or Rule Change as considered necessary</li></ol> <p>The TB Report was published in August 2019.</p> <p><b>Timescales</b></p> <p>The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

**STATUS REPORT ADDRESSING OBSERVATION**

<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/15</b></p>
<p><b>Corrective Action Plan:</b> Annex 15 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 32 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>Being aware of the large uncertainty in fatigue assessment, the reported benchmarking with five sample service data is indeed very limited and results non-conclusive. Instead, the main justification for the fatigue methodology seems to be based on the Consequence Assessment reported in TB Report 21 CA Report General Summary. [paragraphs omitted]</p> <p>The CSR-H fatigue assessment methodology seems therefore not sufficiently benchmarked at this stage and it is not conclusive that the results compare favourably with service history.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"> <li>1. Service history benchmarking - re-examination of benchmark database <ul style="list-style-type: none"> <li>Within the following scope, this activity deals with the question "Do the results compare favourably with service history" and with the observation that the sample data, based on only 5 samples, is very limited.</li> <li>a) Improve the TB document, where necessary emphasising that the rules are based on well-established fatigue design standards, e.g. IIW, physics, experimental findings and are tested by service experience.</li> <li>b) Emphasize that damage experiences are used as input for maintaining the rules.</li> <li>c) Draw attention to the IACS Early Warning Scheme</li> </ul> </li> <li>2. Fatigue assessment methodology benchmarking <ul style="list-style-type: none"> <li>This activity deals with the query "Do the results compare favourably with other standards".</li> </ul> </li> <li>3. Re-check overall TB consistency</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Revised Technical Background Reports and other reports as compiled, and Rule Change if found to be necessary. <ul style="list-style-type: none"> <li>The TB Report was published in August 2019.</li> </ul> </li> </ol> <p><b>Timescales</b></p> <ul style="list-style-type: none"> <li>The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</li> </ul>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/16</b>
<b>Corrective Action Plan:</b> Annex 16 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 36 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>The linear assumption seems not properly justified compared to the statistical corrosion models presented. In the figure above, the linear model is illustrated by the solid black line and the assumed design life average corrosion by the dashed black line. A comparison with the convex red curve shows that the net scantling assumption for fatigue assessment is in general not conservative and the "average diminution through the ship's design life" will be higher than half of the full corrosion addition to be adopted according to the rules.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1. Carry out the fatigue strength assessment of typical structural members by the following two methods and validate the appropriateness of the CSR for BC &amp; OT approach:<ol style="list-style-type: none"><li>(a) Fatigue assessment based on half of the full corrosion addition according to the rules (current CSR for BC &amp; OT method)</li><li>(b) Fatigue assessment based on the statistical corrosion models</li></ol></li><li>2. Compare the fatigue lives obtained using assumptions (a) and (b).</li><li>3. Develop a revised Technical Background document.</li><li>4. Produce a rule change proposal, if found to be necessary.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Investigation report.</li><li>2) Revised Technical Background documents and/or Rule Change as considered necessary. The TB Report was published in September 2019.</li></ol> <p><b>Timescales</b></p> <p>The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</p>	



**STATUS REPORT ADDRESSING OBSERVATION**

<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/17</b></p>
<p><b>Corrective Action Plan:</b> Annex 17 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 37 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>IACS notes that post-weld treatment is widely applied in industry to improve fatigue performance. The vast majority of welds enjoying this fatigue life credit will be located in: (a) void spaces (e.g. bulkhead lower and upper stools), for which there are no rules mandating coatings and which enclose humid-salty air and must be considered a corrosive environment; and (b) ballast tanks (e.g. top side tanks, double bottom, etc.), where PSPC standards mandated by SOLAS require a coating design life of 15 years in "good" condition, where the definition of "good" allows a certain percentage of coating failure, thus not safeguarding corrosion-free conditions even in the first 15 years of a ship's life.</p> <p style="text-align: center;">[paragraph omitted]</p> <p>Furthermore, the post-weld treatment relaxation, requiring the presence of an effective coating, is also inconsistent with IACS's own Rules, which in Pt 1, Ch 1, Sec 2 [4.3.4] state that: <i>"No credit is given in the assessment of structural capability for the presence of coatings or similar corrosion protection schemes."</i></p> <p>Finally, the additional condition established in Pt 1 Ch 9 Sec 3 [6.4.1] that the benefit of post-weld treatment applies only in the absence of low cycle fatigue conditions, appears very difficult to predict and control during the design life.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"> <li>1. Review relevant documents (Rule text and related Technical Background (TB) reports), taking into account the recommendations made by the audit teams together with the para 6 of MSC 96/5/9.</li> <li>2. Consider void space and ballast tank coating provisions and their influence on fatigue life calculations.</li> <li>3. Investigate how areas with low cycle fatigue loads have to be handled.</li> <li>4. Consider the development of an inspection procedure to check on the soundness of coatings at post-weld treated critical locations, in service.</li> <li>5. Make Technical Background clearer and/or make rule change proposal as found necessary.</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Report on document review.</li> <li>2) New IACS procedure for inspection of post-weld treated critical locations if found necessary.</li> <li>3) Revised Technical Background documents and/or rule change as considered necessary.</li> </ol> <p>The Rule Change Proposal (RCP) will be included in RCP to IACS CSR 2020 and TB report will be published in due course.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/18</b>
<b>Corrective Action Plan:</b> Annex 18 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 38 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>The TB Rule reference gives no justification to the chosen damage conditions.</p> <p>In the self-assessment rule linkage table, the justification is described as follows:</p> <p>"In IMO Instruments a relationship between the definition of structural damages and flooded conditions is only defined for damage stability requirements as in Load Line Convention Ch. II Reg 27 for Oil Tankers and in MARPOL Annex I Reg 28 for Oil Tankers. For Bulk carriers only an assumption for flooding cases is given in SOLAS Ch XII Reg 4 and Reg 5 but without a definition of the corresponding structural damage. The selection of damaged areas is therefore based on the careful considerations made for the structural reliability analysis reported in TB Rep_Pt1_Ch05_Sec03_HG Residual Strength and supported by statistical evaluation of damage databases (e.g. the HARDER project)."</p> <p>[paragraphs omitted]</p> <p>The evaluation criterion 5.3.2 requests damage scenarios to represent the intent of damage in relevant IMO instruments, but no information has been provided that shows that this is fulfilled by the rule assumptions.</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"><li>1) Detailed study of the origin of Figures 6 and 7 in TB report.</li><li>2) Investigation of HARDER data.</li><li>3) Produce an explanation for the penetration depth in the rules, B/16.</li><li>4) TB report shall be updated accordingly based on result of the investigations.</li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Update of Technical Background documents. The TB Report was published on 30 December 2019.</li><li>2) Rules Change, if considered to be necessary. The Rule Change does not appear to be necessary.</li></ol> <p><b>Timescales</b></p> <p>The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

**STATUS REPORT ADDRESSING OBSERVATION**

<p><b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020</p>	<p><b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/19</b></p>
<p><b>Corrective Action Plan:</b> Annex 19 of MSC 96/5/1/Add.1</p>	<p><b>Audit Report:</b> Annex 13, page 40 of MSC 96/5</p>
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>The audit standard requests a reasonable level of residual strength after damage (i.e. once damage has occurred) thus, the probability of occurrence of the damage is 1. Therefore, sufficient residual strength in damage scenarios representative of relevant IMO instruments seem not properly justified.</p> <p>IACS has replied to this observation 14 March 2015, with the following statement:</p> <p><i>"In the concept of the overall index of ship subdivision (SOLAS) it is assumed that the ship is damaged. This means that there is no interest in the absolute damage safety of the ship in this concept but in the conditional safety. Therefore, the concept of the ship subdivision is called the "index". In the structural reliability theory we are interested in the safety of the structure and therefore the theory is different ... [paragraph truncated].</i></p> <p>The interpretation given by IACS to the statement of intent appears not in full alignment with the FR II.5 which reads: "Ships shall be designed to have sufficient strength to withstand the wave and internal loads in specified damaged conditions such as collision, grounding or flooding. Residual strength calculations shall take into account the ultimate reserve capacity of the hull girder, including permanent deformation and post-buckling behaviour. Actual foreseeable scenarios shall be investigated in this regard as far as is reasonably practicable."</p> <p><b>Detailed Action Plan</b></p> <ol style="list-style-type: none"> <li>1. Review the current description on the probability used.</li> <li>2. Review damaged condition strength requirements and consider a rule change Proposal, if considered to be necessary.</li> <li>3. Update TB documents based on the results of the investigation.</li> </ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"> <li>1) Updated TB documents and/or Rule Change as considered necessary.</li> </ol> <p style="padding-left: 40px;">The TB Report was published on 30 December 2019.</p> <p><b>Timescales</b></p> <p style="padding-left: 40px;">The outcome will be submitted to the IMO Secretariat as part of "IACS common package" for the first three-year cycle GBS maintenance of verification in March 2020.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR1-8/OB/20</b>
<b>Corrective Action Plan:</b> Annex 20 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 13, page 42 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>The rule requirements on coating of cargo hold in bulk carriers do not specify target useful life or coating performance standard to be followed as required by 6.1.2.1.3-4.</p> <p>As an example of the relevance of this observation, note that while the fatigue assessment assumes target life and performance standards not inferior to those required by SOLAS for coatings in other spaces, no evidence of such requirements were found in the rules for coating required in CSR-H for cargo holds in bulk carriers.</p> <p><b>Detailed Action Plan:</b></p> <ol style="list-style-type: none"><li>1. IACS will investigate coating requirements for the coating in the cargo holds of bulk carriers or develop a standard to satisfy the GBS requirements.</li><li>2. Consultation with owners / operators / coating manufacturers and shipyards will be undertaken to identify if there are any practical solutions for coating part or all of bulk carrier cargo holds.</li><li>3. Subsequent actions will depend on the initial investigation and consultation undertaken.</li><li>4. The actions would depend on the outcome of the initial consultation with owners / operators / coating manufacturers and shipyards. If a consensus on an effective and practical way forward is identified, IACS will develop a coating requirement:<ul style="list-style-type: none"><li>• Establish an IACS project team.</li><li>• Consultation with various parties.</li><li>• Update Technical Background documents and prepare appropriate Rule Change if found to be necessary.</li></ul></li></ol> <p><b>Deliverables</b></p> <ol style="list-style-type: none"><li>1) Summarized report. The outcome of consultations with the industry will be included in a new TB Report on "Coatings in cargo holds of bulk carriers".</li><li>2) Coating requirement or UR for cargo holds of bulk carriers if considered to be necessary. The final draft of TB-Report was completed and is now under review for approval and publication.</li></ol> <p><b>Timescales</b></p> <p>The next status report will be submitted to IMO at the appropriate juncture.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR9-15/OB/02</b>
<b>Corrective Action Plan:</b> Annex 23 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 14, page 8 of MSC 96/5
<p><b>Observation</b> (extracted from the audit report – part only)</p> <p>Objective evidence</p> <p>There is evidence that concept of rule formulation stated in the Technical Background Document is not uniformly adopted while formulating the rules.</p> <p>[paragraphs omitted]</p> <p>With regard to the inclusion of, or reference to, the IMO requirements in the rules as per EC 9.3.6, the concept for rule formulation documented in the TB Document (2.1.2, p.990/1810 of CP2) is not consistently adopted during the formulation of rules. In some cases the references are made as per the concept mentioned in the TB Document, while in certain other cases, similar references (or inclusion) are not made.</p> <p><b>Detailed Action Plan</b></p> <p>1. After identifying structural requirement content which is contained in the various IMO instruments, analyze whether the requirements will be kept in CSR BC &amp; OT or not.</p> <p>The rules and TB will be amended according to following principle:</p> <ul style="list-style-type: none"><li>a) The requirements from the various IMO instruments which are addressed in CSR BC &amp; OT are to be identified.</li><li>b) Where the study determines that an IMO instrument adequately addresses the requirement and it seems appropriate to remove the requirement from the rules then this shall be proposed.</li><li>c) The rule requirements based on IMO instruments, which are necessary to be kept in CSR BC &amp; OT, are to be listed.</li></ul> <p><b>Deliverables</b></p> <ul style="list-style-type: none"><li>1) A report about the analysis undertaken.</li><li>2) Rule Change and/or TB update as considered necessary.</li></ul> <p>The Rule Change Proposal (RCP) will be included in RCP to IACS CSR 2020.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

## STATUS REPORT ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2015/FR9-15/OB/06</b>
<b>Corrective Action Plan:</b> Annex 27 of MSC 96/5/1/Add.1	<b>Audit Report:</b> Annex 14, page 13 of MSC 96/5
<b>Observation</b> (extracted from the audit report – part only)  Statement of facts  Towards meeting EC 11.3.3, IACS have referred to the procedures (IACS PR32, Sec 4.3 and IACS Procedures Volume 4, Sec C5) to continuously update rules. The IACS also commented that the scope of survey requirements listed within IACS UR Z23, Table 1 was collected from experience gained by classification societies through their survey history on newbuilding. However, no evidence has been submitted to show that these procedures are evolved out of a benchmarking process. For example, benchmarking is used to measure performance using a specific indicator resulting in a metric of performance that is then compared to others; however, no evidence on the use of these metrics vis-à-vis the evaluation criteria under 11.3.3 and 12.3.6, have been submitted.  [paragraph omitted]  No evidence has been found on benchmarking of quality construction or construction survey requirements.  <b>Detailed Action Plan</b>  <ol style="list-style-type: none"><li>1. Develop a performance standard indicator which can be used by each class society to benchmark and monitor the quality construction and the construction survey requirements.</li><li>2. Investigate whether any existing "Construction Quality Standards" has been issued by any other entity (e.g. ISO), in order to benchmark the developed performance standard indicator.</li></ol> <b>Deliverables</b>  <ol style="list-style-type: none"><li>1) IACS procedure for benchmarking and monitoring of the quality construction and construction survey requirements.  IACS has drafted a report regarding this observation instead of an IACS procedure, with the details of the investigations of standards pertaining to ship construction and a list of key performance indicators with their benchmarks for monitoring the quality of construction which is already being utilized by classification societies.</li></ol> <b>Timescales</b>  The outcome will be available for the first three-year cycle GBS maintenance of verification in March 2020.	

### STATUS REPORT ON ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2018/Maint/ OB/2</b>
<b>Improvement Action Plan:</b> Annex 2 of MSC 100/6/10	<b>Audit Report:</b> Annex, page 12 of MSC 100/6/5
<p><b>Improvement Action to address IACS/2018/Maint/OB/2</b></p> <p>As shown in page 12 of the Annex to MSC 100/6/5, IACS will develop the Technical Background document to justify that the acceptable limits of yielding have been considered in revising the requirement about net connection area of connecting bracket (Pt 2, Ch 1, Sec 3, [1.4.2]).</p> <p><b>Deliverables</b></p> <p>1) New Technical Background document.</p> <p>IACS work to address this observation is in progress.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

### STATUS REPORT ON ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2018/Maint/ OB/3</b>
<b>Improvement Action Plan:</b> Annex 2 of MSC 100/6/10	<b>Audit Report:</b> Annex, page 17 of MSC 100/6/5
<p><b>Improvement Action to address IACS/2018/Maint/OB/3</b></p> <p>As shown in page 18 of the annex to MSC 100/6/5, IACS will improve Technical Background documentation and explicitly specify in the rules the protective measures to be taken in order to support and clarify the modified rule requirements.</p> <p><b>Deliverables</b></p> <p>1) Revised Technical Background documents such as TB-Report "Fatigue Assessment on Hatch Corner" and Rule Change.</p> <p>The revised TB-Report will be published and Rule Change Proposal (RCP) based on the TB-Report will be included in RCP to IACS CSR 2020.</p> <p><b>Timescales</b></p> <p>The next status report will be submitted to the IMO at the appropriate juncture.</p>	

### STATUS REPORT ON ADDRESSING OBSERVATION

<b>Submitted to:</b> IMO Secretariat <b>Date:</b> 29 February 2020	<b>Observation No.:</b> <b>IACS/2018/Maint/ OB/4</b>
<b>Improvement Action Plan:</b> Annex 2 of MSC 100/6/10	<b>Audit Report:</b> Annex, page 22 of MSC 100/6/5
<b>Improvement Action to address IACS/2018/Maint/OB/4</b> As shown on page 23 of the annex to MSC 100/6/5, IACS will revise the rules in order to ensure consistency in definitions of NDT/NDE. <b>Deliverables</b> 1) Revised UR Z23 and/or IACS CSR for BC&OT. IACS work to address this observation is in progress. <b>Timescales</b> The next status report will be submitted to the IMO at the appropriate juncture.	

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